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Perceived barriers and facilitators to implementing a family-centered approach for cardiovascular disease prevention among adolescents in Uganda

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Article

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Abstract

Background

Globally, cardiovascular diseases are a growing public health concern. Family-centered interventions (FaCe-D) as preventive strategies have shown success elsewhere, but their adaptation to low income settings is underexplored. We explored stakeholder perspectives on the barriers and facilitators to implementing FaCe-D in Uganda.

Methods

In this qualitative study, participants were purposively selected. Data collection was through eighteen focus group discussions and twenty-five key informant interviews. Data was managed using NVivo 12 and analyzed deductively based on Consolidated Framework for Implementation Research constructs(CFIR).

Results

Of the 39 CFIR constructs, barriers emerged from seven and facilitators from twelve. The barriers included; Parents and adolescents' busy schedules, financial limitations, and cultural beliefs. Limited access to safe spaces hindered routine physical activity. Seasonal food shortages and excessive marketing of processed foods hindered healthier diets. Lack of mobile phones and parents' illiteracy hindered access to text messages for health information. Facilitators included; VHTs' assistance with diet planning, contextually appropriate dietary instructions, supporting backyard vegetable gardening, use of dietary recording tools, increased frequency and duration of VHTs home visits and use of peer educators.

Conclusion

While stakeholders showed feasibility of the intervention, they suggested modification to its dosage and address potenial socioeconomic and cultural barriers.

Background

In Sub-Saharan Africa, cardiovascular diseases (CVDs) are increasingly becoming a significant public health concern, with a general rise in the prevalence of associated risk factors. In 2019, Uganda registered over 36% deaths due to non-communicable diseases (NCDs) [1] [2], attributed to tobacco smoking, alcohol consumption, obesity, eating processed foods, adding salt while cooking, urbanization, and physical inactivity [3][4]. A 2016 study revealed that at least 38.6% of participants had one of the above risk factors, while 56.4% had at least two risk factors, and only 5.3% showed no risk factors at all

[5]. While hypertension remains the most prevalent factor for developing CVDs, [6] in Uganda, only 8% of people with hypertension were aware of their diagnosis [7]. Another study on CVDs prevention knowledge found that only 17.7% of participants were knowledgeable about CVD prevention practices [1]. The widespread of misinformation including beliefs that atherosclerosis begins in old age and that stress is the primary cause of CVDs [8][9], keep the prevalence of the conditions high. Yet, research shows that atherosclerotic changes begin in early childhood, long before symptoms appear [10][11][12].

Most predisposing risk factors to developing CVDs are modifiable [13][14][15] and are broadly learnt during early life stages [10][16], emphasizing the importance of early-life interventions [17]. Adolescence is a very critical window for CVD prevention [11][10], especially in low and middle-income countries [18][19][20][21]. Evidence shows that a high proportion of adolescents with obesity are likely to remain overweight in adulthood [22][23]. The challenge and opportunity of such findings lie in the fact that half of Uganda's population is below 18 years of age, with more than 70% being under 30 years [24]. If no preventive efforts are made, the country is likely to register an increased CVD burden in the near future. Studies from other countries demonstrate that designing preventive interventions that target formative years when healthy lifestyles can still be adopted and consolidated can reduce CVD prevalence [22][23].

Our study team planned to adapt an intensive family centered lifestyle intervention known as the iHealth-T2D Family-Centered Approach (FCA), which was delivered in the United Kingdom and South Asia in 2016–2022. The findings provided evidence that the intervention leads to effective reduction in weight, waist circumference and blood pressure among persons at risk of type 2 diabetes [4][25].

As part of the adaptation process, we were guided by the Consolidated Framework for Implementation Research (CFIR) to explore stakeholders' understanding of cardiovascular risk and lifestyle-related factors, identify potential facilitators and barriers to implementing the FaCe-D intervention in the Ugandan context, and use stakeholder feedback to inform the co-designing of a contextually appropriate intervention in rural and urban settings in Uganda.

Methodology

Study design, area and setting

This formative study employed a qualitative exploratory research design, which is increasingly being used to explore participants' perspectives in formative stages of implementation science studies [26]. The design was chosen to allow for an in-depth understanding of the social and cultural contexts as well as relevant behavior influencing knowledge on cardiovascular health and the implementation of the proposed FCA across Uganda's rural and urban settings [27]. The Urban site is in the Nakawa division of Kampala district, Central Uganda, comprising of Bugolobi and Kiswa parishes. The rural sites are in Mafubira division, Jinja district, Eastern Uganda, covering Buwenda and Namulesa parishes. The study settings offer a contrasting representation of urban and rural environments. Nakawa division, Kampala, has a population of 318,447 and 84,793 households, characterized by a predominantly middle-income

earning population engaged in formal employment and living an urban lifestyle. In contrast, Jinja district has a population of 291,733, primarily comprising rural subsistence farmers with few formal sector wage earners and an estimated annual household income of US$100. We will implement the study across 32 villages/clusters: 16 from Nakawa division and 16 from Mafubira division.

