RATHI RAMJI

**HEALTH PROMOTIONAL INTERVENTIONS INFORMED
BY COMMUNITY-BASED PARTICIPATORY RESEARCH
IN A SOCIALLY DISADVANTAGED NEIGHBOURHOOD**

Development, Exploration and Evaluation

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To the women in Lindängen

Action is mandatory in life. If faced with illness, it becomes imperative to fight it.

To do so, one must first understand the challenges and their solutions.

Bhagavad Gita

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ABSTRACT

The overall aim of this thesis was to understand the impact of community-based participatory research-informed health promotional initiatives on the health of communities living in socially disadvantaged neighbourhoods in Southern Sweden. The thesis was part of a larger program, Health promotion, Innovation in Collaboration which was a community-based participatory research program aiming to create novel ways to improve health through participatory and collaborative strategies. The thesis embraces one mixed-method study, a quantitative study, a qualitative study and finally a participatory action research study with a qualitative approach. A total of 49 citizens and 10 families with children aged 7-14 years from a disadvantaged neighbourhood in Southern Sweden participated in the different studies. The mixed-method study (Study I) described the development of initial evaluation of a Community-based participatory research(CBPR) informed physical activity intervention, which showed the need for the intervention to be offered cost-free and exclusively for women. In line with the results of the first study, the CBPR physical activity intervention was offered to 35 women in the neighbourhood and the effect of the intervention was assessed over time both quantitatively (Study II) and qualitatively (Study III), including a perspective on the pandemic. The last study (Study IV) focused on diet and oral health among families, particularly mothers and children. In this study, the children were initially engaged in a photovoice interview which was followed by a focus group with parents. The pre-study revealed that children disliked school lunch and did not eat breakfast regularly owing to time constraints and family situations. Furthermore, children also consumed a high amount of sugar. To this, the parents expressed that they were not able to guide their children appropriately and needed help with aspects such as diet focusing on breakfast, lunch and dinner, as well as knowledge on oral hygiene habits. The quantitative part of Study I and Study II were repeated measures data at different time points before and after the intervention. The

qualitative data in studies I and III were collected in form of focus group interviews in parallel to the quantitative data. The mode of data collection in Study IV was Multi-staged focus groups where the same families met at different time points and engaged in dialogue and reflection on different topics at each meeting. The results of the first three studies show that a CBPR informed physical activity intervention when offered in groups improved health-related quality of life, physical health, induced behavioural change and potentially builds resilience to withstand the psychosocial and physical effects of the pandemic. The last study shows that a CBPR informed oral health promotion through reflection and dialogue among families together with other stakeholders, influences behavioural change and perceived changes in health among parents and children living in a disadvantaged neighbourhood. In conclusion, this thesis highlights that social support is key to improved perceived health, empowerment, and sustainable behavioural change among citizens in the neighbourhood. Although women are most in need of support, they are also gateways to the families and thereby their communities. And finally, health promoters have had a vital role in engaging communities in health promotional efforts and bringing them closer to other societal actors, strengthening their social bonds and helping build community resilience in the face of adversity.

LIST OF PUBLICATIONS

This thesis is based on the results from the following studies referred to in the text by the respective roman numbers. The published papers have been reprinted with permission from the publishers

- I. **Ramji, R.**, Carlson, E., Kottorp, A., Shleev, S., Awad, E., & Rämngård, M. (2020). Development and evaluation of a physical activity intervention informed by participatory research-a feasibility study. *BMC Public Health*, 20(1), 112.
- II. **Ramji, R.**, Carlson, E., Rämngård, M., Shleev, S., Awad, E., Cirovic, S., & Kottorp, A. Long-term evaluation of a participatory research informed physical activity intervention among women from disadvantaged neighbourhoods with a pandemic perspective. *(Under review in Global health action)*
- III. **Ramji, R.**, Carlson, E., Kottorp, A., Rämngård, M. Impact of a CBPR-informed physical activity intervention before-and-during COVID-19 in a disadvantaged neighborhood in Sweden. *(Manuscript to be submitted to Health Promotional International)*
- IV. **Ramji R**, Carlson E, Brogårdh-Roth S, Olofsson AN, Kottorp A, Rämngård M: Understanding behavioural changes through community-based participatory research to promote oral health in socially disadvantaged neighbourhoods in Southern Sweden. *BMJ Open* 2020, 10(4):e035732.

ABBREVIATIONS

BMI	Body Mass Index
CBPR	Community-Based Participatory Research
COVID-19	Coronavirus Disease of 2019
EU	European Union
HRQOL	Health Related Quality of Life
LHP	Lay Health Promoters
MET	Metabolic Equivalent
NGO	Non-governmental Organisation
OECD	Organization for Economic Co-operation and Development
PAR	Participatory Action Research
RITA	Rapid Identification of Themes from Audio
SCB	Statistics Sweden (Statistiska centralbyrån)
SDGs	Sustainable Development Goals
WHO	World Health Organization
WHOQOL-BREF	World Health Organization Quality of Life Questionnaire Brief version
WHOQOL-100	World Health Organization Quality of Life Questionnaire 100-items version

FOREWORD

Fourteen years ago, when I arrived in Sweden, all that I had with me was a degree in dentistry with some experience in the clinical side of dentistry. However, as a student back in those days I felt very moved working with community studies which was still gaining popularity among dentists in my homeland although community screening of oral health was popular. I found that working in the place of the comfort of a patient gave better treatment outcomes. This gave me the very first understanding of the value of culturally competent health care provision.

On arrival to Sweden, I was on the path of further pursuing my career in dentistry, however, my life took a U-turn when I stepped into the Department of Epidemiology and Global Health, Umeå University with totally no expectation of what was to come and in no time was enrolled in the Master program in Public Health. I finally gained knowledge on the wider aspects of global health which also brought me out of the clinical world to be closer to society. As a new Public Health graduate, I felt the need to engage in potential research projects involving innovative methods to achieve goals of direct relevance to society. The dream of pursuing research that merely does not perish within research through publications and reports but rather benefits the community became reality through being part of the Health Promotion Innovation in Collaboration at Malmö University.

At the beginning of my doctoral studies, I had almost no knowledge or experience working with Community-based participatory research nonetheless with participatory methods in research. However, over time I observed that this approach was already embedded in the society in indistinct forms which became visible only after I learnt a little more about it. I also began to see opportunities to be participatory in almost all walks of life. Coming from a land rooted in dharmic philosophy, I was extremely shocked by the thought of inequalities in health, especially in Sweden a

country believed to be dominated by socialistic ideologies. This reminded me of one of the sayings by American activist Martin Luther King

"Of all the forms of inequality, injustice in healthcare is the most shocking and inhumane."

Having an immigrant background, I have gone through the struggles of learning a new language, adapting to the new culture, and have experienced the struggle to understand how the health and social systems work in Sweden. Furthermore, I also come from a society that is rooted in cultural and traditional value systems that have an impact on the daily life of the population. Given my educational background, in health care, I certainly felt that I had an edge over the situation. However, I also observed fellow immigrants struggles to overcome these hindrances to establish a life in the new country. Thus, my own experience turned out to be an advantage in that I had a better understanding of the problems described by the communities and could gain their confidence and trust which was also key to being able to carry out the different studies within this thesis.

INTRODUCTION

Despite Sweden being a welfare state and the average health of the Swedish population has improved over the years there are systematic differences in the health status and access to health care between different population groups particularly in urban neighbourhoods in big cities [1]. These inequalities have had a considerable impact on the quality of life given that it increases ill health and health-related spending, further compromising on the efforts towards education and employment [2]. Health promotion is highly relevant in the current scenario particularly also since the world is facing a triple burden with an unending agenda of infectious diseases, an unprecedented increase in chronic diseases together with emerging and re-emerging diseases [3].

The World Health Organization recommends health promotion with a multistakeholder and multisectoral action where citizens, civil society, health care sector and policymakers are engaged together in action to effectively address determinants of health in efforts to address health inequalities [4]. When inequalities lead to ill health, it becomes necessary to tap on protective factors including mutual trust and social networks to promote health and well-being [5]. Prior research also suggests that successful health promotion is culturally and contextually appropriate and most importantly that it includes community participation [6]. Taking into account these recommendations is the Community-based participatory research (CBPR) approach where researchers and community members together with other stakeholders work collaboratively establishing an equitable partnership with an aim to address problems related to community health through co-producing knowledge followed by action to resolve the problems [7].

While establishing a CBPR based health promotional program is one side of the coin it is also important to understand how the approach led to improved health outcomes

[8]. It is thus necessary not only to elucidate the physical health related outcomes of CBPR interventions but also elevate the perceived benefits from the view of the community members. Such an exploration will throw light into how the activities have contributed to building community capacity, empowerment which leads to improved health and further the sustainability of these efforts [9].

BACKGROUND

Health Inequalities as a public health challenge

Achieving good health and related quality of life among the population has been the ultimate goal of health care and public health globally [10]. Health is a complex phenomenon, not confined only by biological factors, given that changes in economic, social, political, environmental, cultural and behavioural factors can also influence health [11]. Although health has over the years been defined in many different ways the main aim of all of those definitions was to ensure that health is not merely equated to the physical condition of individuals but that it also captures the complexity in relation to the environmental and social conditions in which individuals and populations thrive [12]. One of the most commonly used definitions of health was that proposed by the World Health Organization (WHO) namely “health is not merely a state free from disease rather a complete state of physical, mental and not the least social well-being” [13] (which will also be the definition applied in the context of this thesis). Health also determines the possibility to acquire education and access to the labour market providing economic stability through employment [11].

Taking into consideration the importance of achieving good health the Alma Ata Declaration of 1978 emphasized the right to health for all by the year 2000 [14]. The term health equity has also been widely discussed in public health practice and research when discussing health for all. Health equity has been defined as equal availability of fair opportunities to achieve health. (See Figure 1). The absence of health equity among a certain group of communities compared to the major population may result in inequalities in health [15]. The struggle to achieve health equity continues nearly four decades after the Alma Ata given that one of the Sustainable Development

Goals (SDGs) for the year 2030 strives for reducing health inequalities through universal health coverage and prevention and treatment of noncommunicable diseases [16].

Figure 1: Illustration on the difference between equality and equity

The goal of health care personnel, public health practitioners and policy makers globally, has been to improve health outcomes and related quality of life, as well as to ensure universal access to health care among populations [17]. However, there are avoidable systemic differences in health status between different countries, regions and even between different population groups belonging to different socioeconomic positions within a country or region which in prior literature has been addressed as health inequalities or health gaps [17, 18]. Health inequalities are regarded as systematic and not random since they follow a social pattern and are regarded as modifiable given that they are not a result of any biological process [18]. Evidence suggests that health inequalities are influenced by factors such as gender, sexuality, childhood experiences and development, economy, employment status, housing and neighbourhood conditions, social integration and most importantly practice of risky health behaviours [19]. Moreover, health inequalities frequently stem from social inequalities such as unequal distribution of power, income, access to healthy food and most importantly access to health care which make substantial contributions towards creating differences in health [18]. More specifically disparities in social, economic, environmental, and structural contribute to systemic differences in health both within and between different countries [12].

Health inequalities lead to higher incidence of chronic and infectious diseases, increased morbidity and decreased life expectancy [2]. Aside from the problems related to general health inequalities in are observed even with oral health given that the determinants of general health and well-being also apply to oral health. Oral diseases

also have shared risk factors with other non-communicable diseases such as cardiovascular disorders and diabetes [20-25]. The World Health Organization considers oral health as an integral part of general health. Oral health impairments also have a considerable impact on the quality of life of affected individuals both functionally and esthetically [26-28]. Nevertheless, together with disparities in general health, oral health disparities in all age groups have considerably increased since the early 19th century [29].

For more than a century, the discussion regarding health inequalities was confined to problems in low-income countries [30]. Nevertheless, differences in health have also become prominent in populations living in developed countries owing to economic globalization and migration [31]. Even an egalitarian country as Sweden with a high life expectancy has been facing challenges owing to health inequalities. The difference in health status is predominant in urban neighbourhoods in bigger cities rather than between different regions in the country [32]. One of the main problems in countries like Sweden is that the opportunities for good health are unfairly distributed leaving out a certain group of populations [1]. Prior research also suggests that the delay in addressing this situation would lead to what researchers define as spillover effects. A spillover effect may become predominant particularly during acute situations like natural disasters or may lead to a rapid increase and spread of infectious diseases such as the COVID-19 turning it into a pandemic and affecting also the rest of the population [2, 33]. Thus, inequalities in health are not the only problem for the subgroup of populations experiencing poor health but for the country as a whole [2].

Aside from the humanitarian and ethical concerns around health inequalities, it also poses a major burden on the overall economy of a country from a utilitarian standpoint [34]. The deficit linked to health inequalities accounts for nearly 1.4% of the GDP of the European Union, which is as high as the overall expenditure on defence in all of the EU countries [35]. Additionally, the economic growth of Sweden was nearly 7% lower than expected between the years 1990-2010 due to inequalities in health [36]. A decrease in the overall health of the population may contribute significantly to reduced quality of life, reduced productivity, increased mortality which in turn has an impact on the economic growth of the country [37]. To sum up, there is an acute need to address health inequalities in Sweden and elsewhere. Measures to minimize health inequalities must focus on addressing determinants of health targeting populations facing poverty, vulnerability and social disadvantage [38].

Neighbourhood effects and social disadvantageousness

When discussing health and health inequalities the contextual factors are extremely important given that challenges and needs vary between different settings [39]. Prior research has shown that area of residence is related to health, specifically perceived health, and general mortality and further that those living in affluent neighbourhoods may be healthier than others that live in disadvantaged settings [34, 40-42]. It is in general noted that neighbourhoods are classified as advantaged or disadvantaged based on physical features such as air quality or levels of air pollution, a surrounding that supports healthy lifestyle; access to high quality services such as schools, transportation, and supermarkets and not the least the social reputation as represented by fellow residents and as displayed by other relevant actors particularly the media [43, 44]. A large part of what defines a neighbourhood as disadvantaged is influenced by the structural perspective, given that individuals or communities residing in a certain neighbourhood have almost no control over the local labor market, public transport services and other welfare-based services as, education, and health care [45].

Prior research highlights that social, economic, locational, and environmental challenges interact in disadvantaged urban neighbourhoods which result in negative consequences for families or communities living there [46]. In addition, these neighbourhoods are constructed by a complex interplay between lack of opportunities, weak social networks together with the personal circumstances' individuals living in a community thrive in including poor access to education, unemployment, and low income. Socioeconomic differences, poverty and isolation are potential predictors or trajectories of poor health, low social mobility, violence and criminality [41, 45].

Choice of residence is influenced by a family or individuals' economic situation, lifestyle preferences, access to resources and services, availability of housing, personal and cultural needs and most importantly the presence of social connections [47]. Although the distribution of the population in disadvantaged neighbourhoods is not necessarily random nor completely intentional evidence, prior research suggests that these communities tend to have some form of similarity either in that they share a common culture or that they have similar socioeconomic status or educational level [42]. In some countries within the European Union, communities also tend to be assigned in certain areas because of a lack of personal resources or knowledge relating to local laws and rights especially in the case of asylum-seeking migrants. These factors also seem to explain the clustering of similar health problems in these communities [48]. This was also clearly demonstrated in the context of the COVID-19 pandemic which aside from the higher rate of infection spread among communities living

in disadvantaged neighbourhood mental health and well-being was also severely compromised in these groups, where neighbourhood deprivation was regarded as a contextual factor that intervenes in this relationship [49, 50].

The socioeconomic growth in disadvantaged neighbourhoods is not regarded as completely static; however, it is believed that growth is much slower than that in a more affluent neighbourhood [47]. The growth in these neighbourhoods is frequently determined by societal actors, including staff from the municipality, primary care, local businesses and this in turn affects the lifestyle and health of the communities in the neighbourhood [47]. This given that a place of residence is a unique system where health relevant resources and social relationships are embedded within certain geographical borders and these actors control the resource the communities are dependent on including access to health care, parks, gardens and green spaces, sports facilities and other built environments, availability of goods particularly healthy food and medicines, and further a welcoming context for building social relationships with others in the neighbourhood [40].

Based on the extensive research the association between place of residence and health can be explained by three common explanations that have been discussed including compositional, contextual, and collective social functioning. The compositional explanations focus on the characteristics of the individual members of the community living in the neighbourhood [41]. While contextual explanations indicate the opportunities, the communities have as provided by the physical and social environment including good housing, healthy environment, access to health and social care, employment opportunities [34, 41]. According to previous research, these contextual factors have a strong effect on the physical health and psychosocial well-being of communities living in these neighbourhood [39, 40]. Further studies also show that contextual factors including access to nutritional food, availability of dental services, and access to the natural environment allowing to engage in physical training have an impact on the oral health of children and adults in the neighbourhood [51-53]. The contextual and compositional elements are frequently considered as interlinked in previous research given the contextual elements have a strong influence on individual characteristics [34]. The third explanation namely the collective social functioning which is considered unique for each context refers to the socio-cultural and historical features more specifically the shared norms, traditions, values, and interests of communities living in a neighbourhood in concern [42]. Further, it is also said to include the community support networks or social cohesion, participation and most importantly social support.

The above discussions together with further support from previous empirical research highlight that the neighbourhood or place of residence more in particular social structure within the neighbourhoods has the potential to shape and orient individual behaviour in that they may either be hindrances or on the contrary can offer opportunities [41, 45]. Evidence also suggests that individuals living in disadvantaged neighbourhoods are more often exposed to circumstances that entail increased prevalence of risky health behaviours which significantly contribute, to the health inequalities. Some of the most common risky health behaviours in this group include such as physical inactivity, consumption of unhealthy diet and addiction to tobacco, alcohol and drugs [54].

Health and Risk Behaviours

Any action is classified as a health behaviour if it influences the health status (health promoting behaviours) or increases the risk of disease (risky health behaviours) [55]. Risk behaviours are defined as behaviour or a lifestyle choice that raises the probability of adverse health outcomes [56]. Health behaviours are shaped by the opportunities available for individuals or communities to maintain health in combination with the active choices they make based on these opportunities [55]. The choices are determined by an individual's knowledge, educational qualifications, and cultural aspects. While the opportunities available are dependent on structural resources available in their near environment, personal resources including money and material assets, and social resources are made up of the relationship shared by the individuals with other members in the community [57]. The unequal distribution and interaction between these resources lead to health inequalities and thereby also a higher risk of engaging in risk behaviours [58]. Limited or scarce resources hinder individuals' cognitive capacity to be attentive, and make informed decisions, follow healthy lifestyle plans and above all resist temptations which further explains that the practice of risk behaviours are strongly determined by the availability of external and internal resources [59]. Some of the most common risk behaviours include a poor diet, physical inactivity, poor oral hygiene, smoking, substance use, sleep, risky healthcare-seeking behaviours, and adherence to prescribed medical treatments. Many of these risk behaviours are trajectories to chronic diseases and about 80% incidence of chronic diseases is owing to physical inactivity, poor diet and smoking [60].

Physical inactivity

According to the WHO physical inactivity is the fourth common risk factor for global mortality, which accounts for almost 6% of deaths globally [61]. Together with poor diet, physical inactivity is also associated with type 2 diabetes, cancer, depression and poor oral health [62]. Physical activity here and henceforth in this thesis refers to any type of bodily movement that is produced by the skeletal muscle and results in energy expenditure [63]. Some of the most common movements in everyday life including walking, cycling, playing in school, performing household chores, other recreational activities such as gardening, dancing, yoga, swimming, running, and team sports are referred to as physical activity [64]. Exercise is also known as training in common language is also a form of physical activity, which differs from the everyday activities in that it is purposive, planned, repetitive and structured and is performed with the primary goal of improving health [65].

Sedentary behaviour

Sedentary behaviour is also another term discussed in relation to physical inactivity which includes engaging in activities resulting in energy expenditure way below the recommended levels of ≤ 1.5 metabolic equivalent (MET), where 1 MET is approximately the cost of energy for sitting quietly [63, 66]. These activities include watching TV, playing video games, working on the computer, driving a car, reading, idle sitting and lying. A sedentary lifestyle also has harmful health effects as physical inactivity in that it increases the risk of cardio-metabolic diseases and all-cause mortality [67]. Research suggests that sedentary behaviours are not part of physical inactivity, however, interventions aiming to increase physical activity must also consider addressing sedentary behaviours to better promote health. Poor mental health and isolation are also seen to be associated with sedentary behaviours [67]. Furthermore, poor diet including high consumption of fats and sugars seems to co-occur with sedentary behaviours [68]. The Swedish Public Health Agency recommends physical activity for a minimum of 30 minutes per day in adherence to the recommendations of WHO. Although 65% of the Swedish population above 18 years are observed to be physically active, there are significant differences in physical activity levels among populations from disadvantaged neighbourhoods particularly among those with low social capital and social participation [69, 70]. While the world has been combatting the physical activity and sedentary behaviour pandemic and the inequalities surrounding these two risk behaviours, the COVID-19 pandemic has made it a double burden [50, 71]. Given that populations living in socially disadvantaged

neighbourhoods are disproportionally affected by the COVID-19 while also being at a higher risk for chronic diseases owing to the unaddressed problems with physical inactivity and sedentary behaviours making them extra vulnerable [71].

Diet and Food intake

Poor diet particularly a low intake of fruits and vegetables and high intake of processed food and sugars are also estimated to account for the incidence of 31% of ischemic heart disease and 11% of stroke. In addition, 90% of dental caries and associated tooth loss globally is attributed to consumption of unhealthy diet and poor oral hygiene [72, 73]. Research also shows that sufficient consumption of fruit and vegetable can prevent 2.1 million deaths globally [73]. Despite the EUs' recommendation to promote healthy diet and physical activity for all individuals in member states without difference in age and social status, a large number of children, young adults, and elderly continue to adopt a sedentary lifestyle, consume poor diet and, are at risk of chronic diseases [74, 75]. Furthermore, prior studies show that these risk behaviours are not only more frequent they even tend to cluster among populations residing in disadvantaged neighbourhoods [76, 77].

Oral Hygiene

Oral hygiene including tooth brushing, flossing, and use of fluorides are also health behaviours related to good oral health outcomes. However, the practice of these behaviours is dependent on social and societal conditions [78]. Populations, especially children and adolescents living in disadvantaged backgrounds tend to have poor oral hygiene, and thus were twice as vulnerable to developing dental caries (tooth decay) and tooth loss [79]. Prior work based on Eurobarometer surveys has shown that populations living in disadvantaged neighbourhoods frequently perceive a lack of access to knowledge regarding self-oral care, including the practice of good oral hygiene, diet and use of fluorides [80]. Socioeconomic factors including the ability to pay for care and transportation to dental clinics among populations living in disadvantaged neighbourhoods limits the utilization of dental services resulting in large social inequalities in oral health [79]. Adults in these neighbourhoods mediate oral health-related behaviours to their children based on the support they receive from the dental care staff [81]. Children from disadvantaged neighbourhoods less regularly attend the yearly controls at the dental care. Parents to these children tend to be unaware of the support services that are available owing to language difficulties given that most of the material available is in the Swedish language [81, 82]. Populations living in

disadvantaged neighbourhoods especially with migrant background tend to have unmet expectations from the healthcare system, since their expectations are built on the experience of support, they have earlier received in their home country. The available material support in form of brochures and physical support lack contextual adaptation given that they do not account for the traditional values and family practices that influence the attitude towards health behaviours among these groups [83].

The above discussions clarify that health behaviours result in a multitude of health and well-being related outcomes both at an individual, as well as population level which requires effective strategies that initiate behavioural change. Thus there is a need for health promoting interventions that work with the integration of personal responsibility through facilitating participation while also actively advocating for change in the social systems to effectively address health inequalities [3].

Health Promotion

Health promotion has the inert potential to reduce inequalities in health since it effectively responds to the triple burden of diseases including the emerging and reemerging infectious diseases, newly recognized chronic disease epidemics and the health effects of natural disasters [3]. Further it even has a fundamental role in the realization of the United Nations Sustainable Development Goals 2030 given the common priorities for both such as equity, intersectoral approaches and sustainability [84]. Given the impact of health inequalities on the world economy [34], health promotion also happens to be a cost-effective measure since it taps on the productive capacities of individuals or a communities in concern, setting goals based on the size of the local problem while also taking to account factors influencing the feasibility of a successful intervention [85].

Down in history almost a quarter century ago it was realized that biomedical interventions alone do not result in a better health outcomes [86]. In consensus with this understanding, the definition of health was also reframed from being strictly biological or naturalistic in that it is a state free from disease to more a comprehensive definition that it is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity [73]. In conjunction with these changes the WHO raised the value of applying evidence-based health promotion practices to all policies and programs aiming to address challenges to good health globally [87].

Further to this public health experts lifted the need for an approach that initiates intersectoral action to build healthy public policies and create sustainable health systems in the society at this phase of transition. Besides the interventions were also expected to empower individuals to take actions for the sake of their health [88]. These features happened to be the essence of health promotion, which according to the Ottawa chapter is defined as the process of enabling people to take control over their health and its determinants, with an aim to improve their health [89]. Health promotion involves the population as a whole in the context of their everyday life and does not focus only on individuals at risk or diagnosed with a specific disease. These transitions led to changes in the focus in the core function of public health from health prevention to health promotion [88].

In the late twentieth century when health promotion was recognized as an important public health measure it purely targeted individual behavioural change. This form of health promotion thrived on the belief that an individual has an exceptional amount of influence over their choice and actions concerning diet, physical activity, and other health behaviours and that changes in these health behaviours leads to significant health outcomes [90]. During this phase health education was regarded as synonymous with health promotion which is currently widely criticized. Health education is believed to be one of the tools in health promotion, but health education emphasizes only on behavioural change [3, 87].

The WHO considers health promotion as activities engaging in a wide variety of approaches that go beyond health education and intervention and results not only in behavioural change but also leads to organizational change and community development [91]. Since health promotional interventions work at personal, organizational, social and political levels they facilitate change in behaviour or lifestyle while also addressing the structural or environmental factors thus restoring or preserving health [92]. According to the WHO the key action areas of health promotion include creating supportive environments for health, strengthening community action and enabling the development of individual skills, re-orient health services and finally to build healthy public policy [89]. Creating supportive environments includes addressing the immediate environment in which the lives of individuals and communities are woven by creating opportunities for community members to make healthy choices. Engaging community members in health promotive intervention and empowering communities can assist the creation of supportive environments and positive social norms which further facilitates motivation, confidence and self-management skills [92]. Strengthening community actions yet again draws on involving communities

themselves in setting priorities, decision making, planning and implementing strategies to achieve better health [93]. Empowerment is crucial in this process as it enables ownership and control on their actions and destinies among community members [94]. Health promotion initiatives work towards supporting individual and social development through information provision and health education thereby enhancing life skills [89]. This knowledge assists communities to exercise more control over their health as well as their environments, creating opportunities for making healthy choices. Reorienting health systems is also an action area within health promotion since healthcare sector needs to change its interest towards health promotion and not merely treatment and prevention [92]. In addition, health services and professionals should engage in providing more need oriented care, sensitive to aspects as culture and the local context. To this a multisectoral approach is regarded as vital where the citizens, health professionals, health service institutions, other local actors and governmental agencies work together [89].

From the above discussion, it becomes clear that empowerment is inevitable in all of the key action areas of health promotion and is therefore also regarded as a central element in the theory and practice of health promotion [88].

Community Health Promotion

The Ottawa Charter of Health Promotion suggests that health is created in the context or the settings in which individuals thrive and engage in everyday activities [95]. As discussed earlier, context is not just a location where an individual thrives but is rather an environment in which human social interactions are embedded [96]. Thus, long-lasting or sustainable health promotion can be achieved only when it is implemented at a community level where all community members not just individuals become empowered to solve problems relating to health. Evidence from prior studies also suggests that the approach be a dynamic method to address health inequalities through integrating risk factors and improving quality of life [97]. Community health promotion is defined as a process aiming to address the social, cultural and environmental process related to health through enhancing community participation and thus empowering communities within a defined geographic area to increase control over their health [98].

Empowerment

Empowerment in health promotional research is a multilevel process where the primary aim is to gain control upon personal, social, economic, and political forces in

an attempt to interpose and act in order to improve health and related quality of life [99]. In public health, as well as the field of health promotion empowerment is regarded as the opposite of powerlessness, which accounts for individual or the community's perceptions of helplessness or actual lack of power owing to the situation in which they thrive including lack of economic and political power, poverty, and vulnerability and deprivation of resources [94]. Empowerment is regarded as a recurrent interpersonal process fostered through defining a goal, developing self-efficacy and competence, acquiring knowledge, and finally taking action to achieve goals [100].

Powerlessness has a dual impact on health in that it hinders access to resources thereby affecting the social determinants of health including employment, poverty, social capital, safety in the environment, and further hinders the opportunities to exercise influence on the local political agendas which may otherwise allow recovery from the disempowered state leading to negative health outcomes [101]. Historically the conservative agenda had inadvertently stigmatized communities in disadvantaged situations for lack of skills to revoke their power. Such a notion also led to introduction of rhetoric initiatives that merely targets promotion of self-esteem, job-competencies and literacy completely ignoring the social context and its role in making communities powerless [102].

The health-enhancing capability of empowerment is inspired by the works of a Brazilian philosopher and pedagogist, Paulo Freire, who was the progenitor of empowerment originally in the education discourse, through raising the need for democratic and empowering education [94]. Freire's form of education is something that provides human liberation and not mere knowledge. He proposed education in form of dialogue where all members in a group are equally involved and are co-learners in the learning process thus creating social knowledge [103]. Furthermore, research suggests that empowerment is both a means and goal given that empowerment is one of the goals for health promotion as proposed by philosophers like Freire that empowerment is the desired result. However, empowerment is not only a goal, it also happens to be a means to achieving further, more in that it involves the community members in problem formulation, decision making and action towards achieving better health [104].

Research suggest that empowerment can happen at two levels namely psychological or individual empowerment and on a larger scale as community empowerment. The individual or psychological refers to the dimensions of people's perceived control of

their lives, their level of participation in community change and their critical awareness [105]. While community empowerment is regarded as a social action process, which promotes the participation of individuals, communities and organizations towards the goals of increased individual and community control, political efficacy, improved quality of community life and social justice [106]. Both individual and community empowerment is required to achieve effective empowerment, given that the communities with a set of social values can influence the behavioural choices of individuals, and a collective of individuals make the community [94, 106]. Social support is a form of a personal relationship which is a cluster of emotional, cognitive, and behavioural processes which in turn promote and increase the individual or community's coping skills [107].

Communities may also experience empowerment through increased social support acquired from developing a mutual interpersonal relationships with other members in the community which also provides emotional attachment [108]. Social support is regarded as a psychosocial resource and also a coping mechanism [109]. Furthermore, prior research also shows that social support from positive relationships have an effect on physical and mental health, as well as overall wellbeing [109-111].

It is conclusive based on the above discussions that, there is a need for culture and context-sensitive novel health-promoting solutions addressing health behaviours to help improve general, as well as oral health among populations in disadvantaged neighbourhoods to reduce health inequalities. Such an effort should also encourage community participation in decision-making, planning, and implementation to achieve sustainable outcomes. Further, establishing effective partnerships with the community can forge systemic changes, promote health in otherwise unreached communities and thereby address the health inequalities [98]. Subsequently an ideal community health promoting intervention cannot be designed as traditional research with pre-described strategies, implemented, and evaluated for its effectiveness where the aims and outcomes are well-defined. This type of research necessitates exploration of different issues using a combination of methods in ways not considered as wholly recognized by traditional research in public health and medicine creating an ideological shift given that partnership between community members and academicians from multiple disciplines is considered both essential and ethical [112].

Community-Based Participatory Research

Community-based participatory research (CBPR) is an alternative to the traditional research processes where the research team designs and plans interventions with almost no involvement of community members. CBPR on the contrary takes into account specific social and contextual requirements through increasing community participation and engagement to facilitate change [113]. It must be noted that the CBPR approach differs from traditional health promotion in that they are informed by alternative values and judgments that determine the choice of methods [114]. In contrast to merely accumulating evidence and designing interventions, CBPR lifts the importance of involving members to whom the research aims to benefit as active and equal participants in the design and development of contextually relevant health interventions [7, 113].

Community-based participatory research is defined by Israel and colleagues as the process of addressing social, structural, and environmental inequities through active involvement and partnership between community members, stakeholders from public and private sectors, as well as academic researchers in all aspects of the research process. Such a partnership leads to the development of integrated knowledge on the problems faced by the community. Further, it gives opportunities to identify actions to resolve the problems and the resources necessary to implement them [115]. Given its inert potential to provide a closer understanding of individual's and community's health-related experiences and that it also informs the need for appropriate services, CBPR has gained increased credibility in the field of nursing, occupational therapy, medicine and public health since as early as in the beginning of the twentieth century [114].

Some of the important terms frequently discussed in the context of CBPR include co-learning, shared decision-making, mutual ownership of the research findings, as well as, products developed during the process [7, 113]. CBPR creates a link between academic researchers, other stakeholders, and communities, through shared knowledge, which in turn leads to co-learning and co-creation of valuable experiences. Research is combined with education, co-learning, and action in an attempt to democratize the production of context relevant knowledge to maximize the likelihood that it influences change [116]. Thus the communities are active in the decision making process by creating a mutual understanding of local phenomena and practices specific to the community which contributes to the development of innovative strategies in form of various interventions to promote social change [117].

The role of participation as a transformative tool empowering communities within a CBPR program has its grounding in critical theory and pragmatism and has further been explained based on social change theories. CBPR itself has its initial foundation from the northern traditions of collaborative-utilitarian focused approach which includes problem-solving means to bring about change [118]. The CBPR approach relies much on the theoretical and conceptual foundations for its dissemination strategy that primarily targets building community strength.

Theoretical foundation of CBPR

CBPR stems from the ground principles of action research credited to a German social scientist Kurt Lewin, who initially developed this research approach as means to planned social change [119]. Ever since several action research and participatory inquiry in several forms have been applied to diverse disciplines such as education, social sciences, organizational management, nursing and public health. Some of the other names for this approach include participatory research, participatory action research, community-based research, action science, action inquiry, and cooperative inquiry. Although addressed by different names they all belong to the same genre and have similar ontological assumptions [116]. While on some occasions the terms action research and participatory action research have been used synonymously a predominant group of researchers consider these terms as opposite ends of a continuum, where action research itself is regarded as a utilitarian, problem-solving approach while participatory action research represents emancipatory or transformative action. CBPR is more often discussed in relation to participatory action research approach [120] and more importantly in the context of this thesis.

The theoretical underpinning of CBPR is influenced by Paulo Freire's ideologies which are also reflected in the core principles of CBPR including participation, knowledge creation, power, and praxis [116]. CBPR approach focuses on creating an open space through fostering mutual trust and respect where the community members, academicians and other actors of relevance interact with each other in a power neutral context. It is in such a context that the community members can perceive a sense of inclusion and even a sense of belonging which nurtures their ability to take control of their situation. With this said it is also clear that inclusion, participation and later partnership with fellow community members is the foundation of all CBPR initiatives [121]. Further, the CBPR ideology relies on the notion that knowledge is created from the new information emerging from the community members them-

selves and not just the scientific community. This is given that the community members with the view of the immediate environment they thrive in, and their own perception of the world are the experts on what is actual for them and their context. Like any other health promotional initiative, the central aspect of CBPR is empowerment, which is a mode of practice as well as an aspired goal of research. Empowerment in CBPR is achieved through increasing community capacity and balancing power relations in the collaboration between members of the community and other stakeholders in the public and private sectors facilitated by the academic partners. [94]. Prior research shows that CBPR has the potential to create a setting where community members identify their opportunities to become engaged and dare the chance to establish or re-establish their own voice and within this space and time recognize the feeling of empowerment for themselves [122]. Praxis involves applying the knowledge created in the CBPR process in form of intervention developed together with the community members [116].

To sum up the participation of the community members is the starting point of all CBPR approaches

Participation in CBPR

The key principles of CBPR as described by Israel and colleagues emphasize on the significance of community participation, particularly the need for cooperation and co-learning established through equitable partnerships between community members and academic researchers within a dynamic and constantly evolving context [115]. The importance of community participation has been also raised by the Alma Ata (in 1978) [14] and Ottawa Charter [95] given its role in community capacity building and further in improving health and reducing inequalities [118].

Participation in CBPR refers to the active engagement of individuals or community's in the decision-making process, beginning from developing and implementing health promoting initiatives to even evaluating such programs [7]. The primary difference between traditional research and CBPR lies in that the community members involved in CBPR programs are not regarded as informants or subjects but rather as participants as they themselves define the research problems as well as generate, represent, take responsibility for and act on their needs in collaboration with the research team. Participation is thus the starting point of the change process [8]. Thus, initiating local participation is regarded as vital to theorize and enact in CBPR based projects. Participation should extend beyond mere physical presence and includes ideation and

conception of the problem, contribution to decision making and sharing of responsibility all of which is driven by personal motivation or interest in the outcomes of research from the side of the community members [123].

Certain guidelines have been proposed to classify level of participation in CBPR research [124]. Based on these guidelines the different forms of participation are placed on a continuum between total lack of contribution from participants where research are responsible for all decision making while participants are merely present in the group to a full participant-driven research process where researchers are only facilitators [124]. However, research suggest that the latter end of the continuum where participants have full control as not necessarily to be best practice, since even some of the middle categories, where parts of the research process such as analysis and dissemination of results are delegated by the participants themselves to academic researchers who later confirm the findings and results with the communities have also been considered as an acceptable form of CBPR [125]. Israel and colleagues suggest that the CBPR principles need not necessarily be implemented to the same extent or the same way in all projects, given that it is very much determined by the context in which the research is pursued [126]. Thus, the extent of community participation in different CBPR based research programs may vary based on the different levels of engagement with the local communities in concern [123]. However, participation is said to be primarily determined by the degrees of community's power to control the research process as well as, the absence of tokenism [127]. Tokenism is defined as the process of merely involving representatives of a community to give the appearance of diversity of subjects without their genuine involvement as equal partners in the research process [128]. If power is not redistributed to the community members during their participation a sustainable community engagement cannot be established given that the research team including stakeholders from various sectors will continue to be powerholders influencing the decision-making process [126]. Tokenism also overthrows the actual interests of communities and impedes the primary objective of empowering communities and results in further marginalizing communities who are already disadvantaged thus undermining the emancipatory goals of the CBPR approach [128]. On the other hand, a well-established CBPR partnership between community members, researchers and stakeholders in a power-balanced environment can lead to increased community capacity, autonomy, improved health of communities, safety and in the long-run may also influence policy change. To be able to establish successful CBPR partnerships the research team should demonstrate mutual respect and should approach the communities with the intention to listen and learn from them.

Above all believe that the communities also have equal or even more potential to contribute to the research [115].

It must be noted that health and social inequalities are not a merely effect of natural circumstance, they are constantly changing and revolving through the structures and systems that communities interact with in their everyday lives [7, 8]. Through using a dynamic approach as CBPR within health promotion it is possible to refine meaning, built relationships and achieve visions such as health and social equity, justice, and well-being in a constantly changing context [8]. CBPR is a cyclical and iterative process where the development and maintenance of community-research partnerships as well as development, implementation and evaluation of interventions are ongoing processes. Change is assumed as constant and hence all the actions and decisions are continuously reviewed, retested and revaluated [8, 116].

Evaluating the CBPR informed Health Promotion

Prior research suggests that community members often perceived that in traditional health promotional programs evaluations were never a choice and were nearly imposed upon them. Further that the process of traditional evaluations failed to take into consideration the uniqueness of their community and the available resources and skills [129, 130]. In line with the principles of CBPR itself, the progression from objectives of the evaluation, design, data collection and definition of outcomes related to the health promotional interventions or programs are to be transparently discussed with the participants. The decisions are to be made and operationalized together with the participants based on mutual agreement ensuring that the evaluation itself does not become a disempowering process for the communities [131]. In summary, the evaluations need to be collaborative and also mutually beneficial to both the community members and stakeholders [9].

CBPR interventions are evaluated to understand the need for improvement in the programs based on how it has influenced the health of the communities. In addition, given that these evaluations are in principle iterative, they also inform on the sustainability of these efforts since the process of establishing these programs are time and resource consuming [8]. Prior research suggests that while it is on one hand important that the evaluations are designed to fit with community realities, on the other hand it is also important to consider that the outcome of the evaluations is supportive of what is regarded as standards set by policymakers and funders who also influence the possibility of these initiatives [131].

The core standards of community-based health promotion are discussed frequently in terms of the ‘salutogenic’ orientation to health, where the word salutogenesis emerges from ‘Salus’ meaning health, and ‘genesis’ meaning to give birth [129]. As discussed earlier, the traditional medical research is based on a pathogenic perspective focusing on disease illness and treatment. In contrast to this salutogenesis targets activities such as social capital, capacity building and community engagement which aims to boost the health, well-being and quality of life of individuals and communities [129]. While salutogenesis may be regarded as a golden standard in many circumstances it does not account for the values and pertinent issues of health promotion while aiming to understand the success or failures of a health promotional initiative [129, 132].

Community-based health promotion initiatives often occur in a diverse community setting and more importantly at multiple levels including behavioural, biomedical and socio-environmental which accounts for the diversity of potential objects of interest in these initiatives [131]. In addition, community-based health promotions employ multiple strategies, such as developing supportive environments, fostering individual or community empowerment, strengthening community action and reorienting health services in that it tries to modify and reshape the social context which has an impact on health and well-being [89].

Although a variety of methods have been used to assess the community based health promotions as in a reductionist approach which assumes that assumption that any complex mechanism can be decomposed into a set of indivisible components that can be measured independently. However, this approach does not elucidate what defines the whole [133]. On one hand scientific evaluations with methodological issues will neither elevate the quality nor utility of community-based initiatives. On the other hand, forcefully applying RCT or equivalent controlled designs in these circumstances will make little or no sense both methodologically and contextually. Given this circumstance, it must also be considered that there should be a balance in the choice of evaluation methods since the process and outcomes must be relevant to both community members, policy-makers and funding agencies [131]. Prior research thus recommends an expansionist approach to evaluation which demands the need to understand the process and outcomes as a whole using multiple ranges of strategies or evaluation methods which results in wide range of outcomes that provides a bigger picture of all the potential indicators of success [133].