The proposed FCA intervention

To adapt this intervention to the Ugandan context, the study proposed the following: once recruited in the study, adolescents and their family will receive 60-minute contact sessions during the monthly home visit by the VHT for 12 months, VHTs will support adolescents to identify enjoyable physical activities to be undertaken daily and adolescents or a family member will log into a physical activity diary the time spent doing a physical activity. They will receive healthy diet education and modification, and will also do daily recording of food and drinks consumed by families in food diaries. The recording will be for seven consecutive days in each of the 12 months. The family will receive phone text health message reminders every week. The delivery of these intervention packages will be at the home of the index adolescent (s) and will delivered by the community Health workers also known as Village Health Team (VHT) who are recognized by the Ministry of Health (MoH) as the first level of healthcare in Uganda.

Participants, sampling and recruitment

The study explored the perceptions about the above proposed intervention from a population that included adolescents aged 10–19 years, household heads, primary household food preparers, Village Health Team members (VHTs), policymakers at Ugandan Ministry of Health (MoH) and at district levels, Non-Governmental Organization (NGO) representatives, religious and cultural leaders and health care providers at primary health facilities located in urban (Kampala City) and rural (Jinja district) areas to cater for possible variations in context, and behavior for implementation of the intervention. Participants were purposively sampled to ensure representation across gender, socio-economic status, and geographic location, diverse backgrounds, expertise, and experiences relevant to the study objectives. Local leaders and VHTs supported community mobilization and participant identification. The different interviews were conducted at the health facilities, workplaces, and in the community.

Data collection

We conducted Focus Group Discussions (FGDs), among adolescents aged 10–19 years, household heads, primary household food preparers, and community health workers (Village Health Team members-VHTs). Consultative meetings and individual key informant interviews (KIIs) were held with representatives at MoH, district level, Non-Governmental Organization (NGO), religious and cultural institutions and health care providers, and other researchers in field of study at the onset of the study to introduce the research objectives, seek their input and build rapport. The data collection tools were

piloted, and all research assistants were trained in qualitative interviewing techniques. The interviews were conducted by both male and female research assistants.

Application of the Consolidated Framework for Implementation Research (CFIR)

The Consolidated Framework for Implementation Research (CFIR) was selected to aid systematic exploration, analysis, and presentation of the factors influencing the implementation, uptake, and sustainability of the FaCe-D intervention. Its five domains of, a) intervention characteristics which captured the intervention design, b) outer setting encompassed socioeconomic, cultural, and policy influences, c) inner setting addressed readiness and capacity within VHT and community health structures, d) characteristics of individuals reflected VHT members' and community participants' knowledge, motivation, and self-efficacy, and e) process covered perspectives on planning, delivery, and monitoring of SMS and home visits. This framework enabled a comprehensive and in-depth data collection, and its constructs guided a structured analysis of the behavioral and environmental factors facilitating or hindering FaCe-D implementation in Ugandan communities. The CFIR supported the yielding of context-sensitive recommendations to inform scalable implementation.

Data management

All FGDs and interviews were conducted in local languages (Luganda and Lusoga) or English, depending on participant preference. All FGDs and interview sessions were audio-recorded with participants’ consent, and detailed field notes were taken by research assistants. Data management also involved the following three steps: Verbatim transcription of audio recordings into text scripts word documents; translation of text scripts into English and back translation into local langue. The transcription and translation was done by 12 research assistants. However, to ensure data quality, the research assistants switched text scripts at the stage of back translation. The complete text transcripts were shared with two independent social scientists to review and the two also ensured data anonymization to safeguard the privacy and confidentiality of participants. Each of the two social scientists re-read 10 text scripts to identify codes corresponding to the constructs of the CFIR which were later presented to the three principle investigators who discussed and agreed to adopt them as a coding frame. One social scientist created an NVivo.12 project and shared it together with the anonymized texts transcripts for coding by the 12 research assistants. Each research assistant independently coded the data, and one researcher later merged the coded data into a single project which was used to generate a coding summary report to guide identification of recurring patterns, meanings, and concepts. All the anonymized text scripts have been uploaded onto the Medical Research Council and London School of Hygiene and Tropical Medicine (MRC and LSHTM) Word Protected server for archiving. All audio recordings and the verbatim versions of scripts that had participants identifying information were destroyed by the Information and Technology specialists at MRC and LSHTM in the presence of the Ugandan-based principle investigator.

The anonymized text scripts data on MRC and LSHTM word protected server can access upon approved request by the three principal investigators.

Data analysis

Thematic categorization was then conducted by grouping codes into broader themes and subthemes that reflected stakeholder knowledge, attitudes, and perspectives of CVDs and the proposed FaCe-D intervention. Findings from FGDs, KIIs, and consultative meetings were triangulated to validate consistency and identify divergent views. A table detailing all the constructs of the CFIR [28][29] was generated as per the 19 constructs of the framework domains which emerged. A description of each code under specific constructs was given and evaluated as either a barrier or a facilitator to the implementation of the FaCe-D intervention. The codes and respective evaluations (either as barriers or facilitators) were presented under each construct and interpreted with backing of the direct voices from the participants' transcripts data.

Ethical considerations

This study was approved by: Uganda Virus Research Institute's Research and Ethics Committee, Uganda National Council for Science and Technology (UNCST), the London School of Hygiene and Tropical Medicine Ethics Committee (LSHTM), and the University of British Columbia Behavioral Research Ethics Board. Written informed consent was obtained from all adult potential study participants, while adolescents aged below 18 provided assents after parental consent was obtained.

Results

Demographic characteristics

A total of 18 FGDs lasting 60–150 minutes each were conducted with adolescents, parents/guardians, VHTs and food preparers. We held FGDs for each of these categories separately, and we further stratified adolescents' FGDs by age (10–14 years alone and 15–19 years alone). All FGDs comprised of both males and females, regardless of level of education. Also, 25 KIIs lasting 45–60 minutes were conducted with health professionals, NGO representatives, policymakers, and local council, cultural and religious leaders. In addition, four consultative meetings were held. Below is Table 1 summarizing the demographics of the study participants, numbers of participants in the FGDs and KIIs, and other characteristics of the study population and study area.

Table 1
Participants' sociodemographic characteristics

Focus Group Discussions							
Adolescents Kampala		**Adolescents Jinja**	**Food preparers Kampala**		**Food preparers Jinja**	**VHTs Kampala**	**VHTs Jinja**
Gender	***Number***	***Number***	***Gender***	***Number***	***Number***	***Number***	***Number***
Male	19	19	Male	0	12	1	2
Female	23	26	Female	21	12	9	10
Total	**42**	**45**	**Total**	**21**	**24**	**10**	**12**
Age range			**Age range**	**Number**	**Number**	**Number**	**Number**
10–14	21	23	52+	5	11	1	6
15–19	21	22	36–51	12	7	7	5
Total	**42**	**45**	20–35	4	6	2	1
			Total	**21**	**24**	**10**	**12**
Education level				**Number**	**Number**	**Number**	**Number**
None	0	0		1	1	0	0
Primary	22	23		7	14	0	2
Secondary	19	22		10	5	8	10
Post-secondary	1	0		3	4	2	0
Total	**42**	**45**		**21**	**24**	**10**	**12**
Religion				**Number**	**Number**	**Number**	**Number**
Christian	6	17		19	21	7	8
Muslim	36	28		2	3	3	4
Others	0	0		0	0	0	0
Total	**42**	**45**		**21**	**24**	**10**	**12**
Household Heads Kampala		**Household Heads Jinja**					
Gender	**Number**	**Number**					
Males	10	6					

Focus Group Discussions							
Adolescents Kampala		**Adolescents Jinja**	**Food preparers Kampala**		**Food preparers Jinja**	**VHTs Kampala**	**VHTs Jinja**
Gender	***Number***	***Number***	***Gender***	***Number***	***Number***	***Number***	***Number***
Females	7	18					
Total	**17**	**24**					
Age range		**Number**					
52+	5	15					
36–51	12	6					
20–35	0	3					
Total	**17**	**24**					
Religion							
Christian	15	19					
Muslim	2	5					
Others	0	0					
Total	**17**	**24**					

Results

Overall, 19 constructs of the CFIR framework domains emerged relevant to the implementation of the FaCe-D intervention, where some constructs were barriers while others were facilitators or both. From the **intervention characteristics**, complexity emerged as the barrier while adaptability emerged as both barrier and facilitator. From the **Inner Setting**, all the constructs that emerged relevant (household needs and resources, external policy and incentives and cultural and religious norms) were barriers. In the **outer setting**, only organizational readiness was identified as a barrier. From the **characteristics of individuals**, knowledge and self-efficacy were identified as both barriers and facilitators while motivation was a facilitator. Yet, from the **process of implementation**, all the constructs (the planning, engagement, execution, and evaluation) emerged as facilitators. These are presented in Table 2 below.