Rationale

Sweden has a welfare-based system, where constant effort has been made to strengthen public health work through health events, activities, and interventions in an attempt to address health inequalities, as well as, to enhance the health of the population at different levels. The Swedish national innovation agenda stresses the need for promoting health among populations in vulnerable and disadvantaged circumstances given their specific needs and life situation. The Malmö Commission was one of the first initiatives in Sweden directly after that of the WHO and even much before the national agenda, which aimed at developing scientifically motivated proposals and strategies to reduce inequalities in health. These pointers elevate the need for developing and evaluating health promotional interventions targeting risk behaviours such as physical inactivity, oral health and poor diet using multiple evaluation tools. This needs to be performed not only from a multisector approach but also through initiatives that actively engage members and communities in the research process as equal partners as a means to fully pertain to the actual needs of the population in disadvantaged neighbourhoods to address growing health inequalities.

AIMS

The overall aim of this thesis was to explore the impact of community-based participatory research informed health promotional initiatives on the health of communities living in a socially disadvantaged neighbourhoods in Southern Sweden.

Specific aims

To present the development and initial evaluation of a CBPR informed physical activity intervention built by an established CBPR partnership with communities from a socially disadvantaged neighbourhood in Sweden. (Study I)

To evaluate the effects of a CBPR informed physical activity intervention on the health and related behaviours of women living in socially disadvantaged neighbourhoods in Southern Sweden before and during COVID-19. (Study II)

To explore the impact of a CBPR informed physical activity intervention before and during COVID-19 from the perspective of women from a socially disadvantaged neighbourhood. (Study III)

To understand behavioural change after taking part in CBPR oral health promotion among families living in a socially disadvantaged neighbourhood in Southern Sweden. (Study IV)

METHODS

The design of studies I-III was CBPR informed in that participants were involved in the design and development of the intervention as active partners in research. The research team analysed the data for studies I-III since the evaluation included a unique segment where biomedical data were assessed, requiring the research team to perform the analysis. The results were however discussed and reconfirmed with the participants before dissemination as reports and scientific publications.

Table 1:
Summary of studies I-IV in regard to methods, participants and analysis

	Method	Intervention	Participants	Analysis
Study I	Mixed Methods Surveys Focus groups Biomedical tests	CBPR informed Physical activity intervention	15 residents	Qualitative Content Analysis (Thomas 2005) Parametric and Non-parametric Analysis (Woolson 2007, Ross and Willson, 2017)
Study II	Quantitative – Longitudinal Surveys Biomedical tests	CBPR informed Physical activity intervention	35 female residents	Non-parametric Analysis (Woolson 2007).
Study III	Qualitative- Longitudinal Focus groups	CBPR informed Physical activity intervention	35 female residents	Qualitative Content Analysis (Elo and Kyngäs 2008)
Study IV	Qualitative- Participatory Photovoice (Strack et al 2004) Multistage Focus groups (Hummel 2008)	Oral health promotional activities	10-12 families mothers & children	Rapid identification of themes from audio recordings (Neal JW et al 2015) Qualitative Content Analysis (Thomas 2005)

All three studies (Studies I-III) evaluating the CBPR informed physical activity intervention had a longitudinal design where data was gathered over time. Both qualitative and quantitative data were gathered during the same time points for Study I. Although, data for Studies II (quantitative) and III (qualitative) were also gathered at the same time points they were presented as two different studies. The quantitative part presented in Studies I and II were quasi-experimental examining within-subject differences over time. In contrast to Study, I which had a before-after design, Studies II and III were followed over four-time points with two additional evaluations.

Table 2:

Definition of time points in the studies evaluating the CBPR informed physical activity intervention

Study No.	t1	CBPR Informed Physical activity Intervention	t2	t3	t4
Study I Quantitative and Qualitative	Pre-study	1 day a week for 12 weeks	Post-study	Not included	Not included
Study II Quantitative	Prior to the intervention	Twice a week for 12 weeks	Immediately post-intervention	6-months post-intervention	18-months post-intervention during covid-19 pandemic
Study III Qualitative	Baseline	Twice a week for 12 weeks	Post-intervention	Long-term follow up	During COVID-19

The last study (Study IV) was a participatory action research study with a qualitative approach, where methods such as photovoice [134, 135] were initially used to facilitate discussion among children in particular to understand their needs. The method which has its foundation in Freirean ideology helps to engage individuals in active reflection and dialogue while also creating a safe environment for introspection and critical reflection, and thereby facilitating action. The data used to understand the process of behavioural change in this study was gathered in form of multistage focus group interviews where the same group of participants are engaged in a reflective process over a certain problem or a theme over a longer period. Knowledge is generated during the dialogues focusing on participant experiences [136].

Context

The work presented as a part of this thesis was based in a socially disadvantaged neighbourhood in Malmö the largest city in the Swedish county of Scania (Skåne in Swedish) located in the southern part of Sweden. This neighbourhood lies is located fifteen kilometres distance from the city centre. Health-promoting strategies presented in this thesis was developed, implemented, and evaluated together with the citizens of this urban neighbourhood which is located in the southern part of Malmö city.

This neighbourhood is home to nearly 7800 residents who were predominantly first- and second-generation migrants. This neighbourhood was initially a part of a larger district Fosie until late 1960 when it was established as a residential area of its own [137]. Although the percentage of unemployment was near in par with the general population in Malmö, the average income of an employed individual from this neighbourhood was below 70% of Malmö's average. Nearly half of the population (43%) are second-generation migrants born in Sweden [137, 138]. The residents in this neighbourhood were predominantly from Iraq, Syria, Poland, Denmark and former Yugoslavia, while there were also families from other Arabic speaking countries such as Lebanon, Palestine and Iran [138].

Although, there are two municipal primary schools, several preschools, primary care facilities, dental care, a pharmacy, several supermarkets, a library, amphitheatre, outdoor swimming pool, social meeting places which may be regarded as important social functions in the neighbourhood nearly 60% of the inhabitants considered the outdoor in the neighbourhood as unsafe [139]. Furthermore, a large proportion did not utilize the health and dental care services [82] since they believed that these services were not adapted to their needs [140]. The Swedish reinforcement agency considers this neighbourhood as one of the twelve most socially deprived areas in the country where there exists a high rate of unemployment, crime, low education levels and poor health owing to poor social conditions and practice of risky health behaviours among residents [141]. Further a report evaluating the COVID-19 prevalence in different parts of Sweden has highlighted that the Fosie district to have one of the most affected areas in the country [142].

Health Promotion-Innovation in Collaboration

The current thesis, more specifically the four studies that constitute this thesis was part of a large health promotional project Health Promotion- Innovation in Collaboration was established in the year 2016 supported by the Swedish Innovation Agency, VINNOVA (DNR 2016-00421, 2017-01272) [140]. At the start, this was a research project which is currently developed into a program in the neighbourhood, and henceforth shall be referred to as a program in this thesis. This program was initially established in the above-said neighbourhood in Malmö, with an to reduce health inequalities through developing and evaluating health promotional initiatives using a CBPR approach [143]. Much in line with the definition of the CBPR, the program involved actors from the different sectors including academicians from Malmo University, residents from the neighbourhood, public sector actors as the central health care organization of the region of Scania (Region Skåne) and the municipality of the city of Malmo (Malmö stad), the County Council of Scania Region, together with commercial partners with a public interest as the private pharmacy, TePe Oral Hygiene products, housing companies and large Non-Profit Organizations (NGOs) as Red Cross and Save the Children [140].

Ahead of the start of the planning and collaboration process large *Future* workshops were conducted in an attempt to initiate community involvement The *Future* workshops is a method with origins from Post-war Germany and as the name suggest shas the potential to facilitate the development of new ideas or solutions to social problems through collective decision-making [144]. About 150 residents of different age groups, both adults and even children, from different countries of origin, education levels, and employment status living in the neighbourhood were invited to these workshops. The workshop aimed to explore what could be done to promote health among the residents of the neighbourhood [140].

Aspects related to lifestyle and its effect on perceived health emerged as major concerns during these workshops. Residents particularly lifted the need for increased opportunities for physical activity in the community. Further, problems related to oral health among children and mental health among older adults were also raised. The need to improve health literacy and create safe environments was also highlighted. In line with these discussions, the residents also expressed the need for a setting where all of the above activities can happen such as in form of co-creative living labs within social meeting places in the neighbourhood. They also wanted these activities to be facilitated by culturally competent leaders [140].

Figure 2: Stages in Equal health program in a socially disadvantaged neighbourhood

Based on the discussion in the *Future workshop* the community members together with other relevant actors from private, public and non-profit sectors together with the academicians came together to do a *CBPR planning* using a CBPR model inspired by an existing model developed and used in several international contexts [8]. The CBPR conceptual model comprised of four dimensions namely context, partnership processes, intervention and research, and finally the outcomes [116] was used for establishing CBPR partnerships during this phase [143]. The partners focused on key factors as empowerment and community participation for planning collaboration and designing the co-creative labs based on needs of the community. These labs were regarded as places where participatory group activities were to be developed and implemented together with the community members to promote their health and well-being [140, 143]. Six co-creative health promoting labs (referred to as workshops in some other occasions) emerged within this program including (1) oral health and diet, (2) physical activity, (3) mental health, (4) women's health, (5) social health and (6) safety in the area. This thesis will primarily focus on the development and evaluation of the physical activity lab and oral health and diet lab.

This health promotion program's core ideology was inspired by Freire's empowerment theories [103] together with social psychologist Kurt Lewin's doctrine aiming to shift power relations inside organizations [120]. The initial phase of the program planning started with a *trust building* and orientation phase where academic partners

interacted with residents and local actors as a first step towards involving citizens from the community in the research process within the different labs. Select members from the communities volunteered to active roles in facilitating the living labs together with the research team.

Health promoters

The health promotional activities in the co-creative labs were coordinated by representatives from the neighbourhood known as lay health promoters. These health promoters volunteered during the initial workshops to be part of the program and were initially employed within the program and were later employed full-time by some of the actors such as NGO namely Red Cross and the housing companies participating in the program. All the health promoters are first-generation immigrants and were of different ages and gender. They also came from different countries and spoke, different languages. However, they had migrated to Sweden a long time ago and could communicate fluently in Swedish [140, 143].

The health promoters were engaged in the project from the very beginning and were even involved in the CBPR planning and also sat in the steering group. The health promoters had a primary role in facilitating the program and were instrumental in inviting residents of the neighbourhood to the different labs. The health promoters were included in the core program group given their ability to communicate the cultural nuances of the community to the research team and the collaborating partners. Within the different co-creative labs they facilitated participant recruitment, language interpretation, and most importantly they functioned as trust builders, since they constantly were in dialogue with members in the neighbourhood [140, 143]. Previous research also suggests that including of community members with similar backgrounds as the participants in the research team ensures trust between the research team and the communities, facilitates better communication and increases the credibility of the research [145].

These health promoters although were not formally educated in the fields of public health, nursing or medicine, have been trained in participatory methods by academicians and practitioners, the knowledge of which facilitates the reflection and documentation of processes within the co-creative labs [143]. Furthermore, they were actively involved in the evaluation study assisting participants with their queries concerning the biomedical tests, explaining the survey questions to the participants and even facilitating the focus groups together with the research team.

Development of CBPR Interventions in the co-creative labs

The physical activity intervention program

On recognition of physical activity as one of the problem areas select members who volunteered from the neighbourhood came together in a consecutive *Future* workshop session in an attempt to develop a contextually appropriate physical activity program to address the problems related to physical activity in the neighbourhood identified earlier. Participants in the second workshop were about 70 members from the community, together with the health promoters and the research team. The author of the thesis was not involved in this phase. The second workshop gave insights into the expectations of the community members from the physical activity program which included even practical suggestions for dissemination of the program. The discussions were summarized together with the community members and key action points were generated. From these discussions, it emerged that the community members valued a physical activity program that was catered to individual capabilities. Although they preferred that the program be offered for free, to make it accessible for all members in the neighbourhood, they also wanted a professional trainer to guide them. They wanted to learn exercises that do depend on the use of complex training equipment's or tools that they may not be able to afford, but rather learn exercises that match their daily routine. They preferred training for men and women to be organized separately. There was a certain interest mainly for activities targeting women. Aside of physical activity, they wanted to gain knowledge concerning a healthy diet and a healthy mind. Participants also wanted to understand the impact of physical activity on their health through being monitored regularly. Considering the needs of the residents in the neighbourhood a fitness program was designed to build community and diversity together for a fair and equal health and fitness culture for the entire community. The intervention focused on the gradual change in lifestyle rather than strenuous workouts and crash diets. The tasks initially began with normal body movement, which gradually evolved into learning more complex training methods based on individual abilities. Such an intervention was believed to allow the development of healthy routines that also creates self-awareness of one's own body and thus increase an individual's self-esteem and self-confidence. The academic research team together with one of the health promoters who was a fitness enthusiast with experience in organizing training groups in the neighbourhood, facilitated the delivery of the intervention. The health promoter also grew up in the neighbourhood and was aware of the needs and problems of the communities living there. In addition, he also had a diploma in a fitness program aiming to spread equal access to physical

activity to all citizens particularly in disadvantaged neighbourhoods in the United States.

The intervention was distributed on twelve occasions each lasting for two hours for three months. During the meeting, participants were educated on training and also provided information on diet and coping with stress. All occasions concluded with a dialogue and reflection session related to their daily routines and challenges and possibilities related to integrating the training into their daily life. The activity plan for each of the twelve sessions was similar in both studies I and II. In Study I, the intervention was offered only once a week over three months in two consecutive sessions one following the other. However, during Studies II-III, although the participants met on twelve occasions over three months as in Study I, the intervention was offered on two different days during the week namely on Wednesdays and Fridays, so the participants had the choice to choose the day they joined the group based on their convenience. Participants who missed the Wednesday sessions could go to the Friday session and so on. This change was introduced given that participants in Study I reported time constraints to participate in the intervention when it was offered only once a week.

Oral health promotional activities

Following the initial *Future* workshops conducted as part of the larger program, the oral health and diet lab was established with the families from the neighbourhood in particular parents of children aged 9 years and above who were invited by one health promoter to a workshop together with their children to discuss the development of activities to address the increasing oral health problems in the neighbourhood. The workshop was facilitated by the research team including the PhD student and included other stakeholders from the public sector such as Region Skåne, private sector namely TePe Oral Hygiene Products, Pharmacy and a non-profit organization namely Save the children. A participatory research approach namely photovoice [135], was employed to assess the multidimensional phenomenon of diet from a sociocultural perspective among children. Visual image has been considered an effective tool to encourage participants to share knowledge and engage in an illuminating discussion. This method allows understanding factors surrounding the actual problem in consideration, from within the context of the participants where discussions are initiated from photographs. The method is theoretically founded in Freire's empowerment education for critical consciousness [146].

Ahead of the photovoice session the health promoter who facilitated the oral health and diet lab, invited twelve families from the neighbourhood to participate in the preliminary session. Given that diet and oral hygiene were the key problems raised during the future workshops, the children were requested to bring three photographs, one showing a food they believed was healthy, the second showing a food they believed as unhealthy and third a picture of their toothbrush. Parent and children were met separately during this first meeting. The discussions with the children revolved around the photos and began with concrete reflections at an individual level regarding healthy diet, which later proceeded over to discuss the causes or problems at a group level, which finally results in identifying action steps. The discussions with the children brought to light that children regularly consumed a high amount of sugar. The children frequently skipped school lunch, as the food was not to their liking. In addition, children did not eat breakfast either due to time constraints, cultural aspects and most importantly due to parents having early work schedules, which hindered them from supporting their children at breakfast. Children reported to have visited a dentist only when they suffered pain. Some children had been treated for tooth decays with fillings. Some had also had tooth extractions. Children lacked knowledge regarding the use of fluorides.

Separate focus group discussions were held with parents following the photovoice session with children, which revealed that parents had limited control over their children's dietary choices. Parents were not satisfied with the tooth brushing done by their children. The children refused to let parents to assist them with tooth brushing. Parents expressed the need for dietary advice in specific regarding various meals such as breakfast, lunch, and dinner. They also wanted to gain more knowledge on oral hygiene practice and its importance. Parents believed that all activities should be in the presence of children as they may follow advice from others much better than if given by parents. In response to the needs brought up by parents and children dialogue-based teachings together with related field-experts were initiated facilitated by academic research team. This was the first step in the development of oral health promotional activities together with the citizens from socially disadvantaged neighbourhood informed by participatory research methods.

The aim of the oral health promotional activity so developed was to foster a participatory experience emphasizing on dialogue and reflection following an emancipatory health education session [136]. The academic researcher or a field expert in the subject for example a dietist with expertise on diet facilitated the discussions and debates by initiating the process. Following this, the group took over with self-reflection and

sharing individual knowledge and experiences with each other. The discussion in the group was expected to foster elevation of participant experience and eventually lead to behavioural change.

Participants

Physical activity intervention

The physical activity intervention was developed, implemented, and evaluated in two phases. During the first phase (Study I) following the development of the physical activity intervention one of the health promoters from the main project invited about 20 residents from the neighbourhood who had initially worked with the participatory process of developing the intervention to take part in the intervention program.

Table 3: Background characteristics of participants in Studies I–III

Characteristics	Study I N=15	Study II -III N=34*
Age Range (md)	17-59 (32)	23-77 (49)
Gender		
Women (%)	11 (73%)	34(100%)
Men (%)	4 (27%)	0 (0%)
Ethnicity		
Asian	3 (20%)	9 (26%)
European	2 (13%)	0(0%)
Middle Eastern	10 (67%)	22(65%)
African	0 (0%)	3(9%)
Educational Qualification		
University education ($\geq$ 3 years)	4 (26%)	4(12%)
University education ($<$ 3 years)	1 (7%)	0(0%)
Adult education at high school level	1 (7%)	2(6%)
High school (3-4 years)	3 (20%)	4(12%)
High school (2 years)	3 (20%)	11(32%)
Elementary school	3 (20%)	13(38%)
Occupational status		
Employed	5 (33%)	2 (6%)
Self-Employed	1 (7%)	0(0%)
Parental leave	6 (40%)	1(2%)
Sick leave	0(0%)	4(12%)
Studying/Internship	1 (7%)	10 (29%)
Unemployed	2 (13%)	0(0%)
Homemaker	0(0%)	8(24%)
Pensioner	0(0%)	9 (27%)
Economic margin		
Sustainable	11 (74%)	2 (6%)
Not sustainable	4(26%)	32 (94%)
Financial fragility during crisis		
Present	5(37%)	12(35%)
Absent	10(63%)	22(65%)

*Note that at time t4, there were only 28 participants in Studies II and III

Participant recruitment was done by face-to-face contact or through the distribution of flyers both in Swedish and Arabic. Participants who were free from disabilities that limit their ability to engage in physical activity were included in the study and no other inclusion criteria were considered. Five participants dropped out directly following the introduction session since the training schedules did not match their private commitments including caring for their children or sick family member, language classes or part-time work schedules. The characteristics of the participants are presented in Table 3.

During the second phase (Studies II and III) three health promoters were involved in recruiting participants. This study included only female participants given the feedback from phase one (Study I) where the need for activities targeting women alone was highlighted. Forty female participants were initially recruited for this study through the distribution of flyers among members of the community. Any female from the neighbourhood without differences in age, language, cultural identities, or socioeconomic status and were physically able to engage in physical activity were included in this study. The demographic characteristics of the participants are presented in Table 3.

Oral health promotion intervention

For the oral health promotion intervention (Study IV), families with children aged between 7-14 years were invited by one of the health promoters who were responsible for the oral health and diet lab. A snowball sampling technique was initially used by the health promoter to invite families with young children to participate in a series of meetings once every two weeks. During the initial session, eight families participated however eventually there were 12 families actively involved with the health promotional activities that were being followed. Almost all families who participated had three children aged between 2 and 12 years. The research team did not collect any demographic information regarding the parents such as their family structure, educational levels, and employment status. The knowledge regarding these however, did emerge from the discussions that in quite a few families both parents were employed. Almost all families were from the Middle East specifically from Iraq, Iran, Syria, and Lebanon. ‘

Assessments

Quality of Life

Health in this project is evaluated based on changes in the quality of life of the residents who participated in the health promotional program, more specifically the CBPR informed physical activity intervention [147]. While some schools of research argue that quality of life to be synonymous with the concept of Health Related Quality of Life (HRQOL). A vast majority believe that HRQOL is a sub construct of QOL [148] which according to the WHO is defined as the individuals' perception regarding their position in life in relation to the context of the culture and value systems in which they live, and further it also related to their goals, expectations, standards and concerns [149]. Given this definition it is evident that QOL is not an indicator or measure of any kind of symptoms or diseases or conditions however it is regarded as a useful tool in measuring the effects of disease or health interventions on the quality of life. In addition, QOL is not synonymous with lifestyle, life satisfaction or mental state either, although these factors may also alter the QOL [149, 150]. QOL has been used frequently in the context of health promotion and is regarded in par with or as even more important than wellbeing or health itself. For over a decade tools assessing QOL is frequently chosen for evaluating efforts targeting to prevent or address chronic diseases given that this type of data can inform health policy, planning, and practice [147, 150].

Two instruments have been commonly used to assess the impact of health promotional efforts on QOL namely SF-36 [151] and World Health Organization Quality of Life Brief Version (WHOQOL-BREF) [149]. For Studies I and II in this thesis the WHOQOL-BREF was chosen given that previous studies show that the SF-36 cannot be applied to studies with heterogeneous age groups since it mainly focuses on disability and functional status measures and may fail to capture individual differences in perceptions about the quality of life as it masks rather than illuminating respondents' views about the outcome [152, 153]. Furthermore, in CBPR studies the daily social context and social networks have an important role in the empowerment and behavioural change process which may have an effect on quality of life. The SF-36 does not directly account for this as it only assesses social functioning [151]. However, the WHOQOL surveys are well aligned with WHO's definition of quality of life, as they included the individual perspective while also including their cultural, social and environmental context [149]. It was developed collaboratively in nearly 18 cultural settings over a long period and has also been field-tested in 20 field centres around the

world. For the studies in this thesis the Swedish and the Arabic versions of the WHOQOL-BREF which were previously validated in the relevant contexts were used [149, 154].

A multidisciplinary team with representatives from 37 different countries of the world representing WHO, developed a long version of the WHOQOL survey with 100-questions at first. This survey was field-tested in 37 locations and after much consideration regarding the length of the survey, a shorter version of the survey with 26 questions was developed by including one question from each of the 26 facets in the 100-item version. WHOQOL-BREF emerged as a valid and reliable alternative to the assessment of domain profiles using the WHOQOL-100. In addition the BREF version was favoured in many contexts as it was less time consuming, easy to understand and thus less burdensome for respondents [149]. The WHOQOL-BREF consists of 26 items, of which two of them (perceptions on quality of life and health satisfaction) were grouped as global items. The remaining 24 items were distributed between four domains namely the physical health domain (7 items), psychological health domain (6 items), social relationships domain (3 items), and environmental health domain (8 items). The domain scores, which were initially calculated, were based on the 26-item scale, and later transformed to the 100-point scale as recommended by the WHO. A higher score indicated a higher quality of life. Questions regarding activities in daily life, regular use of medicine and medical aids, fatigue levels, energy, physical pain, and work capacity were placed under the physical health domain. While the psychological domain score included questions on positive and negative feelings, self-esteem, concentration, self-reported stress, anxiety, as well as body image and appearance. Items such as personal relationships, social support and sexual activity were accounted for under the social relationships domain. The environmental domain were factors related to the immediate environment such as health care access, financial resources, safety, the physical environment and transport [149].

Measures of Behavioural Health

Outcomes of physical intervention cannot be assessed effectively without accounting for the actual levels of physical activity and dietary conditions followed. Physical activity can be monitored using self-reports, biomedical self-monitoring devices as pedometers, accelerometers, and heart rate monitors or through real-time observations [155]. Self-reports are commonly used in research given that they are easy to implement in a complex setting where there may be challenges to achieve participant

compliance and also since they are of lower cost[156]. Furthermore, the biomedical self-monitoring devices more readily available in the market do not access are not suitable for older adults, also they fail to account for everyday activities like cycling or performing household chores that may entail energy release[156, 157]. The participants in this study also agreed on the use of self-reporting survey tools for this purpose so they can also learn about their own results after the intervention.

The questions regarding frequency of physical activity as exercise and everyday activities, together with question on diet (consumption of fruits, vegetables, fish and carbonated drinks), as well as a question on time spent sitting to assess sedentary behaviour were selected from the Swedish National Public Health Survey and used only in Study II [158]. The Swedish Public Health Agency in collaboration with the different municipalities in the country developed this survey in the year 2004. The survey is distributed by Statistics Sweden (SCB) as a national study regarding the population health initially annually and since 2016 biennially. The survey is distributed to a randomized group of 40,000 individuals aged 16-84 years who are representatives of all the counties in Sweden. The questionnaire was available in Swedish and English [158]. Therefore, the research team had taken the help of one of the health promoters to translate the selected questions, which was then back translated by another health promoter to ensure that the meaning of the questionnaire had not been lost during the translation process. In addition, health promoters also tested the questionnaire with few other women from the neighbourhood who were not part of the study to reassure if the questions were understood as they should be. Some of the women who tested the questionnaire could understand both Arabic and Swedish. These women were first given the Arabic version followed by the Swedish version. The responses to the different questions were similar for back translated version and the source questions in Swedish. Large scale studies among Arabic migrant groups living in the region of Scania, in Southern Sweden had also used the same method to translate the National Public Health Survey for the purpose of their research [159]. The translated questionnaire used in Study II within this thesis was also verified to be compatible with the previous study with Arabic migrants.

The questionnaire in general has been validated over the years and in particular, the questions on Physical activity and sedentary behaviour aside of being assessed periodically by the Swedish Public Health Agency, their psychometric properties have also been assessed by the National Board of Health and Welfare (Socialstyrelsen) [158, 160]. Further, the questions selected for this study has also been previously

used in larger epidemiological mapping studies involving migrant and asylum seekers in Sweden and was hence regarded as appropriate for this study [159]. The demographic factors accounted for in Studies I-III such as age, gender, mother tongue, educational qualifications, current employment status, socioeconomic status were also collected using questions from the National Public Health survey. Socioeconomic status was assessed with questions one assessing self-reported ability to pay for monthly household expenses as well as in terms of financial fragility which examines the ability of a household to navigate through a sudden crisis demanding financial resources [158].

Biomedical Assessments

Biomedical assessment of physical health was included in Studies I and II as this was one of the things that emerged in the initial *Future workshop* where the residents expressed the need for evaluating and monitoring their health before and after the physical activity program so as to be able to understand the real impact of physical activity on their body. In line with this six biomedical parameters related to chronic disease and that which may be influenced by physical activity including body mass index, systolic blood pressure, diastolic blood pressure, resting heart rate, blood oxygen saturation and glycosylated haemoglobin were assessed in Study I. These parameters were particularly included given that previous research has shown that physical activity to have can help improve cardiovascular functioning through helping to maintain blood pressure, resting heart rate and blood flow rate [161], and also helps to increase oxygen levels in blood [162]. Further, physical activity is known to reduce the risk of overweight and high body fat percent, which in turn influences the metabolic indicators such as BMI, fat mass and muscle mass [163]. In response to the feedback from the participants in Study I, only non-invasive biomedical assessments was performed, and more parameters were included in Study II.

Body mass index was calculated manually after assessment of height in centimetres measured with a length scale MZ10032 from ADE (Hamburg, Germany). The information was manually entered into the Tanita Model MC780MA (Tokyo, Japan), which although had other functions was used only for assessing weight in kilograms for Study I. During Study II, additional measures such as fat mass and muscle mass were obtained from the Tanita machine. BMI was calculated by dividing body weight in kilogram by body height in centimetres. The Tanita model has been previously validated using extensive studies and is considered a reliable tool in bioelectrical impedance analysis in which muscle mass and fat mass are calculated [164].

Both systolic and diastolic blood pressure in (mmHg), as well as heart rate (in bpm), were measured using an iHealth Sense, Wireless Wrist monitor from iHealth (California, USA). The iHealth Sense monitor has also been validated earlier and is suggested to comply with the European Society of Hypertension International Protocol [165] Oxygen Saturation levels in blood, blood flow rate and stress index was measured using an AngioScan 01 from AngioScan Electronics (Moscow, Russia) by placing the device on the participant's right index finger and the levels are reflected after a few minutes on the computer monitor to which the device is paired. This device has also been previously validated and is regarded as more sensitive in detecting abnormalities in blood flow and cardiovascular stress [166]. Blood flow rate and stress index were included only in Study II.

Table 4: Reference intervals of biomedical parameters assessed in this thesis

Assessed studies	Parameter	Reference Interval
I	Glycosylate Hemoglobin	<6.5% Albashir, Elawad, Khougali 2021
I and II	Systolic Blood Pressure	100–140 mmHg Edeoga, 2017
I and II	Diastolic Blood Pressure	60–90 mmHg Edeoga, 2017
I and II	Resting Heart Rate	50–90 beats/min ESER Industrial Design Co LTD
I and II	Oxygen Saturation	95–99% ESER Industrial Design Co LTD
I and II	Body Mass Index	18.5–25.0 kg/m ² Nuttall, 2015 Tanita Corporation of America 2003
II	Fat mass	15–25 kg Gallagher, Heymsfield et al. 2000
II	Muscle mass	47 to 55 kg Gallagher, Heymsfield et al. 2000
II	Blood flow rate	220 to 400 μ m/s Angioscan 2014
II	Stress Index	50–150 Angioscan 2014

The assessment of long-term glycemic control namely glycosylated haemoglobin in blood (%) was performed only in the case of Study I. Blood was collected through capillary blood sampling to assess the level of glycosylated haemoglobin as an indicator for long-term glycemic control using a Hemo-Cue HbA1c 501 System from HemoCue (Ängelholm, Sweden). The Hemo-Cue Hb A1 c 501 has been validated previously and regarded as an accurate and rapid detection tool in diabetes care [174]. The invasive measurements were not included in Study II as many participants did

not prefer invasive assessments using blood, although considered important it was removed considering participant convenience. In addition, validated assessment tools for measuring blood glucose or long term blood glucose non-invasively are not yet available. The reference ranges for the different biomedical parameters used in this study has been presented in Table 4.

Focus group interview guides

Focus groups were conducted in Studies I and III using a thematic interview guide for self-reflection and evaluation of CBPR interventions and partnerships developed by Wallerstein and colleagues has been field-tested in the United States [175]. The CBPR guide focused on the role of power and trust in relation to the quality of life and further perception regarding control over their life situation, factors that hinder collaboration between the community members and stakeholders, the degree of participation in the intervention, perceptions relating to the existing and lacking skills and resources and most importantly on the outcomes focusing on improved health . The evaluation was mainly based on discussions leading to interactions between participants and had the goal of initiating and adjusting the intervention program [175].

The last focus group in Study III happened during the COVID-19 pandemic and hence additional questions regarding the pandemic were added to the thematic guide. Some of the questions included (a) How has your lifestyle changed since the start of COVID-19 in the spring of 2020? (b) How has it been with following the healthy routines that you learned from your participation in health-promoting activities during the pandemic? (c) What kind of information about lifestyle changes related to the COVID-19 pandemic have you received? The purpose of including these questions was to gain a clearer understanding of how the pandemic was related to by those who participated in the intervention

Data Collection

The data collection for study I and study IV happened parallelly with regard to time since the activities in the different co-creative labs within the larger project were initiated almost simultaneously, although the pace of the activities was not always similar. The multi-staged focus groups followed in Study IV concluded at a time nearly when Studies II and III were first initiated. However, for the purpose of this thesis the studies are presented in the said order.

Study I

In Study I of this thesis data was collected at two time points prior to intervention start (t1) and precisely after the end of intervention that lasted for 12 weeks (t2). A total of four focus group interviews (two at time point t1 and two at time point t2) were conducted with 6-8 participants per group. Focus group interviews were conducted over time with an aim to discuss and understand participants' experiences of the intervention and also the process behind the behavioural change across time. The very first focus group, that happened prior to the intervention start was facilitated by the principal investigator of the larger health promotional program where the author of the thesis acted as an observer. Another member of the research team took the role of the observer during the rest of the focus groups which were facilitated by the author of the thesis. The observer had the primary task of making notes about the actual content of the discussion and any possible non-verbal communications that may not be accounted for in the audio recordings. Each interview lasted about two hours and discussions proceeded until no new information emerged. Participants were informed by the research team during all the focus groups that the discussions were to be audiotaped, and that the data would only be used for research purposes. The interviews were mainly held in Swedish while the health promoters translated back and forth between the participants who only spoke Arabic and the research team.

Quantitative data were also collected at the same two time points using the WHOQOL-BREF survey. The Arabic version of the questionnaire was distributed to the participants by the author of the thesis while the participants were assisted by the health promoter to respond to the questions. The author of the thesis together with the health promoter responded to the queries raised by the participants while responding to the questionnaire.

Invasive and non-invasive biomedical measurement was also made at two points of time once before the intervention started and once after the program ended as was the focus groups and the WHOQOL-BREF survey. The biomedical assessments were performed by a biomedical expert from the Department of Biomedicine, in Malmö University who was also Arabic speaking. The health promoter facilitated the biomedical assessments by scheduling participants to the different sessions and also helped with language translation when appropriate. The Arabic language has several dialects and there was a need to ensure participants and the biomedicine expert understood each other. The participants were provided information by the biomedical expert on what the assessments meant to them and were also given the opportunity to ask questions. The biomedical assessments together with the discussions took an

hour to complete for each participant. The author of the thesis coordinated the practical arrangement and participant scheduling for the biomedical assessments aside of staying alongside the biomedical experts and observing the participants when the assessments were made.

Study II and III

The design of the early measurements at time points t1 and t2 were similar for Studies I-III except that as earlier mentioned, Study II included additional biomedical assessments and an extra survey to access behavioural health. Two additional time points one being a long term follow up 6-months post the intervention (t3) and the other during COVID -19 about a year and a half after the intervention ended (t4) were included with the same assessments earlier used at points t1 and t2 were conducted. It must be noted that the intervention was implemented as a group activity between time points t1 and t2, and between time points t2 and t3 the women were expected to train on their own, with their families or through initiating groups by themselves. However, during time points t3 and t4, the women themselves reinitiated the groups with the help of the health promoters since the pandemic affected their lifestyle and the women sought help and trained together with their groups via Whatsapp.

A total of 16 focus group interviews across the four time points. Around 6-8 women were engaged in each focus group. During the COVID-19 focus groups only 28 participants were available. As in Study I, the interviews lasted for about two hours each. All focus groups were facilitated by the author of this thesis except the very first one during the COVID-19 which was facilitated by the program leader, where the author was an observer. In other occasions, researchers from the research team or another PhD student working with the Women's health co-lab took the role of the observer. Actors from the Malmö municipality were present to listen in to the discussion during the last four focus groups held during the pandemic. All discussions were held primarily in Swedish which was translated back and forth by health promoters for the benefit of women who could not understand and speak Swedish. The focus group interviews were audiotaped with the consent of the participants.

The data collected during COVID-19 differed slightly since it was in line with the recommendations from the Public Health Agency of Sweden. The focus group discussions took place in large spacious room where seating was arranged at two meters distance from each other. The participants were requested to wash their hands ahead

of the session start. Similar precautions were also taken when the biomedical assessments were made. The biomedical experts were extra cautious about good hand hygiene and used gloves and facemasks while performing the tests.

Study IV

During Study IV the participants namely mothers and children were invited by the health promoter to circles that happened on alternate Sundays for a period of one year. Although the health promoter invited both parents to children the fathers only attended the preliminary session after which the mothers and the children were only regular to the oral health promoting sessions. It later emerged through discussions with the mothers that the fathers' felt that in areas concerning diet and oral hygiene the mother's seemed to have a more prominent role in these families and hence the fathers believed that it was good enough if only the children and mothers participated. Aside from the families and the health promoter facilitating the oral health lab, other actors including academic partners, as well as representatives from the Primary Care (Region Skåne – mainly dietist and nurses), and private sector actors as the pharmacologist from the pharmacy and TePe Oral Hygiene Products together with NGOs affiliated to the project namely Save the Children were also present based on their knowledge on topic of discussion. At each meeting the participants explored different themes together with academic partners, and other stakeholders who had subject knowledge on the topic of discussion. For example, when the diet was discussed a dietician from primary care was invited to the circles, similarly when oral health was discussed a pediatric dentist was invited to the circles. Other subjects that were discussed include, child psychology related to behaviour was discussed by a pediatric nurse working with nursing education, and the effect of medicines on oral health was discussed by a pharmacist. It must be noted that not all actors were present on all occasions, the external actors were invited based on the topic of discussion. This was primarily done in order to ensure the power balance in the group so that the families had the space to discuss and reflect. During each session participants first learnt from the invited partner with the subject knowledge following which they engaged in a series of dialogue and reflection together as a group. The sessions usually concluded with discussions regarding the topic of discussion for the next meeting. All participants including the children were verbally informed by the health promoter and the members of the research team that the discussions in the groups were audiotaped while also being ensured that only the research team had access to the audio recordings.

The aim of these meetings was to foster a participatory experience, which emphasized dialogue and reflective action in response to emancipatory health education. Data was collected as in case of any focus group during the 9 different dialogue and reflection sessions which were preceded by the preliminary meeting where the families decided on how the activities in the oral health lab was to be. The discussions were followed in order to understand perceived behavioural change over time. Aside from being audiotaped with the consent of the families, one of the members of the research team also meticulously made observational notes on each occasion. Each session lasted for about 2 hours with 15 min break after the first hour where the health promoters arranged some healthy snacks and fruits (*fika*) which was also regarded as educative as it helped parents choose a sugar free snack for their children.

Data Analysis

Study I

The qualitative data from the focus group interviews were transcribed verbatim. Qualitative content analysis [176] with an inductive approach was used to analyse data from the discussions and uncover categories relevant to the goals of the study. The audiotaped data is transcribed verbatim and was reconfirmed with the audio recording ahead of the analysis. Following this the raw data text is read multiple times to gain familiarity with its content and understanding of the different events being discussed. As a next step phrases that tend to respond to the aim of the study were marked and later grouped based on the similarity between the different phrases. The phrases were then grouped under specific categories. The categories or themes are further revised and refined. Each category is later defined and relevant quotes from the actual data were selected. The process was independently performed by the author of the thesis and another member of the research team. The categories identified by the author and the other researcher was discussed together until a consensus was reached. The results were later confirmed by a third researcher from the team who also thoroughly read the data. The results were then summarized and reconfirmed with the participants to ensure credibility and enhance trustworthiness [177, 178].

The quality of life domain and global items' means scores were compared between time points t1 vs t2 using non-parametric analysis namely Wilcoxon's Signed Rank test [179]. The tests of normality were performed on the results from the biomedical assessments to determine the preferred statistical analysis to be used to examine

changes between the measurements before and after the intervention. The paired samples *t*-test was used for the biomedical health parameters, which were normally distributed. Those parameters that were not normally distributed were also evaluated using the Wilcoxon Signed Rank test. Statistical significance was set at a *p* value of <0.05 .

Study II

The results from Study I were the basis for estimating the sample size for the study II. The sample size for study II was determined by a power analysis [180] based on Study I with sixteen participants who responded to the WHOQOL-BREF questionnaire. With an alpha set at 0.05 and power at 0.80, approximately 34 participants were required to observe a significant change in the scores of the four domains of quality of life after participation in the CBPR physical activity intervention. Since no previous studies using the CBPR approach in a similar context assessed biomedical parameters using novel techniques, it was not possible to perform power analysis based on predicted changes in the biomedical measures. As a first step in the analysis, all data were tested for normality. Wilcoxon's Signed Rank test [179] was used to compare both, data from the two surveys, as well as, biomedical assessments at four levels including t1 vs t2, t2 vs t3, t1 vs t3 and t3 vs t4. Statistical significance was set at a *p* value of <0.05 . The research team chose a more conservative approach by performing a non-parametric analysis over a parametric analysis even though some of the variables included in the study particularly the biomedical variables were normally distributed as the study had a small sample size and ordinal-based data in some of the outcome variables [181]. The Mann-Whitney U test [182] was used to compare median of the baseline data of dropouts and remaining participants to ensure that they do significantly differ and thereby not affect the interpretation of the results of this study.

Study III

The audiotaped data from the focus groups interviews were transcribed verbatim and the transcript was analysed using the different steps proposed by Elo and Kyngäs for content analysis with an inductive approach [183]. The first step in the analysis was through reading of the transcribed focus groups in an attempt to recognize and arrange together texts which were interrelated and respond to the aim of the study. These interrelated texts also called meaning units are placed within a table ahead of beginning the next stage in the analysis process. During the second stage, the meaning

units are condensed into manageable texts. In the third stage, the group of texts codes with broad names while ensuring that these codes are as close as possible to the original data. Similar codes are then grouped into sub-themes. The subthemes were re-checked, reflected upon, and compared to each other, and the original data. The overall main theme emerges from these subthemes and is often a concept that summarizes all sub-themes identified. The initial analysis was performed by two researchers from the team including the author of this thesis and was later verified by a third researcher to increase the credibility of the findings [184].

Study IV

For Study IV which was based on a large amount of data from nine focus groups novel methods were applied to extract and analyse data. The focus group interviews were not transcribed verbatim rather done using the rapid identification of themes from audio recordings (RITA) method [185]. Based on previous studies using this method, the RITA method is less time consuming and less labor intensive while also yielding trustworthy results [185-187]. The author of this thesis thoroughly reviewed audios from the discussions repeatedly to understand and familiarize with the discussions. Keeping in mind the aim of the study a content log of the discussions together with a summary was developed highlighting the key discussions. Rapid identification of codes was done through listening to the recordings multiple times, which was also complemented by including findings from the observational notes. The audio recordings were also heard by two other members of the research team who were not necessarily present on all of the focus groups and identified their own set of themes as done by the author. The two researchers and the author together discussed and reflected on the themes and arrived at a consensus regarding the final set of themes. These findings were reviewed and confirmed by yet another member of the research team who regularly participated in the focus groups. The findings were presented, discussed, and confirmed with the families at this stage. Qualitative content analysis with an inductive approach was used for further analysis of data and finalizing the themes [176].

Ethical Considerations

The work presented in Study I and part of the work presented in Studies II and III were approved by Regional Ethical Committee in Lund (DNR 2018/384, DNR 2019-01741). The studies II and III also conducted during the COVID-19 pandemic pre-

sented in Studies II and III were additionally approved by the Swedish Ethical Review Authority (DNR 2020-04063). Study IV was approved by the Regional Ethical Committee in Lund (DNR 2018/591). All the studies presented in this thesis was conducted in accordance with the Declaration of Helsinki.