Table 2
CFIR constructs that emerged as either barriers or facilitators of the FaCe-D intervention

CFIR Domain& constructs	Description	Sample codes	Evaluation
Intervention characteristics • Adaptability • Design quality • Complexity	Examined perceptions of the FaCe-D intervention components (monthly VHT visits, SMS messages, physical activity, and dietary guidance) and their adaptability to household and community contexts.	• Adaptability-Intervention highly adapted by household members • Easy to implement by the VHTs • Design quality-home visits and health education are part of VHT routine but will need VHTs further training • Complexity-Diet component (healthy meal preparations, salt intake) needs to be simplified for the VHTS and food preparers	• Facilitator • Facilitator • Facilitator • Barrier
Outer setting • Household needs and resources • External policy and incentives • Cultural and religious norms	Assessed how poverty, time constraints, cultural beliefs, and policy or partner support, shape families' ability to adopt healthy lifestyle behaviors and VHTs' capacity to deliver the intervention.	• Household needs and resources-household limited physical space, financial hardship, time constraints, • External policy and incentives-lack of facilitation, for VHT transport, airtime, and allowances • Cultural and religious norms-participation in certain physical activities may be limited due to cultural and religious affiliations.	• Barrier • Barrier • Barrier
Inner setting • Implementation climate • Organizational readiness for change • Compatibility • Organizational Incentives & Rewards	Explored VHT operational capacity, supervision systems, community trust, and resource availability that influence readiness to implement the FaCe-D program.	• Implementation climate-compatible with existing VHT roles and community health structures. • Organizational readiness-would be hindered by logistical challenges such as inadequate equipment, lack of supervision, and limited trust in some VHTs • Organizational Incentives & Rewards-incorporating peer champions to complement the role of the VHTs and the recognition and reward mechanisms were proposed to strengthen foster behavioral change	• Facilitator • Barrier • Facilitator • Facilitator

CFIR Domain& constructs	Description	Sample codes	Evaluation
		• Provision of personal protective equipment like raincoats, umbrellas and gum boots for their use especially during the rainy season.	
Characteristics of Individuals • Knowledge • Motivation • Self-efficacy	Investigated community members' and VHTs' understanding of healthy lifestyles, their motivation to change behaviors, and confidence in carrying out recommended practices.	• Knowledge-limited understanding of cardiovascular disease prevention • General awareness of risk factors to CVDs • Training of VHTs will boost confidence and motivate them to deliver intervention • Self-efficacy-VHTs' knowledge about health education and home visits is part of their routine. • Limited knowledge to deliver proper dietary information	• Barrier • Facilitator • Facilitator • Barrier
Process of implementation • The planning • Engagement • Execution • Evaluation•	Analyzed stakeholder engagement, community sensitization, coordination, and feedback mechanisms necessary for successful rollout of the FaCe-D intervention.	• Involving households to identify enjoyable physical activity • Engaging stakeholders to design final FaCe-D intervention • VHT monitoring system to ensure effective delivery • Identification of peer champions to support VHTs	• Facilitator • Facilitator • Facilitator • Facilitator

Intervention characteristics

Regarding the intervention characteristics domain, three constructs emerged as relevant. These were *adaptability, design quality, and complexity. Adaptability* was perceived as a facilitator to the implementation of the intervention. Participants indicated that the FaCe-D intervention components including monthly VHT home visits, SMS communication, physical activity routines, and dietary modification, were practical and adaptable to their routines and to community contexts. *Design quality of the intervention* was perceived to be both a facilitator and a barrier. Most participants emphasized the need to tailor the frequency and format of VHT home visits to fit household schedules. They emphasized that the initial intensive engagement could foster long-term adherence to the intervention.

*"We prefer at least two visits in the first month, so that we get used to the program, and then once every month after that."***(FGD, parent, Jinja)**

Similarly, by its design, the inclusion of SMS reminders as a component of the intervention was seen as an innovative and sustainable way for reinforcing education messages by the VHTs, particularly because messages could be re-read at convenience.

"Even if you don't understand immediately, you can read it again later." **(FGD, VHT, Kampala)**

However, the intervention design was also perceived to be a barrier, with concerns about complexity and design clarity expressed. These were mainly about phone text message content and language to be used. A few participants expressed skepticism based on previous negative experiences with unsolicited or unclear SMS messages. They also narrated that there are some adolescents from low-income households who have limited access to mobile phones. Illiteracy among some parents and younger adolescents may also hinder their ability to comprehend SMS content. They emphasized the need for concise, bilingual (English and local language) messages and that the messages are sent bi-weekly

*"Make the messages short and in our language, so everyone can follow."***(FGD, adolescent, Jinja)**

Outer setting

Based on the outer setting domain, our analysis revealed *household needs and resources*, *external policy and incentives*, *cultural and religious norms* as key constructs that could facilitate and hinder implementation of the FaCe-D intervention. In terms of *household needs and resources*, participants across all categories identified household limited physical space, financial hardship, time constraints, as major contextual barriers affecting their ability to adopt healthy lifestyles. In urban settings, some participants in slum communities reported that it is challenging for them to engage in physical exercise due to space constraints.

"We stay in one room that serves as everything: bedroom, kitchen, sitting room. Where can you skip a rope from?" **(FGD, household head, Kampala)**

Regarding time constraints, parents, especially those in urban settings, explained that they are very busy with work, leaving home early and returning late, sometimes finding their children already asleep. Some also work on weekends, all of which could limit their participation in physical activities with their children. Similarly, adolescents, particularly those in transitional candidate classes, spend most of their time at school, which could also have the same impact.

*"Ttuli mukampala kukakalukana kulaba family zaffe zibeewo [we are in Kampala to toil to make sure our families survive]. Getting time for exercising is very hard even if we wanted to. You wake up at 5 am when children are sleeping and you return at 9 sometimes 11pm when children are sleeping. Where can I get time to do exercises with the children"***(FGD, Household heads, Kampala)**

Participants reported fear of stigmatization when engaging in physical exercise as these activities are associated with affluent lifestyles and can lead to gossip, social labeling, and ostracism.

"Haaa, here when people see you jogging, that's when they will call you names like "owakajanja, yeraga [show off], abasoma [educated people]" to simply show you that those are lifestyles for the certain group of people who stay in affluent communities and that you are pretending to live a lifestyle that is not yours hahaha." **(FGD, food preparer, Kampala)**

Participants frequently emphasized that, while they understood the importance of a balanced diet, affordability constrained their food options and influenced dietary decisions. They revealed that financial hardships would force many families to prioritize food quantity over nutritional quality.

"Even if you know what food is good, sometimes you can't afford it. You buy what is cheap but enough for the family." **(FGD, parent, Kampala)**

A few adolescents in the urban setting expressed a lack of appropriate sports gear and exercise monitoring tools, such as sports shoes, jump ropes, and sports watches. When asked about exercise preferences, most boys chose football, while girls preferred jumping ropes. They wondered whether their parents or the study team would provide them with the requisite items.

"If our parents can buy us footballs, we can play at home or we can form a team in the village and play against another village." **(FGD, adolescent, Jinja)**

Equally, *external policy and incentives* emerged as potential barriers to the VHTs implementation of the intervention. Both policy makers and other participants noted that without adequate financial allowances, airtime, or transport facilitation, sustaining home visits would be difficult.

"What I can say is that if the VHTs are not facilitated with at least airtime to enable them to call to inform the household heads of their visit beforehand, it will be difficult to find us at home especially here in Kampala where some of us work even on Sunday." **(FGD, Household heads, Kampala)**

Some community leaders and policymakers expressed concern that cultural and religious norms may limit adolescents' participation in physical activity. A notable example was given where the required attire in a game may conflict with cultural and religious dress codes that mandate female clothing to extend to ankle level.

"Children who belong to a religion that I will not mention, keep their bodies fully covered including the head, how can those children do exercises. You see how religion can also promote unhealthy lifestyles…!" **(FGD, VHTs, Kampala)**

Inner setting

Within the inner setting, four constructs emerged: *implementation climate, organizational readiness, compatibility, and organizational incentives and rewards.* The FaCe-D intervention was generally perceived

as compatible with existing VHT roles and community health structures. VHTs expressed a willingness and commitment to delivering it, as home visits were already part of their routine activities.

"By nature of my work as a VHT, I visit homes to educate on sanitation. This will just help me do my usual work better." **(FGD, VHT, Jinja)**

However, organizational readiness would be a barrier, hindered by logistical challenges such as inadequate equipment, lack of supervision, and limited trust in some VHTs. A few participants raised concerns about the integrity of the VHTs. These were mainly policymakers, one of whom wondered how the VHTs would assume this additional role after having not met expectations in the delivery of the core paid role allocated to them by the Government.

"Well, I have heard that in certain areas, the VHTs are not working at all. They are busy doing other things not related to health at all. So, you have to be careful with which VHTs you are going to work with. I think it's better to let the community members or the health workers select the VHTs of their choice, I'm sure they know those who really are active" **(KII, Policymaker, Jinja)**

Therefore, organizational incentives and rewards were identified as facilitators to strengthen implementation climate and improve the quality of the FaCe-D intervention. Some stakeholders suggested incorporating the recognition of the best-performing adolescents and empowering them as peer champions to complement the role of the VHTs.

"If we recognize adolescents who do well, others will want to follow them, and it will boost participation" **(Adolescent workshop, Kampala)**

Other forms of organizational incentives suggested by VHTs were personal protective equipment like raincoats, umbrellas and gum boots to protect them from bad weather and ensure smooth delivery of the intervention.

"How shall we manage during the rainy season! We need to be given raincoats to enable us to work.**" (FGD, VHTs, Jinja)**

Characteristics of individuals

Under the characteristics of the individuals, *knowledge and beliefs about the intervention, self-efficacy, and motivation* emerged as relevant constructs acting as both facilitators and barriers. Our findings show that in terms of knowledge, most community members demonstrated general awareness of healthy living, but with limited understanding of its link to cardiovascular disease prevention. Some equated living a healthy lifestyle to one's ability to meet family needs, and live free of illness or financial stress.