Nonmalficence and Beneficence

The design and data collection of the four studies presented within this thesis has considered the ethical principle of nonmaleficence and the health promoting interventions and the evaluations were strictly based on the perceived needs of the community members. On the contrary, the studies were well aligned with the principle of beneficence, in that both the health promotional interventions had the overall aim of improving the health and behaviour of the community members thus regarded as beneficial for all participants. Furthermore, the larger program in which the thesis itself is situated is primarily driven by the residents of the neighbourhood who also direct and control the happenings within the program. The residents together with local stakeholders have also formed an association that supports all the processes within the larger program and ensures that the program is beneficial in that it responds to the need of the communities [140].

Data for studies II and III were collected during the COVID-19 pandemic when the restrictions were relaxed. However, the research team followed the recommendations from the Swedish Public Health Agency during all occasions when data was collected. The author of the thesis contacted the participants via the Whatsapp group the day before the focus groups and ensured that all the participants were free from flu symptoms on the day of participation. On the two occasions the participants met (one for the focus groups and one for biomedical tests and responding to the questionnaires) the participants were requested first to wash their hands on their arrival. The focus groups happened in large spacious rooms with a seating arrangement allowing for two meters distance between one and another. The biomedical experts were extra cautious when performing the assessments, they washed their hands between the test and also disinfected the instruments and the surfaces after each assessment. They also used face masks and gloves for each participant.

The assessments were performed in a room while participants waited for their turn while also responding to the questionnaire in another room to avoid crowding when assessments were performed.

Confidentiality and Anonymity

Research informants involved with studies informed community based participatory research may be regarded as a small easily identifiable group who frequently met in small groups where their identities may not be completely concealable. Furthermore, the health promoters' acquaintance with the participants individually can also be perceived as placing them in a vulnerable circumstance. Thus, they may risk sharing sensitive information or their perspectives concerning public services like health care or dental care both with their fellow participants or in the presence of stakeholders and being held accountable or penalized for it. The health promoters in the larger program were educated in participatory methods as a part of their competence development as they assumed the role of health promoters. This made them accustomed to handling sensitive information discussed during the focus groups. The health promoters and the research team ensured the participants that privacy and confidentiality concerning the data were shared during the discussion. This was also provided in writing to the participants. The trust building phase was crucial in minimizing the sense of insecurity and fear of negative consequences and hesitance to share information among the participants. The other actors who participated especially during the multistage focus groups in Study IV were engaged with the families in the oral health lab from a very early stage in an attempt to build trust. Thus, the families were familiar and comfortable with almost all actors in the group and were not hesitant to share sensitive information including their views and grievances concerning the health care systems.

CBPR method itself is built upon egalitarian principles [94], therefore the feeling of oneness and equality was ensured to all participants from the beginning of the research process by the research team including the author of this thesis who spent time in the neighbourhood in the trust building phase. Ensuring and building trust has been discussed in prior literature as an agreed-upon measure to ensure that anonymity, confidentiality and privacy are respected and maintained [188].

During the focus group interviews in Studies, I and III the issues concerning confidentiality were specifically discussed within the groups and participants were requested to keep the sensitive issues discussed to themselves and only share the knowledge gathered through their participation with others in the communities. The health promotor constantly supported and reassured participants' anonymity, which encouraged the participants to share their views without hesitation. Participants themselves expressed that they only benefitted from their participation since they came to know more people in their community and were not stigmatized in any way owing to

any personal information they shared. Social activities were also initiated by the health promoters to help the participants get acquainted with each other outside the research context as a way of integrating the group and building trust between them. The research team who facilitated the health promotional activities' ensured confidentiality through frequently assessing and discussing these issues with the group through initiating a discussion in this regard after each intervention session concluded. The CBPR focus group guide also included questions relating to challenges related to the partnership between members in the group during the intervention.

Parts of the data collection in studies III and IV were conducted during the COVID-19 pandemic which has been a very stressful experience for the entire world in that research shows that desperation, panic, heightening of the preexisting trauma, mental health vulnerabilities and poor communication are common problems making populations in general more vulnerable. Given that the aspects of research conducted during COVID-19 were based on an ongoing process built on trust, and that the participants were well acquainted with the others in the group the challenges related to confidentiality seem to have been bested and this was also evident from the results of the study. However, the research team regarded it as a responsibility to assure confidentiality particularly with regards to the participants study records which may be important at all times and more than ever during the pandemic when data was collected for studies II and III. Participants were assigned a unique identification number from the very beginning for both studies I-III that was applied to all data and research records related to the particular participants. A key Word-document file that links names and codes is kept in a separate and secure location far from research records and is handled only by the author of the thesis. Audio recordings and transcripts of interviews especially during the COVID-19 where participants expressed their grievances concerning health care personnel and also shared their family members and friends experiences on being diagnosed with COVID-19 (in case of study III) were stored securely locked in a special cabinet together with surveys the participants responded to (Studies I and II) and was handled only by members of the research team.

Yet another challenge in CBPR related to ethical principles is that it may be difficult to completely conceive the identities of participants. Participants may or may not be willing to be named or even credited for something that is co-produced, like in the case of Study IV where families together developed a brochure and only some were willing to include their names in the credit section. Some participants said they were not willing to disclose their identity owing to their migration status, means of survival including financial support received from the state. This is also of particular concern

when participants in all the studies were engaged with the research team for a prolonged period threatening their anonymity owing to familiarization. Another aspect that could be considered a challenge is that the health promoters had assessed participants personal information as well as details concerning their physical health from the biomedical assessments which the participants may or may not want to share with others in the neighbourhood. In the case of Studies, I and II the data assimilated in form of surveys and biomedical assessments were collected and handled by the research team. The results were only presented at a group level to the participants although individual participants could access their own results.

The problem of confidentiality and anonymity can also be challenging when children are involved particularly when they are in the same context as both their parents and other adults since complete confidentiality can never be guaranteed. This was something to consider for the health promoters and the research team in the case of Study IV in this thesis. More specifically the children and parents were together in the activities which may have felt overpowered or perceived lack of confidentiality while discussing in the groups. The health promoters, together with a research team ensured that the children felt comfortable in the study. The children were asked one on one if they would like to be part of the activities before engaging them in the group. Children in this study expressed that they felt more secure when they participated in the group together with their parents. They were also involved during the discussion and always had opportunities to discuss and reflect. They played a major role in deciding topics for every session and were very involved in the groups. The use of photos was also a favourable method according to previous research to help gain confidence among children [189].

Informed consent and voluntary participation

The research team assisted by the health promoter informed all participants in the four studies about the research goals verbally during the very first meeting during all four studies. Participants also received written information together with the contact information of the research team involved both in Arabic and Swedish. The participants were informed that participation was voluntary, and they could leave the study at any point in time. All participants signed informed consent, and these consents were preserved in another cabinet than the audio recordings and the surveys.

Health promoters were responsible for mobilizing participants for the different activities. There may be a risk that they may force family, friends or relatives into partic-

ipation. However, it must be noted that health promoters in this project are representatives from the community who volunteered to help improve health in their neighbourhood. They only motivated fellow citizens to participate through sharing their own experiences of participation in health promotional activities and thus created interest among the others in the community. Health promoters were trained in dealing with similar issues from time to time by local experts within the team and also worked in close collaboration with the PhD student (the author of this thesis). The research team ensured that the participation is voluntary through verbal discussions, in addition to obtaining written consent from the participant. The information was preliminarily provided in Swedish and was explained and clarified by the health promoters to participants who could only speak Arabic. The author of the thesis was in regular one-and-one communication with the participants through Whatsapp to ensure that participation was voluntary through engaging in discussions with the group ahead of the beginning of the activities. The participants were also provided with the full contact information in writing of the research team and were encouraged to contact the research team if they had questions or concerns.

Co-ownership and conflict of interest

In the case of Study IV, information or knowledge is shared and all outcomes are co-produced. However, when it comes to the dissemination of results the community partners have little role. The activities described in study IV of this thesis led to the development of a culturally appropriate brochure displaying sugar content in different food items commonly eaten by members. Community members contributed with pictures of food items and decided which food items should be included in the brochure, the academic research partners, and health care workers together with the participants calculated the sugar content in the selected food. The private actors in this project facilitated the printing of brochure copies. These brochures are co-owned by the community members and were intended as a way of giving back to the community in contrast to research that merely results in academic publications and reports. Another aspect of Study IV is the involvement of actors from the private sectors in the core research team. The involvement of a private company may be regarded as a conflict of interest as they may be mistaken to have hidden agendas with their two roles especially while working with vulnerable populations. However, the representative from the private institution involved in Study IV was the head of Research and Scientific affairs of the organization. The representative was also a Paediatric Dentist

who could share her knowledge as a dentist with the group in addition to understanding the needs of these communities to develop a solution based on communities own needs.

RESULTS/FINDINGS

The results of this thesis are presented in two parts, where the first part will focus on the CBPR informed physical activity intervention which will be described in two phases. Phase I will include the development and initial evaluation of the CBPR informed physical activity intervention and Phase II will detail out the long-term evaluation of the CBPR informed physical activity intervention. In the second part of the results section, findings from the participatory evaluation of the oral health promotional activities shall be described.

Evaluation of the CBPR physical activity intervention

Phase I - Qualitative findings

Using qualitative exploration, the research team at first attempted to rationally and subjectively uncover the underlying process that determines the outcome of the intervention through engaging the fifteen participants in a discussion regarding the strengths of the CBPR physical activity intervention as well the aspects that need to be improved. These results were further complemented by quantitative evaluations to assess the effect of the intervention on the physical health and quality of life of the participants. The views of the participants from Study I regarding participation in CBPR intervention was described based on four main themes namely sense of fellowship, striving for inclusion and equity, changing the learner perspective and health beyond illness.

Sense of fellowship

The participants initially expressed that they had to be motivated by the health promoters to be regular to the training sessions since they lacked motivation. For a short

while in the beginning participants also said that they were hesitant to accept that they had to be in unfamiliar surroundings since they for a long time had led an isolated lifestyle and were not acquainted to situations meeting new people. Over time, however participants perceived a sense of fellowship within the group and started to feel a connection with others, which motivated them to be regular to the group activities. Participants explained that it was a question of respecting a commitment they gave to their group that motivated them the most to participate in the intervention without missing sessions. Given the isolated lifestyle they had led before engaging themselves in the physical activity group, the participants also appreciated the social aspect of being in a group intervention since they had opportunities to make new friends and expand their social network. They suddenly felt that they knew many more people from the neighbourhood since they recognized faces when they were in the supermarket or the neighbourhood square which in turn made them feel safer in their neighbourhood. These factors led to them to become more physically active. In addition to learning for themselves in the group, they also wanted to share their own knowledge with others in the community by being role models. Overall participants believed that intervention when offered as a group motivated them to be physically active.

"It was nice training with the group. Because we laugh, we talk, it's fun for us, so. When we train by ourselves, it's boring. It's not possible" (*Post-interview, female*)

Striving for inclusion and equity

Participants in this study also described the problems owing to isolation and lack of social inclusion as reasons for physical inactivity specifically among women in the neighbourhood. Many women were unaware of the opportunities available in their locality and thus did not engage in physical activity. While initially participants discussed the lack of possibilities to engage in physical activity, after participation in the intervention and gaining the skills, they felt more confident and started to believe that had a role and can be part of building social health through creating an environment where everybody cares for the other and nobody is isolated or left out. Participants in the group also mentioned three main reasons for physical inactivity particularly among women in the neighbourhood namely family situation, psychosocial problems and a general disinterest in physical activity owing to lack of motivation. Participants perceived that women in the neighbourhood were responsible for the general maintenance of the household including cooking, shopping, and caring for children, which kept them busy that they had no time to exercise. The participants

also added that women suffered isolation, socioeconomic problems and mental distress owing to their lifestyle and could not afford to pay for gyms even if there were any exclusively for women. In addition, women in the group themselves discussed the traditional restrictions against training in public places and together with men. Even though there were women who wanted to train their desires were limited by the lack of activities adapted to their needs. In summary, participants highlighted the need for the physical activity intervention to be inclusive of women and that by having groups that are exclusively for women in the neighbourhood.

“There is no access to training or physical activity targeting women in the locality. There is a need for training or swimming or something else that is adapted and is only for women. They just sit here and cook or sew or do something. But do nothing special like exercise.” (*Pre-interview, female*)

Changing the learner perspective

Participants in this study had a general sense of dependence on the health promoter or other participants at the beginning of the intervention program but after participation in the intervention program, they also said that they started to trust in their own capabilities given the knowledge they gained. While in the beginning before the intervention they said that they believed there were here to learn but after participation they started to believe that not only could they change themselves and their families in terms of becoming physically active they also desired to become coaches and thus change agents for their community. They also expressed through being certified as health ambassadors after completing the intervention they became even more confident to pursue others in their near surroundings to train with them. In short, they believed that the health promoters kindled their initial motivation to train, without which they would not have broken their isolation and learnt means to be physically active to the extent that they could also help others.

“I think, I would like to be a coach like a training group leader and show others what I have learnt.” (*Post-interview, female*)

Health beyond illness

Several participants who in the beginning reported that they were motivated to train since they wanted to see changes in their physical health in terms of weight loss. They believed that measuring health and monitoring their changes was good for them since they learnt more from it than they did in primary care, which they seldom trusted. However, with participation and time they realized that they had to focus on being healthy and training rather than deriving motivation from the physical effects on the body. Almost all participants reported that they felt better after participation in the intervention program even if their physical conditions may not have reflected on it. Hence measuring health over time and gaining knowledge regarding the different health parameters was regarded as an important component in the intervention, especially since it initially motivated the participants to be more physically active.

“I have no confidence in the health care system, so I felt it was so luxurious to do tests. There came a guy there and we asked about everything he tested, what does that mean? What does this mean? How can I do that? Can I do something about it?” *(Post-interview, female)*

Phase I - Quantitative findings

The perceived well-being and quality of life after physical activity was also reflected in the results from the subjective assessments of the intervention. There was a significant increase in scores of the four domains and one of the global items namely the self-rated health satisfaction of WHOQOL-BREF assessed after the intervention (t2) ended when compared to scores from the responses at time point t1 ahead of participation ($p\text{-value} < 0.05$). There were no significant group differences in glycosylated haemoglobin, resting heart rate, systolic and diastolic pressure, as well as BMI on comparing after the intervention compared to that before. However, there were notable individual changes for select participants particularly for those who had higher levels of glycosylated haemoglobin ahead of participation in the intervention.

Figure 3: Median differences in the WHOQOL-BREF scores between the two time points

Action points

The results of the initial exploration and evaluations were used to optimize the implementation of the intervention further to address the needs of the residents in the neighbourhood in the next phase. Participants did not perceive any difficulty in responding to the surveys used during phase I and were curious to understand the results. The health promoters also reported that they did not experience any challenges in administering the survey. The research team discussed with the participants of Study I regarding the study design, and the participants perceived the need to be monitored for a longer period since they were curious to know if the health parameters may change with time. Considering these aspects two extra follow-ups were planned 6-months and one year post intervention with a similar mixed method design evaluation. However, the emergence of the COVID-19 imposed slight delays in the last follow-up, which also allowed assessing the impact of the intervention in the context of the pandemic in maintaining health and behaviour. The results from the WHOQOL-BREF survey assessed in the feasibility study also informed the calculation of sample size for the main study. The participants also appreciated the possibility to assess their physical health using biomedical tests as they believed that it gave

them evidence of the health impact of the intervention, which further motivated them to be physically active, rationalizing the need to keep even this part in the evaluation of the intervention. However, many participants perceived invasive assessments as uncomfortable and stressful, and preferred the non-invasive tests. The behavioural health survey was also included in the next phase to understand the frequency of engagement in physical activity and changes in diet, particularly given the long-term follow-up in the absence of organized group activities.

Some practical implications from Study I were considered in the implementation of the intervention in phase II. The foremost aspect considered was the need for separate activities for men and women and also the immediate need to focus on women, since they were isolated and suffered from stress and anxiety issues. Secondly, the uptake of interventions was perceived better when offered as a group activity. Finally, the need to offer the intervention at least twice a week was given that participants had the liberty to choose between sessions according to their convenience and also that more participants could be accommodated.

In the phase II, both quantitative (Study II) and qualitative (Study III) assessments were performed in an attempt to understand the impact of the intervention on health of the women and to further elucidate its implications during the COVID-19 pandemic.

Phase II – Quantitative Findings

Among the 40 women who were initially invited by the health promoters two participants decided not to participate since the schedules on both Wednesdays and Fridays did not match their other commitments. Three participants were excluded from the study since they did not participate in two or more of the 12 occasions when the intervention happened. Only 34 (88%) attended at least 10 of 12 occasions and performed all assessments until time point t3. All of them were Arabic speaking although some spoke English fluently. At the final follow-up during COVID-19 however, only 28 participants were available, since two participants had not returned from their home country due to international travel restrictions and unavailability of flights. At least three participants who were over the age of 65 years did not want to participate since they considered themselves high risk groups.

Table 5: Median differences in baseline QOL and behaviour between participants vs those lost at follow-up

WHOQOL-BREF	Participants in study N=28 Median scores (Range)	Participants lost to follow-up N= 6 Median scores (Range)	p-value
Physical Health Domain	56.0 (69)	59,5 (43)	0.38
Psychological Health Domain	56.0 (56)	66.0 (31)	0.07
Social Relationship Domain	65.5 (44)	62.5 (50)	0.62
Environmental Health Domain	56.0 (62)	55.5 (44)	0.11
Perceived Health Satisfaction	3.0 (4)	3.5 (3)	0.3
Perceived Quality of Life	3.0 (4)	4.0 (2)	0.09
BEHAVIOURAL FACTORS	Participants in study N=28 Median scores (Range)	Participants lost to follow-up N= 6 Median scores (Range)	p-value
Everyday activities	2.0 (6)	2.5 (6)	0.65
Physical activities	1.0 (5)	2.0 (5)	0.61
Vegetable intake	3.0 (5)	3.5 (5)	0.92
Fruit intake	5.0 (6)	4.0 (3)	0.60

Table 6: Median differences in baseline assessments between participants vs those lost at follow-up

BIOMEDICAL ASSESSMENTS	Participants in the study N=26 Median levels (Range)	Participants lost to follow-up N = 8 Median levels (Range)	p-value
Systolic Blood Pressure	129 (62)	116 (60)	0.13
Diastolic Blood Pressure	60 (37)	81 (39)	0.80
Resting Heart Rate	76 (30)	82(13)	0.05
Body Mass Index	31.2 (22.7)	26.6 (16.3)	0.26
Fat Mass	28.3 (42.5)	23.8 (26.2)	0.37
Muscle Mass	46.6 (23.4)	14.8 (17.2)	0.16

The health promoters were informed that one of the participants who was initially scheduled for the biomedical test was diagnosed with COVID-19 two days ahead of the assessments and could not participate. The baseline or pre-study (t1) data from 28 women who participated in all four occasions when data was collected between t1-t4 were compared with baseline data from 6 drop-outs for examining differences in scores for quality of life, initially reported health behaviours and most importantly the biomedical parameters including systolic and diastolic blood pressure and BMI.

No significant difference for any of the analysed parameters was found when comparing baseline data between women that participated in all the time points and those who dropped out.

On comparing the domain and global item scores of the quality of life survey over the four-time points there was a significant increase in the scores for the physical health domain, psychological health domain, social relationships, and environmental health domain after the completion of the physical activity intervention (t2) compared to that before the intervention. However, the effects tended to disappear at the first follow-up t3 which was 6 months after the completion of the intervention which coincides with a period when the group activities were paused. While other domains and the global item quality of life remained unchanged, there was a significant increase in the environmental health domain and self-reported health satisfaction significantly increased at time point t4 (during COVID-19).health domain after the completion of the physical activity intervention (t2) compared to that prior to the intervention. However, the effects tended to disappear at the first follow-up t3 which was 6 months after the completion of the intervention which coincides with a period when the group activities were paused. While other domains and the global item quality of life remained unchanged, there was a significant increase in the environmental health domain and self-reported health satisfaction significant increased at time point t4 (during COVID-19). The pattern of changes in quality of life domains and global items compared between four time points is presented in figures 4-5.

Figure 4: Pattern of change in the quality of life domains over four-time points

Figure 5: Pattern of change in global items over four-time points

The results from the behavioural survey show a significant increase in physical activity levels between t1 vs t2 as well as between t2 and t3. However, there were no significant changes in leisure time physical activity during COVID-19, compared to that at point t3. There was a significant increase in everyday activity levels and consumption of fruits and vegetables between t1 to t2, t2 to t3 and even t3 and t4. The other behavioural factor did not change significantly in response to the physical activity intervention. A pattern of changes in behaviour compared between four time points is presented in figures 6-9.

Figure 6: Pattern of change in health behaviours over four time points

The biomedical parameters including systolic blood pressure, diastolic blood pressure, blood flow rate and fat mass reduced significantly at time point t2 compared to t1. However, only systolic blood pressure significantly reduced further at time point t3 compared to t2, while there were no significant changes in other parameters. However, the diastolic pressure of participants in this study which remained nearly the same at points t1 and t2 reduced significantly at time point t3, 6 months after the intervention ended when compared to that at time point t2. All biomedical parameters remained stable and within reference intervals at time point t4. Pattern of changes in biomedical parameters over the four-time points is presented in figures 6-9.

Figure 7: Pattern of change in key cardiovascular markers over four time points

Figure 8: Pattern of change in other cardiovascular markers over four time points

Figure 9: Pattern of change in metabolic risk markers over the four time points

Phase II - Qualitative findings

The women's perceptions concerning the impact of the CBPR informed physical activity interventions on the health was explained by an overarching theme From Ambivalence to Decisiveness which emerged from four subthemes wavering between frustration and recuperation, shifting from prioritizing family needs to taking control of self, between isolation and social support, and unavailable specialist knowledge to the utilization of internalized knowledge (Study III). The subthemes evolved from understanding of the process which women perceived to have gone through that led them to change their behaviour, while also influencing the external factors that determined their lifestyle and thereby improving their health. The perceptions were followed over time across four time points baseline (t1), Post-Intervention (t2), Long-term follow up (t3) and During COVID-19 (t4).

Wavering between frustration and recuperation

Stress was described as a common problem among women in the study. Women also expressed that they were burned out owing to household work which kept them bound to their homes. Despite having lived in Sweden for a long time many had not had the time to learn the language, which restricted them from finding a job, making them completely economically dependent. Women perceived frustration owing to their situation and also since they could not understand vital information and regulations from different societal actors as health care and social care. Despite the awareness concerning the ill-effects of a sedentary lifestyle, some women in the group said their lack of social life and impending thoughts about the conditions in their homeland

affected their mental health. The women also added that they did not receive help catered to their own needs from the health care which made them feel helpless.

“Before I easily got annoyed and angry. I was insecure and afraid all the time. Since I started training with the group, I have become calm and happy. I think physical activity has unique effect on our mental health ” *(Woman participant, Post-Intervention)*

Through participation in the intervention, changing their lifestyle to be more physically active the women said that they had experienced relief from their stress and frustration. Women also reported that they could think better and did not often have mood swings as they did before. Women believed that realizing the effect of physical activity motivated them to make it a routine and during the long term follow-up they started to feel frustrated only when they could not be physically active. Women also reported that the initial phase of the COVID-19 pandemic had laid an additional toll especially among those who had experienced stress and anxiety earlier. Women recollected that when they could receive no external help, they decided to draw on their inner strength based on the knowledge gained from the intervention to revive themselves from the situation. They said they had decided to at least go on walks in the absence of group activity instead of merely locking themselves in owing to fear, as they knew from their experience that physical activity gives relief from stress and anxiety.

“After participating in the group activity, I have become accustomed to being active and exercising. If I do not do it, I start to feel sad and frustrated”

(Woman participant, Long-term follow-up)

Shifting from prioritizing family needs to taking control of self

Women in the group said that they tended to prioritize their family needs first as it was their tradition. Furthermore, women also were responsible for all the household work including nurturing children, that they hardly focused on themselves, or their own health needs. Some women also experienced guilt if they did not perceive their family needs ahead of their own and had the thought that they did not care for their family especially their children. Despite their initial hesitance of being judged the woman felt motivated to join only since they were invited by the health promoters. After participation however, the woman believed that the intervention gave them the possibility to think in a new direction. This according to them made them view their life situation with a new perspective since it also took into consideration their family

circumstances and did not merely offer knowledge that was not responsive to their situation. They also started to understand that if they were not healthy, they may not be able to sufficiently care for their family. The women also reported they inspired their children and spouse to lead an active life.

"I have come to understand that healthy women mean healthy family, because we tend to the family, we cook and care for our children." (*Woman participant, Post-Intervention*)

The participants believed that the intervention was meaningful to the women in the neighbourhood only since it was designed based on their own needs. Women perceived that by creating a welcoming environment for them, listening to their views, and including them without judging their practices they started to believe that they were also part of the society and that they were important. During COVID-19 the women believed that despite that they were initially frightened, rebuilt themselves and also supported the family. They even trained together with their families using daily objects as bottles of pickled cucumber in place of weights.

"It finally felt like our views were heard, that we were important and in fact I started to believe that I am important" (*Woman participant, Post-Intervention*)

Between isolation and social support

Women in the study initially decided to participate in the intervention owing to the social aspect associated with it such as making new acquaintances that may help break their isolation. Women in the group said that they initially lacked motivation and needed to be persuaded by the health promoters to leave their homes although they were quite aware of the benefits of being physically active. Although some women also reported that they were unaware of all the possibilities available in the neighbourhood for being physically active, they also said that the little facilities that they knew existed like gyms were expensive and thus they could not afford it. Women also added that these gyms were not suitable for them since the women did not prefer to train in the presence of other men owing to their family traditions. Further women outlined that although there were a few parks and outdoor training possibilities in the neighbourhood there was a general sense of insecurity owing to violence and crime in the neighbourhood that refrained them from utilizing these facilities. Women also reported they lacked the motivation to train all by themselves even if they wanted to try being active from within their homes. Post-participation in the physical activity

intervention women believed that engaging in group physical activity and meeting people motivated them to leave their home breaking their isolation which even helped to relieve their anxiety and grief. In moments when the women perceived a dip in their motivation, they were motivated by the other group members through a Whatsapp group created by the health promoters. Women also felt engaging with the group for a long time and regularly made them feel more secure in the group that they were able to share their thoughts and concerns freely without feeling threatened about their privacy. They also believed that through connecting to more people from the neighbourhood they started to perceive a sense of security while moving around the neighbourhood since they started recognizing more familiar faces and felt at home. Furthermore, some women said that their definition of health was very much influenced by the social circle in which they mingle, and that they could perform or train better in that circumstance than being all alone. They also said that while training together they could motivate and also challenge each other to do better. Women in the group said that they became so attached to their group that they felt sad if they did not meet each other once a week.

“I have no one in my life and was in a lot of grief, but when I started in the group and met others here, I started to be very happy. It now feels like I have a big family”

(Woman participant, Post-Intervention)

During the long-term follow up when regular group activities were not available the woman perceived they did not feel motivated to train by themselves and that it even made them depressed, since they had learnt that they had to train for their sake but could not do so despite the knowledge. Women felt that the being in the group strengthened them in a special way that they constantly felt motivated to be active and this they could when training alone. Women who could gather small groups to train said they had a practical challenge given that they did not have access to spacious training rooms and even could not organize or schedule the activities as systematically as the health promoters. Women insisted that it was not just gathering in the group that gave the experience since some of the women engaged in other group activities did not feel strengthened in the same way. Some women raised the example of a sewing circle where they felt that there was no interaction and sharing of views between members in the groups, since they sat quietly in circles and sewed. Similarly, some participants had also tried other physical activity groups in nearby localities, but the training was very different and was not adapted to the individual needs, the group was stressed since they neither had been corrected nor helped by the facilitators

of the training, and there was no opportunity even to communicate with others training with them either. Women also said that in the CBPR informed physical activity intervention group they had the opportunity to discuss their own views and relate them to others experiences while also giving each other tips. Women pointed that such an interaction only motivated them to make changes in their own lifestyle. During the COVID-19 pandemic the woman experienced isolation yet again due to the physical distancing recommendations which led to social distancing. Many women said they felt captivated initially until they decided to contact the health promoters urging them to reinstate group activities. Social media especially Whatsapp became means of communication breaking their isolation. The women said that although there were many social media support groups and channels providing information regarding COVID-19 they trusted only the groups created by the health promoters as they thought it was more locally relevant and even was adapted to their own needs. They also said that they shared health tips and COVID-19 related information with each other via Whatsapp. Women said they perceived a certain comfort in those groups given that they knew other members and they could freely contribute to the group and learn from each other as they did before during the intervention.

"I do not like social media and stuff like that. But I am in a group created by the health promoter and other women in the area who came with me to the training. We share knowledge with one and another in the group and we compete for being the first to share information, it makes it fun and I think we feel more stronger when we are learning together though we cannot meet in person ." (Woman participant, During COVID-19)

Unavailable specialist knowledge vs utilizing internalized knowledge

Women in the group expressed a general dissatisfaction among community members with the support received from the health care staff who they believed did not understand their needs. Women believed that the health care was unlike that in their homeland and the nurses and even the doctors seldom offered them sufficient time to explain their problems, nor gave them health-related advice. The women highlighted that language was not a barrier since even women who could fluently communicate in Swedish perceived a lack of help from the health care side. The woman said that they could not understand the Swedish health care system in general and had difficulties to navigating through the different levels of health care providers such as nurse assistants, nurses, doctors, and specialists. Although many woman in the group who were suffering from problems such as diabetes, hypertension and muscle dystrophy

and were informed that they must be physically active, they believed that they never received the necessary support and motivation from the health care staff. Following participation in the intervention women reported they were able to change their routine and become physically active. The participants also reported that their diabetes nurse at the health care became pleasantly surprised when the women's blood sugar and blood pressure levels had significantly improved. Many participants also said that their knee problems had resolved, while some others had lesser body pain than earlier and some even reported that they had lost weight all of which the participants perceived to motivate them to continue being physically active. The women believed that the difference between the advice from the nurse and that from the health promoters was that the health promoters came from a similar context as the women and were aware of the women's cultural and traditional circumstances. Moreover, the women said they saw the health promoters as their role models since the health promoters only recommended that they have tried and has had an impact on their health.

“It is important for us to know what improves health and also controls blood sugar and hypertension which is a common problem here, nobody has told us things so clearly not even my doctor” (*Woman participant, Baseline*)

Women diagnosed with diabetes who visited a medical doctor during the pandemic for control reported that the doctors never discussed COVID-19 and its impact on diabetes or high blood pressure. Participants said that due to the precautional recommendations they followed during the pandemic there were changes in their lifestyle, which they felt that the doctor neither discussed nor gave specific recommendations to maintain health during the uncertain times. The women also said that the knowledge they earlier had gained through the intervention was still within them as an inner resource. They said that all they needed at that crucial times was some motivation or a little reminder from the health promoter to become physically active and healthy. The women also said that they received many brochures and information leaflets during the pandemic. They also learnt that there were several resources on the internet providing information and health tips. However, the women said that they decided to hold on to one resource and that was from the health promoter since they could not understand many things that were presented on the local television or the internet and were not sure if they could trust those sources. The women also believed that in the group created by health promoters they had the opportunity to discuss and understand recommendations from the local authorities and their implications which they felt also brought them closer to the local actors despite language barriers.

“I am on Whatsapp only in certain groups created by health promoters with other women in the area. Here we have all the activities we used to have before even group training. This is how I also get all-important information that is summarized in a simple language. This way we get to understand what local authorities really recommend.” (*Woman participant, During COVID-19*)

Evaluation of process and health related behaviour following the Oral health promotional activities

The Sugar brochure was an important practical implication from this study (Study IV) which also had a role in inducing behavioural change among the families and even others in the neighbourhood via the families. The process of behavioural change among mothers and children through participation in the CBPR oral health promotion over eight months was made understood using three themes namely including meaningful social interactions, family dynamics and health trajectories

Co-production of a Sugar Brochure

During the initial culture circle sessions, it emerged from the discussions that the health related information material and brochures available in Sweden particularly in the dental care as well as with the diabetic nurses which outline the sugar content in the different food products are believed to be adapted to the local Swedish context. These brochures highlighted the positives and negatives of consuming certain Swedish food which was seldom part of the diet these families consumed regularly. The families also felt that they appreciated the way the sugar brochures showed the sugar content but believed that if it also included the food, they consumed it can benefit them and even others in their neighbourhood. Thus, it was determined within the group to co-produce a unique sugar brochure that caters to the needs of their neighbourhood and also other similar contexts around Malmö. The participants themselves selected and photographed the food they wanted to include in the brochure with the support of the research team. The diabetic nurse together with the rest of the research team helped the participants understand the ingredients in different packaged food and from there on to calculate and convert sugar content from grams to cubes. The pictorial representation of sugar content as cubes was particularly appreciated since it was easy for all age groups to understand. The brochure was then printed in multiple copies by private company TePe who was part of the research team and was distributed to the participants. The brochure was regarded by the families as a piece of evidence when discussing and spreading the knowledge gathered from the sessions

to their families and friends in the neighbourhood. Copies of the brochure were also shared with the primary care, maternity care, and dental care for further use within the different organisations. The mothers started an oral health promotional drive in the neighbourhood known as “Fight against sugar intake” using the brochures. The children also spread the initiative in the school and were appreciated by their teachers who wanted them to make this more regular. Thus, children expressed their desire to educate themselves more in detail about oral health which also led to a one month specialized education for children in TePe. Following this these children were also certified as oral health ambassadors particularly spreading the knowledge in their respective schools.

Process of behavioural change

Meaningful social interactions

The mothers in this study reported that they initially decided to participate in the study as they knew the health promoter and believed that she would only recommend the best for their family. Over time the mothers said that they began to appreciate the social aspects associated with their participation as they usually sat idly home during weekends while children spent time watching television or playing games on the telephone. Although mothers reported that the social aspect was enjoyable, they also felt that they appreciated the opportunity for interaction while also fulfilling the primary motivation for attending these sessions as it benefitted themselves and more particularly their children thereby making normal social interactions also meaningful. The mothers explained that from the beginning they expressed their desire to gather knowledge on oral health and diet since their children consumed a high sugar diet and also had several decayed teeth. The parents felt that the social context motivated especially the children to actively engage themselves since they otherwise did not like to learn about their oral health or diet from their parents or even the health care personnel during their dental care visits or at the primary care. Mothers in the group also believed that they received better health-related information through their participation in the activities when compared to the information they received from a nurse at primary care. The appointments at the hospital or primary care were of short duration and that they could not discuss and reflect on different perspectives as they did in the group. While the mothers said that the presence of the experts was beneficial in initiating the discussion in the right directions, the fact that they had the possibility to steer the discussion also made these sessions meaningful for them. Mothers believed that learning was also better in the groups as they shared tips and some even

had similar experiences which made it comfortable for them to discuss. Some mothers initially said that they were unsure if they could change their diet but with time and regular engagement in the group, they believed that they also could change. Further they also expressed the desire to be change agents for others in the community. Children in the group reported that they enjoyed participating together with their parents and other children. They also said that they wanted to be child health ambassadors for oral health in the neighbourhood for which they also wanted to gain additional knowledge on oral health through a special education program.

Family dynamics

Oral health related behaviour in participants was reported to be strongly influenced by the family dynamics, which included the role of the mother as primarily responsible for the children's needs. Some working mothers initially said that they had challenges in monitoring the diet consumed by their children especially when they were at work. The children reported that the fathers were unaware of the dietary requirements as the mothers always cared for it in many households in the neighbourhood. Children said that in the absence of their mother they consumed a high sugar breakfast during the mornings. Mothers and children both expressed that they consumed tea with several spoons of sugar as part of their tradition in the initial meetings. After participation in the activities, both the mothers and the children reported that they gained social support from fellow participants through discussions and tips, which were reported as motivational and beneficial. Working mothers said when they used the tips, they received from others in the group to prepare breakfast for children the earlier night they realized that they could help their children eat healthy, which made a huge change in their daily life and they also said they felt satisfied. Children on the other hand said they started to be more conscious about what they were consuming and even on occasions reminded the mothers regarding sugar content in various foods based on the knowledge they gathered during the activities. Mothers said that they initially did not believe that they could motivate their husbands to change. After participation in the activities when the mothers and children decided to change their dietary intake the fathers themselves decided to change. Almost all mothers reported that the fathers became self-motivated on observing the mothers and children. Some children said that they discussed with the fathers with the support of the sugar brochures that the group developed as part of the activities which further made the fathers more interested to change their diet.

Health trajectories

During the initial discussion mothers said that they decide to participate because it would benefit their children and even improve their oral health. Over time mothers themselves changed their diet and began to realize the relationship between oral health and general health since the changes they made in their diet also help them lose weight and feel mentally stronger and better. Mothers who initially felt out of control said they started to feel relieved that they provided a healthy diet to their children. Both mothers and children benefitted much from the brochure they together developed with the research team as part of their participation. They reported that it was very useful as a shred of evidence in their venture to spread the knowledge they gained as oral health ambassadors for their community.

Figure 4: The process of empowerment and behavioural change in families

METHODOLOGICAL CONSIDERATIONS

In this thesis both quantitative and qualitative methods were applied within the different studies. The choice of methods for studying the impact of the two health promotional initiatives was both based on the community needs and was also influenced by the characteristics of the health promotional initiative itself. The design of the CBPR informed physical activity intervention accommodated the possibility to include both quantitative and qualitative assessments before and after the intervention, given that the citizens engaged in structured intervention for a short period of time. Thus, there was a need to use multiple methods to recognize and understand the complexities of the context while also accounting for the diversity of the communities so all voices can be sufficiently heard within the short duration of time. According to Creswell (2009), when the problems to be addressed is complex, the combine use of both quantitative and qualitative approaches provides a broader understanding of the problem.

Revisiting the choice of CBPR approach

The four studies within this thesis have shown that through pursuing community-inspired health promotion work using a CBPR approach has been fruitful in the chosen neighbourhood since it led to improved health outcomes and empowerment among the citizens. CBPR as an approach created a context for citizens whose opinions were usually not considered in health promotional work, to discuss their own health needs with others from the neighbourhood. They also together were involved in developing strategies to improve their own health as well as the health of others in the neighbourhood. Aside from creating a context for developing health promoting interventions, CBPR approach also allows measuring health related outcomes within its design. Within the CBPR approach partnership was established and dialogue was

initiated in the context of this thesis at different moments using different action-oriented methods such as photovoice, culture circles, and multistage-focus groups.

Despite the strengths of the CBPR approach in the context, it may be a concern that the participants included may not be representative of the neighbourhood as a whole. In particular, the CBPR informed physical activity intervention was quantitatively evaluated to examine impact among a small group of participants from the neighbourhood. Although having a larger group may have certainly been desirable, participant inclusion in CBPR studies is also based on the participants own needs and choices. Participants in all the four studies in this thesis were a select group from the 150 individuals from the neighbourhood who initially engaged in the *future workshop* within the larger health promotional program. The participants in Studies I and II were those who specifically highlighted physical inactivity as one of the challenge areas during the *future workshops*. Further the results from both studies I and II showed that the CBPR informed physical activity intervention induced change in behaviour and improved health not only among the participants in the study but through them it also reached their families and other friends in the neighbourhood.

Previous studies using a CBPR approach have showed that including a smaller group of participants initially seemed to be beneficial in that it paves way to gaining trust among seldom accessible citizens living in vulnerable situations [134]. In one of the studies in the current thesis, participants themselves highlighted that their views were never given importance earlier and including their own views and going by it was the reason why the intervention was successful. Prior studies have also identified that populations living in disadvantaged and vulnerable contexts were traditionally approached by researchers with their own agenda which seldom considered the actual needs of the population. The impact of such a research seemed to diminish when the actual research project ended. In addition, the populations in disadvantaged neighbourhoods are often believed to be exhausted and overwhelmed by the academic researchers approaching them to engage in research projects that may not be relevant to their context as they seldom perceive tangible results following the research activities [191, 192]. On the contrary, all the participants in the studies included in this thesis and those even in the larger program were extremely receptive to the health promotional efforts as it emerged directly from their needs and more importantly since they could continue to influence the decision making throughout the process.

CBPR is a collaborative effort where aside from the participants and the academic research team who facilitated the process, the health promoters, and other societal actors from public, private and NGOs were also involved in the larger program in

which this thesis is included. The presence of other societal actors gave opportunities for the participants to learn about the role of the different actors in the society and also engage in knowledgeable dialogues with them as that in the oral health promotion lab in the context of this thesis. The participants always outweighed in number in the different labs, compared to other societal actors and thereby had an upper hand throughout the process of decision making. Thus, power conflicts which may be expected in such a collaborative environment were completely eliminated in all the labs within the larger program.

The health promoters who were part of the core research team in the larger program were instrumental in facilitating the activities in the different labs communicating both verbal and the written information about the research studies together with the other members of the research team. Their task was not restricted to managing the labs and recruiting participants, as they were also actively engaged in the development and planning of health promotional work as part of the larger program. Including health promoters actively has motivated prolonged engagement of the participants as shown in the oral health promotion lab and the physical activity lab. One aspect to consider when discussing the role of health promoters working closely with members of their own neighbourhood is the possible risk of participants being forced to take part which can be regarded as an ethical and methodological challenge. However, the health promoters, as part of the larger program, were educated in participatory methods by academic researchers and practitioners. They also regularly reflected and documented the processes within the labs which were then shared and discussed with the research team. They also received support from CBPR practitioners to handle conflicts and difference of opinions that may emerge within the labs so as to ensure an open, respectful, and pluralistic environment. The tasks carried by the health promoters in this thesis and within the larger program were thus well aligned to both ethical and utilitarian goals.

In addition, in the case of this thesis, the author also, a PhD student in the larger project worked in close collaboration with the health promoter. The author communicated with the health promoters and even the participants on a regular basis to ensure that participants were fully aware that participation was voluntary and that they did not feel pressured to be part of the labs. Furthermore, in one of the studies within this thesis, the participants themselves stated that they considered the health promoters as role models since the health promoters recommended to them only that they themselves practiced. The participants in this thesis were inspired by the health promoters since the health promoters themselves practiced all that they shared with the

participants. For example, the health promoters became physically active themselves, trained regularly and even changed their diet. Prior research based on CBPR approach also shows that involving fellow members of the community, also known as culture brokers or lay health promoters as part of the research team as advantageous given their knowledge on the local conditions, community needs, and most importantly the cultural norms that may hinder or support research participation [193, 194].