"If I can afford to pay school fees for my children, I can feed them and I don't have any diseases disturbing me or any of my family members, then I have good health." **(FGD with Household Head, Kampala)**

Similarly, most community members, except adolescents, were able to identify common CVD conditions such as stroke, heart attack, and blood clots, often drawing on personal or community experiences. Several participants shared first-hand accounts of older family members or acquaintances increasingly being diagnosed with CVDs, with resulting hospitalization or death.

"These days old people are dying of strokes, my father-in-law has been hospitalized for now two weeks due to a stroke." **(FGD with Household Food Preparer, Kampala)**

Participants also identified multiple behavioral and contextual risk factors contributing to CVDs like physical inactivity and alcohol and substance abuse. All participants felt that these behaviors are common among men and boys compared to women and girls.

In terms of *self-efficacy and motivation*, VHTs expressed confidence in delivering the intervention while emphasizing how this knowledge, especially about health education and home visits, are part of their routine. However, they suggested that they would be highly motivated if adequately trained and facilitated. Parents and adolescents reported willingness to adopt physical activity and diet changes when supported by clear guidance from VHTs especially detailed health information and practical examples on how to live a healthy lifestyle.

"If you teach us how to cook better or what exercises to do, we shall follow." **(FGD, household head, Jinja)**

However, self-efficacy among VHTs was also identified by healthcare workers and policy makers as a barrier to intervention implementation given that the health education content differs from their routine work. It is therefore important to train VHTs specifically on the components of the intervention to maintain fidelity and strengthen their self-efficacy. In addition, policymakers emphasized the importance of monitoring VHTs during implementation to ensure effective delivery and so that adolescents and family members can sustain these behaviors on their own after the program. To further strengthen the self-efficacy of the family members, participants appreciated the need to support adolescents to identify their preferred physical activities.

"If we can help these children engage in what they like and what is possible at home considering the space, will ensure continuity after this program". **(KII, policymaker, Jinja)**

Process of implementation

Under the process of implementation of the FaCe-D intervention, there are four constructs including; *engagement, planning, execution and reflection/evaluation* that emerged as relevant. *S*takeholders proposed joint planning between VHTs and households to schedule convenient home visit times. Training and community sensitization were emphasized as essential preparatory steps.

"Before they come, they should first make an appointment. Otherwise, they will find no one at home." **(FGD, food preparer, Jinja)**

In terms of *execution and evaluation, p*articipants suggested integrating cooking demonstrations, allowing families to identify their most enjoyable physical activities and participatory designing of physical activity plans. The participants also recommended the conduct of regular performance evaluations for adolescents who adhere to recommendations. Reflection meetings involving VHTs and local leaders were recommended for tracking progress.

*"We need to monitor and know if the VHTs are actually visiting homes and families are benefiting."***(KII, health worker, Jinja)**

Most participants believed that this intervention is feasible and can be sustainable even after the end of the program period.

Discussion

The study presents the perspectives and recommendations of key stakeholders that affect the viability, adaptability and implementation of the FaCe-D intervention in Uganda. The findings of this study show that the views of different stakeholders in Uganda's rural and urban areas offer a complex understanding of healthy lifestyle choices and how these affect the prevention of CVDs. In addition, these findings resent a comparable context with other similar low-resource settings. Adoption of CFIR as our framework for guiding the conduct of this study, has revealed both barriers and facilitators for the successful implementation of this proposed intervention.

Although the findings indicate that the characteristics of individuals (knowledge, motivation, and self-efficacy) could be facilitators to implementation of the intervention, the study also indicates that inadequate knowledge may act as a barrier. In this regard, our findings show that, whereas participants demonstrated varied levels of knowledge on CVDs and their risk factors which is consistent with earlier studies, gaps in general health literacy and disease-specific knowledge still exists among community health workers and this has been widely reported in other low and middle-income nations [30][31][32][33]. This presents an opportunity for this study to contribute towards addressing this need through our planned rigorous VHTs-quarterly training and monitoring schedules that will ensure VHT-empowerment to deliver the intervention. Relatedly, while emphasizing capacity building for the VHTs, our targeted outcome is a transferred self-efficacy among adolescents and their families. Most community-level participants associated a healthy lifestyle with general well-being, meeting basic needs and the absence of illness rather than specific cardiovascular risk reduction behaviors. Only health workers, researchers, and policymakers explicitly linked avoidance of smoking and drug abuse, adequate sleep, and stress management, to the prevention of CVDs. These findings highlight persistent challenges in translating health knowledge into practice, consistent with prior studies [30][34].

Participants' concerns about financial strain and its links to chronic stress, hypertension, and stroke shows evidence of connecting poverty to poor cardiovascular outcomes in rural and urban settings across low- and middle-income countries [36][37]. This understanding reflects the social determinants of health, which emphasizes how economic insecurity and psychosocial stress shape health behaviors and

outcomes [35]. Findings also highlight the importance of VHTs in delivering the intervention as a tool for behavior change. Communities generally supported VHTs conducting monthly home visits to provide health education sessions on diet and physical activity to adolescents and their families [38] as reported elsewhere [39]. In this study, most participants suggested more frequent VHT home visits in the first month, to foster close relationship and understanding of the intervention. This aligns with research that noted the value of establishing relationships in programs that are delivered by community health workers and the necessity of continual communication to strengthen learning and accountability [40].

Based on these findings, the research team adapted FaCe-D intervention to include two home visits in the first month and one visit per month for the remaining eleven months to be conducted by VHTs. One significant facilitator to this was reflected in the construct of adaptability under the intervention characteristic and by the VHTs' own reception of the intervention. Strong provider feasibility is shown by the VHTs' perception of the intervention as a normal extension of their regular duties.

Nevertheless, reservations were made about the suggested 60-minute home visit duration. Adolescents and residents in the urban setting felt that the duration was excessive, and they proposed 30 to 45 minutes. However, some participants in the rural setting felt that even 60 minutes would not be enough for in-depth education. These varied opinions on the ideal length for home visits with some preferring shorter sessions are reflective of broader implementation science principles that acknowledge the need for flexibility and cultural sensitivity in intervention delivery [42]. This further brought to light contextual and generational disparities in information processing and attention span between rural and urban population. Therefore, in order to cater for both rural and urban population needs, the study team revised the duration of a home visit to last 45 minutes to 90 minutes.

The lack of consistent support of the VHTs with transport facilitation and communication by the Ministry of Health, emerged as potential barrier to regular home visits and sustained delivery of health education, mirroring operational challenges reported in similar studies [43][46]. In this case, while delivering this intervention, the study team will provide the VHTs with airtime to facilitate communication with participants. Participants also raised concerns regarding the integrity of some VHTs and suggested the involvement of community members in the selection of trustworthy individuals, highlighting the significance of community ownership and trust in health care systems [44]. This equally emphasizes the need for monitoring mechanisms and community engagement to ensure accountability, which reinforces the view that community health interventions require both technical and logistical investments to be sustainable [45]. The study team will conduct VHT support supervision to monitor progress and fidelity.

In terms of the feasibility of adopting heart-healthy dietary practices, our findings showed both structural and cultural influences, and constraints on the proposed intervention. Similar to related studies, it is important that the intervention is simplified enough for a culturally diverse country like Uganda so that it does become a barrier as cited in one study [46]. Participants consistently identified cultural norms, seasonal variability, and affordability as key barriers to adopting healthier diets, despite the reports of availability of a diverse range of local foods that are easily accessible in rural communities and in local

markets within urban areas [47][48]. The FaCe-D intervention had been designed to include a monthly healthy diet education session by the VHTs for the entire family during the home visit. The education session is aimed at promoting the use of affordable, locally available foods and establishment of kitchen gardens as some of the sustainable strategies to mitigate seasonal food shortages. By aligning dietary recommendations with existing food practices and cultural contexts, the feasibility and acceptability of the intervention may be enhanced. Furthermore, periodic food demonstrations for households on how to utilize available spaces and re-usable materials to grow different fruits and vegetables will be conducted. In this study, adolescents were reported to resist vegetable consumption, a finding consistent with prior studies showing age-specific preferences in food choices [48][50]. Participants reported that the pervasiveness of street food culture, time constraints, and a lack of understanding about a balanced diet further complicate the shift to healthier diets. It has been reported that there is a common desire for fried and processed foods over boiled foods, especially in urban areas, which is in line with findings from other studies [51] [49], highlighting how urbanization contributes to a nutrition transition characterized by unhealthy food environments.

The role of physical activity in CVD prevention was acknowledged, albeit inconsistently practiced by the youngest people in both rural and urban settings [52]. While rural participants showed a limited knowledge of structured exercise beyond manual labor, urban participants often mentioned a lack of time and open safe places as barriers to adopting routine physical activity. These findings are in line with other studies that identified infrastructure and environmental constraints as major contributors to physical inactivity in Sub-Saharan Africa [54][55]. Similarly, the existing evidence on factors related to time and poverty is consistent with our study participants' feedback that parents' work schedules and adolescents' school obligations, especially in urban setting may make participation difficult [56][57]. Therefore, our proposed intervention recognizes the need to have the VHTs engage the families in deciding on a flexible program schedule with enjoyable activities to meet the daily recommended 60 minutes of physical activity by the adolescent. In general, the idea of regularly recording physical activity and food intake was positively received, especially when simplified with pictorial illustrations.