The activities within the labs in the larger program, including those included in this thesis, were offered in the neighbourhood so as to increase accessibility to the participants, which was also in line with their needs described during the *future workshop*. The labs were in general open for all residents in the neighbourhood irrespective of age, gender, and ethnicity. However, in the case of this thesis, the participants were predominantly women which may raise concerns about the sampling and analysis given that the fathers or men in general were not sufficiently represented. The inclusion of only women was not an active choice by the research team or research criteria rather a need that emerged from the residents themselves. In the Study I within this thesis both men and women were engaged in developing and experiencing the intervention, however during the discussion, it emerged that there was a need for activities that are exclusively for women, since they often did not have a social context to be in and perceived to be isolated. They had little time for themselves and were also bound by traditions which limited them to train with other men and hence local gyms were out of bounds. Even if there were specific hours for women in certain gyms, the women could not afford the fee due to their economic situation. Another study, from the larger program showed that women in the neighbourhood experienced physical and mental health issues owing to perceived lack of support from health care [195]. The participants' perceived needs are regarded as the basis for determining the research goals and design in all studies within the larger program including that in this thesis thus, studies II and III included only women.

In Study IV although children together with both their parents were initially invited to be part of the activities the fathers were present in the very first focus group when parents discussed the diet and oral health conditions of the children. However, despite inviting the whole family to the activity sessions, only the mothers and children were present. Again, it may be noted that the research team did not make an active choice to not include fathers. However, the findings from the study IV in the current thesis revealed that, despite not being active participants, the fathers had also changed their diet and consumed lesser sugar after observing the changes among the mothers and children who participated regularly in the study. Thus, despite the non-participation

in the intervention, the fathers still gained knowledge through the mothers and started to consume a healthy diet. Thus, it may be seen that mothers and children were means to reach fathers.

Although the four studies within this thesis showed that health promotional initiatives had a significant impact on the health and behaviour of the members of the community who participated in the intervention, the lack of control group may raise concerns regarding the conclusions that can be drawn from the results particularly in the case of studies I and II. However, the design of the studies was also driven by the participants from the neighbourhood who wanted the health promotional initiatives to be open for all without differences. In addition, controlled intervention trials are often required to control the research context, however CBPR highly values the contextual aspects, in the process of capacity building, and empowerment [196]. Using control groups may also undermine the principle of egalitarianism in CBPR in that all health related resources and support should be equally available to all members of the community. Previous research suggests that implementing controlled evaluation of CBPR interventions may require the full support of the communities involved, and they may even propose the need for alternative support activities for these groups which may not be cost-effective and also be time consuming to implement and monitor [197].

The role of the health promoters has also exceptionally contributed to participants' prolonged engagement in all the four studies within this thesis particularly during Studies II - IV. However, in the Studies II and III, some of participants could not participate particularly during the COVID-19 which may have undermined both the quantitative and qualitative results of the studies. Given that in the current thesis the reasons for non-participation were directly pandemic-related, the methodological considerations were outweighed by the ethical values of beneficence and nonmaleficence. The research team prioritized the health and wellbeing of the participants and the health promoters during the pandemic and meticulously followed the recommendation from the Public Health Agency of Sweden. Though the loss of follow-up in Study II was less than 20%, the difference between the participants who were lost during follow-up vs those who remained in the study the baseline data from the behavioural assessments, the domain scores of the WHOQOL-BREF and the key biomedical data including blood pressure, resting heart rate, BMI, muscle mass and fat mass were compared to identify significant differences between the two groups using non-parametric test. The results of the Mann -Whitney tests show that the women who dropped out were not significantly different from the ones who remained in the study. Previous research also elucidates the experiences of loss of follow-up during

COVID-19 was most commonly due to inability of the participants to be present when data is collected or completing parts of the study owing to COVID-19 related reasons [198]. Similar methods as used in case of Study II within this thesis were applied to previous work to identify significant differences between the groups. In case of significant differences, the assessments were complemented by sensitivity analysis in those studies [198, 199].

Evaluation

The CBPR approach within the larger program not only created a context for the residents in the neighbourhood to identify health related problems, determine activities and define the research questions but also to determine how the activities are to be evaluated. Particularly of interest to this thesis is that the research questions and the criterias for evaluation were discussed already in the first CBPR planning sessions within the two labs. With time the research questions were also further developed within the labs, while also assessing means to address various challenges that emerged during the process of implementing the health promoting activities within the labs.

Using the CBPR focus group guide

The CBPR processes were continuously evaluated in all labs as part of the larger program to understand how the collaboration between participants and other collaborating actors as well as academic researchers worked and how it contributed towards improving health among residents. This was done through initiating regular dialogue and discussions between participants in the respective labs together with health promoters within focus groups facilitated by the research team using the CBPR focus guide [175] for a prolonged period of three years as part of the work within the larger program. The interview guide helped assess aspects such as level of participation in the activities within the concerned labs, trust in the collaboration with other actors, challenges, and favorable conditions for neutralizing power, and most importantly the outcome of the activities. Yet another advantage using the CBPR guide was that the evaluations were ongoing and thus created room for adjusting ongoing activities to the changing needs of the residents of the community. One example from the context of this thesis is that the discussions lifted in the focus group discussions conducted during the COVID-19 pandemic, where the needs of the participants were constantly assessed, and the activities were readapted according to the circumstance.

The citizens who engaged in the studies within this thesis were predominantly Arabic speaking, however the official language used in the research project was Swedish. Hence all the focus group discussions in Studies I,II and IV happened primarily in Swedish and the health promoters helped to translate the information back and forth in Arabic to the participants and Swedish to the research team. The reliability and validity of the qualitative data collected need to be considered with caution when discussions are translated back and forth between the participants and the research team by the health promoters who were not professional interpreters. However, in this context, these health promoters were also members of the same community, they could speak the local dialect and thus could explain to the participants in a colloquial language that is understandable. In addition, the author of this thesis also had a dialogue with the health promoters ahead of each focus group discussion and informed them of the importance of reproducing the discussion as accurately as possible. It may be argued that the health promoters were better-suited in this context as interpreters since they not only spoke a more colloquial language but were also persons who the participants trusted and would not mind sharing information with. Having lived in Sweden for a long period all the health promoters within the larger program were also fluent in Swedish and hence the back and forth interpretation happened in a hassle free manner. Prior studies from a similar context show that use of fellow community members as interpreters may be beneficial in that they would not only translate the discussion but also help the research team understand the inner meaning of certain discussion which are embedded within the communities cultural and traditional values [200].

Development and translation of the behavioural health survey

In accordance with the participants' own needs that they would like to follow change in behaviour and its impact on their health over time, level of physical activity, sedentary behaviour and diet were assessed in Study II using selected questions from the Swedish National Public Health Survey. This survey was administered annually among the Swedish population aged 16-84 years for over two decades. Although the Swedish National Public Health Survey has several sections, specific questions related to the aim of the study were only chosen. The use of these questions was considered appropriate for this study, since the questions were aligned to the recommendations for physical activity and diet proposed by the Public Health Agency of Sweden, as well as the WHO. The National Public Health Survey is a multidimensional survey developed based on selected questions from several regional surveys aiming to assess health and lifestyle of the populations. Although the use of only part of the

questions from the National Public Health Survey may raise a concern, it is noteworthy that given the psychometric properties of the National Public Health Survey as a whole have not been assessed previously, since the original survey itself addresses each question as its own unit and not as a part of a group and no total scores are calculated, but rather individually followed-up longitudinally. On the contrary only the construct validity of the individual items was tested by the Swedish Statistics Bureau through a theoretical evaluation aiming to understand if the item sufficiently measured what it was intended to measure. The question on levels of physical activity and sedentary behaviour have also been validated by previous studies [201, 202]. Further, the questions on food and diet have been validated by the Swedish Food Agency (*Livsmedelsverket*) [203]. Thus, using these questions has also facilitated the future possibility of compare the national data with that from residents in the neighbourhood.

The participants in the Study II were predominantly Arabic speaking and thus all instruments were required to be available in Arabic so they could themselves understand the questions and respond to it. Although the WHOQOL-BREF was available in Arabic, the National Public Health Survey was not. Hence, one of the health promoters helped translate the survey to Arabic. Another large scale study also from the Scania region Sweden have used the same survey questions among newly arrived migrants and have also applied similar methods to translate the National Public Health Survey for the purpose of their research [159]. It was noted that the questionnaire used in Study II was comparable to that used in the other study.

Previous studies also argue that language translation and cultural adaptation are to be considered in research with surveys administered in multilingual and multicultural contexts. This is given that respondents should themselves be able to grasp and interpret the questions and even the response so as to be able to provide a response that best reflects on their actual thoughts without the need for external support [204]. Back to back translation has been used in behavioural science and social science for translating surveys for over three decades. Despite its challenges it has been regarded as one of the most efficient and less time consuming methods when the steps in translation are performed meticulously [205].

An alternative approach to translation of the surveys was face-to-face survey interviews, where a member of the research team or any other person who is aware of the research goals and is fluent in both the respondents language and the language in which the survey is available help the respondents through clarifying the questions and marking the responses for the participants. However, even such a method could

also be prone to reliability related issues and in addition be susceptible to interviewer and information bias [206]. Although the research team did not elucidate the psychometric properties of the translated survey used in Study II given the small group of participants included, all results were reconfirmed in the focus group discussions (Study III) which also happened parallelly. The use of mixed methods increased the validity of the study further.

One of the strengths of studies I and II measured is that a wide variety of objective health related outcomes in relation to participation in the CBPR informed physical activity intervention were measured. However, concerns may arise regarding the possible confounding factors which were not accounted and that may have possibly influenced the results such as intake of medicines and participation in other activities. Although confounding factors may not have been accessed statistically, participants from both studies also engaged in focus group interviews aiming to understand the impact of the intervention and the process of change. During these interviews, the research team also initiated discussion regarding other factors that may accelerate or hinder the impact of the intervention. The overall findings from the focus group discussions confirmed that the intervention did play a role in behavioural change and health improvements irrespective of any other activity they engaged in since the participants mentioned that they disliked other interventions they tested and did not last more than one occasion. However, it also emerged that many participants consumed medication for blood pressure and diabetes regularly, which may have potentially influenced results of the biomedical assessments in particular. These participants also had regular contact with the primary care to monitor their health. During the discussions it also emerged that the behavioural change was also recognized by the healthcare personnel since the participants had long been advised to improve their lifestyle which they had difficulties with. The participants themselves perceived that the intervention changed their life unlike any other initiative they have followed previously. Previous studies have also shown the process evaluations as valuable tools to rule out potential confounders in the absence of quantitative data [207, 208].

The use of non-invasive biomedical assessments in Studies I and II were regarded as less intrusive and less time consuming means to screen health in populations who otherwise perceived lack of awareness about monitoring health using portable diagnostic instruments. The biomedical assessments were used in accordance with the residents' needs that highlighted they wanted to learn more about their physical health measures and that they wanted to be followed over time to understand changes in their health following their participation. Previously studies have also highlighted the

need for improving access to non-invasive health assessment tools to help self-monitor and understand the health status among populations living in vulnerable situations especially in disadvantaged neighbourhoods [209, 210]. Although the Studies I and II included several interesting risk markers for cardiovascular disease and even metabolic disorders, glycosylated hemoglobin which was assessed in Study I was not included in Study II. This may have raised concern given that glycosylated hemoglobin is an important marker that can be altered following physical activity according to previous studies [211]. Glycosylated hemoglobin was measured invasively using blood samples drawn from the participants during Study I. The results of Study I showed that the participants perceived invasive tests of blood as uncomfortable and painful. The research team together with the participants decided to totally omit this parameter in Study II since there is a lack of validated non-invasive glycosylated hemoglobin measure. Although the glycosylated hemoglobin is an important parameter, the use of the CBPR approach in Study II the design was influenced by the choices of the residents in the neighbourhood.

While the research team has validated the biomedical devices used in the context of research [212], the reliability of the measures was significantly questioned by the loss of data despite being collected systematically from the participants. The missing data was a result of technical errors rather than human error. All biomedical devices used in Studies I and II were directly connected (using a cable or via Bluetooth) to a laptop computer. A technical error is said to have occurred during the automatic data transfer process between the non-invasive diagnostic apparatus to a local computer where the data from all the devices were sent to and stored. This led to exclusion of values for individuals from certain devices while the data from other devices with stable connection to the computer was still available. The loss of data for different parameters within Study II was observed during several time points but for different measurements at each time. Although we did not systematically account for bias, the last observation carry forward method was applied to observe possible significant differences in the obtained results. However, the results remained unchanged even after. In addition, we also performed the Mann-Whitney U test to examine participant data at baseline to observe for significant differences between the groups in relation to a certain biomedical parameter and no differences were found between the two groups. Despite the limitations of the last observation carry forward method, it has been used over two decades to access missing data in Biomedical science [213].

Data analysis

The choice of non-parametric analysis

The quantitative data for Studies I and II were both longitudinal over time, the comparison of means was done using paired sample t-test for normally distributed biomedical data and Wilcoxon's Signed Rank test was used to compare medians of the other parameters which were not normally distributed. However, evaluating interventions using biomedical data have the tendency for non-human related errors and in particular among studies that involve a small number of participants parametric tests have been regarded as unsuitable [214, 215]. Moreover, given the loss to follow-up and technical errors leading to missing data in Study II, the test for normality may not reflect the true distribution of the data. Thus, parametric analysis was not considered in the Study II and all data were analysed using non-parametric analysis namely Wilcoxon's Signed Rank Test since it does not make prior assumptions about the population under study and was thus considered suitable in the given context. Although the choice of non-parametric analysis is regarded as a more conservative approach than parametric, the results must be interpreted cautiously since they are viewed to have lower statistical power.

The choice of the RITA method

In Study IV which had a qualitative approach, the audiotaped data from the Multi-staged focus groups were not transcribed verbatim ahead of data analysis. An alternative method namely the Rapid Identification of Themes from Audio (RITA) [216] where analysis is conducted by repeatedly listening to the recording was chosen for since the data analysed was obtained from nine focus group discussions each lasting two hours. The research team including the author of this thesis regards this method as less time consuming and more efficient. Although previous research suggests that the transcribed text is critical for the chosen analytical method and design of study as it facilitates the analysis by placing the researcher closer to the actual data. In addition, a workable data text also helps in coding and analyzing data. However, transcription is also said to have its limitations in that written text differs from the actual words spoken in terms of grammar and phrase construction [217]. In the context of the Study IV, it was believed that accurate transcription of the data cannot always be achieved since the discussion in focus group interviews were not entirely based on what the individual is actually saying but the social and cultural circumstances surrounding the conversation. The process of transcription itself has in addition been

regarded as an interpretative action where the text is merely a representation of what is heard and how it is perceived by the person performing a transcription [218]. The research team in Study IV chose RITA method not only because it is time and cost effective but also since it facilitates analysis which captures the non-verbal cues including silence, tone and even the emotions displayed in the voice of the participants which is usually lost when the material is transcribed. In the case of Study IV, many discussions by the children and mothers involved sensitive issues which were either accepted or even rejected by other participants using non-verbal cues. Further, this method also kept the researchers as close as possible to the participants' own voice while also following the interactions between participants even when listening long after the focus groups were completed. Previous studies also suggest that non-verbal cues play a role in the reliability and validity of interpreted results of a qualitative study [218].

Qualitative Rigor

Similar to testing validity and reliability of results in quantitative studies, qualitative rigor is regarded as a means to ascertain robustness of the findings from studies with a qualitative approach. Three of the four studies within this thesis (Studies I, III and IV) were CBPR studies with a qualitative approach. Given that all the three studies are built on the CBPR ideology of collaborative and equitable partnerships between the research team and the community members all through the research process, the data accumulated through this partnership presumably meets the criteria for achieving the four principles of qualitative rigor namely credibility, dependability, transferability, and confirmability. However, an attempt to fulfil these goals within the studies required to be meticulously assess the methodological and practical aspects pursued during the respective studies.

Credibility

Credibility in qualitative research is established through understanding if the study measures what it intends to sufficiently in that it reflects on the reality and elucidates the truth of the findings [219]. Credibility in all the Studies I, III and IV within this thesis was ensured through prolonged engagement with the community which assisted the process of building partnerships which was based on mutual trust between the research team and the participants. This partnership was also further strengthened by the active involvement of the health promoters. This partnership ensured that the

participants shared a true account of their thoughts during the discussion. Furthermore, the research team also continuously summarized and reconfirmed the main findings with the participants to ensure that the participants' thought have been accurately interpreted. In addition, the research team also presented the results of all the three studies ahead of submitting them for peer review in scientific journals. The debriefing of results was held on three different occasions to the concerned participant groups who also had the opportunity to reflect and reconfirm the findings thus ensuring its credibility. In addition, all the focus group data were analysed by three researchers (one of which was the author of this thesis). Two of the three researchers at first worked individually and later collaboratively to discuss and summarize the results. A third researcher who independently analysed the material reconfirmed the results summarized by the first two researchers. This method known as investigator triangulation, also contributed to ensuring credibility of the findings. One possible risk to credibility of the data is participants who were lost to follow-up whose voices may have raised critical aspects related to improving the intervention further. However, it is noted that those who dropped out predominantly did so due to the unavoidable circumstances surrounding COVID-19 and may not have differing views to those actually present, since the participants have been reflecting on their views together as a group through social media.

Dependability

Dependability concerns the integrity of the study. Dependability is the measure of consistency of the findings of a qualitative study if the study was repeated in the same context [219]. Dependability in Studies I, III and IV was achieved through investigator triangulation. In addition, in Studies I and III triangulation of methods was also used where quantitative assessments were made in parallel to the qualitative assessments to ensure dependability. Although the context of the study was subjected to constant change which may have threatened the dependability of the findings since, the findings may be reflective of the context in a particular time point. However, involving participants in the decision making process in Studies I, III and IV helped constantly reassess the changes and continuously define the research design that clearly corresponds to the aim of the research.

Transferability

Research is regarded as transferable when the study of similar design could be applicable in other communities or contexts [219]. Given that communities even within

the same city vary widely with regard to their perceived needs which may be connected to the local and environmental factors that are also significantly different between neighbourhoods or districts [220]. In order to achieve transferability, the research team have provided a comprehensive and robust account of experiences during design and data assimilation of Studies I, III and IV. Furthermore, the findings have also tried to highlight the social and cultural aspects that may influence the behavioural changes following the CBPR informed Physical activity intervention and the CBPR based Oral health promotional activities. The methodological aspects both surrounding the development of the intervention and the contextual aspects particularly the neighbourhood characteristics including the underlying problems faced by the communities were also described clearly for all the three studies. Memos planning meetings ahead of data collection were also written systematically and shared with the members of the team. Observational notes were made for all focus group interventions which were used to understand the non-verbal and methodological aspects that were considered during the focus group discussions. Baseline demographic data were also collected in Studies I and III which provided a description of the population characteristics.

Confirmability and Reflexivity

Confirmability is the extent to which the findings of the study reflect participants' own words without being influenced or biased by the researchers' perceptions or observations. In addition to investigator triangulation, confirmability in studies I, III and IV were achieved through presenting and discussing the findings with the health promoters and the participants to ensure that the researchers have not misinterpreted their thoughts. During this session the participants were also allowed to add new information, as well as rectify any misconceptions made by the researchers. During this session the participants confirmed that their views have been accurately captured and that they did not have anything further to add to the findings presented.

Yet another term discussed together with confirmability is reflexivity. Reflexivity is a type of awareness that a researcher should reflect upon given that their own thoughts, actions, and experiences from similar situations may inevitably impact the interpretation of discussions between the participants. Research shows while reflexivity may affect the confirmability of the results, the lack of reflexivity may also hinder the recognition and understanding of the cultural and contextual factors which may influence the research process [221]. Previous research suggests that the re-

searchers age, migration status, gender, mother tongue, political ideologies, traditional beliefs, and emotions affected the interpretation of research findings [222]. The author of this thesis, and the rest of the research team are from different backgrounds to that of the participants which may have resulted in the analysis of the data from a multicultural perspective particularly in Studies I,III and IV. In addition, all these three studies were also CBPR studies and are equity-focused where power relations are balanced with the partnership between community members and the research team. However, if the researchers do not consciously pursue the research process reflexivity may influence methodological, epistemological, and ethical decision making at all stages [223]. The author of this thesis has consciously reflected on her own pre-understanding based on her background as an immigrant and periodically discussed this within the research team which predominantly included native Swedish persons. In addition, the mutual trust established between the participants and the research team facilitated co-learning where rich perspectives from the participants emerged. The position of the author as an immigrant additionally created a sense of comfort among the participants and thus willingly shared their views particularly about their cultural and traditional beliefs without fear of being judged or misunderstood. During the analysis of data, the author of this thesis also observed an extra conscious outlook in order to prevent her own perceptions influencing the interpretation but rather completely engage with the data itself so as to produce a more comprehensive analysis.

DISCUSSION OF FINDINGS

The overall aim of this thesis was to explore the impact of a community-based participatory research informed health promotional activities on the health of communities living in a socially disadvantaged neighbourhoods in Southern Sweden. The four studies included in this thesis shows that active participation of citizens from a disadvantaged neighbourhood led to increased social support and a sense of community which mediated empowerment. In addition, perceived social support strengthened the empowerment processes among individuals and in the group in such a way that it led to behavioural change and improved health among the participants which they further spread to their families and friends in the neighbourhood resulting in increased community capacity. Although the evaluation of the CBPR informed physical activity intervention showed that all perceived health effects diminished six months after the group intervention ended, despite those participants continuing to be physically active. Further, the CBPR informed physical intervention also facilitated reestablishing social support during the COVID-19 pandemic when recommendations for physical distancing were in place which seemed to have contributed to increasing community resiliency in the neighbourhood. However, it must be noted that not all parameters related to health improved especially during COVID-19 when the perceived quality of life remained unchanged compared to a head of the pandemic, although participants perceived to be satisfied with their health. In addition, most of the biomedical parameters neither worsened nor improved during the COVID-19 pandemic while they only remained within normal intervals, thus indicating that health was maintained.

Social support for breaking isolation

The results from all four studies showed that the citizens living in the disadvantaged neighbourhood perceived that they were isolated since they were unemployed, had

large families living in a small apartment and could not afford to go to activities because of their socio-economic situation. At the beginning participants in Studies I-III further added that many of them experienced increased anxiety and mood swings owing to being lonely and isolated. There was also a general dissatisfaction among the citizens regarding access to health care which seemed to have affected their desire to seek help. Previous studies have also shown that citizens living in disadvantaged situations particularly migrants tend to experience isolation as a result of lack of social interactions which led to lack of life satisfaction, depression, perceived poor quality of life, consumption of poor nutrition, and even immune suppression [224]. Prior research also suggests that community initiatives, aiming to promote health and reduce health inequalities among citizens living in disadvantaged neighbourhoods should address social isolation given its deleterious health outcomes.

After participation in the two health promotional initiatives described in this thesis participants met with others from the neighbourhood with whom they were not previously acquainted. Although the participants were initially hesitant to meet unknown people, they seemed to be pleasantly surprised after participation since they became bonded with each other in short duration. Previous studies show that individuals from isolated communities often tend to seek social support only from their family members or friends and not from unfamiliar networks [225-227]. In the current study however, social support was derived from the health promoters and other members who were individuals with whom they were not acquainted since earlier, motivating them to participate in the activities instead of sitting idly at home. Furthermore, it also heightened the participants' sense of security in the neighbourhood, and they started to become more open to interacting rather than being lonely.

The participants in all four studies following participation in the studies felt that they had found an extended family in form of the group whom they could trust and confide in without feeling threatened. Previous research shows that frequent social interactions not only with friends and family but also with other non-kin, have the potential to initiate the development of a general sense of trust which emerges following the shared social experiences or mutual problems and goals of the members in the group. However the previous study also pointed that bringing together groups unknown to each other may threaten their sense of security putting them out of their comfort zone [227, 228]. The current study on the other hand shows the value of a CBPR approach in addressing social isolation through promoting social cohesion between a group of

community members bound by similar problems and thus building community capacity which led to empowering individuals and thereby influencing behavioural change and improved health.

The results from the Study IV also showed that it was not just about being in a group but rather the interactions between the group members that made the whole experience unique. It also emerged in Study III that the CBPR informed physical activity intervention group differed from the other group activities like sewing circle where women also came together as a group however, they hardly interacted with each other and always focused on their own sewing task. Previous research on loneliness and isolation shows that the quality of the social interactions within the groups plays a significant role in ensuring health outcomes in individuals who had otherwise been isolated [229]. While several studies have previously identified the value of group interventions in changing behaviour and improving health the actual factors initiating social interactions are not clearly described since these factors were observed to be constantly changing given the ever evolving local needs [224]. In the group health promotional activities described in the current thesis participants believed that the uniqueness of these initiatives was that the group members had a context that they themselves could influence, where they could constantly engage in dialogues and motivate each other. They also received support and feedback from the health promoter and the other group members. The activities were perceived as educative, while also relaxing and enjoyable since the participants also had the possibility to laugh and converse socially.

The studies within this thesis also added although social aspects were the initial motivation to participate in the health promotional activities interaction, it was regarded highly not only because it helped in breaking isolation but also since the time was spent meaningfully learning, reflecting, and sharing knowledge related to health. In addition, the results of Studies I, III and IV also showed that the dialogues and reflections with the other group members helped build collaborative skills and collective knowledge which also made the participants believe in their own abilities and gave a new meaning to their life. This is in line with prior studies which also show that social support mediated the implementation of CBPR informed health promotion [230].

The participants in all four studies said that the social connections motivated them to be regular during the sessions. Particularly in Studies I and III it also emerged that when any of the participants ever felt low or if their motivation to train dipped at any point of time, the others in the group would motivate them to join. The CBPR health

promotional group initiatives seemed to have created a context for the group members to exert a positive interpersonal influence on each other which led to them taking control over their own health and practising healthy behaviour. Previous studies evaluating a culturally sensitive health promotion intervention among newly arrived Arabic migrants in Sweden also showed that social support motivated the adoption of health behaviours and increased health literacy [231]. Studies also show that creating a participatory environment boosts the self-confidence of the participants, since the context offers them the opportunity to engage in the joint learning and decision making process which help promote empowerment [232]. However, this study was not based on Community based participatory research and did not include a long-term evaluation of the intervention where participants were active in the evaluation of the intervention. The social aspects were also particularly of interest in the case of Study IV where social interaction between children also showed promising results relating to behavioural change where children reported consuming lesser sugar, and healthier food after participating in the intervention. An earlier study also shows that social interaction shapes children's cognition and alters their attitudes and beliefs which leads to behavioural change [233].

Results from Study II shows that social aspects of being in a group had a strong relationship to perceived health and related quality of life. This is given that the absence of the structured group physical activity facilitated by the health promoters between time points t2 and t3 led to poorer perceived health. In particular the connection between social support was further strengthened with that the social relationships domain of quality of life which measured personal relationships and social activity considerably increased immediately after participation in the intervention. However, the social relationships domain score drastically dropped during the long-term follow-up, six months after the structured group intervention ended and continued to reduce even during the pandemic when no physical distancing led to lack of social contact which clearly showed that social relationships had an impact on the quality of life of the participants. This shows that not only when social support was available but even its absence made a difference in how women perceived health, pointing to a strong correlation between social relationships and perceived health in this group of women.

Even though participants continued to be physically active as reflected from their self-reports on lifestyle. This yet again retorts on previous studies that show that lack of social support was related to perceived health [224, 226, 229, 234]. However, the participants perceived the CBPR informed physical activity as unique since from

Study III, (where participants from Study II were engaged in a focus group discussion) it emerged that during the COVID-19 pandemic when physical isolation was recommended, they were well aware that it would affect their mental health from their prior experience. Thus, they immediately sort the help of their group via social media. They only connected to this group since they trusted the group members and were comfortable sharing and receiving knowledge only from this context. The four studies are also related to Wenger's Community of practice [235], when a group of individuals who shared a domain of interest are gathered, they tend to build relationships that enable them to help each other, share information in that group and even learn from each other. They seem to start valuing their collective knowledge and are bound to trust each other even if they were not known to each other from the beginning. Here in the case of this thesis, the participants who came together although belong to the same neighbourhood were not priorly acquainted with each other. They were only bound by a common goal which was to improve their health, which as Wegner suggest, helps them build trustworthy social relationships that became the basis for them to form learning networks where they could share their experiences and stories while also identifying tools or means for addressing their problems and supporting each other in the process.

Thus, the four studies within this thesis show that CBPR informed health promotional group initiatives engaging participants actively in the research process increased social support which motivated behavioural change and thereby improved health.

Behavioural change and changes in health status

Behavioural changes were reported in all four studies within this thesis. Participation in the CBPR informed physical activity intervention led the participants who were initially isolated and idle to make physical activity a routine. They continued to be physically active even after the intervention ended and even perceived a sense of guilt when they could not be physically active on occasions. They also started to perform more everyday activities to avoid a sedentary lifestyle. A previous study among women migrants in the USA, showed similar results following participation in a CBPR physical activity program. However, the qualitative exploration of the women migrant participants in that study showed that they experienced language barriers that limited their interaction with the fitness expert who facilitated the study. This may have challenged the perspective of long-term compliance to physical activity among the participants given that they may have challenges recalling what they have learnt

after the intervention ended. Longitudinal assessments were however, not made in that study [236].

Participants both mothers and children in Study IV, reported to have consumed lesser sugar and had become watchful of the ingredients in all food items they consumed. Mothers in this study were initially unsure if they could themselves change their poor food habits, because they had not self-reflected on their own behaviours. However, the interactive reflective dialogue sessions stimulated the mothers and even children to reevaluate their own behaviour, while also being exposed to alternatives behavioural choices simultaneously. The participants also received motivation and support from other members of the group who also discussed their own challenges. The group members even discussed tips and suggestions towards improved oral health and diet. According to Paulo Freire, knowledge gained through dialogue and reflection enhances individuals to take control over their situation and thereby achieve their goals, which in the case of the current study was to change their lifestyle [237].

A previous study among immigrant families in the United States also showed similar changes in dietary patterns among mothers. However, in contrary to the current study, the health promotional initiative did not have an effect on the children's behaviour [238]. The children in Study IV were engaged in the problem identification and also planning the oral health promoting activities. Furthermore, children were also involved in the development of the sugar brochure which motivated them to keep watch on their sugar intake. Another Australian study with a CBPR approach among migrant families with children aged 1-3 years also focused on diet and oral hygiene [239]. The children in the Australian studies were toddlers an age group where parents seemed to have better control over their health and behaviour, compared to children in the Study IV within the current thesis who were in their pre-teens. Behavioural interventions in children within the age-group of 9-13 years have been regarded as more effective when offered as a family compared to merely offering parents support as similar information reaches children and parents simultaneously so they can together come to consensus regarding the action [240]. Participation in the CBPR informed physical activity intervention also induced changes in dietary habits, given that participants began consuming more fruits and vegetables after participation. Previous studies have also shown that culture-sensitive CBPR physical activity promoting programs help reduce high calories intake in migrant women. However, in that study the frequency of consumption of a nutritious low calory diet has not been assessed over time [236].

Despite that participants did not receive additional information from health care staff regarding the importance of physical activity and diet during the COVID-19 pandemic, the participants in Studies II and III continued to consume nutritious diet and were also physically active, even when they had to maintain physical distancing through engaging in more everyday activities that result in energy expenditure. The effects of maintaining a healthy lifestyle during the pandemic were also reflected in the biomedical parameters most of which remained within normal intervals. In addition, participants of this study reported that they were satisfied with their own health despite the ongoing pandemic. On the contrary to these results, other studies during the pandemic show that disadvantaged and vulnerable groups experienced poor health [50, 241], stress and anxiety and dissatisfaction with the health and life in general [242]. Despite the WHO recommendations to promote physical activity during COVID-19, physical inactivity owing to physical distancing is becoming public health challenge among populations globally [71, 243]. While Public Health agencies and the health care systems have been struggling to handle this dual burden, the results from Studies II and III in this thesis happen to be among the first to show that a priorly established initiative ahead of the pandemic which involved communities as equal partners seemed to have helped maintain behaviour and health, and thereby also played a role in recovery from the anxiety caused by the pandemic.

The results of Studies I and II show that participants perceived improved quality of life (QOL) indicated by the increase in the four domains of QOL immediately after participation in the CBPR informed physical activity intervention. However, Study II showed that, the effect seemed to have diminished during the first follow-up in the absence of a formal CBPR informed physical activity program in groups between the two time points. Numerous studies have previously shown the association between physical activity and quality of life [244], but studies assessing the quality of life following a CBPR physical activity initiative are relatively dearth, particularly those that were implemented in a local neighbourhood. A pre-post evaluation of a CBPR health promotional initiative targeting physical activity which was implemented among migrant women in the United States also showed that the quality of life of the participants improved significantly following a culturally adapted CBPR physical activity program. However, the American study had some major limitations in that the SF-8 survey used to assess quality of life was not available in the native languages of the participants who also did not speak any English. The data were therefore collected using face-to-face interviews by professional interpreters who were not part of the research team and not formally informed about the research study. The participants in this study also perceived problems with communication during the intervention

owing to language issues, thus it is unclear if the results were free from bias or if the results were sustainable [236].

The participants in Study II reported an increase in perceived environmental health during COVID-19 when compared to the long-term follow up. The environmental health domain which is part of the WHOQOL-BREF assessed aspects such as safety and security in the neighbourhood, perceived quality and accessibility to health and social care, opportunities to recreational activities in leisure time, opportunities to gain new information from authorities and access to transportation. Since the first meeting with the participants in all studies within this thesis, perceived issues with safety in their neighbourhood, as well as a general dissatisfaction in access to health care. Participants in Study IV mentioned that their contact with health care was always limited by time and that health care personnel did not take into consideration their traditions and needs while providing care. However, during COVID-19 participants reported that although they received many information leaflets, they did not trust the sources. They always trusted the information received in the groups from the health promoters. It seemed that language was not a barrier to access to health care and information received from authorities rather the format in which information was provided. The participants seemed to have understood the recommendations and precautionary measures provided by the authorities through the health promoters which seemed to have brought them close to the societal actors. This may have contributed to a higher perceived environmental health. A prior study among immigrants in a disadvantaged neighbourhood in Sweden showed the citizens perceived that they had been denied their basic rights since they did not gain access to most of the information, nor did they understand any of the recommendations that they received from the authorities. [245]. Studies II and III within this thesis has identified a method to address these issues which may be of relevance in similar disadvantaged context to better prepare for in acute circumstances as the pandemic.

Although no self-reported or clinical assessments were made in Study IV, the subjective discussions revealed that by practising good oral hygiene and consumption of a nutritious and low sugar diet the mothers themselves reported that they had lost body weight and experienced changes even in their physical health including relief from pain and even mental health after engagement in the oral health promoting CBPR initiative. Previous studies have shown that diet is a common risk factor for several chronic diseases as it is for oral health [246]. Following participation in the CBPR informed physical activity intervention systolic and diastolic blood pressure levels,

as well as fat mass decreased significantly. These parameters happen to be well-established risk markers of chronic disease also known to be influenced by physical activity [247, 248]. Previous studies have also shown that health promotional efforts aiming to address risk behaviours often struggle to reach populations living in disadvantaged and vulnerable populations given its cultural and contextual inappropriateness [249]. CBPR based initiatives have previously elucidated similar inferences among migrants when followed before and after the participation in a physical activity intervention [236]. However, in the current study Systolic blood pressure continued to decrease during the long-term follow up when participants reported having kept up the physical activity patterns. In addition, during the COVID-19 pandemic when the risk of infection was regarded higher among suffering from chronic diseases, almost all biomedical parameters remained within normal intervals indicating that the CBPR informed physical activity intervention had a regulatory role on health during the pandemic, thereby could have also led to community resilience. Community resilience is the ability of the community members to use the already available resources both from within and from their immediate external environment in an attempt to improve community members' physical, behavioural, and social health while also sustaining, recovering during an emergency as the COVID-19 pandemic [250].

Participation in a CBPR physical activity intervention and the CBPR oral health promotional initiative has seemed to have improved health and well-being particularly among women in the neighbourhood.

Women as gateways to their families

Women living in the disadvantaged neighbourhood being studied in this thesis seemed to be commonly affected by stress and anxiety owing to the traumatic experiences in their life and frequently lived an idle and isolated life without much social contact. They were also bound by the traditional believes that influenced their health and lifestyle. Studies in the past have also elucidated similar results among Arabic women living in Sweden also raising the need for culturally appropriate health promotional activities targeting women [251]. The results from Studies I-III also showed that women in the neighbourhood were most in need of support since they were bound into the role as a caregiver for their family and perceived to have little time to themselves. Study IV also confirmed the women's role in the family, given that the fathers who participated in the very first meeting later decided that the mothers were the ones who need to gain knowledge concerning the health and behaviour of children since

they were responsible for the upbringing of the children. Similar gender roles were also referred to in several other studies among Arabic migrants in Sweden, where women themselves reported that the fathers role was external in that they were financial providers and thereby also decision makers while mothers were responsible for the well-functioning of the families [251-253].

It also emerged from Studies I-III that the lack of time hindered women from learning the local language or participating in activities that helped improve and maintain their health. The women also seemed to be conflicted by their traditional thoughts since they did not want to choose their needs by compromising on the needs of the family. The Post-Colonial Theories show that Arabic women commonly consider their families as central in their lives which itself become a barrier for them to care for themselves. The theory also states that they tend to become enmeshed in their own web that they may have difficulties identifying and sorting their own needs, goals, and desires. It was also noted that the women felt guilty if they ever prioritized themselves or their needs [254]. Further to Post-colonial theories, theories on intersectionality, also show that while addressing concerns of women their situation must be taken into account concerning factors such as migration, gender, and their socio-economic circumstances [255].

Women who participated in the CBPR informed physical activity recognized that they had the opportunity to identify themselves, without disrupting the harmony of their family. They also seemed to have realized that it was important for them to care for themselves so they could better care for their family. Previous studies show that women from traditional upbringing elsewhere in the Middle East and Asia are enmeshed in their own family bubble, often tend to feel more secure in a social network or group consisting of other women who follow similar sociocultural norms. Such an environment was also considered to provide a context to revive and take control of themselves. However, the studies also state that there are numerous challenges to bringing together these groups such as women's own motivation [256, 257]. The women who participated in Studies II and III although were initially motivated by the health promoters who also belonged to the same social context as them. In addition, the women also believed that the CBPR informed physical activity was unique, not only since it was tailored to their own needs but also that they could discuss, reflect, and decide the course of actions together as a group.

The women who participated in Studies II and III even started to train with their family members. The women who earlier regarded themselves to be enmeshed in their situation also perceived satisfaction especially during the pandemic when they

showed their families different training using simple household tools. Similarly, mothers in Study IV who initially did not believe that they could change the dietary habits of their husbands, noticed that their husbands automatically decided to change their dietary behaviour and consumed less sugar after observing the wives and children. The women in all the four studies within this thesis perceived a sense of satisfaction for having been channels for influencing healthier lifestyle among their family members. A prior study has also recognized the importance of tapping the role of women as gatekeepers of the families through including them health promotional initiatives aiming to reach families and thereby even their communities in order to achieve meaningful and long-term effects on the health and addressing health inequalities [258].

In the studies within the thesis women who initially were reliant on the support of the health promoters, after participation in the respective CBPR health promotional initiatives not only spread the intervention to their families but also assumed the role of health ambassadors and spread the knowledge to other members in the neighbourhood.

Health promoters as facilitators in the CBPR process

Health promoters have played a vital role in all four studies within this thesis. They have been instrumental in motivating otherwise isolated women from the neighbourhood to participate in the study. Studies show that the use of health promoters (also known as culture brokers in an international context) has been fruitful in gaining trust and motivating members of the community to take part in the research process given their own experience as a member of the same community and their understanding of the cultural aspects of the community [259-261]. The health promoters have been regarded as role models by the women in the neighbourhood since they always had practised the activities they suggested to the other women. The women said to have trusted the health promoters given that they spoke the same language and that their traditional and family practices were similar even if they belonged to different countries within the Middle East. Previous studies show that community members engaging in health promotion intervention studies are regarded as natural helpers since the community members naturally sought after these health promoters for social support and even gaining information and advice about health issues common in the community [262].

The health promoters acted as bridges between the women (mothers in the case of Study IV) in the group and worked towards establishing a trustworthy relationship

between members in the group through constant dialogue with the group members independently and collectively. Studies have shown the role of lay health promoters in building social cohesion within smaller groups, which helps bridge with other members of the community [263]. Social cohesion itself has previously been shown as an effective means to shaping health related outcomes, particularly self-perceived health and health behaviours through increasing community resilience [264-266]. The importance of the role of the health promoters was further established during the COVID-19 pandemic when they not only supported the groups via social media but also provided them with information from the authorities which otherwise would not have reached members of this neighbourhood. Previous studies have also shown the role of lay health promoters play the role of communicating between the members to the authorities by bringing the women closer to the other authorities by applying resources in a culturally suitable way to the community [261, 267].

To sum up the health promoters in all the four studies within this thesis took a leading role in the process of empowering their own community members to improve their health and well-being particularly since these communities perceived dissatisfaction and mistrust towards healthcare providers and other governmental authorities.

CONCLUSIONS

This thesis was set in the context of Sweden where growing health inequalities and the differences in health based on the place of residence has been a public health challenge. Further, evidence also shows that the place of residence and the immediate living environment altered the choice of health behaviours which in turn influenced the health of the population. This motivated the studies within this thesis to focus on health promotion using a community-based participatory approach which relies on equitable partnership with the local communities in an attempt to promote health and reduce health inequalities in a socially disadvantaged neighbourhood in Southern Sweden.

- Socioculturally responsive health promotional activities developed using a CBPR approach led to improved health related behaviours and quality of life and thus may have the potential to reduce the risk of chronic diseases.
- CBPR based health promotional initiatives had a better uptake when participants gathered in groups and more so when it is facilitated by the health promoters.
- The absence of organised group activities may result in poorly perceived health although actual health may continue to improve.
- The health promotional activities using a CBPR approach where participants were actively engaged as partners in research contributed to empowerment processes within the two labs.
- There is a need to assess health using multiple methods to monitor and measure health from different angles given that health itself is multidimensional.
- Understanding their own health status through the health tests motivated participants towards a more sustainable behavioural change.