However, obstacles like illiteracy levels, time constraints, and ignorance of measuring of appropriate food proportions are likely to make it difficult to accurately and consistently record physical activity and food consumed. These results are consistent with other studies that highlight the need for culturally appropriate and literacy-sensitive tools for effective nutritional self-monitoring in low-income settings [58]. Participants preferred recording food intake that was structured around entire meals over individual food items to enhance feasibility and cultural fit. In line with other studies [41], findings on continuous health education sessions were suggested as a means of reinforcing healthier dietary habits, and other behavior modification programs.

Consulting cultural leaders on the intervention adaptation emerged as an important aspect. They will be consulted to support the refining of dietary phone messages and culturally acceptable meal preparation practices in addition to the use of visual aids to demonstrate health plate and meal planning for all family members

The stakeholders' response to phone SMS messaging as a viable strategy for delivering dietary and healthy lifestyle content, are consistent with evidence that micro-content delivered via SMS can facilitate health literacy and incremental behavior change [41] and that low-cost digital interventions can improve health behaviors in low- and mid-income countries [60]. Nonetheless, barriers such as illiteracy and limited mobile phone access, especially among adolescents, warrant consideration to ensure equitable reach and impact. The proposed intervention was therefore re-designed to include bi-weekly SMS with all messages translated into the two common local languages.

Study limitations and recommendations

Although this study offers deep qualitative insights, the purposive sampling strategy used was limited to only the two intervention sites in two regions of the country and thus the data saturation is also limited to these two regions, yet Uganda, being a multicultural country, means another country-wide study will be required to cater for representativeness in the remaining 3 regions. In addition, given that this study was limited to the confinements of the CFIR framework, renders it void of the pure inductive rigor that would have been leveraged through ethnographic approaches that are more open-ended in procedures.

Conclusion

Overall, the study findings show that the adoption of healthy behaviors related to CVD prevention is shaped by a complex interaction of structural barriers, cultural norms, individual knowledge, and policy requirements, as reflected in all four relevant constructs of the outer setting, two of the intervention characteristics, two of the characteristics of individuals, and one construct of the inner setting domains of the CFIR framework. Therefore, successful implementation of the FaCe-D intervention depends on addressing outer setting barriers (financial constraints, cultural norms), strengthening inner setting readiness (training, supervision, facilitation), and reinforcing individual motivation and knowledge through tailored education, participatory delivery, and feedback mechanisms. The participation of different community actors, including adolescents, heads of households, health professionals, and policymakers, however, contextualizes these issues and makes the case for successful implementation. Multi-sectoral collaboration is an essential long-term strategy to fight CVDs. Therefore, findings obtained after implementation and evaluation of the proposed FaCe-D intervention could inform policy formulation to better address the rapidly increasing burden of NCDs in the country and similar settings.

Abbreviations

FaCe-D
Family centered approach to enhance lifestyle change and behavioral modification for prevention of cardiovascular diseases among adolescents and their families in Uganda
CVDs
Cardiovascular Diseases
NCDs

Non communicable diseases
FCA
Family Centered Approach
VHTs
Village Health Teams
CFIR
Consolidated Framework for Implementation Research
FGDs
Focus Group Discussions
KIIs
Key Informant Discussions
UNCST
Uganda National Council for Science and Technology
LSHTM
London School of Hygiene and Tropical Medicine
NGO
Non-Governmental Organization
MoH
Ministry of Health
SMS
Short Message Service
GACD
Global Alliance for Chronic Diseases
CIHR
Canadian Institutes for Health Research

Declarations

Ethical approval and consent to participate

In accordance with the declaration of Helsinki, all ethical principles were observed and the study was approved by Uganda Virus Research Institute's Research and Ethics Committee, and the London School of Hygiene and Tropical Medicine Ethics Committee (LSHTM), and the University of British Columbia Behavioral Research Ethics Board, and ethical clearance was obtained from the Uganda National Council for Science and Technology (UNCST). All participants aged 18 years and above provided consent while adolescents aged below 18 years provided assent after parental consent to participate in the study.

Clinical trial number

Not applicable

Consent for publication

Not applicable

Competing interests

All authors declare that they have no competing interests.

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Author Contribution

All authors participated in all the processes of writing this manuscript. JB, DM and RK conceived the study and provided technical guidance during implementation, MA and CMN led the development of the study protocol, JB, DM, RK, MM, OS, PO SN, IK, CMT, LM, AN and IN implemented the study. MA and CMN lead the data collection and data analysis process and made the first draft of the manuscript. All authors reviewed all the revised drafts. JB, DM and RK were the principal investigators on this study and provided the final revisions of the manuscript.

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Data Availability

The data used in this manuscript is protected by the data protection agreement that was reached by the participating institutions. Our participants only consented to data that is anonymized for publication and

not their personal data. Equally, only upon approval by the study principal investigators will any other researcher access the anonymized data and data collection tools from the MRC and LSHTM server for research purposes.

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