- CBPR approach does not only lead to momentaneous benefits but is an on-going process of reflection, dialogue, and action and thus change in behaviour and quality of life alone did not mark the end of the research process.
- Building on established CBPR partnerships within existing local health promotional programs builds community capacity and pandemic preparedness among populations living in socially disadvantaged situations
- Tapping on the role of health promoters as bridges between the population in disadvantaged situations and other societal actors and agencies can ensure timely outreach of vital information.

SOCIETAL IMPLICATIONS

Outcomes of this thesis both those that were intermediate including the shift in power relations that empowered and promotion of sustainable behavioural change, together with the more distal outcomes, such as co-production of culturally responsive information material as well as identified alternative means of communication between health care and other governmental bodies and community members are highly relevant from a societal perspective. Given that all these together may contribute to better health while also reducing the systemic differences in that health of the communities compared to that of the general Swedish population.

Isolation and perceived insecurity owing to lack of support from their immediate environment and place of residence has been an unaddressed challenge particularly among the migrant population living in disadvantaged neighbourhoods in Sweden. The CBPR health promotional initiatives presented in this thesis gives substantial evidence regarding how health promotional work can be carried out effectively among populations living in vulnerable and disadvantaged situations in society. The results from this thesis also show that involving communities themselves in the research process and mobilizing local knowledge that can be translated into evidence for action empowers communities to take control over their lives and further help reduce health inequalities. Further, the close collaboration with other societal actors within the larger program bring these actors more closely to reality and help them better understand the needs of these populations. This enables them to influence system changes within their own organisations to meet complex societal challenges.

The culturally appropriate sugar brochures co-produced by the community members together with the other stakeholders, have apart from being used by the mothers to spread it to their families in Sweden and abroad was also shared with the primary care and dental care for further use within their organisations. The health promoters

have also had a collaboration with maternal care staff to spread the knowledge concerning oral health, diet, and hygiene to expectant mothers from a similar context. The brochures are also currently used in schools and preschools to educate children in the neighbourhood about health effects of high sugar consumption. The oral health promotion living lab has grown to include nearly a hundred families who participate regularly in the activities. These families are not only from the original context where the living labs emerged but from other similar neighbourhoods in the city of Malmö. The role of the health promoters can be regarded crucial in pursuing sustainable health promotional work in a similar context, given that these health promoters, not only link populations but also bridge them to policymakers and other local authorities. Thus, the presence of health promoters can also enhance work done by other societal organisations, thereby motivating the need to recognize their roles similar to that of other professions and to embed them into the societal systems including the municipality, health care, NGOs, and even private organisations such as housing companies that cater to the needs of these populations.

The physical activity living lab also continued to grow via the participants who were certified as health ambassadors. The use of the train the trainer system together with the CBPR informed physical activity intervention helped faster outreach of the intervention, as each of those who were initially trained went on to train their friends at the workplaces or the language schools and spread their knowledge and subsequently spread their knowledge to a larger audience eventually make it a community movement. A similar effect was also observed in the oral health promotion lab, where families extended their knowledge by organizing healthy parties for friends and other community members thereby spreading their knowledge to all their acquaintances. This thesis also highlights that the Train-the-trainer model can be implemented as a cost-effective and sustainable means for spreading health information or health intervention particular in combination with a CBPR approach for its better uptake among larger population groups. The model can be applied by various societal actors who can begin by training health promoters, who may further help spread the knowledge to the communities and so on.

The impact of the CBPR informed physical activity intervention during the pandemic in increasing community resilience, was yet another result of societal importance given the acute challenge the pandemic imposed on the health care system and that the citizens in the disadvantaged neighbourhoods were regarded as risk groups. Through the knowledge, the women gained from the intervention they recovered

from the stress and fears and even took care of their family's health needs in addition to their own during the pandemic.

The health promoters engaged in the physical activity living lab were critical connection points for the community members during the pandemic. They not only provided culturally competent support to the community members but also acted as bridges between the communities and health care authorities. Health care personnel and other authorities tend to have benefitted much through these local community channels in form of health promoters during the pandemic when they could not directly reach out to the communities. This could not have been possible if it was not for the existing community engagement and trust built as part of CBPR informed physical activity intervention.

FUTURE RESEARCH

Although the whole study cannot be exactly replicated, the CBPR model and the lessons learnt from this neighbourhood can be reapplied in another similar context in Sweden, and the results can also be compared to that of the current study. Given the fruitfulness of a mixed-method approach applied in the evaluation of the physical activity lab, both quantitative and qualitative assessments can be applied parallelly to follow the other co-creative labs within the larger program in the future.

While CBPR studies are predominantly qualitative in their approach there is also a need to develop contextually relevant survey tools to assess aspects such as the structural changes using a CBPR approach together with the community members. The survey should also be grounded in the CBPR model that was adapted to the context in concern as a part of the larger study. Such an instrument should give insight into the potential of similar studies to minimize health inequalities and social injustice.

It may be interesting to explore the views of the children regarding their participation in TePe's oral health education program, and even compare them with other children who took part only in the activities in the oral health promotional lab together with their families to see if the program has offered additional knowledge. Changes in oral health and oral hygiene among children can be observed clinically or assessed using questionnaires, which may be something to consider for the future given that these changes do not happen momentarily and need to be followed over a longer period. Furthermore, it would also be interesting to understand the experiences relating to the COVID-19 pandemic among families who participated in the oral health promotional activities.

Given the role of the health promoters particularly during the COVID-19 pandemic, health care organisations and authorities must also tap on this potential model in future to collaborate more formally with health promoters to be able to better connect

with citizens in these neighbourhoods to understand and adapt their services so that they reflect actual needs. Future research should also aim at further deepening knowledge related to experiences of the collaboration between health care staff and the health promoters.

POPULÄRVETENSKAPLIG SAMMANFATTNING

Trots att svensk hälso-och sjukvård syftar till att alla ska ha samma möjligheter till en god hälsa, så är hälsa och livskvalitet ojämlikt fördelad, särskilt bland den befolkning som bor i utsatta stadsdelar i stora städer. Hälsan är framför allt påverkad av livsvillkor, levnadsförhållanden, levnadsvanor och individuella förutsättningar som ålder, kön och socioekonomi att fatta beslut som gynnar hälsan. Det är också ett komplext samspel mellan brist på möjligheter, svaga sociala nätverk tillsammans med personliga omständigheterna såsom brist på tillgång till utbildning, arbetslöshet och låg inkomst som vidare också påverkar hälsan. Den sociala strukturen inom stadsdelarna har potential att påverka individuella beteenden genom att de kan erbjuda möjligheter för att förbättra hälsa bland befolkningen. Därför kan en större fokus på hälsofrämjande åtgärder bidra till bättre hälsa. Ett framgångsrikt hälsofrämjande arbete är kulturellt och kontextuellt anpassat och framförallt att det utgår från medborgarnas egna behov. Ett ansats som tar hänsyn till dessa rekommendationer är Community Based Participatory Research (CBPR) där forskare och medborgare tillsammans med andra samhällsaktörer samarbetar för att etablera ett jämlikt partnerskap. Forskningen har sin utgångspunkt från medborgarnas egna behov relaterade till deras hälsa vilket medborgarna och forskarteamet tillsammans identifierar; därefter utvecklat lösningar för att möta behoven problemen och därmed främja hälsa.

En sådant CBPR program, *Hälsofrämjande innovation i samverkan*, initierades av Malmö universitet baserat på den lokala befolkningens behov i ett av de socialt utsatta områdena i Södra Sverige. Det hälsopromotiva arbetet i program genomfördes i samverkan med Malmö stad, regionens primärvård samt andra aktörer från privata och idéburen sektor som Rödakörset och Rädda Barnen. Programmet samordnas främst av lokala aktörer från samverkanspartners och lokala hälsofrämjare som är boende i

området. Som ett första steg i programmet genomfördes en workshop med 150 medborgare från området för att identifiera insatser för att främja hälsa med syfte att öka välbefinnandet och livskvalitet bland befolkningen. En CBPR-modell för strategisk planering av det promotiva arbetet utvecklades tillsammans med medborgarna och lokala partners. Sex gemensamt skapade hälsofrämjande labs, fokuserade på problemområden som lyfts i den stora workshopen, etablerades tillsammans med medborgarna på olika Malmö stads öppna platser inom området. Även om varje labb hade ett eget syfte och fokusområde, var det en gemensam utgångspunkt att utveckla CBPR interventioner i alla labben. Varje labb koordinerades av en hälsofrämjare som samarbetade med forskningsteamet.

Det övergripande syftet med denna avhandling var att utveckla, utforska och utvärdera effekten av en CBPR hälsofrämjande aktiviteter på hälsan hos befolkningen som bor i ett socialt utsatt område. Avhandlingen fokuserar två av dessa co-creative labb: (a) fysisk aktivitet och (b) munhälsa och kost.

Den första studien i avhandlingen beskrev utveckling och genomförande av en CBPR-informerad fysisk aktivitets intervention med femton medborgare från området tillsammans med en hälsofrämjare. Effekten av interventionen på fysisk hälsa och livskvalitet utvärderades med hjälp av enkät och biomedicinska tester. Erfarenheterna av deltagande i interventionen utvärderades också genom fokusgruppsdiskussioner, vilket också gav ytterligare insikter om hur man kan förbättra interventionen. Resultaten visade att bland deltagarna förbättrades livskvaliteten efter deltagande i interventionen. Även om de biomedicinska parametrarna som blodtryck och långtidsblodsocker samt BMI inte minskade, så höll de sig kvar inom normalintervallen. Diskussionerna med deltagarna visade att aktiviteten som erbjöds i grupp var meningsfull och att de också upplevde en bättre hälsa. Diskussionerna visade också behovet av att implementera interventionen vid fler tillfällen per vecka samt att den ska vara inriktad mot kvinnorna i området eftersom de var den grupp som behövde interventionen mest. Deltagarna upplevde också viss rädsla för blodprovet och önskade biomedicinska tester som inte involverade blodprovstagnig.

I den andra studien som utgick från erfarenheterna från den första studien, riktades mot kvinnorna i området, där 34 andra kvinnor deltog i den intervention som tidigare utvecklades i Studie I. Denna studie följde upp kvinnorna vid tre tidpunkter efter deras delaktighet i interventionen. Livskvalitet mättes med samma instrument som användes i Studie I, men en ytterligare enkät var inkluderad i denna studie för att också kunna följa förändringen i levnadsvanor kopplat till fysisk aktivitet och kost. Dessutom användes icke-invasiva biomedicinska tester för att mäta blodtryck, vilopuls,

BMI, fettmassa, syresättning och flera andra indikatorer för kärlsjukdom och diabetes. I och med att COVID-19 pandemin dök upp när utvärderingarna pågick skedde en av uppföljningarna under pandemin, vilket också gav möjlighet att förstå effekten av interventionen också under pandemin. Den tredje studien i avhandlingen utforskade uppfattningarna om deltagande i interventionen och hälsoeffekterna bland deltagarna genom fokusgruppsdiskussioner, vid samma tidpunkter där den kvantitativa datainsamlingen genomfördes.

Resultaten av den andra och tredje studien visade att en CBPR fysisk aktivitetsintervention, som erbjuds som en organiserad gruppaktivitet av hälsofrämjarna, förbättrade livskvaliteten och även minskade blodtrycket bland deltagarna. Deltagarna blev också mer motiverade och tränade regelbundet efter sitt deltagande i interventionen. Men när den organiserade gruppaktiviteten avslutades, så upplevde deltagarna en försämrad livskvalitet, även om deltagarna fortsatte att vara fysiskt aktiva och deras systoliska blodtryck fortsatt sjönk. När gruppaktiviteterna återupptogs via sociala medier under pandemin upplevde deltagarna sig vara mer nöjda med sin hälsa. Kvinnorna upplevde också ett förbättrat stöd och förtroende för samhällssystemen under pandemin, eftersom de fick hjälp av hälsofrämjarna och andra i gruppen att bättre förstå rekommendationerna, vilket verkar ha bidragit till en bättre förståelse för statliga organ som sjukvården och Folkhälsomyndigheten. Även om deltagarnas biomedicinska parametrar inte förändrades, var de fortsatt inom de normala intervallen trots den pågående pandemin. Från studierna två och tre är det alltså uppenbart att en CBPR-informerad fysisk aktivitetsintervention när den erbjuds i grupper förbättrade hälsorelaterad livskvalitet, fysisk hälsa, medförde beteendeförändring och kanske även har byggt motståndskraft för att uthärda de psykosociala och fysiska effekterna av en pågående pandemi.

Den fjärde och sista studien i avhandlingen fokuserade på kost och munhälsa bland familjer med barn i åldrarna 9–14 år. Som ett första steg i studien möttes barnen och föräldrarna var för sig med forskare och andra samhällsaktörer som var intresserade av barnens hälsa och välmående, såsom tandläkare, Rädda Barnen, Apoteket och representanter från ett privat företag, TePe, som utvecklar munhygienprodukter. Diskussionerna med barnen visade att det inte gillade skollunchen och inte heller åt frukost regelbundet på grund av tidsbrist och familjesituationer där bägge föräldrarna jobbade tidigt på morgonen. Dessutom åt barnen också en kost med hög sockerhalt. Många barn hade flera tänder som drabbats av karies och besökte ofta tandvården akut. Föräldrarna uttryckte att de hade brist på kunskap och inte kunde vägleda sina

barn på rätt sätt och önskade mer kunskap om hälsosam kost och även om munhygien vanor för sig själv och sina barn. De hälsofrämjande aktiviteterna i detta lab skedde genom reflektion och dialog, där varje session inleddes med en kort presentation av ett ämne relaterat till kost och munhygien som senare gick vidare till diskussioner och reflektioner mellan familjerna och de andra aktörerna. I slutet av varje möte bestämdes ämnet för nästa session av familjerna. I utvärderingen av dessa aktiviteter användes en metod som kallas flerstegsfokusgrupper. Ett tiotal familjer träffades regelbundet och följdes under 6 månader. Diskussionerna mellan deltagarna visade att CBPR aktiviteter som satsar på att främja munhälsa och förbättrad kost bland barn och familjer, genom reflektion och dialog tillsammans med andra samhalls aktörer och forskare, kan påverka beteendeförändringar och förändringar i hälsan. Dessutom ledde labbet till att utveckla en kulturellt anpassad socker-broschyr om socker innehåll i olika livsmedel som är vanlig bland familjer i detta område vilket hjälpte deltagande familjer att sprida kunskaper till andra i området, till barnen i skolan och även till släktingar utomlands.

Avhandlingens sammantagna resultat visar att ett socialt stöd är nyckeln till förbättrad upplevd hälsa, egenmakt och hållbar beteendeförändring bland medborgare i utsatta områden. Även om kvinnor är mest i behov av stöd, är de också ingången till familjerna och därmed även andra i områden. Genom att möjliggöra för deltagare att påverka sin egen situation bidrog CBPR processerna till ökad egenmakt bland deltagarna. Hälsofrämjare hade en viktig roll i att engagera befolkningen i områden i hälsofrämjande insatser, föra dem närmare till andra samhällsaktörer, stärka deras sociala relationer och bidra till att stärka samhällets motståndskraft inför akutsituationer som den pågående pandemin. Slutligen, det hälsofrämjande arbetet byggde en kapacitet i området mot egenmaktsprocesser på community nivå som involverade flera grupper av medborgare.

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ORIGINAL PAPERS I - IV

I

RESEARCH ARTICLE

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Development and evaluation of a physical activity intervention informed by participatory research- a feasibility study

Rathi Ramji^{1*}, Elisabeth Carlson¹, Anders Kottorp¹, Sergey Shleev², Eman Awad² and Margareta Rämngård¹

Abstract

Background: Despite numerous interventions aiming to improve physical activity in socially disadvantaged populations, physical inactivity remains to be a rising challenge to public health globally, as well as, in Sweden. In an effort to address this challenge, a community-based participatory intervention was developed through active community engagement and implemented in a socially disadvantaged neighborhood in Sweden. The current study aims to present the development and initial evaluation of a participatory research driven physical activity intervention.

Methods: Fifteen participants (11 females and 4 males) aged 17–59 years volunteered to participate in the physical activity intervention program. The intervention program was evaluated using a longitudinal mixed methods design measuring health impact changes over time through focus group discussions and quality of life surveys. Further additional biomedical health parameters such as levels of glycosylated hemoglobin, blood pressure, levels of oxygen saturation and body mass index were monitored before and after the intervention. Focus group data were analyzed using content analysis with an inductive approach. The pre-and post-test scores from the survey-based quality of life domains, as well as the health parameters were compared using non-parametric and parametric statistics.

Results: Four themes emerged from the analysis of the focus group discussions including sense of fellowship, striving for inclusion and equity, changing the learner perspective and health beyond illness. The scores for the domains Physical Health, Psychological Health, Social Relationships and Health Satisfaction were significantly higher after participation in the physical activity intervention program compared to the pre-test scores ($p < .05$). There were however, no significant changes in the scores for the environmental domain and overall quality of life after intervention compared to that prior to intervention start. Overall, the biomedical health parameters remained stable within the normal ranges during intervention.

Conclusion: The focus group discussions and results from the surveys and biomedical measures reveal important findings to understand and further develop the intervention program to promote health equity among citizens in disadvantaged areas. Evaluating the feasibility of such an intervention using multiple approaches contributes to effective implementation of it for larger communities in need.

Keywords: Community-based participatory research, Action research, Health promotion, Health equity, Socially disadvantaged

* Correspondence: rathi.ramji@mau.se

¹Department of Care Science, Faculty of Health and Society, Malmö University, Jan Waldenströms Gata 25, SE-20506 Malmö, Sweden
Full list of author information is available at the end of the article

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Background

There is countless evidences supporting that physical activity improves overall health and wellbeing [1–7]. The World Health Organization (WHO) defines physical activity as any form of movement of the body that leads to energy release owing to activation of skeletal muscles [1]. Physical activity also has a long-term effect in reducing the risk of chronic diseases [8–10]. Despite the known benefits of leading a physically active lifestyle, a high level of inactivity has been reported among adult population globally [11, 12]. The burden of chronic diseases has also been increasing worldwide and not the least in the developed world [13]. Studies show that physical inactivity contributes to a global burden of mortality as comparable with tobacco smoking [14]. Leading a physically active lifestyle may be influenced by factors such as physiological conditions, personal ability and psychological attributes [15]. Encouraging individuals and groups to be physically active has earlier been the focus of public health initiatives in a drive to prevent chronic diseases [16].

Sweden is one among the few nations in Europe meeting the World Health Organizations' recommendation of performing physical activities at least 30 min daily. Nearly 65% of the Swedish population over the age of 18 years are reported to be physically active on a regular basis. However, there are reported differences in physical activity levels among subgroups of populations from disadvantaged backgrounds [14, 17–21]. Socially disadvantaged populations are diverse subgroups of the population who are heterogeneous with regard to their ethnicity, historical background, religion, culture, immigration status and practices related to health [22]. They may also differ based on income, employment, education, socioeconomic status and sociogeographical aspects as living in deprived neighborhoods compared to the majority population [14]. These subgroups commonly experience a higher risk of poverty, social exclusion, and discrimination. They are also exposed to several risky health behaviors owing to their poor living conditions [14, 18–21].

Several physical activity promotion campaigns addressing the whole population have proved unsuccessful since they often fail to reach out to these socially disadvantaged subgroups. Promoting healthy eating and exercise with consideration to the social dimension provides a better opportunity to initiate healthy lifestyle [23]. Therefore, an alternative approach in public health efforts aiming at health promotion may be necessary to understand the impact of individual action together with the context, while designing preventive measures against risky health behaviors in socially disadvantaged populations [16]. Taking into consideration specific social requirements and increasing community engagement to

improve health, is an alternative paradigm for health and social research, namely the Community-based Participatory Research (CBPR) [24]. This form of research involves close collaboration between different stakeholders such as academic partners and the community in order to identify communities priorities. The partnership between community members, who have direct knowledge of local circumstances and the academicians, is central in developing successful health interventions. This partnership identifies health issues that are of concern to the community and addresses it through research and action. CBPR helps generate relevant evidence through integrally involving community members throughout the research process [25]. This research approach is considered appropriate particularly since the communities themselves are involved in designing interventions that focus on the interlink between health behaviors and the social determinants of health. Success in these efforts is achieved by working with the communities to not only understand their needs and developing an intervention but by further empowering them, to address multiple barriers to health within their socio-cultural context [26]. CBPR allows working collaboratively with the community members through building trust, and sharing power throughout the different stages of the research [25]. The process of building trust between the community and the different actors, paves way to understand the multiple and complex factors associated with health of citizens in the community. Furthermore, it facilitates the assessment of behavioral and environmental factors that influence health and wellbeing and thereby guides the development of successful health promoting interventions [25, 27]. CBPR has the potential to not only promote health but also informs the need for changes in practice and policies. Above all, CBPR aims to build community capacities to ensure sustainable change [25].

There are a few international studies on physical activity interventions guided by a CBPR approach [28–31]. Moreover, studies evaluating CBPR based intervention using multiple health evaluation methods longitudinally [26] are sparse. This study aims to present the development and initial evaluation of a participatory research driven physical activity intervention built by an established CBPR partnership with communities from socially disadvantaged neighborhoods in Sweden.

Methods

Context

The current study was part of a larger initiative developing and studying health-promoting activities informed by community-based participatory research in a socially disadvantaged neighborhood in a city located in the South of Sweden. There is a large proportion of non-

Swedish speaking population residing in this locality. The locality has been considered one of the twelve most socially deprived areas in the country [32]. The municipality in this region initiated a collaborative program that [33] emphasized the need for sustained efforts to improve this part of the city. There is a high rate of unemployment, crime, low education levels and poor health among residents. Previous studies in the city have also identified high incidence of risky health behaviors among citizens in this neighborhood [20, 21].

Development of interventions and health promotion resources

The physical activity intervention being described in the current study is part of a larger project [34]. The larger project began with future workshops [35] where 150 citizens of different age groups and genders from the geographical community participated. The discussion within these workshops aimed at identifying initiatives to promote health, well-being and quality of life of the community based on their perceived needs. The discussions revealed that sedentary lifestyles or physical inactivity, poor oral health among children, mental health problems and reduced access to coping strategies are factors affecting the self-perceived health of this community. In addition, the citizens perceived a lack of access to health care, specifically evaluating and monitoring their health at a low cost, understanding their own health status, and lack of access to information on healthy diet in their area. The citizens perceived the need for activities free of cost in the area and held during the day. The citizens of the locality together with different stakeholders from private, public, non-profit sectors and academic partners created a CBPR model influenced by a previously tested model [26, 36] in a similar context for strategic planning of collaboration and development of health interventions focusing on key factors such as empowerment and participation at all stages including planning, implementation and evaluation.

The health promotional activities focused on five problems areas including (a) physical activity, (b) mental health, (c) self-care, (d) oral health and (e) health literacy.

The health promotional activities are coordinated by representatives from the locality, often known as community health workers or multicultural health brokers or gatekeepers in an international context [37], but in Swedish context they were known as *health promoters*. The health promoters were among the citizens who were part of the initial future workshop who expressed their interest in assisting the research team and being change agents for their community. These health promoters were instrumental as facilitators for participant recruitment, language interpretation and above all informing

the research partners about the nuances and cultural sensitivities within the community to be considered when approaching individuals for various activities. In addition, they have in-depth knowledge and experience of the issues faced by these communities in accessing health and services, and are likely to offer culturally appropriate support to the research project. Previous research indicates that individuals who share a similar background with the target groups are better able to respond to the health needs of these subgroups [37].

This was the first stage in the development of the intervention program being evaluated as a part of the current study.

Development of the physical activity program

After the strategic planning and development of CBPR model, about 70 members from the community, together with the health promoters participated in a new workshop to develop a socioculturally appropriate physical activity program. The academic partners together with one of the health promoters who was a fitness specialist facilitated this workshop together with different stakeholders. Dialogues were held within the community regarding expectations from the physical activity program, as well as, the best ways to deliver it. Discussions were also extended to explore the cultural factors that may influence participation in the physical activity program. The main points from the discussions were categorized together with the community members to identify relevant action points. Community members suggested that an ideal physical activity program must include exercise and training that is tailored to individual capabilities. They wanted one of the health promoters to be the personal trainer. Community members wanted training to be related to the daily activities they perform rather than working on devices or machines so they can learn to handle their body in the right way using tools that are easily available. Participants also preferred having gender specific groups since their culture did not permit women training with other men. Participants wanted to be counselled about healthy diet and healthy mind, as they frequently experienced lack of motivation when training alone. In addition to physical activity, participants also wanted to follow the effect of physical activity on their health.

A unique fitness program was framed by the health promoters based on the input from the community members. The structure of the program was presented to the community members who participated in the development workshop for feedback and approval. The main purpose of this fitness program was to build community and diversity together for a fair and equal health and fitness culture among the citizens in the neighborhood based on the perceived needs. The fitness program

focused on facilitating a gradual change in the citizens' lifestyle, from simply moving the body and eventually to learning training methods based on their own abilities. By doing so, one develops healthy routines that in turn creates self-awareness of their own body and therefore self-esteem and self-confidence can grow. The training as a part of this program aimed to promote change without distinction by age, language, socioeconomic status or cultural identities. The physical activity program was also designed such that it could be offered free of cost and thus accessible to those with a disadvantaged background. Through integrating people of different ages and with different cultural backgrounds, an additional incentive is that the program promotes increased integration among citizens in the neighborhood. Participants in this program gain social support from within the group of actors and other citizens, which motivated them to make lifestyle changes, based on their own perceived living conditions. Aside from training participants to perform physical activity, this program also educated participants to become future trainers. As future trainers, these individuals can train their acquaintances in the neighborhood, thereby spreading the fitness culture to more members in the community. A prior study has also identified the usefulness of the train the trainer method in spreading interventions to larger communities [38].

Participants

Health promoters approached 20 individuals from the neighborhood who were also part of the physical activity program development workshop to participate in the physical activity program and the research study through face-to-face interactions, as well as, using messages and flyers. It was only noted, if the participants were in good health with the ability to perform physical activity and free from medical conditions that might hinder participation. Participant were not asked about prior training experiences or ranked using standard scales, rather included as health seekers who volunteered to participate. Five participants dropped out due to the inability to understand the design of the intervention and lack of time. Participants who mentioned lack of time expressed that they really wanted to participate however they were unable to since the time scheduled for the physical activity program did not match with their daily routines including attending language classes, or caring for their children or a family member. The health promoters and the participants in this study were ordinary citizens from the neighborhood and did not hold any specific positions within the community and were not politically or otherwise involved outside of the community.

The participants were organized into two training groups with eight to ten persons in each of the two

groups. Each group met once a week for about 2 hours over a period of 3 months. During each session, participants performed physical activities outdoors, as well as, indoors together with the health promoters with periodic breaks between the training spurts, which lasted for about 60 min. In addition to training, participants were also involved in a dialogue about eating healthy and the relationship between diet and physical activity. At the start and end of each session, participants also sat in circles to reflect and share their experience with one and other as well ask questions.

Study design

The current study used a concurrent mixed method evaluation model where both qualitative and quantitative data were gathered over time. The quantitative method was quasi-experimental assessing the differences within subjects utilizing a pre-test prior to intervention start and a posttest directly after the end of the intervention. Qualitative data was also collected at similar two time points, pre- and post-intervention.

Focus group interviews

Focus group interviews were conducted in two separate groups with six to seven participants in each group before starting the physical activity intervention program (t1), and at the end of the intervention program (t2). Each interview lasted for about 2 hours and discussions proceeded until data saturation was achieved. The questions posed in the focus groups aimed at gaining a deeper understanding of the participants' perceptions of participation in a process where several different actors work together. The focus groups were conducted using an interview guide based on the CBPR model [25]. The model relates to how participants perceive participation in the group they belong to and how they perceive and think about the collaboration with the participating partners, including the health promoter who leads the physical activity program and university employees who participate in the evaluation of the group. Since the program is designed as an intervention based on the participants' own needs, it was important to ensure that all participants in the program experienced compliance with actors and other participants. Minimizing power relations was necessary so individuals could develop themselves, with the support of the program, to change their health.

Surveys

Participants were asked to respond to the World Health Organization Quality of Life-BRIEF survey (WHOQOL-BREF) [39]. WHOQOL-BREF was chosen as appropriate for this study as it examines the perceptions of individuals in relation to their culture and value systems, as

well as, their personal goals and standards. The validity and reliability of the instrument has been tested in 15 field centers around the world and the instrument is available in 20 different languages including Swedish [39] and Arabic [40]. The instrument includes 24 items, each scored from 1 to 5 measuring quality of life scores across four domains. Physical domain is the first of it with seven items; examples include questions on pain, fatigue, and use of medication. In the psychological domain are six items including questions on stress, anxiety and concentration abilities. The social relationships domain is the third with three items focusing on social support and relationships. Finally, the environmental domain, which included eight items focusing on physical environment and access to health care. In addition to the four domains, two questions measuring general quality of life and health satisfaction were also included.

A raw score of each domain was calculated and transferred into range between 0 and 100 for compatibility with the scores used in World Health Organization Quality of Life-100 item survey (WHOQOL-100) as directed by the standard guidelines provided by the WHO. Higher scores denote higher quality of life [39].

In addition to this instrument, additional information including age, gender, mother tongue, educational qualifications, current employment status, diet and physical activity levels were included. Further, information related to socioeconomic status including household income was also gathered.

Health tests

Given the known effect of physical activity on the incidence of chronic disease in adults [9, 13], there is a need to assess of metabolic risk markers of chronic disease such as body mass index, blood pressure, blood sugar and level of oxygen saturation in blood, as a part of evaluating health effects of the physical activity intervention [41, 42]. These assessments were also included since they were in line with participants need as indicated by them during the initial workshops.

Height in centimeters was measured with a length scale MZ10032 from ADE (Hamburg, Germany). The information on height in centimeters was manually entered into the Tanita Model MC780MA (Tokyo, Japan) which was primarily used in the current study to assess the weight in kilograms as well as to calculate the BMI using Eq. 1:

$$\text{Body Mass Index} = \frac{\text{Body Weight (kg)}}{\text{Body Height}^2} \quad (1)$$

Blood pressure was measured using an iHealth Sense Wireless Wrist monitor from iHealth (California, USA).

The device measured systolic and diastolic blood pressure (mmHg), as well as, heart rate (bpm). Level of oxygen saturation (%) was measured using an Angioscan 01 from Angioscan Electronics (Moscow, Russia). Blood was collected by capillary blood sampling to investigate the level of glycosylated hemoglobin in blood (%) as an indicator for long-term glycemic control using a HemoCue HbA1c 501 System from HemoCue (Ängelholm, Sweden). Assessments of the health parameters were performed in comparison to their reference intervals. The reference intervals for oxygen saturation and for body mass index (BMI) were set to be 95–99% [43] and 18.5–25.0 kg/m² [44], respectively. Systolic and diastolic pressure was assessed using reference intervals 100–140 mmHg and 60–90 mmHg [45], respectively. The reference interval for heart rate at rest was considered to be 50–90 beats/min [46]. As for glycosylated hemoglobin, the cut-off value for healthy individuals was assumed to be 6.5% [47].

The health tests were performed at two time points once before the program start (t1) to ensure stability between the test parameters, and the second measure was made after the completion of the physical activity program (t2).

Analysis

Qualitative analysis

The focus group discussions were recorded and transcribed verbatim. Interviews were conducted primarily in Swedish since most of the participants spoke Swedish sufficiently despite having different cultural backgrounds. The analysis aimed at capturing change in perceptions of participants before and after participation in the intervention. An inductive content analysis of the transcribed interviews was conducted. Unlike other qualitative analytical techniques, an inductive approach is usually used to uncover key categories that are relevant to the research objectives [48]. After verbatim transcription of the focus group discussions, the transcripts were thoroughly examined by two members of the research team to identify codes for each response through repeated reading. Similar codes were then grouped together to more general themes. The process was repeated a few times until concrete themes emerged and no further themes were identified. The researchers worked on the original transcripts until no new insights were identified. A joint list of themes were finalized after discussions between the first two researchers. A third researcher also a member of the research team, independently worked on the transcripts following similar guidelines followed by her colleagues. The third researcher then reviewed results from the analysis made by the first two researchers, and validated their findings. Thus, triangulation was achieved.

To ensure trustworthiness and address issues such as reflexivity, the research team involved in analyzing the data attempted to set aside their own pre-understanding of the social setting and contextual factors associated with the population and locality. Furthermore, reflexivity was also addressed through meticulously planned methodological consideration and analytical procedures including peer debriefing and triangulation through inclusion of several persons in both the focus groups (as observers), as well as, in transcript analysis [49, 50].

Quantitative analysis

Since the current study is a feasibility study, and that similar studies with this population have not been made earlier data necessary for a power analysis is not available. Comparison of the scores of quality of life domains before and after the fitness program was done using Wilcoxon's Signed Rank Test models, due to small sample size and ordinal data. Analyses focused on group level over time to identify patterns in changes, but we also monitored changes on individual levels. Statistical significance was set at a p value of < 0.05 . Effect sizes were computed and interpreted using the following effect sizes references, $d = 0.2$ or lower was considered small, $d = 0.5$ as medium, and $d = 0.8$ as large [51].

For the health parameters, tests of normality were initially performed to find out which type of statistical analysis should be used in determining statistically significant changes between the first and last measurements (t_1 and t_2 values). Using the Shapiro-Wilk test with a significant level of $p < 0.05$ it was found that all data were normally distributed apart from BMI [52]. The paired samples t -test was therefore used for all health parameters, except BMI due to its assumption of normality within the data set. Indeed, for BMI the Wilcoxon Signed Rank test was used instead of the paired samples t -test [53]. The effect size in the Wilcoxon Signed Rank test was calculated using Eq. 2:

$$r = \frac{z}{\sqrt{N}} \quad (2)$$

Triangulation of methods was performed to additionally validate the results through a comparison of questionnaire results with that of the focus groups interviews.

Ethical considerations

All participants were initially informed that they will participate in a research process with their participation in the physical activity program. They were also informed that the purpose of the research is to investigate the impact of the fitness program on the health and well-being of the participants and not on individual

performance. Participation was voluntary and participants were informed that could leave the study at any time. Written information on the research process was also provided and participants were asked to sign an informed consent form. All material collected were marked by code, and are kept confidential and shall be accessed only by the research team members. Prior to initiation, the Regional Ethical Committee in Lund approved this study (DNR 2018/384).

Results

A total of 15 participants (11 females and 4 males), aged 17–59 years participated in this feasibility study. There was over 95% attendance rate in all sessions. Participants who missed a training pass often did so because of caring for their sick child or if they were unwell themselves. Participants were predominantly were of Middle Eastern origin with a few Europeans, and Asians. Table 1 includes a description of the participant's demographics. Although all the fifteen participants considered themselves active through performing daily household chores they had not been involved in physical activity or training ahead of their participation.

Table 1 Characteristics of participants

Characteristics	Participants (n = 15)
Age	
Range (md)	17–59 (32)
Gender	
Women (%)	11 (73%)
Men (%)	4 (27%)
Ethnicity	
Asian	3 (20%)
European	2 (13%)
Middle Eastern	10 (67%)
Educational Qualification	
University education (≥ 3 years)	4 (26%)
University education (< 3 years)	1 (7%)
Adult education at high school level	1 (7%)
High school (3–4 years)	3 (20%)
High school (2 years)	3 (20%)
Elementary school	3 (20%)
Occupational status	
Employed	5 (33%)
Self-Employed	1 (7%)
Parental leave	6 (40%)
Studying/Internship	1 (7%)
Unemployed	2 (13%)

Qualitative findings

Process evaluation of the physical activity intervention

On exploring, the focus group interviews concerning participant's views on the physical activity intervention revealed four main themes including sense of fellowship, striving for inclusion and equity, changing the learner perspective and health beyond illness.

Sense of fellowship

Sense of fellowship in this study was about how individuals developed interest over time to be physically active and healthy through being inspired by others in the group. Participants, who were initially disinterested and joined the intervention program for the sake of their friends, started liking the activity within the group eventually. They believed that they gained more while being in a group and desired to be role models to others.

Before participating in the physical activity intervention, participants perceived lack of motivation to train by themselves. They frequently chose not to train if they were to train alone. They needed a companion who could drive them to train and even participate in the intervention program.

"When I enrolled myself, I had no desire to come and train, whatever type of training it be, I came because my friend persuaded me to." (Pre-interview, female)

However, when participants started training they started to develop a sense of togetherness with other participants in the group, which positively influenced them to continue training. Participants felt committed to the group and were determined not to miss training passes due to respect for the fellow participants.

"Tomorrow, I have a scheduled training pass, Ohh it is tomorrow.. I feel tired and believe I cannot manage. But, no I cannot do that, I must respect. I must respect others in the group. We must keep our word, if we promise." (Post- interview, female)

On starting to train, participants started to gain interest in training especially since they were training in a group. They usually felt demotivated when they had to train all by themselves.

"It was nice training with the group. Because we laugh, we talk, it's fun for us, so. When we train by ourselves, it's boring. It's not possible" (Post- interview, female)

Participation in the program also made participants glad as it was also about meeting new people and getting to

know them, thus expanding their social network in the locality. Becoming familiar with more persons increased their sense of safety in the locality.

"Through training in these new groups, with new people, gives a sense of security in the locality. We get to know new faces" (Post- interview, female)

Participants also expressed their desire to share the knowledge they had received with others. However, they believed that taking care of self, practicing a healthy lifestyle, training and showing others through action could help spread the intervention to others more effectively than merely sharing experiences verbally.

"Taking care of oneself, like to live healthy, train and we try to show it to others by being a role model. Thus, for example, people are watching me, they see that I have lost weight in the last month. I said I had been in training, and I told them what we were doing during this month." (Post- interview, female)

Striving for inclusion and equity

Striving for inclusion is a voluntary action taken to meet the needs of different people. It includes creating environments or situations where everyone feels included and welcome. Through the discussions with participants emerged a general sense of isolation among citizens in this locality. The citizens, predominately women restricted themselves to their homes, and often avoided external contact. Many were not even aware of the activities and possibilities available in the locality. This was primarily owing to their family situation, psychosocial conditions and the lack of interest. There was a general lack of motivation particularly to get involved with physical activity. They were dependent on the company of their friends or family members to go out of their homes.

Participants described lack of access to health related activities for women in the locality at the beginning of the intervention, but with eventual participation, they started to believe that they had the potential to drive change. Towards the end of their participation in the intervention participants realized that they can create a positive atmosphere which welcomes especially those that were excluded.

Women from Middle Eastern culture do not train in public places such as recreational facilities and sport gyms due to the presence of men. Participants perceived that there was a lack of access to recreational activities, specially directed to women in the close proximity. Women in the locality felt excluded since they were not able to perform physical activity even if they desired to do so. Some women had disabilities preventing them

from going to the sport centers or gym even if they had exclusive training times for women. They really wanted to train but often excluded since there were no activities adapted to needs and capabilities of women.

"There is no access to training or physical activity targeting woman in the locality earlier. There was a need for training or swimming or something else that is adapted and is only for women. They just sit here and cook or sew or do something. But do nothing special like exercise." (Pre- interview, female)

When participants started attending the intervention program, they came to understand that the responsibility to create an open environment was within every individual. In the current study, most of the women participants did not mind participating in the intervention program together with men. Some women who refused to perform certain activities within the intervention program in front of men, made notes and videos of training and tried it at home instead. They also had the opportunity to film themselves and take help from the trainer. Participants believed that they could also be part of building social health where everybody cares for the other.

"I believe that it is we who can create this a welcoming environment for people. It is only we who can open the doors for everyone. We need more of this "community care" we can together build social health wherever we are." (Pre- interview, female)

After participation in the intervention program, participants felt that they could spread positive energy to others that in turn makes others in the locality feel more welcome to participate.

"It's good that there is someone who can help others. That they feel welcome to train together in a group. To give them also the energy and chance to train now, even if they can't do it all by themselves." (Post-interview, female)

Changing the learner perspective

Changing the learner's perspective was about strengthening individual knowledge and capabilities in collaboration with others such as a physical instructor or members in a group. Individual participants moved from stage of seeking knowledge to becoming coaches themselves during the process of participation in the intervention program.

Prior to the intervention start, the participants believed that having a personal instructor was ideal since it would help them create an individually adapted training regime however, they could not afford such a service, as it was

expensive. Through the intervention program participants felt that they had, the opportunity to learn from a person with such a knowledge. The coach who was also a health promoter was not an external person but was also from the locality and he shared knowledge concerning the challenges and needs of the citizens in the locality. Participants believed that they could learn better under the guidance of the coach about what was most suitable for them as individuals.

"I want to start by learning what to do, to make my body feel better, learn about health, food and training. For example, which training is better for me. I want to do something that is good. He can teach me, and he knows which is best, so one can feel good and be healthy" (Pre- interview, female)

Participants were aware that physical activity and food were interrelated determinants of healthy body functioning. Therefore, they were curious to learn how to work with both so the body is in a state of balance.

"I think food and training are completely for the body, because if you train and eat sweets and fatty food, it does not work. And it's the same, if you eat healthy and don't move your body. One must learn how to balance with both." (Post- interview, female)

After starting to train with the help of the instructor and learning for themselves, participants went on to spread their knowledge to their family members. Participants aspired being instructors in future and hence tried sharing what they learnt from their own participation in the program with their own families.

"I have started to train at home with my mother, father and my siblings. I do the same things that we do here, as to talk and train with them. I try to teach them what I myself have learned here." (Post-interview, female)

At the end of the intervention program participants expressed their desire to be future ambassadors for the program and spread it to more people from the location.

"I think , I would like to be a coach like a training group leader and show others what I have learnt." (Post- interview, female)

Health beyond illness

There was a general lack of trust in the health care system among citizens in the locality which was reported ahead of participation. The citizens in the neighborhood expressed that the health system was not similar to that

in their home country. They also believed that they did not get the help they expect when they approached the primary care centers and thus did not trust the system. Participants perceived that patients had to wait for long to meet a doctor. Even if they did meet a doctor for a specific problem, they were not provided diagnosis and treatment in time. Most patients are offered paracetamol and asked to wait for prolonged periods before being diagnosed and actual treatment is provided. They felt uninformed about their health and the different health parameters that can be monitored early in time to understand the risk of getting exposed to diseases such as diabetes and other cardiovascular disorders.

After participation in the physical activity program participants developed an understanding that healthy lifestyle and training contributes to better physical and mental health and thereby a better quality of life.

"I feel healthy and brisk and there is a difference since the beginning to now. I think of my body, and what exercise I have to do, which food is better, which is not so good. Exercise makes me feel good and I started to feel that my body works, that I feel good mentally, it is beyond just health .. I am happy." (Post- interview, female)

Participants were very excited about the health tests since there was a lack of trust in the health system in general. Participants appreciated the health test even better since they had been offered the time and contact when being tested that they had the opportunity to learn the significance of different parameters tested.

"I have no confidence in the health care system, so I felt it was so luxurious to do tests. There came a guy there and we asked about everything he tested, what does that mean? What does this mean? How can I do that? Can I do something about it? Then, that you were told that you were like 20, 25, it just did something even better for us." (Post- interview, female)

Some participants were curious about their results after participation in the intervention program, and were extremely disappointed if the results were not as they expected. It was perceived that they were intending to quit the program if their health status did not change.

"Some in the group are eagerly awaiting the results of the test. They think about it all the time. If results are not as expected they are disappointed. It could make them give up, and not continue." (Post- interview, female)

Some others in the group were careful in not drawing motivation for participation through the results from the health tests. Participants believed that they must focus on their own health and lifestyle through being physically active and eating a healthy diet. By doing so, they believed that the changes in health status might eventually happen.

"I don't focus much on the testing. I focus on my health and on my lifestyle, how it should be. With diet, exercise and one can improve one's own health by themselves." (Post- interview, female)

Quantitative findings

The scores for the domains Physical Health, Psychological Health, Social Relationships and Health Satisfaction were significantly higher/better after participation in the 12-week physical activity intervention program compared to the pre-test scores (see Table 2), with a moderate effect size in all domains. However, the tests did not elicit a statistically significant change in scores representing the Environmental domain, as well as, self- rated quality of life after participation in the 12- week physical activity intervention program. Table 3 includes a description of results from the Wilcoxon's signed-rank test.

Health tests

The Wilcoxon Signed Rank test and the paired samples *t*-test showed that there was no statistically significant mean difference between the values of biomedical parameters, viz. BMI, heart rate at rest, systolic and diastolic pressure, as well as, glycosylated hemoglobin, measured before and after the physical activity intervention on a group level (Tables 4 and 5).

Table 2 Descriptive characteristics of quality of life scores, and health parameters before and after intervention

Domain/Health Parameter	t1-Mean (SD)	t2-Mean (SD)
Physical Domain	58.81 (21.6)	69.95 (19.8)
Psychological Domain	56.94 (20.3)	66.08 (19.1)
Social Relationships Domain	64.44 (15.8)	71.66 (15.3)
Environmental Domain	57.71 (15.8)	59.58 (14.7)
Quality of Life	3.33 (1.2)	4.13 (0.5)
Health Satisfaction	3.13 (1.1)	3.93 (0.7)
Body Mass Index (kg/m ²)	25.17 (5.9)	25.03 (5.8)
Systolic Blood Pressure (mmHg)	123.87 (12)	119.27 (16.4)
Diastolic Blood Pressure (mmHg)	78.47 (7.4)	74.6(12)
Heart Rate at Rest (BPM)	73.2 (7.7)	72.93 (6.4)
Blood Oxygen Saturation (%)	96.23 (1.2)	96.31 (1.0)
Glycosylated Hemoglobin (%)	6.19 (1.3)	5.93 (0.4)

t1- pre-test; t2- post-test

Table 3 Wilcoxon signed rank test comparing quality of life domain scores and health tests before and after the physical activity intervention

Comparison of QOL Domains/Health test	Mean difference (SD)	z	p-value	Effect size
Physical Health Domain t ₂ -Physical Health Domain t ₁	7.14(8.5)	-2.59	0.009*	0.47
Psychological Health Domain t ₂ -Psychological Health Domain t ₁	9.14(12.0)	-2.77	0.006*	0.50
Social Relationships Domain t ₂ -Social Relationships Domain t ₁	7.22(12.5)	-2.07	0.039*	0.38
Environmental Domain t ₂ -Environmental Domain t ₁	1.87(9.86)	-0.75	0.450	0.14
Self-Rated QOL t ₂ - Self-Rated QOL t ₁	0.80(1.4)	-1.92	0.055	0.35
Satisfaction with Health t ₂ - Satisfaction with Health t ₁	0.80(0.9)	-2.52	0.012*	0.46

QOL Quality of life; t₁-pre-test; t₂- post-test; * p-value < 0.05

Discussion

This feasibility study presents findings from the evaluation of a physical activity intervention informed by community-based participatory research aimed at communities residing in a socially deprived locality in Southern Sweden. This study primarily aimed at, presenting the development and initial evaluation of a participatory research driven physical activity intervention through triangulation of data, collected using different methodologies. In an attempt of doing so, the study also provided insights on both challenges as well the aspects contributing to the successful implementation of this evaluation approach to examine a complex intervention.

The current study elucidated the importance of the group process in the successful implementation of a physical activity intervention. Group activities promoted collaborative actions creating an environment for positive interpersonal influence that lead to commitment, which in turn influenced behavioral change. Development of group skills strengthened individuals' faith in their own abilities and boosted their self-confidence, which successively led to personal empowerment. This is in line with previous studies describing social support as an important determinant of successful implementation of health promotional intervention [54–57]. However, in the current study participants became empowered through social interaction with other participants in the intervention program, which gave them the confidence to spread their knowledge to others thereby creating a wider social network bounded by common goals such as physical activity and health. This was in line with the process of empowerment explained in a previous study [58], specifying three central components including that empowerment must lead to an increased control of one's own health which further leads to an increased ability to control their life and thirdly it should

increase the ability to change the world. The process is reflected in our current study through participants perceiving a change in their own health followed by the emergence of the thought that health was beyond being disease free, which gives the feeling that participants achieved a higher control over their life through their participation. Through being coaches at the tertiary level, the participants were inclined towards changing the world.

In addition, participants in this study were unacquainted to each other ahead of participation however, they developed a sense of trust among each other and thereby an increased sense of security in the locality in the group during the course of 12 weeks. This was in contrast to previous studies describing the mechanism of social support in promoting health where social support was derived primarily from family members and friends [59–61]. The current study shows that empowerment can arise while meeting with other unknown people especially when they are bound by common goals. This helps them as individuals to take control of factors that improve their quality of life especially with health as focus.

In line with previous studies [62–64], participants in this study, specifically women with Middle Eastern backgrounds perceived an unavailability of activities that were exclusive for women ahead of participating in the intervention program. Through participation in the current intervention program women from the community felt motivated to become role models and engage themselves in creating new and meaningful initiatives where secluded groups within the community in particular women are welcomed. Previous studies have recommended the need for involving women representatives from the community in designing such activities to increase social inclusion [64], but no such interventions

Table 4 Wilcoxon Signed Rank test comparing body mass indexes before and after the physical activity intervention

Comparison of Health test	Mean difference	z	p-value	Effect size	Number of measurements
Body mass index t ₂ - Body mass index t ₁ (kg/m ²)	0.14	-0.06	0.95	-0.33	15

t₁-pre-test; t₂- post-test

Table 5 Paired samples t-test comparing biomedical parameters before and after the physical activity intervention

Comparison of Health test	Mean difference	t	p-value	Number of measurements
Systolic pressure t_2 - Systolic pressure t_1 (mmHg)	4.60	0.99	0.34	15
Diastolic pressure t_2 - Diastolic pressure t_1 (mmHg)	3.87	1.19	0.25	15
Heart rate at rest t_2 - Heart rate at rest t_1 (bpm)	0.27	0.18	0.86	15
Blood oxygen saturation t_2 - Blood oxygen saturation t_1 (%)	-0.08	-0.32	0.75	13
Glycosylated hemoglobin t_2 - Glycosylated hemoglobin t_1 (%)	0.25	0.84	0.42	13

t_1 -pre-test; t_2 - post-test; Due to some technical difficulties data for two volunteers were missing, when it comes to blood oxygen saturation t_2 and glycosylated hemoglobin t_2

have been implemented and evaluated prior to the current study.

Participants in this study became more self-sufficient through participating in the intervention program. Although they started with being curious to acquire new knowledge from others and thus were dependent on the coach or other participants in the group, they eventually improved over time to the extent that they were confident of becoming coaches themselves and sharing their knowledge with others in their community. The application of the train-the-trainer educational model together with the physical activity intervention in the current study made participants confident in their capabilities to spread the intervention to other members of the community. Train-the-trainer model has earlier also been proven successful in enhancing public health preparedness in particularly in disadvantaged communities [38, 65, 66]. There has however been limited research on the impact of CBPR informed intervention in Middle Eastern migrant population, particularly women. However, existing literature has recognized the value of the participatory process in adequate adoption and spread of interventions targeting lifestyle modifications [66].

In an attempt to understand the impact of the intervention the study also shed light to the barriers experienced by participants that may influence the intervention. Participants related to the lack of motivation to train, lack of access to culturally sensitive physical activity programs primarily for woman as barriers to being physically active ahead of the intervention. After participation in the intervention, however they also discussed how the intervention help them to overcome some of the barriers. Empowering women and encouraging them to participate in intervention programs focusing on building trust among community members was seen as way to overcome these barriers [67].

Among the four domains and two global items, measuring quality of life assessed before and after participation in the intervention program there was a significant improvement in physical health, psychological health, social relationships, as well as, perceived satisfaction in health among participants in this study. These results are in line with results from previous studies assessing the health effect after participation in behavioral

interventions [68–71], however these studies targeted subgroups of population such as older adults or population cohorts with a particular disease or recovering from illnesses. Interestingly, there were no changes identified in the environmental domain before and after participation in the intervention. An explanation to this could be that the components assessed within this domain include higher-level factors such as policy changes, accessibility to health care, financial situation and safety. These factors will not be directly impacted by a short-term physical activity intervention. These results were in line with previous studies involving older adults [63] unlike the current study, which included a subgroup of population in different age groups.

Interestingly the results from the quantitative surveys were very consistent with that of the findings that emerged from the focus group interviews, supporting triangulation of the findings. Participants experienced better health and wellbeing overall with improved physical and mental health. The aspect of being together and the effect of working in networks through bonding and bridging have emerged both from the quantitative, as well as, qualitative results. However, it was also evident that participants remained unsatisfied about the access to health care throughout their time in the intervention program, which reflected on the environmental aspects of the quality of life assessments. The triangulation of the results from the qualitative and quantitative studies, have reached similar conclusions, which not only indicates the possible validity of the results, but also provides a deeper understanding of the underlying mechanisms behind the possible success of the intervention.

Participation and trust emerged as key aspects guiding the success of the intervention in the current study. In contrast to interventions implemented at a population level, Transformative CBPR interventions are grounded on the principles of CBPR which also emphasizes the pivotal role played by participation (defined as a process of organizing to achieve meaningful social change), in influencing health outcomes at a community level [26]. Through merely participating in the intervention program participants in the study experienced changes not only in their lifestyle and health but also their social life and existence in the locality.

The initial evaluation of a participatory research driven physical activity intervention was demonstrated to be feasible in that it was highly acceptable to participants, while also elucidating significant improvement in self-reported health and quality of life, together with individual improvements in some parameters, e.g., glycosylated hemoglobin. One should note that many participants in this sample demonstrated biomedical measures within the reference intervals already at the pretest evaluation, which indicates that no major changes were expected in relation to the physical activity intervention. The triangulation of methods used for evaluation of the interventions indicates that using multiple perspectives and indicators of health is important to include as outcomes in order to determine the complex effects of a CBPR based health intervention as in this study.

On the one hand, positive outcomes mirror previously published studies in similar groups in Sweden, as well as, elsewhere in the United States [57, 72]. On the other hand, the current mixed method evaluation study differs in principle from previous investigations. Specifically, this CBPR informed intervention has not only proven to be vital in health and related quality of life, but it has also empowered especially women to be future health ambassadors in their communities.

Implications for practice

Several implications may be drawn from the current study. Firstly, the use of local knowledge through the involvement of members of the community together with other stakeholders in planning and making informed decisions on actions has had a significant impact on health related quality of life of members in the community. In addition, the unique role of academicians as facilitators in the process of knowledge mobilization and application of such knowledge to improve health among members of the communities is also an important take home message from this study.

Secondly, participants became certified as health ambassadors after completion of the 12-week physical activity intervention. As health ambassadors, they were encouraged to spread the intervention to other members in their community which participants in this study were willing to do. Finally, participants started also smaller training groups with their friends, families or colleagues at work after the completion of the intervention program. They did not only continue to be physically active but also became role models for their friends and family.

The learnings from the current study is also important when considering designing similar health promotional activities in other socially disadvantaged neighborhoods elsewhere in Sweden or in global context. The authors would like to provide several recommendations to overcome practical barriers when designing similar studies.

- Health promotional activities should not merely be based on participants perceived needs. Rather it should allow the participants to involve in the CBPR process and thereby design for themselves, activities suited to their own needs.
- The role of the health promoter, a representative from the community is considered vital in including members who are otherwise isolated from the rest of the community.
- Multiple training sessions should be offered on different days, and at different times to increase participation and minimize dropouts. Time schedules should be discussed ahead with potential participants.
- Participants should be placed in groups such that they feel comfortable and welcome within their groups. If individuals wish to train only with members of their own gender owing to religious reasons it should be made possible.
- After completion of the intervention, the health promoters or the coach should also mentor participants periodically to boost their motivation.

Limitations

The study had a small sample size with predominantly females in the group. Despite the small sample size, the study results indicate a positive direction for further large-scale studies in this context. Problems such as isolation including the need to remain indoors owing to sociocultural practices, language barriers and lack of social network leading to physical inactivity is regarded as more common among women in this context compared to men [19]. Hence, the reach out to more women was considered a positive effort to reduce disparities. Furthermore, the results of this study must be interpreted with caution since the intervention may have been too brief to make substantial changes to health behavior. However, participants in this study were inclined towards maintaining positive health behavior and presumed that by being coaches themselves they could also continue training especially since they believed in teaching others through being role models. The research team also intends to perform long-term follow-up measurements, which will further encourage participants to follow routines. The lack of control group in this study also limits the possibility to discuss the causal effect of the intervention on measured parameters.

Conclusion

The intervention supported by participatory approach presented in this study appears feasible and potentially effective in promoting health in communities in socially deprived regions. In addition, health promotional activities offered as a group activity may improve the effect of

the intervention through creating social cohesion. Further research is needed to substantiate the findings from this feasibility study. However, the initial evidence from such interventions can guide future studies using similar models and approaches where community participation is key for both the development of CBPR informed health intervention, as well as evaluation of such programs.

Abbreviations

BMI: Body Mass Index; CBPR: Community Based Participatory Research; WHO: World Health Organization; WHOQOL – 100: World Health Organization Quality of Life Survey – 100 items version; WHOQOL-BREF: World Health Organization Quality of Life Survey –Brief Version

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Authors' contributions

All authors including AK, MR, RR, EC, SS and EA participated in the design of the study. RR and MR performed the study apart from biomedical tests, which were carried out by EA using a biomedical testbed developed by SS. RR and AK analyzed all the quantitative data, together with EA and SS who worked on the biomedical data analysis. EC, RR and MR analyzed the qualitative data. RR wrote the first version of the manuscript under the guidance of AK, MR, and EC. All authors revised, read and approved the final version of the manuscript.

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Availability of data and materials

The datasets generated and analyzed during the current study are not publicly available due to copyright issues and GDPR regulations but are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

The current study was approved by the Regional Ethical Committee in Lund (DNR 2018/384). Participants signed an informed consent form indicating their consent to participate in the intervention program, as well as, research study. The consent forms can be made available upon request.

Consent for publication

All data is presented at a group level and participants consented to publish their anonymous results.

Competing interests

The authors declare that they have no competing interests.

Author details

¹Department of Care Science, Faculty of Health and Society, Malmö University, Jan Waldenströms Gata 25, SE-20506 Malmö, Sweden.

²Department of Biomedical Science, Faculty of Health and Society, Malmö University, Jan Waldenströms Gata 25, SE-20506 Malmö, Sweden.

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III

**Long-term evaluation of a participatory research informed
physical activity intervention among women from disadvantaged
neighborhoods with a pandemic perspective**

Rathi Ramji, M Sc.,¹

E-mail: rathi.ramji@mau.se

Margareta Rämgård Ph.D¹

E-mail: margareta.ramgard@mau.se

Elisabeth Carlson, Ph.D.,¹

E-mail: elisabeth.carlson@mau.se

Sergey Shleev Ph.D²

E-mail: sergey.shleev@mau.se

Eman Awad M Sc.,²

E-mail: eman.awad@mau.se

Stefan Cirovic M Sc.,²

E-mail: stefan.criovic@mau.se

Anders Kottorp, Ph.D¹,

E-mail: anders.kottorp@mau.se

¹ Department of Care Science, Faculty of Health and Society, Malmö University, Jan Waldenströms
Gata 25, SE-20506 Malmö, Sweden

² Department of Biomedical Science, Faculty of Health and Society, Malmö University, Jan
Waldenströms Gata 25, SE-20506 Malmö, Sweden

Corresponding Author: Rathi Ramji; rathi.ramji@mau.se

Abstract

Background: Citizens living in socially disadvantaged neighborhoods, especially women are susceptible to chronic diseases associated with risk behaviors as physical inactivity and poor nutrition and even to emerging threats as the COVID-19.

Objective: This study aimed at evaluating the effects of a participatory research informed intervention on the health and related behavior of women living in disadvantaged neighborhoods in Southern Sweden before and during the pandemic.

Methods: Thirty-four women participated in a physical activity intervention facilitated by lay health promoters. Health related quality of life, behavioral outcomes and biomedical parameters were assessed and compared statistically across four time points: prior to intervention, immediately post-intervention, 6 months post-intervention and 18 months post-intervention during covid-19 pandemic.

Results: The scores of all domains of health-related quality of life increased at t2 compared to t1 ($p < .05$), but they reversed back at t3. On comparing scores at t3 with t4 there was a significant increase in health satisfaction and environmental health domain score while the other domains remained stable during the pandemic. Physical activity, everyday activities, and intake of fruits and vegetables significantly improved at time points t2 and t3 compared to time point t1 ($p < .05$). Everyday activities and intake of fruits and vegetables was significantly higher during t4 compared to time point t3, while other behaviors remained stable. Systolic and diastolic pressure significantly decreased at t3 compared to t2 ($p < .05$). There was a significant positive change in the biomedical outcomes such as oxygen saturation and blood flow rate at t4 compared to t3

Conclusion : This study elucidates that a participatory research informed intervention in organized groups may not only promote prolonged engagement in physical activity and improved diet but also help to maintain behavior and health during the pandemic among women in disadvantaged neighbourhoods.

Keywords: Community Based Participatory Research, Physical training, Diet, Risky behavior, Blood pressure

Background

Physical activity and nutrition are essential behavioral factors that contribute to overall health and well-being of individuals. Despite the fact that the World Health Organization (WHO) recommends leisure time physical activity of 150 minutes of moderate intensity aerobic activity per week for adults aged 18–64 years nearly 30% of the population over the age of 15 years are considered to be physical inactive globally thus making it a widespread global pandemic [1, 2]. Similarly, despite WHO's recommendation of at least five servings of fruits and vegetables as a part of daily routine nearly 4.4% of the overall burden diseases in the European population was a result of low intake of fruits and vegetables [3]. Rapid rise in chronic diseases owing to physical inactivity and poor nutrition exerts a substantial economic burden on health systems. Previous research also shows that individuals tend to choose unhealthy snack directly after exercise thus it was considered important to include nutrition education in physical activity intervention programs [4].

Studies show that nearly 65% of the Swedish adult population followed the recommendation of 150 min of moderate-intensity physical activity per week [5, 6]. However, populations living in low socioeconomic areas in larger cities in Sweden, exhibited low fitness levels due to prolonged sitting owing to lack of access to physical activity, such as sport or training [5]. Physical activity levels not only differed by age, gender, and disability [7], research suggests a social gradient associated to it, since socioeconomically disadvantaged citizens often tend to lead a sedentary lifestyle and experience adverse health outcomes related to inactive lifestyle compared to their more advantaged peers [8-10]. The unequal distribution of physical activities both in Sweden and elsewhere is owing lack of access to preventive health care and most importantly lack of access to affordable leisure time physical activity centers or gyms in disadvantaged neighborhoods [11]. Citizens living in socially disadvantaged neighborhoods

are often migrants who differ from the general population by language, cultural beliefs, education levels, and access to the labor market. Problems with integration in these communities has led to low social contact, segregation and mental suppression [12, 13]. They also face issues such as unemployment and those few that are employed are less informed about employment rights in the host country and tend to have poor work-life balance leading to lack of time for self-care or physical activity [13]. Women from these neighborhoods frequently experience more challenges than their male counterparts owing to being financially dependent together with social and traditional values they carried from their home country apparently influencing their view of their current context. The rate of chronic disease seemed higher particularly among these women due to their lack of access to knowledge regarding behavioral risk factors and the lack of access to health care services owing to financial and language barriers, resulting in delay in access to primary care, late diagnosis and treatment [6, 14-16]. They are also highly susceptible to newly emerging diseases such as the COVID-19 due to factors such as overcrowded housing, multigenerational cohabitation, poor access to information owing to language barriers, poor working conditions with almost no possibility to maintain social distancing, poor health more specifically presence of multiple comorbidities, and not the least poor economy [17]. According to the data from the Public health agency of Sweden 32% of the population who were initially infected by COVID-19 in the early stages of the pandemic were from disadvantaged neighborhoods. Studies have also shown that COVID-19 related mortality was thrice as higher among citizens with migrant background living in socially disadvantaged neighborhoods compared to the general Swedish population [17]. Aside of this COVID-19 has led to a health crisis further accelerating the physical inactivity pandemic which the public health authorities have failed to address for over two decades [18, 19]. Despite the fewer COVID-19 restrictions in Sweden studies show that negative changes in lifestyle including physical inactivity, which was significantly higher

among women from socially disadvantaged neighborhood as they spent more time in sitting at home, and had higher odds of mental ill-health [20]. Recent research shows that physical activity as a therapeutic strategy to mitigate COVID-19 since it induces anti-inflammatory response in the tissues and bloodstream which inhibits the immunosuppressive mechanism of the virus restricting the spread of infection while also alleviating related symptoms of depression and anxiety [21].

Citizens living in disadvantaged neighborhoods have not benefitted from large populations level interventions given that those interventions are not designed in accordance with the actual needs of these citizens [22, 23]. Thus, there is a need to adapt to alternative approaches such as Community based participatory research (CBPR) [24-27] through actively engaging citizens from these neighborhoods together with academic, public, and private actors in the design, development and implementation of interventions [26]. Prior research shows that interventions with CBPR approach enhances community involvement and have the potential to induce behavioral change since it facilitates increase understanding in communities needs and includes the members of the community throughout the research process [28, 29].

CBPR based interventions are relatively dearth in Sweden. However, one physical activity intervention program was developed together with the citizens from a socially disadvantaged neighbourhood in Southern Sweden. This intervention was part of a larger health promotional program [30] based on community-based participatory research whose aim was to create means to improve health through participatory and cooperative strategies within the health promotion platform. Future workshops [31] where conducted at part of this program there the citizens' from the neighborhood expressed their needs and identified strategies to promote health, well-being and quality of life. Five problems areas including (a) physical activity, (b) mental health, (c) self-care, (d) oral health and (e) health literacy, emerged from these

discussions [30]. Following this the citizens from the neighborhood together with the academic partners and other stakeholders identified, developed and implemented health promotional activities, one among which was a participatory research informed physical activity intervention [32]. The health promotional interventions within the program including the participatory physical activity intervention were coordinated by select members from the community known as health promoters (lay health promoters) who had the role of assisting the research team in identifying participants, language interpretation and most importantly to inform the research team about the cultural nuances of the community.

The development and initial evaluation of the participatory physical activity intervention has been presented earlier in the feasibility study [32]. The results of the feasibility study showed that participants perceived an improvement in their health-related quality of life after participation. Furthermore, the feasibility study highlighted the need for activities separately for men and women and an immediate need to focus on women as they were isolated and suffered with mental health related issues. The uptake of interventions was perceived better when offered as a group activity and participants also appreciated the possibility to assess their physical health using biomedical tests as believed that it gave them an evidence of the health impact of the intervention, which further motivated them to be physically active [32].

The feasibility study however lacked clarity on the sustainability aspects of the intervention since only the short-term follow-up of the perceptions relating to health-related quality of life and some of the biomedical parameters were assessed directly after the end of the intervention. In addition, the feasibility study included only some of the citizens who were involved with the development of the intervention. However, an evaluation of the intervention applied to other citizens from the neighborhood who initially participated in the initial Future Workshops and expressed the need for such an activity but were not involved in the

development of the physical activity intervention was also warranted. Considering the ongoing pandemic, statistical data on COVID-19 shows a cumulative incidence of being infected was 74% for every 10,000 residents living in a district in Southern Sweden (with seventeen neighborhoods) in which the neighborhood where the intervention was implemented was one. [33]. The high incidence of COVID-19 in this neighborhood may have influenced compliance to physical activity and related health and thereby the effects of the intervention.

Thus, the aim of the current study was to evaluate the effects of a participatory research informed physical activity intervention on the health and related behaviors of women living in socially disadvantaged neighborhoods in Southern Sweden before and during COVID-19.

Methods

Context

The intervention program being evaluated was based in one of the disadvantaged neighborhoods located in Southern Sweden which was enlisted as highly vulnerable by the Swedish national security agency owing to problems, such as high rate of criminality, low education levels and unemployment. [34]. The citizens living in this neighborhood are predominantly non-Swedish speaking migrants from the Middle east [32].

Study design

The current study used a longitudinal evaluation design to assess the health effects of the participatory research informed intervention. Since the current research is based on the community based participatory research approach the evaluation is an iterative and ongoing process [35]. Quantitative data in form of surveys and biomedical assessments were gathered over time at four points of time, at first ahead of the intervention (t1), the second measure was precisely after the intervention (t2), the third about six months post-intervention (t3) and the last (t4) during COVID-19 about additional 12 months after t3.

Participants

Three health promoters were involved in participant recruitment for this study. These health promoters initially reached out to about 40 individuals from the neighborhood who were not part of the development of this physical activity intervention [32], but had participated in the initial future workshops. Participants were contacted through face-to-face interactions, as well as, using flyers in Arabic, Swedish and English languages. There were no specific inclusion criteria for this study as the entire platform was grounded in the participatory principles, which

insists on social inclusion. However, in line with the perceptions of citizens that emerged from the feasibility study [32] the current intervention targeted to include as many women as possible. The research team only ensured if participants had any medical or physical restrictions that could hinder their participation.

Participatory physical activity intervention

The physical activity intervention aimed at building community and diversity through provision of a fair and equal fitness culture among community members. The intervention program aimed at introducing gradual change beginning with simple bodily movements to more advance exercises in the absence of complex gadgets, replaced by everyday objects. The citizens taking part in the intervention were certified as health ambassadors who could further spread the intervention to others in the community. As health ambassadors the participants could spread their knowledge to others in their family and in their neighborhood. Such a method has previously been proven effective in spreading the intervention to larger population groups [36, 37]. The intervention was offered for free with an intention to make it accessible to all.

The intervention was offered twice a week in two different groups with fifteen to twenty persons in each of the two groups. Each session lasted for about two hours over a period of three months between March 2019- May 2019 (Figure 1). The intervention included physical activity indoors and outdoors, as well as dialogue and reflection sessions focusing on other health determinants associated with physical activity such as diet and stress. The health promoters together with other community members certified as health ambassadors since they had participated in the feasibility study and initial development of the intervention facilitated these sessions. A minimum of two facilitators from the health promoters or health

ambassadors who developed and tested the intervention were present on all occasions to help the participants. After the three months intervention program participants had the opportunity to train on their own or in self-organized groups of their choice for a period of six months until December 2019. During this period, they also had the opportunity to communicate with the health promoters via social media. With the emergence of the COVID-19 and the physical distancing recommendations the participants actively sought support from the health promoters and reinitiated online physical activity sessions an adapted version of the intervention for the groups.

Assessments

Quality of Life and Behavioral Health Surveys

Data was collected using a survey evaluating the different domains influencing health related quality of life using the WHO Quality of Life-BREF survey which is a modified version of the WHOQOL-100 [38]. The survey was distributed by the research team together with the health promoter at all four points of time, first before the intervention start at a point t1, the second immediately after the intervention program ended (t2), the third about 6 months after the intervention program ended (t3) and the fourth during COVID-19 pandemic (t4). The survey includes 26 items, of which 24 items are grouped into domains namely the physical health, psychological health, social relationships, and environmental domains. The remaining two items were known as global items [38]. The domain scores were calculated from the responses and were later transformed into a 0–100 point scale according to the guidelines of the WHOQOL-BREF [38]. A higher score indicates better quality of life. The questionnaire is available in several languages including Arabic and Swedish. Since most of the participants in this study could only understand Arabic, the Arabic survey was uniformly distributed to the

all the participants. The health promoter assisted participants who had difficulties to independently respond to the questions. This survey has been previously validated in 15 different locations and the reliability and validity of the Arabic version has also been assessed in similar population [39]. In addition, the survey was also tested in the feasibility study performed by the research team with participants from the same neighborhood who were involved with the initial development of the questionnaire [32].

Aside of quality of life assessments, participants demographic details such as age, gender, mother tongue, educational qualifications, current employment status, socioeconomic status, as well as, behavioral factors such as diet, physical activity levels, leisure activities were also gathered using standard questions from the national public health survey [40] at the same four points of time when the quality of life assessments were made [32].

Biomedical assessments

Physical health was measured using non- invasive biomedical devices. Cardiovascular functioning was monitored through assessment of blood pressure and resting heart rate using an iHealth Sense Wireless Wrist monitor from iHealth Labs Inc. (Sunnyvale, California, USA) by placing the device on the participants' wrist. Blood flow rate and stress index were measured using an AngioScan-01 from AngioScan-Electronics (Moscow, Russia). The device was placed on the participants' right index finger. Oxygen saturation levels, as an indicator for cardiovascular health and also as measure to understand the condition of the lungs given its relevance to COVID-19, were assessed using an iHealth Air-Pulsoximeter from iHealth Labs Inc. . Body mass index, fat mass, and muscle mass were assessed using a Tanita Model MC780MA. The participants' height was manually entered into the Tanita machine, which further calculated the Body mass index based on the weight measured. The participants were

instructed to stand on the device with bare feet placed on the electrode platform until their body weight was displayed. Then, the participants were instructed to hold the handlebars with their arms straight down until the remaining parameters were displayed. Body composition were determined to evaluate the risk for metabolic diseases.

All biomedical assessments were completed in about an hour for each patient on each of the four occasions. A biomedical researcher (SC) who was also part of the research team assisted by health promoters performed the assessments. The biomedical experts followed the necessary safety measures particularly during the last occasion during COVID-19, including good hand hygiene, and used gloves and facemasks while performing the test in accordance with the recommendation from the Swedish Public Health Agency.

Participants were not requested to follow any protocol ahead of the biomedical tests; however the participants were tested around the same time of the day at all four-time points (See Figure 1).

Statistical analysis:

Before initiation of the study, the sample size was determined by a power analysis based on the feasibility study with fifteen participants who responded to the same questionnaire at two points in time, i.e., before and after the intervention. With an alpha set at 0.05 and power at 0.80, approximately 35 participants were required to identify a detectable change in the quality-of-life scores pre-post intervention.

As a first step in the analysis all variables, both from the biomedical data and the quality-of-life scores, were tested for normality. The non-parametric analysis was preferred over parametric analysis although some of the variables were normally distributed due to a small sample size and ordinal-based data in some of the outcome variables. The scores of the four

quality of life domains and two global items, the behavioral factors, and biomedical measures were compared in three stages, viz. measures at t1 prior to intervention start vs. that of t2 measured directly at the end of the intervention, followed by t2 vs t3 measured 6 months after completion of the intervention and, finally, t3 vs. t4 during COVID-19. The comparison of medians were done using Wilcoxon's Signed Rank Test models [41]. The changes were monitored at group level. Statistical significance was set at a p value of <0.05 . Effect sizes were finally calculated and interpreted based on reference levels, $d = 0.2$ or lower was considered small, $0.2 < d < 0.5$ as medium, and $d = 0.8$ or larger as large [42].

Ethical considerations

The health promoters verbally informed all participants through a video call via Whatsapp in Arabic language about the purpose of the research study prior to first data collection occasion. Participants were also assured that participation was voluntary and that they were allowed to leave the study at any point in time without any consequences.

In the later part during COVID-19 participants were assured that all activities were to be carried out in accordance with guidelines from the Swedish Public Health Agency. Participants were also ensured that the biomedical researchers who collected biomedical data would follow the necessary safety measures, including good hand hygiene in accordance with the Swedish Public Health Agency's recommendations. All the above information was also provided to the participants in writing together with contact information of the research team. Participants were asked to sign an informed consent form during the first occasion. All data collected were anonymized and kept confidential. The data was only accessible to the members of the research team. The Swedish Ethical Review Authority approved this study (DNR 2018/382 and DNR 2020-04063).

Results

All participants in this study were of Arabic descent and were aged between 23-77 years. Nearly 29% of the participants in the group reported to be pursuing further education, mainly language training and about 8% of the participants reported to be employed and the remaining were homemakers, retired or on parental leave. The demographic characters of participants are presented in Table 1.

Of the 40 females who were invited 34 (88%) of them participated in the intervention program, and the research study. Two of the forty participants, who were invited initially dropped out ahead of the start of the intervention since the training times did not match their individual and family commitments or schedules. Data from three participants were excluded, as they were not present in two of three test occasions when research data were collected. At the final follow-up during COVID-19 at time point t4 only 28 participants were available, since three of the thirty-five women who were invited could not participate as they had not returned from their home country after summer vacation due to unavailability of flights. One other woman who dropped out had been diagnosed with COVID-19 two days ahead of data collection. Three participants mentioned that they feared being infected, as they were risk group and thus refused to participate. Dropout analyses in terms of baseline behavior, biomedical parameters and quality of life scores showed that the women who dropped out did not significantly differ from those who remained in the study ($p < .05$).

Health Related Quality of Life

The median and range of the WHOQOL-BREF domain scores at the three points of time is presented in Table 2. The participants perceived better health related quality of life at time point t2 compared to t1. The mean score increased for all the four quality of life domains

including physical health, psychological health and social relationship, and environmental health ($p < .05$) at time point t2 compared to t1. However, there were no remaining significant changes at point t3; rather the perceptions reversed after six months of completion of the physical activity intervention at point t3 compared to t2. The participants did however perceive an increased satisfaction in their health at time point t4 as compared to that in t3. There was also an increase in environmental health domain scores ($p < .05$) between t3 and t4. The effect sizes for change in perception of health-related quality of life at time point's t1-t2, as well as t3-t4 were overall low. The results from the health-related quality of life measures in presented in Table 3.

Behavioral Factors

The descriptive scores for the different behavioral factors at the three points of time is presented in Table 2. The physical activity intervention also yielded direct and positive significant changes in behavior especially concerning nutrition and fitness at t2 compared to t1 (Table 3). After participation in the intervention, the women were significantly more likely to consume more vegetables and fruits ($p < .05$) than ahead of their participation in the intervention at all three times compared t-t2, t2-t3 and t3-t4. With regards to fitness behavior, the results indicated that participants spent significantly more time on physical activity or sports and reported to have a more active lifestyle in their everyday life ($p < .05$) at t2 compared to t1. Physical activity levels reversed back at time point t3 compared to t2 but were still higher than t1 while observing the descriptive scores. There was a significant increase in everyday activities and fruit and vegetable intake at point t4 compared to t3 and earlier ($p < .05$). The intervention did not significantly influence soda intake, fish intake and

hours of sitting at all points of time. The effect sizes for change in behavior before and after intervention both at t2 t3 and t4 was low to moderate.

Biomedical assessments

The descriptive measures for the different biomedical assessments at the three points of time is presented in Table 2. Systolic and diastolic blood pressure significantly decreased ($p < .05$) at t2 when compared to the initial t1. The levels were also significantly lower at time point t3 compared to the first measurement t1 ($p < .05$). Blood flow rate increased significantly directly after participation in the intervention at point t2 compared to point t1 ($p < .05$), point t3 and appeared again between t3 and t4 ($p < .05$). There was a significant difference in fat mass at time point t2 compared to t1, but the effect significantly reversed at point t3 ($p < .05$). Oxygen saturation reduced (however, levels were within the normal reference interval) and blood flow rate increased significantly between time points t3 and t4. All other biomedical parameters assessed remained stable and within normal intervals at time points t2, t3 and t4. The results from the biomedical assessments are presented in Table 4.

Discussion

The participants in this study perceived a higher health related quality of life after participation in the intervention program, but the perceived quality of life reversed six months after the organized intervention ended. The participants did however maintain their level of quality of life during the pandemic situation. The intervention program seems to have succeeded in increasing the daily physical activity levels of women from disadvantaged neighborhoods who otherwise reported to have led a sedentary lifestyle ahead of their participation in the intervention. Moreover, it led to sustained activity during the follow-up period even when no organized activities were available as well as during the pandemic. Similar results were also observed relating to consumption of fruits and vegetables. These behavioral changes were also partly reflected in objective physical health since there was a decrease in the levels of blood pressure, 6-month post intervention. These results also indicate that the participatory research informed physical activity intervention program had a potential impact on some of the important markers of cardiovascular disease. Although there was a significant increase in blood flow rate, there were no changes in blood pressure levels during COVID-19, and more so it was well within the normal reference intervals indicating that physically activity had a regulatory role on health and well-being during the pandemic. The role of physical activity in increasing blood flow rate and enhancing the immune system thus suppressing the severity of the COVID-19 infection has also been previously identified in large patient studies [43]. With regard to physical health status participants self- reported that they were satisfied with their own health during the pandemic while health in general was deteriorating in the overall population. This study also shows that an increased score in the environmental health domain after participation in the intervention indicates that participants

trust in the health care system and other public agencies was higher than it was previously at time points t2 and t3.

This study demonstrates that participation in the physical activity intervention program also led to sustainable increase in habitual physical activity levels among women in the community who otherwise led a sedentary lifestyle. This is particularly interesting since nearly half of the women were homemakers who lead sedentary lifestyles and seldom had performed physical activity at their leisure before participating in this intervention. Women also became conscious about their diet and began consuming more vegetables and fruits after taking part in the intervention. The change in physical activity levels together with dietary changes were also reflected on physical health of the participants with significant improvement in at least one of the risk markers for chronic diseases, i.e., blood pressure, directly after participation in the intervention. In addition, participants opted to increase their everyday activities when they were unable to perform physical exercise or sports in public premises during the COVID-19 pandemic. A few participatory research informed physical activity interventions in adult populations previously implemented and evaluated in other countries, have shown also reported changes in health- related behavior and perceived-health. A study among migrant women studying an adult education center in United States, who attended a 6-week participatory intervention and were evaluated using similar assessment tools as that in the current study with a before-after designing whose results also reported increased health related quality of life, frequency of physical activity and alterations in body weight and blood pressure post intervention [26]. However, the American study was facilitated by fitness instructors and nutritionist and the power balance in the group was not clearly described. In addition, the participant also experienced language barriers which caused frustration and disinterest which may have also influenced the long-term compliance to physical activity which was not evaluated in the study [26]. In contrast to the American study the current study the intervention

was facilitated by lay health promoters who were also citizens of the same neighborhood with an increased understanding of the women's need. In addition, the health promoters were in continuous dialogue with the women in the group and worked with building trust between and among the women to address power imbalances as described in the feasibility study [32].

The results relating to objective physical health assessed by biomedical tests after the intervention in the current study are also in line with a randomized controlled trial evaluating a culturally adaptive physical activity intervention offered by the primary care to migrants with high risk for cardiovascular disease where participants reported changes in frequency of physical activity, increased health related quality of life and decrease in blood pressure post intervention compared to the control group [44]. The intervention evaluated in the previous study was however, not informed by participatory research. An earlier review study assessing the impact of interventions targeting health related behaviors also suggest that working with health literacy and knowledge provision helps promote health and change in behavior among community members [45]. The sustained compliance to physical activity among women in the current study may be attributed to the participatory nature, where the women themselves set their priorities based on their needs, while other stakeholders and academicians facilitated the knowledge transfer process together with the women in a power neutral environment in an attempt to foster empowerment which may in turn be a means to long lasting behavioral change [46]. In addition, participants also received more information about the biomedical assessments and their own results, which they frequently missed during their visits to the primary care according to results from the feasibility study [32]. This could have in addition to promoting sustained engagement in both the intervention, as well as the evaluation study also motivated women to continue to be physical active even in the absence of organized activities.

The results of this study suggest that social aspects of training in a group had an impact on the perceived health, given the decrease in health related quality of life during the long-term follow up (t3). While engaging in physical activity in organized groups there was increased social contact and peer support, as well as, increased social interaction in otherwise isolated women as shown in the feasibility study [32]. In addition, when women took initiative to reconnect with the other women in the group through social media during the pandemic they received social support which provided them strength to revive and also reinitiated the group physical activities with the support of the health promoters. This in turn seems to have helped them maintain their physical health even during an acute situation which was further strengthened by that the women despite the rapidly spreading pandemic had reported an increased satisfaction in their own health. These results were much in contrary to other studies in similar groups [17, 19, 47, 48] which showed that disadvantaged populations sedentary lifestyle had worsened and they also perceived poor health and symptoms related to mental ill-health during the pandemic thus unveiling the potential effect of a participatory physical activity intervention on behavior and health of women in disadvantaged neighborhoods over time. Such a social support may have an impact not only maintaining health during the pandemic but also introducing community resilience given the evidence from prior research which shows that prolonged engagement in neighborhood activities in groups creates a feeling of social connectedness. This connectedness makes the individual feel recognised and along with perceived support from other community members which comes through trust building, together with the the actual support received from the health promoters and the fellow group members when they share and discuss health information in the groups [49, 50]. Such a process has been shown to strengthen individual empowerment which may have enforced resilience among the women in this study and through the women the families and thereby their communities.

The role of the health promoters may also be of interest in this study since together with facilitating activities they have also been instrumental in bridging between participants and creating a bond between them leading to the formation of a social support network. Earlier studies have also identified the role of social factors in better uptake of physical activity interventions [6, 51, 52]. Aspects such as social support and social networks relate to the concept of social capital, which is the ability of individuals to acquire mutual benefits through being members in certain social networks. This may relate to the case of the current study where performing physical training as a group lead to changes in perceived health acquired with the support of the social network [53, 54]. Moreover, with the support from the health promoters and other community members which promoted social connectedness through Whatsapp despite the physical distance, participants better understood the prevailing situation and were more positive towards their health, they also acquired trust towards the health care authorities and other public actors all of which may have helped them become more receptive and resilient during acute situations such as the pandemic

Limitations

Although the results from this study show both individual and societal benefits from participating in the intervention, there were also some methodological limitations. The lack of control group limits the possibility to elaborate on the causal effects of the findings. The results from the biomedical test should be interpreted with caution since information relating to medications consumed by the participants were not obtained and could therefore influence the variables measured. Another limitation is missing data in the biomedical parameters' due to technical issues faced while the biomedical assessments were performed. However, previous

studies have also identified challenges in conducting invasive health assessments using blood in large groups of populations living in disadvantaged neighborhoods [55, 56]. Thus, the use of novel non -invasive techniques as used in this study and earlier [32] appears to be a stress-free and less time consuming alternative useful in identifying underlying health problems which may otherwise remain unnoticed in these subgroups of populations. Including only women can be considered as another potential generalization limitation in this study. However, the learnings from the feasibility study indicated that women in these neighborhoods are more often isolated and are prone to lifestyle related health problems more often than their male counterparts. In addition, the men in the neighborhood had access to several other forms of physical training including gyms and outdoor training facilities unlike women who had traditional restrictions to train in public or together with other men [32].

Conclusion

This participatory research informed physical activity intervention program shows a beneficial effect on both physical health and behavior in women from disadvantaged backgrounds and in addition paved way to increasing resilience during the pandemic. The results from this study suggests that similar initiatives developed in the future, for citizens living in disadvantaged neighborhoods to include more long-term organized health interventions that also promotes social interaction and networking among participants for achieving sustainable improvements in perceived health related quality of life. Above all building on existing community based participatory research program may be effective means to enhance community resilience in disadvantaged neighborhoods even during an ongoing pandemic. Considering the dual burden of the two pandemics and its association to chronic diseases future efforts should target building

on existing participatory programs to enhance pandemic preparedness and preserve health among citizens living in disadvantaged neighborhoods.

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Authors' Contributions

All authors including AK, MR, RR, EC, SS, SC and EA participated in the design of the study. RR and MR performed the study apart from biomedical tests, which were performed by EA and SC using a biomedical testbed developed by SS. RR and AK analyzed the data. RR wrote the first version of the manuscript under the guidance of AK, MR and EC. All authors revised, read and approved the final version of the manuscript. The authors declare no personal, financial or other conflicts neither had any competing interest.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Ethics and consent

This study was conducted in line with the Helsinki Declaration and Swedish Ethical Review Authority approved the study (DNR 2018/382 and DNR 2020-04063). The data collected are anonymized and kept confidentially. Participants were given verbal and written information and written informed consent was obtained. They were also informed that participation was voluntary and they were free to leave the study at any point of time without consequences.

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Paper context

Women living in disadvantaged neighborhoods frequently lead a sedentary lifestyle and consume less healthy diet. Use of Community Based Participatory Research approach where citizens themselves are involved in developing interventions has become common. However, it is unclear if these interventions are sustainable over time and how they help during the pandemic to maintain lifestyle and health. Such a knowledge will inform design of future interventions to address the dual burden of communicable and non-communicable diseases.

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Figure 1: The timeline of events in the study

Table 1: Demographic characteristics of participants

Characteristics	Participants n= 35
Age	
Range (md)	23-77 (49)
Country of Origin	
Iraq	10 (29%)
Syria	8 (24%)
Lebanon	5 (14%)
Palestine	4 (12%)
Iran	4 (12%)
Algeria	1 (3%)
Egypt	1 (3%)
Sudan	1 (3%)
Educational Qualification	
University education	7 (19%)
High school	11 (31%)
Elementary school	18 (50%)
Employment Status	
Employed	3 (8%)
Sick leave	4 (12%)
Parental leave	1 (2%)
Studying/Internship	10 (29%)
Retired	9 (26%)
Home maker	8 (23%)

Table 2: Descriptive statistics of all variables before (t₁), directly after the intervention (t₂) 6 months post-intervention (t₃) and during COVID-19 (t₄)

HEALTH & BEHAVIORAL VARIABLES	<i>t₁</i> <i>Median (Range)</i> <i>n=35</i>	<i>t₂</i> <i>Median (Range)</i> <i>n=35</i>	<i>t₃</i> <i>Median (Range)</i> <i>n=35</i>	<i>t₄</i> <i>Median (Range)</i> <i>n=28</i>
I. Quality of Life Domain				
Physical Domain	56 (19-88)	63 (13-94)	56 (19-94)	56 (19-88)
Psychological Domain	56 (25-81)	69 (25-94)	56 (6-94)	56 (19-94)
Social Relationships Domain	56 (19-100)	75 (44-100)	69 (31-100)	69 (25-100)
Environmental Domain	56 (19-94)	63 (25-88)	56 (25-88)	63 (38-88)
Quality of Life	4 (1-5)	4 (1-5)	4 (1-5)	3 (2-5)
Health Satisfaction	3 (1-5)	4 (1-5)	4 (1-5)	4 (1-5)
II. Behavioral Factors				
Leisure time Physical activity	1.0 (0-5)	3.0 (0-5)	2.0 (0-5)	1.0 (0-5)
Everyday activities	2.0 (0-6)	4.0 (1-6)	2.0 (0-6)	3.0 (0-6)
Hours of sitting	5.0 (0-6)	5.0 (0-6)	5.0 (0-6)	5.0 (0-5)
Vegetable intake	3.0 (5.0)	5.0 (4.0)	3.0 (0-5)	4.5 (0-5)
Fruit intake	4.0 (0-5)	5.0 (2-6)	4.0 (0-6)	5 (0-6)
Soda intake	3.0 (0-4)	3.0 (0-5)	3.0 (0-5)	3.0 (0-4)
III. Biomedical Parameters				
Oxygen saturation	98 (92-99)	98 (94-99)	98 (96-99)	97 (93-99)
Systolic blood pressure	126.5 (96-162)	117.5 (98-164)	123 (98-180)	125 (88-196)
Diastolic blood pressure	80 (55-104)	75 (62-98)	74 (62-98)	77 (45-99)
Resting heart rate	78 (60-90)	77.5 (60-92)	78 (56-96)	73 (48-84)
Blood flow rate	329 (273-371)	334 (295-386)	324 (207-385)	334 (274-395)
Stress index	199 (25-675)	186 (6-1087)	252 (50-1055)	128 (12-899)
Body mass index	30.7 (21.7-44.4)	30.5 (20.7-43.7)	30.2 (20.7-40.8)	29.5 (20.0-41.0)
Muscle mass	46 (34.3-61.0)	46.2 (35.6-62.9)	44.6 (34.0-60.7)	45 (36.0-61)
Fat mass	27.2 (14.2-56.7)	26 (12.9-56.6)	28.6 (13.4-50.9)	27.6 (12.0-50.0)

Table 3: Wilcoxon Signed Rank test comparing quality of life domains and health behavior variables before, directly after the intervention and 6 months after the intervention

HEALTH & BEHAVIORAL VARIABLES	t2- t1 n=35			t3-t2 n=35			t4-t3 n=28		
	Mean difference (SD)	z	Effect size	Mean difference (SD)	z	Effect size	Mean difference (SD)	z	Effect size
I. Quality of Life Domain									
Physical Domain	7.4 (14.1)	-2.9*	0.3	-7.4 (14.6)	-3.2*	0.4	-0.19 (13.70)	-0.31	0.0
Psychological Domain	10.1 (12.4)	-3.9*	0.5	-9.7 (23.6)	-2.2*	0.3	1.22(16.66)	-0.36	0.0
Social Relationships Domain	8.6 (16.9)	-2.9*	0.3	-0.9 (23.3)	-0.2	0.02	-4.70 (19.93)	-1.76	0.2
Environmental Domain	5.4 (13.3)	-2.3*	0.3	-4.9 (12.6)	-2.1*	0.3	8.04 (16.54)	-2.26*	0.3
Quality of Life	-0.9 (1.2)	-0.5	0.1	0.9 (1.0)	-0.4	0.1	-0.18 (1.00)	-1.01	0.1
Health Satisfaction	0.6 (1.1)	-3.0*	0.4	-0.5 (1.4)	-2.0*	0.2	0.59 (1.15)	-2.37*	0.3
II. Behavioral Factor									
Leisure time physical activity	1.4 (1.7)	-3.9*	0.5	-0.7 (1.7)	-2.2*	0.3	0.8 (2.21)	-1.53	0.2
Everyday activities activity	1.4 (2.0)	-3.3*	0.4	-0.7 (1.7)	-2.3*	-0.2	-1,18 (2.53)	2.29*	0.3
Hours of sitting	-0.1 (1.2)	-0.2	0.02	-0.1 (2.0)	-0.5	-0.1	0.0 (1.52)	-0.16	0.0
Vegetable intake	1.7 (2.0)	-4.0*	0.5	-0.7 (1.5)	-2.4*	-0.3	1.03 (1.84)	-2.66*	0.4
Fruit intake	1.1 (1.7)	-3.1*	0.4	0.5 (1.4)	-2.1*	0.3	1.00 (1.70)	-2.79*	0.4
Soda intake	0.3 (1.5)	-1.6	0.2	0.1 (1.0)	-0.5*	-0.1	0.04 (1.40)	-0.41	0.1
Fish intake	-0.2 (0.7)	-1.4	0.2	0.1(0.9)	-0.1	-0.01	0.04 (0.96)	-0.22	0.0

t1-pre-test; t2- post-test; t3- 6 months follow-up; t4- during COVID-19 * p-value <0.05

Table 4: Wilcoxon Signed Rank test comparing biomedical assessments before, directly after the intervention, 6 months after the intervention and at t4 – during COVID-19.

Biomedical parameters	t2- t1				t3-t2				t4-t3			
	N	Mean difference (SD)	z	Effect size	N	Mean difference (SD)	z	Effect size	N	Mean difference (SD)	z	Effect size
Oxygen saturation	31	0.1 (1.7)	-0.1	0,0	31	0.3 (1.2)	-1.3	-0,2	26	18.89 (34.92)	-2.43*	0.3
Systolic blood pressure	32	-8.2 (14.3)	-2.9*	-0,4	31	2.4 (17.9)	-0.9*	-0,1	26	1.58 (12.19)	-0.73	0.1
Diastolic blood pressure	32	-5.0 (10.3)	-2.3*	-0,3	31	1.2 (11.8)	-0.4	-0,1	26	-0.71 (9.29)	-0.20	0.0
Resting heart rate	32	1.1 (7.3)	-1.0	-0,1	31	-1.2 (8.4)	-1.0	-0,1	26	-3.67 (10.84)	-1.43	0.2
Blood flow rate	32	12.9 (27.8)	-2.2*	-0,3	25	-19 (44)	-2.5*	-0,4	26	-15.8 (1.57)	-2.66*	0.4
Stress index	30	1.6 (221.3)	-0.1	0,0	30	42.6 (328)	-1.0	-0,1	26	-109.18 (268.15)	-1.83	0.3
Body mass index	31	-0.1 (0.5)	-1.5	-0,2	32	-0.4 (2.2)	-0.1	0,0	26	-0.21 (1.72)	-0.16	0.0
Muscle mass	31	-0.4 (1.3)	-1.2	-0,2	32	-0.4 (1.5)	-2.1*	-0,3	26	0.01 (1.92)	-0.16	0.0
Fat mass	31	-0.6 (1.0)	-2.7*	-0,3	32	1.4 (5.9)	-2.1*	-0,3	26	-1.23 (6.54)	-0.17	0.0

III

Impact of a CBPR-informed physical activity intervention before-and-during COVID-19 in a disadvantaged neighbourhood in Sweden

Rathi Ramji, M Sc., *

E-mail : rathi.ramji@mau.se

Elisabeth Carlson, RN, MNEd, Ph.D.,¹

E-mail : elisabeth.carlson@mau.se

Anders Kottorp Reg OT, Ph.D.¹

E-Mail : anders.kottorp@mau.se

Margareta Rämgård Ph.D.¹

E-mail : margareta.ramgard@mau.se

¹ Department of Care Science, Faculty of Health and Society, Malmö University, Jan Waldenströms Gata 25, SE-20506 Malmö, Sweden

Abstract

Background: Public health practitioners have been striving to reduce the social gradient and promote physical activity among citizens living in disadvantaged neighbourhoods. The emergence of the COVID-19 pandemic which has affected these citizens extensively has posed a significant challenge to efforts to maintain a physically active lifestyle. Thus, the aim of this study was to explore the impact of a CBPR informed physical activity intervention before and during COVID-19 from the perspective of women from a socially disadvantaged neighbourhood.

Methods: Thirty-four women participated in a CBPR informed physical activity intervention previously developed in collaboration with lay health promoters and other citizens from the same neighbourhood. Focus group discussions were conducted at four time points including at baseline prior to intervention start, post- intervention, six months after the intervention ended, as well as during the COVID-19 pandemic. The data were analysed using quality content analysis with an inductive approach.

Results: The main theme that emerged from the discussions was From Ambivalence to Decisiveness, which was built from four sub-themes: Wavering between frustration and recuperation, Shifting from prioritizing family needs to taking control of self”, “Between isolation and social support” and “Unavailability of specialist knowledge to utilization of internalized knowledge”

Conclusion: The results of this study reveal that building on CBPR informed health promotional initiatives has a potential to foster individual empowerment and assists during acute situations like the COVID-19 pandemic through mobilizing communities and their resources which leads to increased community resilience and health.

Key words: Community resilience, community empowerment, Community based participatory research, Social support.

Summary

The unequal distribution of physical activity among those living in disadvantaged neighbourhoods has been a challenge to public health globally and nonetheless in Sweden. The situation raises increased concern during the COVID-19 pandemic given the association between physical activity, chronic diseases, and COVID-19. This study presents the perspectives concerning the impact of CBPR-informed physical activity intervention, before and during the COVID-19 pandemic among women from a disadvantaged neighbourhood. The data is based on 16 focus group interviews with 34 participants conducted at four time points namely at baseline, post-intervention, six months post-intervention, as well as during the COVID-19 pandemic. The results of this study show that a CBPR-informed physical activity intervention has a potential to foster individual empowerment and behavioural change. It also strengthens communities to identify their inner resources during COVID-19 which led to increased community resilience. The role of health promoters has been substantial starting from encouraging community members to participate in the intervention to reinitiating activities through social media during the pandemic. They also played a vital role in disseminating information from various authorities in a form suitable for communities, thus acting as bridges connecting community members and the authorities.

Introduction

The world has been confronting novel challenges owing to the triple burden of diseases including the unending era of communicable diseases both newly emerging and re-emerging diseases as well as the unexpected rise of noncommunicable chronic diseases (NCDs) [1]. A fair share of the risk leading to rapid increase in NCDs is owing to poor lifestyle including decrease in physical activity (PA) and unhealthy dietary practices [2]. Despite the vital role PA plays in health promotion and disease prevention, physical inactivity has reached epidemic proportions globally [3]. In parallel to these challenges, public health practitioners have been debating about equity in health and the distribution of health determinants [4]. This is not the least when it concerns PA since findings sedentary behaviours also have a social gradient and that communities living in socially disadvantaged neighbourhoods have lower access to PA compared to their counterparts [5].

Furthermore, the COVID-19 pandemic has also disproportionately affected populations living in disadvantaged neighbourhoods globally even in a welfare state as Sweden [6]. In addition, the COVID-19 pandemic has created a double burden on health especially among citizens living in disadvantaged neighbourhoods as physical inactivity and mental ill-health has been exacerbated [3]. Previous research suggests that citizens in these neighbourhoods require special support tailored to their needs to help dealing with complexities of new diseases. Such a support should also promote integration to the society where actors such as health care can better understand and respond to the needs of the citizens [6]. Further, research also shows that inequalities in health in general may not be completely explained by differences in the individual characteristics of citizens living in disadvantaged neighbourhoods alone but rather the social and contextual features of neighbourhood [6].

Thus, the current situation calls for reorientation of the traditional public health practices and renewing interest in health promotion from solely achieving individual lifestyle change to a more broadened approach to include social and environmental factors [7]. The Ottawa Charter of Health Promotion suggests that health is created in the context in which individuals thrive and engage in everyday activities [8]. Previous research also suggests that the context is not merely a location where an individual exists rather an environment in which human social interactions are embedded [9]. Thus, a sustainable form of promoting health can be achieved through facilitating health promotion at a community level where communities become empowered to use and shape their environment to solve problems relating to health. Such an approach is also regarded as a dynamic method to address disease prevention through integrating risk factors and improving quality of life [10]. Community health promotion aims to address the social, cultural and environmental process related to health through enhancing community participation and thus empowering communities within a defined geographic area to increase control over their health [11]. In recent years several health promotional initiatives have prioritized efforts to increase physical activity at a community level [12, 13]. Enhancing community participation in health promotion makes it a collaborative process, creating an ideological shift and research based on a partnership between community members and academicians has become both essential and ethical [11].

In contrast to the traditional model in which an academic researcher drives all aspects of research on health promotion conducted in a community setting, a translational research paradigm known as Community based participatory research (CBPR) has been used in community health promotion [14]. The goal of this approach is to achieve community empowerment through actively involving community members in the research processes and assuring that the true needs of the community are effectively addressed [15]. This approach is regarded as means to broaden the horizons of traditional public health practices with new

visions for improving community health and well-being [14]. Previous research on disease and natural disaster management and health also show that an approach driven together with the citizens could help mitigate stress, as well as protect the health and well-being of communities' through promoting resilience and recovery [16, 17]. The value of a well- established CBPR partnership between the citizens, stake holders and academic researchers, with its potential to strengthen civil society and citizens particularly during acute situations like the COVID-19 pandemic has been established in a few studies. These studies showed that activities with a CBPR approach strengthened the individual and collective resilience of participants while mitigating the adverse effects of the pandemic in addition it also seemed like an appropriate means to enhance emergency preparedness and communicate risk to vulnerable populations [18-20].

Several CBPR informed PA interventions have been developed and evaluated around the world however the experiences from these studies are often not formally published in scholarly journals. CBPR Interventions implemented in urban residential areas are sparse. Some of the existing CBPR interventions targeted specific groups such as elderly [21], cancer patients [22] or members of a church congregations [23, 24] or students [25]. These interventions were often evaluated quantitatively from a researchers' perspective and seldom explored experiences of participants over time [26].

Based on CBPR approach a community health promotion program - Collaborative Innovations for Health Promotion was established in a socially disadvantaged neighbourhood in Southern Sweden in year 2017 by researchers from Malmö University together with the citizens from the neighbourhood and other stakeholders from public, private and non-profit organization sector [27]. The main aim of the program was to develop and study health- promoting activities based on participatory research methods taking into consideration the

community perspective through having them as equal partners in research [27]. As a first step towards the program during year 2016, *future workshops* [28] were conducted in which the citizens from the neighbourhood expressed their needs and identified strategies to promote health. Five problem areas including (a) physical activity, (b) mental health, (c) self-care, (d) oral health and (e) health literacy, emerged from these discussions [29]. During the future workshops, some of the citizens from the neighbourhood volunteered to become health promoters to help co-ordinate the activities within the program. The lay health promoters also facilitated participant recruitment, language interpretation, and above all were instrumental in building trust between the research team and the citizens [27]. As a second step in the program the research team, together with other stakeholders, and the health promoters created a CBPR model inspired by a model earlier developed by Wallerstein and colleagues [30] for planning collaboration and implementation of health promoting initiatives focusing on the problem areas earlier described. Six health promoting co-creative labs were established thereafter. Physical activity was one of the labs established where citizens together with academic research and the lay health promoters developed a PA intervention program based on the needs and taking to account the varied capabilities of the community members.

The initial evaluation of the PA intervention showed that there was lack of activities exclusively for women in their near proximity that was linguistically welcoming, lack of affordable transportation to exercise facilities elsewhere, and lack of places to gather for group activities in their neighbourhood [31]. Thus, the PA intervention was offered cost-free and exclusively for women in the neighbourhood. The evaluation of the intervention was an ongoing and iterative process. With the emergence of the pandemic exploration of the experiences of participants before and during COVID-19 was warranted to understand the

impact of the CBPR informed PA intervention. Furthermore, experience from a prior epidemic has shown that, when a new disease emerges and an acute situation arises an already existing environment built on mutual trust, can help to improve understanding of disease control and suggest change that is reflective and community sensitive without compromising on individual safety [32].

The aim of this study was to explore the impact of a CBPR informed physical activity intervention before and during COVID-19 from the perspective of women from a socially disadvantaged neighbourhood.

Methods

The current study reports on a qualitative evaluation of a CBPR informed PA intervention with a COVID-19 pandemic perspective. The participants were engaged in focusgroup discussions at four time points, ahead of the intervention start (Baseline), precisely after the intervention ended (Post-intervention), six months after the intervention ended (Long-term follow up) and the last was conducted during the ongoing COVID-19 pandemic (During pandemic) which was about a year after the long-term follow-up (Figure 1).

Context

The participants were members residing in one of the socially disadvantaged neighbourhoods located in Southern Sweden [31]. The neighbourhood is among those, regarded as highly vulnerable by the Swedish National Security agency owing to issues such as low education levels, unemployment, high rate of criminality and poor health among the inhabitants [33].

Participants

Thirty-four women aged between 26 -78 years were invited to participate. All participants in this study were non-Swedish speaking migrants of Arabic descent. Three local lay health promoters were involved in contacting the women and facilitating the intervention and the focusgroups. In addition, studies from the neighbourhood have also shown that empowering women and helping them with behavioural change led to them empowering their families and further on their community [34]. For the focus groups held during the pandemic, the health promoters and the research team meticulously followed the recommendations of the Swedish Public Health Agency. The participants were requested to inform the health promoters if they experienced any flu symptoms on the day of the focusgroups and were offered the possibility to reschedule the session. Of the thirty-four women in the group about six of them could not participate in the focusgroups held during COVID-19.

Community based participatory research informed intervention

The intervention had the aim of building community and diversity through promoting a fair and equal fitness culture among citizens in the neighbourhood. The fitness exercises focused on gradually facilitating a change in the participants lifestyle, starting from simple body movements, which in due course evolved into more complex exercises customised to individual abilities. The participants had the opportunity to choose between one of two sessions during the week based on their convenience. Fifteen to twenty participants were accommodated in each session. Although participants trained with special equipment during the intervention, they also gathered knowledge regarding the daily objects that could be used in place of these equipment. There was also dialogue and reflection on diet, stress and other factors related to PA during each session. The program was not merely a short-term intervention, but it also provided women the skills to become future health ambassadors who could spread the knowledge gained to others in their family and neighbourhood. Evaluation of the intervention was an ongoing process where the participants were also actively engaged.

Focusgroup interviews

The current study included data from 16 focusgroup discussions over the four time points. On the first three occasions including baseline, post-intervention and long-term follow-up, women in groups of six to eight per session engaged in focusgroup discussions. The last focus group during the COVID-19 pandemic happened when recommendations against gathering in public spaces was temporarily lifted in early autumn 2020. The focusgroup discussions happened in large spacious room where it was possible to be seated within two meters distance from each other. All participants were requested to wash their hands ahead of the session start. Participants were informed at all occasions that the discussions would be audiotaped, and that the material would be used for research purposes only. Each focus group lasted between 1-2 hours and discussions proceeded until no new information was identified. The interviews were primarily

held in Swedish while the health promoters translated back and forth between the participants who mainly spoke Arabic and the research team. The research team included an observer who was either the second or third author or another PhD student from the program [29] together with the first author. During the focusgroups the participants discussed between each other and together with the research team. A CBPR interview guide based on CBPR model previously developed by Wallerstein and colleagues [35] was used to initiate the discussion focusing on potential benefits of having participated in the community based participatory research informed PA intervention and understand the effect of collaboration with the health promoters and other group members during the activities.

The focusgroups guide included questions on perceptions related to how their context and surroundings affected the participation in the group intervention and how they perceived the collaboration with the other participants, the health promoter and academic researchers were also posed to understand aspects that may hinder participant development. Further questions also explored the perceived outcomes related to the intervention. Additional questions related to the pandemic such as (a) How has your lifestyle changed since the start of COVID-19 in the spring of 2020? (b) How has it been with following the healthy routines that you learned from your participation in health-promoting activities during the pandemic? (c) What kind of information about lifestyle changes related to the COVID-19 pandemic have you received? were also included in the last focus group discussion.

Analysis

The audiotaped data from the focusgroups interviews were transcribed verbatim and the transcripts were analysed using inductive content analysis method guided by the approach of Elo and Kyngäs [36]. As a first step, all transcribed interviews also called the unit of analysis were meticulously read to identify text of relevance to the aim of the study. Text that were related to each other in terms of their content and context were grouped together. These

interrelated texts known as meaning units were placed in a table for analysis. Later the different meaning units were condensed into manageable texts. Finally, codes with names as close as possible to the original data were assigned to the condensed meaning units. Codes with similar content are grouped together into sub-themes. The sub-themes and the codes were rechecked and compared to each other, as well as the original data. The overall main theme was identified at this stage, which summarized the information from all sub-themes earlier identified. The initial analysis was performed by two researchers from the team (MR) and (RR) and later verified by (EC) and (AK) in an attempt to increase the credibility of the study [37].

Ethical considerations

The health promoters verbally informed all participants in Arabic language about the purpose of the research study prior to baseline focusgroups and reminded them of the same in the following two occasions. participants were also assured that participation was voluntary and that they could leave the study at any point in time without any consequences. Ahead of the during COVID-19 focus groups participants were contacted by the health promoters through a video call via Whatsapp and informed about the details of the study. Participants were also assured that all activities were to be carried out in accordance with guidelines from the Swedish Public Health Agency. The research group also ensured that there were no more than eight participants per group during the focus group interviews. participants who preferred to avoid social contact due to COVID -19 and not participate in groups were offered the opportunity to be interviewed individually or through video conferencing. However, none of the participants desired this alternative.

All the above information was also provided to the participants in writing together with contact information of the research team both at baseline and again when data was collected during

COVID-19. participants were asked to sign an informed consent form at baseline, as well as, when they were invited to the focusgroups during the COVID-19. All data collected were anonymized and kept confidential. The data was only accessible to the members of the research team. The results from this study were presented to the participants and reconfirmed if the research team has interpreted their thoughts in a meaningful way. The Swedish Ethical Review Authority approved this study (DNR 2018-382 and DNR 2020-04063).

Findings

The participant's experiences of the participation in the CBPR informed PA intervention before and during the pandemic have been described using four sub-themes namely "Wavering between frustration and recuperation", "Shifting from only prioritizing family needs to taking control of self", "Between isolation and social support" and "Unavailability of specialist knowledge to utilization of internalized knowledge". From these four subthemes a main theme, "Ambivalence to decisiveness" emerged.

Ambivalence to decisiveness

The main theme suggests that although participants expressed, that they initially suffered stress and anxiety leading to frustration owing to lack of help it was resolved through engagement in the intervention in which they decided to participate initially only because of the health promoters. However, when distancing led to isolation during the pandemic together with the lack of understanding about the novel COVID-19 infection and the recommendations, they developed conflicting feelings and a state of ambivalence. There was a brief period of hesitance owing to their ambivalent state following which women eventually identified their inner strengths with the support of the health promoters and other members in their group which helped them reminisce the knowledge they gained from the intervention.

They also gained understanding regarding the roles of the different public actors and the recommendations to be followed through the health promoters, which further helped them to

recover and become resistant towards physical, social, and psychological effects of the pandemic through continuing to maintain their health and being physically active.

Wavering between frustration and recuperation

During the baseline focusgroup the women explained that they had an inherent tendency to be stressed often. Since they were unemployed and were overburdened by household chores they mostly stayed at home and had little knowledge on their surroundings. They also perceived a lack of time to develop their local language skills through participating in courses offered in the city centre. They experienced mood swings owing to their sedentary lifestyle, lack of social life and impending thoughts about the conditions in their homeland. Some women also said that they initially were very lonely and sad that they even refused to participate in the intervention and had to be motivated by the health promoters to take part. After participation in the intervention believed that they learnt how to focus on their health and change their lifestyle rather than being stressed and constantly worried about their well-being.

“Before I easily got annoyed and angry. I was insecure and afraid all the time. Since I started training with the group, I have become calm and happy. I think physical activity has unique effect on our mental health ”(Post-intervention)

At the long-term follow up participants mentioned that through participation in the intervention their body and mind got used to being physically active that if they ever lacked opportunities to being active and were idle it started to affect their mental health and so they continued to be physically active even in the absence of group activities.

“After participating in the group activity, I have become accustomed to being active and exercising. If I do not do it, I start to feel sad and frustrated” (Long term Follow-up)

Women who previously suffered from mental health problems particularly anxiety believed that their condition worsened during the pandemic and felt frustrated since they did not receive necessary help to recover. They faced mix of emotions including sadness, anger, and helplessness which led to more frustration since they realized that they were heading to nowhere with their feelings.

“I was scared, depressed. I could not do anything. Could not stand it anymore. That is how it was. I feared everything, everything seemed stressful. I got angry for nothing; I could not even go out to get help” (During COVID-19)

Women said that they thus started to draw on their inner strength to recover from COVID-19 related fear and sadness through being more physically active since they have previously experienced after participation in the intervention that PA gave them relief from their sadness and fear. Women reported that the knowledge gained from the intervention had always been with them as an inner resource and with some motivation from the health promoter and it was activated during the pandemic. They also believed that mental health was related to PA and that poor psychological status led to decrease in PA and it was also vice-versa.

“I have learnt from the group training that if one is sad, they cannot be physically active but if you are not physically active you do not feel happy either it is like a chain reaction. Yes, physical activity helps me to reduce my anxiety” (During COVID-19)

Shifting from only prioritizing family needs to taking control of self

During the baseline focusgroup the women said that as a tradition they usually perceived their family needs ahead of their own that sometimes they had little time to themselves. After participation in the intervention, they started to believe that only if they are healthy can they provide a good life to their family. Some women also said that their children observed a positive change in their mothers and were very happy for them.

"I have come to understand that healthy women mean healthy family, because we tend to the family, we cook and care for our children." (Post-intervention)

At the long-term follow up the women said that the intervention was successful only because it was designed in accordance with their needs. The women said that initially they were hesitant to join but they trusted the health promoters as they are more alike them than others given that they are from similar backgrounds and family circumstances thus, had a closer understanding of their individual needs. Women also mentioned that through including them and taking their views seriously they started to feel that they were important. The women also mentioned that when others realized their importance, they themselves also started to believe that they were important.

"It finally felt like our views were heard, that we were important and in fact I started to believe that I am important" (Long term Follow-up)

Women in the group said that although initially it was very frightful when the COVID-19 pandemic emerged, they also came to realize that their fear was also affecting their general health in a negative way and the consequences of it could be more severe than if they

contracted the virus. Women in the group perceived that over time they understood that all that they could do was to be positive and follow the recommendations. They also tried to spread the positivity to their families and friends which made them feel calm. The participants mentioned that they also used the knowledge they gained from the intervention and tried to replicate activities they did earlier such as lifting small weights where they replaced weights with a bottle of pickled cucumber or a simple ball and did the same activities they did with the group at home with their families.

“I use two cans of pickled cucumber to train. I kept five kilos in one hand and another five kilos in the other and do some movements we learnt in the group. And then, I have a big ball that I also use and then I lie on the floor, and train. I also helped my family to be active” (During COVID-19)

Between isolation and social support

During the baseline focusgroup some of the women said that they decided to participate in the PA intervention to overcome their isolated and lonely lifestyle. They also believed it would give them an opportunity to make new acquaintances, but also to do something useful for their body instead of throwing their time to sitting idly and being depressed. The participants also mentioned that women in the neighbourhood often lack motivation and are less informed about the importance of being physically active therefore lead a idle life and needed someone like the health promoter to motivate them.

"I do not have great desire for anything, I live alone and I am very depressed I need someone to push me all the time " (Baseline)

After participation in the intervention women believed that doing PA in a group helped them break their isolation and it also improved their mental health. Women also said that when they felt less motivation on any occasion the other group members started to message and motivate them on the Whatsapp group created by the health promoters for the group. Women felt meeting

regularly made them more comfortable and secured in the group that they could freely share their views and discuss concerns without feeling threatened of their privacy. The women also mentioned that it was not just about being in a group but rather the interaction between the group members facilitated by the health promoters. They said that they have participated in other group activities as the sewing circle where there was no interaction at all although they sat in a group.

“I have no one in my life and was in a lot of grief, but when I started in the group and met others here, I started to be very happy. It now feels like I have a big family” (Post-intervention)

During the long-term follow up the women insisted on the need to have more organised group activities especially when it was dark in late autumn and winter since as the climate affected their mental health. They also mentioned that they did not feel motivated to train by themselves since the group activities were also PA used then and it was making them more depressed. Some women also mentioned that despite creating their own groups they had challenges to find a large enough place and facilitate the activities at stipulated times as health promoters had done. Women also said that they had tried other group training in the neighbouring areas, but it was not the same since they did not receive the guidance and help from the coaches in those activities as the health promoters and fellow group members did during the PA intervention.

“I have friends who want to train with me but we cannot afford to rent a room and do activities, it is difficult to do it at home. It's more fun when we are many, and that is why we need activities that is organized by health promoters ” (Long term Follow-up)

The women perceived that when the pandemic emerged, and the related recommendations were introduced physical distancing led to social distancing which contributed to feeling isolated irrespective of age. Women said they felt captivated and felt that they were going back to being isolated as in the beginning before they participated in the intervention.

Women also said their mental health became worse because of social distancing which was perceived as isolation since initially they did not leave their home or meet anybody. If they later on had not decided to at least go for walks they believed that their mental well-being would have been seriously deteriorated.

“It also got worse and worse since in the beginning I met no one. I’ve been alone since Corona started. I felt really bad. I felt like I was in prison. I needed to train at home myself. But, I had no desire to train myself. If I had not decided to go for a walk I would have become crazy.” (During COVID-19)

Women regarded social media as means to breaking isolation among community members. Women were aware of the negative effects of being isolated from their earlier experiences and started to use Whatsapp and other social media more frequently during the pandemic as it helped them communicate and stay close to their family and friends from the neighbourhood despite the physical distance. The women in the group even shared health tips and COVID-19 related information to each other via Whatsapp. Despite access to several Whatsapp groups that provided information on COVID-19 the women said they preferred the group created by the health promoters as it seemed more locally relevant. They also said it felt more comfortable in those groups since they knew other members and they could freely contribute to the group and learn from each other as they did before.

“I do not like social media and stuff like that. But I am in a group together with other women in the area who came with me to the training. We share knowledge with one and other in the group and we compete for being the first to share information, it makes it fun and I think we feel more stronger when we are learning together though we cannot meet in person .” (During COVID-19)

Unavailable specialist knowledge vs utilizing internalized knowledge

At the baseline women in the group believed that there was a need for knowledge regarding how to protect and maintain health among citizens living in the neighbourhood. They expressed dissatisfaction with the support they received from the health care system since the staff at the primary care and even specialist doctors did not give the necessary time and attention to providing tips to improve health which is based on their living conditions. They felt language was not a barrier however they could not understand the how the Swedish health care system worked.

“It is important for us to know what improves health and also controls blood sugar and hypertension which is a common problem here, nobody has told us things so clearly not even my doctor” (Baseline)

During the baseline women said many who had diabetes, hypertension and muscle dystrophy were even aware that PA had a positive impact on these conditions. They said the problem was that they had no motivation to be physically active when they had to train all alone. After participation in the intervention women believed that they could change their health behaviours which they previously could not despite the awareness. They also reported that the diabetes nurse at the health care was pleasantly surprised since they suddenly observed changes in blood sugar and blood pressure levels.

“I have diabetes and I know its good to train but it was very difficult to change my eating habits and move my body, but now after participating in the activity I have changed everything, and my diabetes nurse is completely surprised as I have much lower blood sugar than before.” (Post-intervention)

Women who had visited a medical doctor during the pandemic for control of diabetes or other health ailments perceived that doctors never discussed COVID-19 and its impact on diabetes or high blood pressure. participants felt that due to social distancing there was a change in their

own lifestyle, which the doctor did not discuss further or give specific recommendations in that regard.

“We hardly get appointments with the doctor these days for adults they only see children. I go to the doctor once a year for a referral to control my diabetes. They talked about coronavirus but nothing about exercising and eating well during these times.” (During COVID-19)

During the pandemic the women believed that they received health-related information from many sources, but they thought that it was better to know about health and different ways to improve their health from someone in their circle who has similar background as them and has tried it and did not believe in merely following advice from doctors. Women believed that it was better to hold on to one resource for information although there were many channels of communication. In the group created by the health promoters the women believed that they not only participated in the group activities but also had the opportunity to discuss and understand recommendations from the authorities and their implications.

“I am on Whatsapp only in certain groups created by health promoters with other women in the area. Here we have all the activities we used to have before even group training. This is how I also get all-important information that is summarized in a simple language. This way we get to understand what local authorities really recommend.” (During COVID-19)

Discussion

The current study shows that a CBPR informed PA intervention helped the women recover from the state of ambivalence to become more decisive, making more informed decisions by taking control of their own health and well-being while also helping others in their family and community to do so. Women in the current study initially gained awareness about the need to lead an active lifestyle through the support from the health promoters which led them to make the choice of participating in the intervention. Through their participation they gained the strength to take control over their own health and become empowered. Empowerment was initiated through bonding with their social connections particularly the support they received from other members in the group who were connected or bridged to each other via the health promoters. The health promoter also linked the group to other societal actors. This process being iterative recurred during the pandemic, where the women realised that the need to overcome the agony caused by the pandemic through being physically active. However, when the women realised that they could not train by themselves they sought the help of the health promoters who reinitiated group activities on social media. Social support from the health promoters and other members strengthened the women and helped them maintain health while also promoting recovery from stress owing to the pandemic and thereby also increased community resilience. These findings were in line with previous research on disaster management highlighting the role of social capital (social connectedness) in an environment built on trust where community members bond with each other and further link with societal organizations resulting in increased community resilience during acute situations [38].

This study shows that an intervention informed by CBPR increased social connectedness and led to individual empowerment which over time may have led to community empowerment and increased community resilience during an ongoing pandemic such as COVID-19.

Community resilience is regarded as the collective ability of a neighbourhood to cope with

stressors and efficiently return to the rhythms of daily life through a collaborative initiative built on social support following an adverse event such as a natural disaster or pandemic [38,39].

Lack of physical contact and physical inactivity became an added burden to the existing mental health condition due to traumatic experiences and thoughts of their homelands among the women making them helpless and frustrated given there was no support. After participation in the intervention women realised that being physically active was means to revival from psychological stress and mental health problems and also made it a routine that they experienced mental ill health whenever they stopped being physically active. Numerous studies in the past have identified the effect of PA on mental health [40-42]. However, in this study such a relation also led to long lasting commitment to being physical active since participants themselves reported to have experienced the effects of it.

When the pandemic emerged, it had a strong effect on the psychological wellbeing of the participants especially in the early stages since limited information was available and the women began feeling unsure and frustrated just as they felt prior to participation. This was also, in line with the previous studies [43, 44] where fear, anger and hopelessness were identified as most frequent traumatic emotional responses among the general public during the initial stage of outbreak of the COVID-19 while it was still an epidemic and not declared as global pandemic. Although the World Health Organisations had raised the importance of maintaining health and engaging in regular PA during the pandemic especially to gain relief from the related anxiety and stress [45], the general recommendation against gathering in public places, restrictions in gyms and training centres together with the fear of even moving out of home have been barriers to PA during the pandemic [3]. However, women in this study said that based on the knowledge they gained from the intervention they realised that the best means to relieve themselves from anxiety and psychological distress caused by pandemic was by being physically active in a

group. Although they could not train in the groups initially many of them started to do walking regularly which helped them alleviate their frustration and decrease their mental stress. This is also in line with the results from a cross-sectional study in Canada which show that preserving mental health was a motivating factor for increased PA during the COVID-19 pandemic [46].

In the beginning of this study prior to intervention start women explained their social circumstances and culture carved them to prioritise their family needs over their own. Women They lacked time to learn language or get accustomed to the context in the host country. Post-colonial theories have raised concepts such as enmeshment and familism when discussing the sociocultural practices which is common in many Arabic families [47]. Arabic women are considered to be deeply bound to their families, and the family played a central role in their life. Women become enmeshed in this situation where they are continuously working to meet family needs that they lose touch with their own needs, goals, desires, and feelings. The theory also suggests that women sense guilt when they choose caring for themselves time to time assuming that they compromised their families and are frequently lost in the process of identifying a balance [47]. However, through participating in this intervention women in the study identified the strength to rebuild themselves and understood that they needed to take care of themselves so they could care better for their family and thus family became a positive motivation for enabling self-change. The women also explained the feeling of being empowered in that they felt more recognized in the society than they previously did. Further when the pandemic emerged, they were initially worried for themselves and their family's health. However, they eventually realised that they had to be positive and reutilized the knowledge they gained in the intervention to be physically active from their own homes and even showed their families what they learnt from the intervention and spread a positive spirit to their family at the time of crisis. Previous research has also shown that interventions informed by the CBPR approach has the potential to induce empowerment since the voices of communities which are otherwise not included in

traditional research are heard and also recognized. Further, the communities take part in the decision-making process, develop critical thinking, gain autonomy over their own life and thereby the ability to change [48-50]. However, in this study empowerment has been means to overcome enmeshment without disrupting family dynamics or cultural orientations, but rather affecting them positively, strengthening family relationships in times of crisis while also improving women's health.

Women in this group had led an isolated lifestyle ahead of participating in the intervention and needed to be motivated by the health promoters to participate in the activity. For some women training was an opportunity to being physically active and also making new acquaintances to break their isolation. Atleast three studies from Sweden have also highlighted that migrant were isolated to an extent that it contributed to their mental ill health [51-53]. Through social support received from fellow group members and the health promoters, women became motivated to be physically active. The findings from this study thus highlight the role of social support as a key factor for behavioural change and thereby the empowerment process. This is also in line with a previous study where empowerment is described as cyclical, interpersonal process facilitated through dialogue and reflection among a group of individuals with similar background and interest. The process of empowerment was further explained in the previous study as starting with an initial dialogue and reflection primarily establishing the group goals often aiming for change, and further building efficacy and competence through gaining knowledge through discussion and knowledge mobilisation, and finally taking action towards reaching the set goals [54]. This cycle seems also well aligned with proceeding of events in the current study where the women met in a group with others from the same context facing similar problems and had mutual goals to improve their health and being physically active, they gained knowledge from each other and motivated each other and finally made a change in their lifestyle by becoming physically active with the support of the group. Social support was a motivating factor to be

physically active among women in this study since when many women could not train by themselves in the absence of group activities during the long-term follow-up.

In line with previous study from the Nordic countries [55], participants in this study also described that the physical distancing recommendation during the initial phase of COVID-19 led to social isolation and loneliness. Women in this study communicated with their family and other community members through social media which helped them recover from isolation. Prior research on pandemic isolation also suggested use of social media as means to overcome depression and anxiety related to the pandemic [45, 56]. A recent study has also highlighted the challenges in use of social media as a communication channel for health-related information since many feared misinformation and lacked trust in the information shared particularly if the sources were unknown [57]. However, in this study the women reportedly trusted only the group created by the health promoter together with other group members with whom they could engage in a collaborative conversation.

The women could communicate freely and did not feel threatened about their identity in the group given the strong bond between the group members that they had established during the intervention. The reflections and dialogues within the group helped them to move from a confused or ambivalent state to a more stable state where they could make informed decisions. Women were much stronger when being connected to the group despite the distance since they felt encouraged, motivated, and cheered each other which helped them live through the acute situation. These results are well aligned as evidences, to the recommendations by the European Union in the OECD report lifting the need to integrate COVID-19 related prevention work to existing local initiatives based on mutual trust to maximize the reach to communities that are frequently not covered by larger efforts at a population level [7].

Furthermore, earlier studies also highlight the role of social support or social connectedness and its relationship to community health which is facilitated by merely making contact with other community members and being an active part of the community. Further, it also involves taking turns on roles to support each other aside of side of taking control of their own health. Studies have also shown that social connectedness may become foundations for recovery from natural and manmade disasters such as wars [39].

Despite the COVID-19 related recommendations from the World Health Organisation on promoting health behaviour and PA [58], the women in this study said they were no discussion concerning healthy lifestyle or being physically active during their diabetic control visits at the primary care. Although several studies have highlighted that PA has decreased significantly during the pandemic [3, 59, 60] no study to date has assessed the role of health care staff in the context of changed lifestyle during the pandemic. Despite the lack of support from the health care side, the health promoters reminded the women about the knowledge they had gained through participation in the intervention through a text message and they were able to recollect themselves and train from home and feel better.

In line with findings in a previous study [61] the women in this study did not rely on the information material and brochures from various sources. However, the women trusted the information provided by the health promoters since they adapted and recommunicated the health information from health care authorities and other governmental organisations.

Previous studies have also shown that lay health promoters are culturally competent in the context, and often communicate informally with the community members making them more comfortable [62, 63]. Furthermore, prior studies showed that lay health care workers served as a bridge between the community and health-care professionals due to their ability to empathize

with participants as they followed and adhered themselves to the actions, they were promoting to their fellow community members [64]. On considering the results from this study it seems the health promoters have also been links between the community members and other societal actors who have a direct implication on their everyday lives such as the public health authorities, governing bodies, and health care staff.

Strengths and Limitations

The current study despite giving an unique insight on the impact of a CBPR intervention also taking into account the COVID-19 perspective. The main constraint in this study was that most of the discussions were held in Arabic and were translated to Swedish by the health promoters and the audio recordings were later transcribed verbatim and again translated to English for the purpose of analysis and presentation in the manuscript. Such a back-and-forth translation of data could have resulted in translation and interpretation bias which may affect the trustworthiness of qualitative data. However, the authors of this study have cautiously handled the data. The health promoters who translated Arabic to Swedish were fluent in both languages. In addition, all the four authors of this study were bilingual in that they could speak both Swedish and English. The analysis was performed after prolonged engagement with the data which enable understanding of intricate and implicit reflections of the women's experiences. Furthermore, the analysed data was presented and discussed with the health promoters and participants to ensure no misunderstanding of the actual views.

Conclusion

A CBPR informed PA intervention empowered women from a disadvantaged neighbourhood to become physically active and remain physically active even during a novel pandemic. Thus, the

intervention seemed to have had a positive effect on how women coped with both chronic diseases and newly emerged infectious disease as the COVID-19. Further, it can be concluded that community-based resources particularly social support and trust are critical for promoting well-being and resilience among communities living in disadvantaged neighbourhoods. Future research must focus on developing community-based initiatives catering to local needs through actively engaging citizens in the research process and thus empowering communities to become resilient in face of emerging crisis.

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IV

BMJ Open Understanding behavioural changes through community-based participatory research to promote oral health in socially disadvantaged neighbourhoods in Southern Sweden

Rathi Ramji ¹, Elisabeth Carlsson,¹ Susanne Brogårdh-Roth,² Anna Nilvéus Olofsson,³ Anders Kottorp,¹ Margareta Rämgård¹

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¹Department of Care Science, Malmö Universitet, Malmö, Skåne, Sweden

²Department of Pediatric Dentistry, Faculty of Odontology, Malmö Universitet, Malmö, Skåne, Sweden

³Department of Odontology and Scientific Affairs, TePe Oral Hygiene Products, Malmö, Skåne, Sweden

Correspondence to

Rathi Ramji; rathi.ramji@mau.se

ABSTRACT

Objectives Inequalities in oral health have been on the rise globally. In Sweden, these differences exist not between regions, but among subgroups living in vulnerable situations. This study aims at understanding behavioural change after taking part in participatory oral health promotional activity among families living in socially disadvantaged neighbourhoods in Southern Sweden.

Setting The current study involved citizens from a socially disadvantaged neighbourhood in Malmö, together with actors from the academic, public and private sectors. These neighbourhoods were characterised by high rates of unemployment, crime, low education levels and, most importantly, poor health.

Participants Families with children aged 7–14 years from the neighbourhood were invited to participate in the health promotional activities by a community representative, known as a health promoter, using snowball sampling. Between 8 and 12 families participated in the multistage focus groups over 6 months. Data were analysed using qualitative content analysis.

Results Three main themes emerged from the analysis, providing an understanding of the determinants for behavioural change, including meaningful social interactions, family dynamics and health trajectories. The mothers in the study valued the social aspects of their participation; however, they believed that gaining knowledge in combination with social interaction made their presence also meaningful. Further, the participants recognised the role of family dynamics primarily the interactions within the family, family structure and traditional practices as influencing oral health-related behaviour among children. Participants reported having experienced a change in general health owing to changed behaviour. They started to understand the association between general health and oral health that further motivated them to follow healthier behavioural routines.

Conclusions The results from this study show that oral health promotion through reflection and dialogue with the communities, together with other stakeholders, may have the potential to influence behavioural change and empower participants to be future ambassadors for change.

Strengths and limitations of this study

- Involvement of community members in the development of health promotional activities.
- Working with both parents and children together to promote oral health.
- Triggering knowledge mobilisation through reflection and dialogue.
- Partnership between community members and different stakeholders facilitated by health promoters.
- Non-participation of fathers may have been a potential source of selection bias.

INTRODUCTION

There has been an overall improvement in oral health of the Swedish population in the past decades owing to the advancements in public dental services and state-financed insurance policies.^{1,2} However, large discrepancies in oral health do exist.^{1,3–7} The level of inequalities is not substantially different between regions in Sweden but rather between small areas within the major cities, where there is a concentration of subgroups in marginal or vulnerable situations.³ These socially deprived groups frequently include heterogeneous populations who differ by their ethnicity, migration status, historical background, culture and practices related to health, in comparison to the majority population.⁸ Oral health disparities have been on the rise owing to challenges such as lack of knowledge and poor social policies, unavailability of context-based information and, most importantly, the disconnection between oral and general health.⁹ This disconnection is a result of the current dental care system globally, as well as in Sweden, considering merely individual behavioural risk factors while addressing oral health problems.

However, sociocultural as well as policy-related aspects are key determinants of oral health and general health and well-being. Healthcare providers tend to look at diseases in isolation rather than employing a collaborative approach to address health from a broader perspective. Thus, widening the gap between oral and general health and increasing the burden of disease among socio-culturally different and disadvantaged subgroups of the population.^{10–13}

Since the early part of the 20th century, there has been a global drive in reducing health inequalities.^{14 15} Health inequalities in general are associated with various social determinants including living conditions, employment status, childhood conditions as well as ageing.¹⁶ These determinants also apply to oral health disparities. Moreover, oral diseases also share risk factors with other non-communicable diseases and are associated with cardiovascular disorders and diabetes.^{17–22} According to the WHO, oral health is an integral part of general health and is fundamental to overall well-being and quality of life. Thus, addressing oral health disparities is an inevitable part in health promotional activities aiming to reduce health disparities.²³ Oral health impairments have a considerable impact on the quality of life of affected individuals both functionally and aesthetically.^{24–26}

Poor oral hygiene and excessive or frequent intake of sugar between meals are leading causes for caries and poor oral health in general.²⁷ The consumption of fermentable carbohydrates containing added sugars has been on the rise, particularly among children and young adults.²⁸ High consumption of fermentable carbohydrates provokes bacterial action leading to the demineralisation of tooth enamel, which might lead to the development of caries.²⁹ The WHO recommends limiting free sugar intake and replacing it by increasing the consumption of fresh fruits and vegetables, nuts, seeds and wholegrain starch-rich foods, together with practising good oral hygiene as measures to prevent dental caries and periodontal disease, and promote oral health. Tooth brushing with fluoridated toothpaste in combination with a well-balanced diet is the foundation for good oral health.^{28 30 31}

Dental caries is one of the most common preventable diseases in children globally.^{23 32 33} Cariological risk assessment among younger children is important as caries in early childhood progresses more rapidly since the enamel is thinner in the primary teeth than in the permanent teeth. Caries incidence in preschool age increases the risk of caries in adolescence and later in life.³⁴ Moreover, caries impairs the quality of life of children by disrupting vital everyday functions.² Children with dental caries tend to have poor self-image and self-esteem.^{21 23 35} Furthermore, caries may lead to adverse effects including reduced social interaction, pain, discomfort, disturbances in the development of occlusion, stress and depression.³² According to previous studies, dental caries has been shown to be twice as common among non-Swedish children and adolescents belonging to socioeconomically

distressed families compared with their Swedish counterparts.^{1 3–7} Determinants for dental caries in immigrant children include parents' education level and ability to assimilate to Swedish dietary conditions since they are not often similar to the dietary patterns of immigrant families.³ Parents in a socially vulnerable environment may need community support to establish good dietary and oral hygiene habits, including using fluoride, as part of caries prevention. In vulnerable areas, oral health problems may be part of a number of different social problems and a number of actors in the community, such as maternal care, child healthcare and pharmacies, may need to make joint efforts to provide health interventions for families with different cultural backgrounds.^{5–7}

The Swedish dental care system has a strong tradition of preventive dental care in children and adolescents. Since the 1960s, there has been a steady decrease in caries prevalence among children owing to the effective and timely preventive measures implemented by the Swedish dental care system. Despite these efforts, caries prevalence is considerably higher among selected subgroups of the Swedish population who are more often from socially disadvantaged backgrounds. Studies based on Eurobarometer surveys have identified that socially disadvantaged populations frequently lack knowledge on self-care, including practice of good oral hygiene, diet and use of fluorides.³⁶ This is especially true concerning children in disadvantaged communities who experience more caries than their Swedish peers. Swedish dental care including preventive measures and treatment is provided free until the age of 23. Nevertheless, these efforts have been insufficient in providing dental care without disparities. Children from socially disadvantaged settings are less regularly attending these visits. There has been a lower level of utilisation of dental care despite the increased need among socially disadvantaged migrant groups.^{1 3 4} Oral health behaviours are mediated to children through their parents with the support of the regional dental care.^{3 4} Often immigrant parents are unaware of the support services that are available due to recognised practical barriers such as language difficulties and health literacy. Parents also have different expectations from the healthcare system, which are based on their experiences from their own home country.^{37 38}

Most of the information available in the Swedish dental care is evidence based, but lacking contextual adaption. Traditional values and family practices influence the attitude towards health and how communities value oral health as well as what is considered as a standard for good health.^{3 4 37} An understanding of specific populations, their socioeconomic position, the influence of their traditional practices and, above all, the influence of all of these factors on their health behaviour is necessary to improve utilisation of dental care in socially disadvantaged groups. This will in turn contribute to reduced oral health disparities.^{3 4 6 9}

There is an acute need for appropriate interventions and services to effectively address the oral health

disparities of the underserved. These interventions must be culture and context-sensitive novel oral health-promoting solutions and not merely based on the views of the concerned, but rather influenced by the active participation of the populations in need.³⁹ Active participation by representatives from the target groups is crucial for reducing the gap in knowledge as well as tackling and allocating resources that support specific community needs.⁴⁰

Community-based participatory research (CBPR) is one such a method, which focuses on addressing the determinants of health from a social as well as environmental perspective through active engagement of the community members and other concerned actors throughout the research process.⁴⁰ Taking into account specific social requirements and increasing community engagement to improve health, CBPR has emerged as an alternative paradigm for health and social research.^{39–40} CBPR is considered a significant part of translational research, which helps improve the health of specific communities, eliminate inequality and achieve equality in health through community empowerment.⁴¹ The principles of CBPR are based on core concepts, including partnership and colearning, capacity building or training community members to become future health ambassadors, knowledge production for societal transformation and prolonged commitment which facilitates achieving higher level goals like reducing disparities.³⁹ CBPR is a systematic effort to integrate active participation by the community in the process of decision-making by creating a mutual understanding of local phenomena and practices specific to the community which contributes to the development of innovative strategies to promote social change.⁴⁰ Empowerment has been considered critical in the CBPR process although the phenomenon was not frequently explored while evaluating CBPR-based health promotional activities. Empowerment is defined as the ability to control one's own life especially in relation to own health and well-being.⁴² Studies addressing oral health disparities focusing on diet and oral hygiene using the CBPR approach involving multiple actors from the community, public sector, private sector as well as non-profit organisations are sparse.

The current study was part of a larger project Health-Promoting Innovation in Collaboration. The aims of the main project were to develop and study health-promoting activities based on participatory research methods. Focus group interviews based on CBPR principles were conducted with residents in a socially disadvantaged neighbourhood in 2016. The interviews aimed at identifying measures to improve health among the residents. During the discussions, the citizens in the neighbourhood identified several problem areas where they needed help, including poor oral health, lack of access to physical activity, poor mental health and lack of knowledge concerning health and healthy behaviours.

Health promotional activities were held as part of the larger project focusing on the challenges identified by

the community members. The health promotional activities targeted behavioural change through knowledge mobilisation using a participatory design focusing on key factors such as empowerment.⁴⁰ Knowledge mobilisation is a process where reciprocal and complementary knowledge is shared between multiple actors, to promote multidirectional co-construction of knowledge. The basis for knowledge mobilisation is interactions that create knowledge and reflections during and after the interactions that facilitate sense-making of the acquired knowledge.⁴⁰ Community members participated in all stages of the project, including planning, implementation and evaluation. Representatives from the neighbourhood, known as health promoters, were integral in coordinating the activities in the different workshops. In an international context, they are known as culture brokers, and their role has been proven promising in participatory research-driven initiatives.^{43–44} However, the health promoters working in this project had a unique role since they were educated in participatory research methods. These health promoters were instrumental in identifying and recruiting participants, assisting with language interpretation and, most importantly, to inform the research team about the cultural nuances of the community.

As members of the community, they also had deep knowledge and experience of the common problems faced by these communities particularly in relation to access to healthcare.⁴³

Oral health was one of the challenge areas identified by the community and addressed among the activities initiated as a part of the larger project. This was considered a priority area since dental caries was on the rise in families with young children. The initiatives focused on oral hygiene, the role of fluoride, as well as diet since the residents also perceived a lack of access to personal advice on diet and health in their area.

The aim of the current study was to explore the behavioural change initiated by a participatory community-based health promotion targeting oral health in children and parents living in a socially disadvantaged neighbourhood in Southern Sweden.

METHODS

Context

The current study was based in a socially distressed neighbourhood located in Malmö city in Southern Sweden. The majority of the population living in this neighbourhood are non-Swedish speaking. According to a report from the Swedish Intelligence Unit, this neighbourhood has been considered one of the 15 most vulnerable localities in the country.⁴⁵ The report also highlights challenges like high rates of unemployment, crime, low education levels and poor health among residents which was also supported by prior research concerning high incidence of risky health behaviours among citizens in this neighbourhood.^{46–47}

Figure 1 Chronological timeline of the multistage focus group interviews.

Participants and actors

The health promoter involved with the oral health-related activities sent information about the activities 2 weeks ahead of the first meeting and invited families with children between 7 and 14 years to participate in the meetings. Initially, a few families identified by the health promoter volunteered to participate during the first session. More participants were later recruited through purposeful snowball sampling, mainly through spreading information through word of mouth. A total of 12 families were regularly involved in the activities. Although no specific demographic information was collected from the parents concerning the family structure, parental educational status and employment, it emerged from the discussions that quite a few of the mothers in the group were employed. Almost all families had three children, aged between 2 and 12 years. Most of the families were from Middle Eastern countries such as Iraq, Iran, Syria and Lebanon. During the initial meetings, children were present together with their fathers and mothers. Eventually, only the mothers participated regularly together with their children. There were 8–12 mothers during each of these nine sessions and about 15 children during each meeting (see figure 1). Each meeting lasted for about 2 hours with 15 min break after the first hour.

Aside from the participants and academic partners, the research team included representatives from the public and private sectors as well as non-profit organisations affiliated to the project such as the Primary Care (Region Skåne), Pharmacy (Apotek Hjärtat), Save the Children and TePe Oral Hygiene Products. Not all actors were however present in all meetings; their presence was determined by the theme discussed on the different occasions. The presence of a private company among the actors involved in the project may raise questions related to conflict of interest. However, the relationship between the private company TePe Oral Hygiene Products and the research project was mediated by the mutual goal of creating social value for disadvantaged populations. Through their presence in the project, the company TePe Oral Hygiene Products aimed at understanding user needs in order to develop products and solutions for improved oral health

in socioeconomically distressed communities. TePe Oral Hygiene Products had no financial gains through their participation in the research project. The head of their odontology and scientific affairs section was the primary representative of the company in the project. Additionally, the representative is also a specialist in paediatric dentistry, which made her presence useful since she could share her valuable knowledge, and experiences with the research team as well as participants. Previous studies have also considered academic–private partnerships in health research as an advantage rather than a limitation, because through such partnership emerge innovative strategies and positive effects which help achieve higher public health goals.^{48 49}

Patient and public involvement

The CBPR approach promotes the involvement of the citizens of the community, and relevant representatives of public and private organisations together with academic researchers in a power-balanced environment while working to identify and implement contextually relevant health promotional activities to promote behavioural change.

Design

The current study is a participative action research study with a qualitative approach where multistage focus group interviews were the mode of data collection. Multistage focus groups are characterised by the same group of persons exploring different themes during several meetings.⁵⁰ This method was inspired by Paul Freire's culture circles where the aim is to foster a participatory experience with an emphasis on dialogue and reflective action in response to an emancipatory health education.⁵¹ The power relations are balanced within the circle, where one person facilitates the discussions and debates by initiating the process. The facilitator then leaves it to the group to take responsibility for the progress in the inquiry process through self-reflections and sharing individual knowledge and experiences with each other. The dialogues help elevate the participants' experiences to a higher level of abstraction. The focus groups deduce

individual learning, as well as collective ways of thinking through reflection and dialogue within the group. During each meeting, the participants try to identify a common problem in the community, explore the problem further to identify resources and solutions while simultaneously implementing them to bring about transformation.^{51 52} As a first step in this process, the participants gained knowledge from experts like dieticians, nurses or dentists, in the form of a dialogue exchange. Some examples of the topics selected by the participants include discussions on sugar content in their routine diet and possible healthy alternatives to it (with a dietician). Paediatric nurses provided information regarding psychosocial support for behavioural change. The dental experts in this study were present during all occasions and added knowledge concerning oral hygiene, fluoride and the role of diet in relation to oral health.

Data collection

Preliminary meeting

The families who agreed to participate met at nine different occasions once in 2 weeks over a period of 6 months beginning in September 2018. The first step in the multistage focus groups was to understand the participants' perceptions on oral health. Prior to the initiation of the actual activity sessions, the research team used a participatory research approach photovoice, to assess the complex phenomenon of diet from a sociocultural perspective among children. In this method, photography was used as a tool to understand the factors surrounding the actual problem in consideration, from within the context of the participants. This is also a form of qualitative research where the photos act, as a focal point to initiate discussion and promote better understanding of participants' needs. This method helps overcome language and communication barriers and enhances discussions within the group.^{53 54}

The children were requested to bring pictures of healthy and unhealthy food and discussions were initiated based on their photos. In addition, they were also asked to take pictures of their toothbrush, as a base for discussing oral hygiene habits. The children sent the photographs via WhatsApp to the health promoter a few days prior to the scheduled introductory meeting. Photographs sent by the children were compiled, printed and later presented to the children for review together with the rest of the group. One of the team members initiated the discussion with the children using the pictures they sent and led the discussions.

Action points from the preliminary meeting

Through the discussions during the preliminary meeting, it emerged that the children consumed a high amount of sugar as part of their daily diet. The children also expressed a dislike for the lunch served at school. It came to be known that most of the children did not eat breakfast owing to time constraints, family situation and cultural aspects. Through discussions with parents, it was

understood that they had limited control over their children's dietary choices. Regarding oral health and oral hygiene, children frequently visited the dentist when they suffered pain, some had fillings and a few even had teeth extracted in early childhood. Concerning oral hygiene, there was a lack of awareness of fluoride use and its importance for oral health among children. It appeared that despite suffering tooth decay they were not informed about the role of fluorides in caries prevention. The session was followed by a debriefing and discussion with parents to understand their concerns about oral health of their children and the families in general. It emerged that parents were not satisfied with the tooth brushing carried out by their children. The children did not permit parents to help them with brushing despite being advised by the dentist or dental hygienist. In conclusion, parents felt the need for dietary advice focusing on the different meals: breakfast, lunch and dinner. In addition, they also wanted to gain more knowledge on oral hygiene habits. They preferred all sessions to be in the presence of the children since they would follow the advice of others better than they would do if the parents told them the same thing.

In the consecutive occasions, dialogue-based teachings or reflective dialogues were facilitated by experts in the related fields to address different challenges that emerged in the first meeting. Behavioural change in children through educating parents was also driven by the reflective dialogues. Previous studies⁵⁵ state that reflective dialogue-parental education is an effective method to enhance parental awareness and improve parenting skills. This is achieved through confidence building, which is promoted, by social support and peer influence. The discussions in the group were predominantly held in Swedish and interpreted in Arabic by the health promoter for the benefit of some parents who could not speak Swedish. At the beginning of every meeting, families had the opportunity to provide feedback from the previous session. They also discussed their ability to make changes inspired by what was learnt from their participation and the challenges faced in doing so. All discussions were audiotaped with the consent of the families. A member of the researcher team also acted as an observer and was responsible for taking notes during each meeting.

Data analysis

One team member (RR) reviewed audio recordings repeatedly to develop a content log of the discussions as well as summary. Listening to the recordings several times facilitated rapid identification of codes together with the help of the observational notes. Two other members from the research team who were not involved in the data assimilation process listened to the recordings to complement the preliminary analysis performed by the first researcher (EC, MR). Following this, the researchers discussed and reflected on their findings together and came to consensus over a final list of codes which were finally confirmed by SBR. The discussed codes were

placed under categories and each category was further defined in detail to identify overarching themes. While data extraction was done using rapid identification of themes from audio recordings (RITA) method, qualitative content analysis with an inductive approach⁵⁶ was used to identify themes relevant to the research goals. The RITA method has previously been established as a method that yields prompt and detailed results from qualitative data while also being less time consuming and less labour intensive.^{57–59}

Qualitative rigour

Results from qualitative studies are evaluated based on certain criteria such as following Guba and Lincoln's criteria⁶⁰ as factors that predict the authenticity of the results. According to these criteria, the quality of results depends on the methods of data collection and the technique of data interpretation. The current study is built on the CBPR principles of colearning and sharing, thereby holding the contact between the researcher and community members closer; thus enabling better understanding and interpretation of information provided. Furthermore, the involvement of the health promoter at the different stages of the research process ensured open communication. This provided an opportunity for the participants to share trustworthy accounts of experiences to other members in the group ensuring credibility. The research team made observational notes describing the context to support the audiotaped data, which contributed to transferability of the findings. Dependability was attained by involving a third researcher who was not involved in the initial data collection and analysis to review the coded data. To achieve confirmability, the third member from the research team rechecked audio recordings and the observational notes in iterations. Findings were shared with participants and reconfirmed when necessary.

Issues related to reflexivity were addressed using constant communication with the participants after each meeting, through peer debriefing, as well as triangulation by including several members in the research team in the focus groups as well as analysis of audio recordings. Self-reflexivity or personal reflexivity of the members of research team was considered rather positive since it gave the possibility for the team to reflect on power and privilege issues in relation to the context. This is also in line with guidelines indicated by prior work in participatory research.⁶¹

Ethical considerations

The Regional Ethical Review Board in Lund approved the study (DNR 2016/824). All participation was voluntary, and the participants were informed that they could leave the discussions at any time without any explanation or consequences. The parents received detailed information regarding the purpose and nature of the study, and were requested to provide written informed consent before enrolment. Parents were requested to consent their own as well as their children's participation. All invited

participants consented both their own participation as well as that of their children. The children also gave a verbal consent. Participants were ensured confidentiality at the time of data collection. In addition, participants were also informed that all results were to be presented abstracted and at a group level and no individual shall be identifiable through their expressions in neither reports nor scientific articles that emerge from this study. This information was explained verbally as well as included in the information letter that they received when they signed the informed consent. Considering the nature and design of the multistage focus group, it may be difficult to ascertain confidentiality; however, the research team explained to the mothers concerning this and requested them to refrain from discussing sensitive or personal opinions shared in the group elsewhere.

FINDINGS

Three main themes including meaningful social interactions, family dynamics and health trajectories were identified on exploring reflective thoughts and discussions in the focus groups with an aim to understand the process of changed behaviour within the group.

Meaningful social interactions

The mothers reported in the beginning that they agreed to participate in this study since they trusted the health promoter. However, after a few meetings they began to enjoy the social aspects of being with new people especially since they would otherwise sit idly at home.

In the beginning I came here because we knew the 'health promoter'. After coming here a few times, we started to interact with the others in the group. Now we do activities outside of this group, for example we go out on picnics or barbecue together. Coming here and meeting people is definitely better than sitting idle. (Mother, Meeting 8)

Although the mothers enjoyed the social aspects during the initial meetings, they began to look forward to interactions that were more purposeful and considered gaining knowledge as primary focus.

It is not just for meeting others. It is good that I get information about healthy food and what a good breakfast is for both my children and me. I just do not go there every time to meet someone else. We can do that in a different way. (Mother, Meeting 8)

The mothers in the group believed that the discussions and information they received were better than what they had received from the nurses at the primary care. They highlighted the importance of being in a group in the learning process since the discussions were interactive and not controlled or determined by the facilitators or field experts.

When we meet a nurse at a primary care center, they sound tired and disinterested and hence do not

provide the same information we get here. It was not of good quality neither educational nor motivating as we do here within the group. (Mother, Meeting 6)

The mothers felt that they were given the opportunity to gain new knowledge and learn, and the possibility to discuss and share their own knowledge and experiences. They also gave and received tips from each other within the group.

It was not just a lecture, we got to ask, discuss and learn from the experts and from each other. It was fun to give tips and suggestions to each other based on our experiences. (Mother, Meeting 7)

Some of the mothers were unsure from the beginning if they could make changes to their diet. After participation for a few weeks, they felt motivated and gradually started to make changes.

In the beginning I was drinking 5–6 liters of juice a day, after being here I have reduced it to 1 liter per week. I initially thought that I can't but when I was told about the sugar content of the juice and learnt about others changing their dietary patterns, I too decided to change. (Mother, Meeting 7)

Towards the end of the sessions, several mothers expressed their interest in communicating the knowledge they gained to the rest of the community, as they believed that the information was important. They even went a step further and mentioned that they would like to join the research team in the future to support the mission to improve oral health among the population in the neighbourhood.

I want to be one among your team, you are few and there are many people who need help so I want to help others as you do. (Mother, Meeting 8)

Children in the group were also interested in spreading their knowledge to their friends and classmates. One of the children in the group had already begun speaking about sugar intake and oral health to his class.

I told my classmates about why eating sugary things is harmful and how sugar affects the teeth. My teacher was impressed with me and wanted me to share more information in the class after each meeting. (Child, Meeting 6)

Family dynamics

The role of individual members in the family, bonding and interactions between family members together with sociocultural or traditional values carried within the family influence lifestyle and behaviour of the children. Acculturation and migration also have an influence on the relationship between children and parents, specifically mothers. Thus, a sustainable change in diet of children is influenced by family dynamics.

Mothers in this study perceived that they had important responsibilities but were merely limited to executing actions with little influence on decision-making. This was considered as a direct challenge in promoting dietary changes in the family.

I am a woman I can decide only for myself, I cannot tell my husband what he has to eat. My children eat what their father eats. I drink a lot of tea and my children drink tea too. It is our tradition. (Mother, Meeting 2)

Children in the families acknowledged their traditional practices and consumed high amount of sugar as part of it. They believed that following the parent's action was also associated with culture.

We drink tea as a family in the evenings and during weekend. I cannot drink tea without sugar in it. I usually put four teaspoons of sugar in my tea. That is how my parents drink too. It is a cultural thing. (Child, Meeting 1)

From the discussions with the children, it emerged that they were often alone when they ate breakfast so they ate whatever they found in their refrigerators.

I eat breakfast alone and I eat whatever is available in the refrigerator. I mostly eat bread with Nutella, as it is easy to make. My mother goes to work and my father is still sleeping then. My brother never helps me even if I ask. (Child, Meeting 3)

Some mothers believed they could not provide enough attention to their children's diet due to lack of time and a stressful life in Sweden. Mothers also believed that fathers could not help children, as well as the mothers, as men have low involvement in the upbringing of children. After participation in the activities, the mothers found a solution to this through the tips they got from fellow participants.

I leave early to work and my children eat breakfast by themselves. My husband cannot prepare food and take care of the children, sometimes he forgets everything, he miss to put on their wooly caps in winter. It is cultural. (Mother, Meeting 2)

Mothers valued the involvement of children in the activities since they recognised changes in children's behaviour at home after participation. Children were more cautious about their diet and sought their parents' help while brushing their teeth, which they refused to do previously.

The good thing is that we got to be here with our children, and that they also got to listen and learn. They have become more responsible at home; my son does not want to eat as many bananas as he did earlier because he has learned that it has more sugar. He wants me to help him brush his teeth; he would never

allow me to do it before even if I insisted. (Mother, Meeting 5)

Mothers were initially unsure about influencing the diet and lifestyle of their spouses, but when they made changes for themselves their husbands chose to do so too. In some households, women brought home information material from the meetings to convince their husbands.

At first I thought it might be hard for me to influence my husband, but when I changed my own diet he chose to change his too. (Mother, Meeting 8)

When I told him about sugar content in each food and showed the sugar brochure my husband was shocked and immediately decided to change. (Mother, Meeting 8)

Health trajectories

When the mothers initially volunteered to participate in the activity and attended the meetings, they were concerned about their children's oral health behaviour and diet. From the initial discussions with parents and children it emerged that children frequently consumed sugar in form of candies, juices and tea with sugar, which was a part of their tradition. Parents were also worried since children frequently complained of toothache and some of them had several fillings or a lost tooth.

Some parents even believed that they needed some amount of added sugar for normal body function. Parents were unable to monitor and control their children's sugar intake.

I must have juice in the refrigerator all the time because my children want to drink juice once every hour. I cannot say no to them because they will not eat anything else. I can't help but buy juice as I also like it. (Mother, Meeting 1)

After participation in the activities, mothers reported a sense of satisfaction and relief since they were able to take control over their situation and bring about change, promoting a healthier lifestyle for their children. This in turn made them happier and they slept better.

I felt bad when I realized that it was me who bought juice and sweets. I understood that if I stop buying things it would help my family. Since I did that, I sleep better because I know I have provided healthy food to my children. (Mother, Meeting 8)

Children in the group were particularly excited about learning to brush their teeth from experts and the use of different kind of toothbrushes. They also spoke about the relationship between healthy teeth and healthy living after participation in the discussions.

It was fun to see all the different brushes. I never knew there existed so many. I learnt to brush my teeth. I think that we must brush our teeth well since it makes us feel healthy. (Child, Meeting 7)

Mothers began to understand the influence of diet on their health more distinctly after participation in the activities. Mothers reported a change in self-perceived health owing to behavioural change after participation in the activities.

Since I made changes to my diet, I started feeling fresher and healthier. I was at the doctor last week and he was surprised because I have lost weight. (Mother, Meeting 8)

Participants began to understand the connection between oral health and general health and well-being after having participated in the activities.

Through participation in this activity I have learned about the connection between oral health with general health. I have actually seen a change in my physical health. (Mother, Meeting 8)

DISCUSSION

Participation in the health promotional activities led to changed oral health-related behaviour, and appeared to empower mothers and children, to gain control over their health, which in turn extended into the entire family as illustrated in the main findings of social interactions, family dynamics and health trajectories. The analysis also draws on Zimmerman's definition of psychological empowerment, which includes the dimensions of people's perceived control of their lives related to their level of participation in community change.⁶²

The current study shows that a participatory dialogue and reflection, targeting behavioural change considering the actual needs of the community, may initiate lifestyle changes among socially disadvantaged immigrant families compared with mere personal dietary counselling in primary care centres or at the dental clinics. This is in line with a previous study⁶³ which shows that dietary counselling offered by healthcare workers is frequently inconsistent, unclear—and beyond all—not culturally tailored and hence not effective in promoting dietary changes. On the other hand, in participatory research, participants are engaged in a collaborative process of social transformation, which enhances the possible uptake of knowledge through reflection within a social circle.⁶⁴ The role of mothers as important channels for behavioural change in the families is in line with a previous study based on oral health educational interventions involving immigrant families with children living in Australia.⁶⁵ However, the intervention offered in the Australian study was a predetermined intervention, unlike in the case of this study where the participants determined the health promotional activities. In addition, the health promotional activities in the current study were implemented over a longer period with frequent visits and involved children aged 7–14 years in contrary to the Australian study where the intervention was provided for 3–4 weeks and children of younger age (1–3 years) were included. Involving

older children in the discussions offered an additional benefit, as they were also active during the sessions, had the opportunity to ask questions and learn from experts, and thereby made changes in their lifestyle.

The interaction between individuals in a group appeared to exert a strong influence on the behaviours, which was beyond the mere social aspect of meeting people to break isolation. The process involved utilisation of collective knowledge to bring about changes in daily life through mutual sharing and motivating each other. These results are in line with discussions in a review study⁶⁶ that shows that participation in interactive lifestyle interventions in small groups better promotes behavioural and lifestyle changes. This is because individuals in a group are often in similar situations and through being role models to each other even the harder to convince participants in the group tend to change.⁶⁶ Similarly, according to an earlier study, social interaction between children is known to help in shaping their cognition, altering their attitudes and beliefs, as well as understanding of reality that in turn promotes behavioural changes.⁶⁷

The findings from the current study are in line with a previous study which describes the process of change in parental conception following reflective dialogues which facilitated behavioural changes in four stages, including awareness of one's current conception, dissatisfaction with one's current conceptions, support and understanding from others, exposure to alternate ways, opportunities for encouragement and reflection.⁵⁵ Freirean principles state that the consequence of offering knowledge via dialogue as a tool enhances the individuals' control over self and their beliefs thereby leading to self-empowerment,⁶⁸ and such an empowerment may result in behavioural change.⁶⁹ These principles were exemplified in the current study where the mothers in the group became conscious and aware of what constituted the meals they served their families through reflecting on the images of their own breakfast during the initial meeting. Further, through participation in the group meetings they realised that they had a significant role in promoting a healthier diet to the rest of their family. Despite being frustrated in the beginning, they eventually found support from other participants in the group who were in similar situations. The support, understanding, mutual respect and caring shared among each other in the group tended to have made the mothers psychologically stronger to accept the fact that their families did not consume healthy diets. They began welcoming alternative conceptions that they were exposed to both from the different actors providing knowledge as well as through interaction with other members in the group with varying perceptions. Over time, the participants progressed from a stage of seeking knowledge to sharing knowledge through providing tips to one another as well as to their friends and relatives in the community. The mothers expressed a feeling of confidence in self and appeared to be empowered after participation, which they were lacking in the beginning of the study when they really felt powerless due to their inability

to take control over their children's oral health-related lifestyle.

Practical implications

It became known through this study that brochures and health education material used in the Swedish healthcare were adapted to the Swedish context and were considered less useful for needy communities. The participants believed that educational material showing sugar content in various food products would help understand sugar intake among families in socially disadvantaged neighbourhoods. As a part of the activities, participants learnt to read and understand the ingredients list printed on the package of different food products. They also learnt to convert the quantity of sugar in grams to sugar cubes, which helped them communicate and spread the knowledge they gained. Participants gathered photographs of food products and some culturally specific dishes which they wanted to include in a new brochure. Together with the actors in the research team and a dietitian, the participants developed a sugar brochure. The sugar brochures were printed in multiple copies by TePe and distributed to the participants. The brochure was also shared with the primary care, dental care and pharmacy for further dispersal of the material. The participants, both mothers and children, found the brochure as a concrete tool for informing their family and friends in the community about the harmful effects of sugar consumption. The mothers in the group became oral health ambassadors in the community and started an initiative 'Fight against sugar intake'. They organised small gatherings with other women in the community to talk about the knowledge they gained from their participation in this study, together with the help of the brochure. Some of the children in the group who expressed interest to learn more about oral health, diet and healthy lifestyle were specially educated by experts from TePe over a period of 1 month with one lecture a week. After participation in the educational sessions, the children were certified as child oral health ambassadors. These child oral health ambassadors began spreading their knowledge in their respective schools.

Limitations

The current study could have been complemented with a quantitative assessment to explore changes in oral health-related behaviours after participation in the activities. Such an evaluation is planned with this group using a participatory approach where health promoters will have an active role in distributing health surveys and analysing them together with researchers.

Another potential limitation in this study is the non-participation of fathers, which may have introduced a selection bias. This, however, does not undermine the value of the findings from this study. Fathers in this study decided not to participate in the activities since mothers had the primary role of raising children and steering their behaviour in these communities. This is also in line with prior research on family traditions and the significant role of mothers in raising children.^{70 71} A notable feature

in multistage focus groups used in the current study is that participant dynamics may change during subsequent meetings in that new families take part or some of the original families do not take part in some of the meeting series. According to previous studies, the introduction of new members has a positive effect in that new discussions emerge and more knowledge is generated.⁵¹ However, in the current study it must be noted that 8–12 families attended almost all meetings while there were also a few new families in every occasion, which steered new discussions and new perspectives that benefited even those families who came regularly.

The RITA may be considered a methodological limitation. However, in contrast to the original method of listening to the audio for 3 min,⁵⁷ the themes were identified after listening to the entire audio recording several times. In addition, extensive field notes were collected during each of the nine sessions, which were used as complementary information to the audio recordings during analysis. Aside from this, the research team also had a deeper understanding of the participants' views from a contextual perspective owing to their prior engagement with participants in the trust-building phase, which was also enhanced by the involvement of health promoter.

CONCLUSION

The current study highlights the importance of working with the family, to ensure sustainable lifestyle changes. Placing the focus on both the process of change as well as the action paved ways to explore how families experienced their participation in the activities offered as well the determinants of behavioural change. Providing mothers and children with the knowledge and skills to promote oral health behaviours influences their immediate family and their communities or social groups. However, the success of knowledge transfer is mediated by the principles of participatory research that strengthens and appeared to empower individuals, and may contribute to a healthier society and reduced health disparities.

Reflective dialogue and interactions within the social context influence the health promotion process, and through the participatory approach, individuals seem to gain empowerment that in turn can lead to behavioural change. Such a strategy can be considered in future work targeting to promote health in disadvantaged populations.

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Collaborators There were no external collaborators who were involved in the work described in this manuscript.

Contributors RR, EC, SBR, ANO, AK and MR conceptualised and designed the study. RR, SBR, ANO and MR collected data. RR, EC, MR and SBR analysed the audio recordings. RR wrote the initial version of the manuscript under the guidance of AK, EC and MR. All authors gave detailed feedback on early iterations of the manuscript, and have read and approved the final version of the manuscript.

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Competing interests The presence of a private company TePe Oral Hygiene Products here, represented by the fourth author (ANO) who is the head of the odontology and scientific affairs section, may raise questions related to competing interests. However, ANO aimed at understanding user needs in order to develop products and solutions for improved oral health in socioeconomically distressed communities. TePe Oral Hygiene Products represented by ANO had no financial gains through the participation in the research project. The representative from Apotek Hjärtat, private pharmacy, was a trained pharmacist who participated in some of the sessions to inform the participants about the oral health-related side effects of different medications such as dry mouth and how these can be prevented or treated. They did not have any financial gains from their participation in this study. A representative from the non-profit organisation, Save the Children, participated in all the sessions with an intention to offer children and mothers in the group social support and counselling if sensitive issues were discussed. They also informed the participants concerning child rights. The representative from the Primary Care (Region Skåne) was a dietist who was active in the sessions where diet was the subject of discussion, as well as in the development of the brochures.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not required.

Ethics approval The Regional Ethical Review Board in Lund approved the study (DNR 2016/824).

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. The audio recordings from the focus groups generated and analysed during the current study are not publicly available due to institutional policy and GDPR regulations but are available from the corresponding author on reasonable request.

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ORCID iD

Rathi Ramji <http://orcid.org/0000-0003-4603-9974>

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