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Use of transtheoretical model to facilitate physical activity and promote cardiovascular health knowledge in an urban community setting

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Abstract

Background: There is increasing evidence that physical activity promotes cardiovascular health (CVH) and reduce the chances of cardiovascular disease (CVD). The aim of this study was to determine the impacts of a complex physical activity intervention designed collaboratively with the community and tailored to the needs of individual on physical activity knowledge and behaviour with the intention to improve CVH within an urban population context.

Method: A physical activity programme involving 50 participants was developed and implemented collaboratively with the community, in a participatory approach at least twice a week, and monitored at two-week intervals throughout the project. Focus group interview was used to explore the barriers and ways of overcoming barriers to physical activity among the participants. One-to-one interviews were used to explore challenges that each participant encountered in trying to improve physical activity and to tailor specific advice depending on a participant's peculiar circumstances. Questionnaire was used to monitor participants' reported physical activity as well as evaluate changes in knowledge about how physical activity affects CVH.

Results: At baseline, most participants reported that they were unaware of the importance of physical activity to cardiovascular health. At week 4, there was a shift, with more participants reporting awareness, contemplation, and intention to increase levels of physical activity, compared to baseline. At week 8, there was another shift, with more participants reporting attempting to exercise 30 minutes a day, five days a week, although not always meeting up to the challenge. At week 10 there was a shift to more participants in the adoption phase (compared to week 6) and many reporting that the behaviour had become sustainable (compared to week 4). By week 12 there was a significant shift towards more participants encouraging others to become more physically active, that continued to increase at week 14.

Conclusion: Programmes such as this can have a significant impact on awareness within a few weeks, and many participants reported that they are maintaining a change in behaviour, that might impact on future health, after three months.

Keywords: Physical activity; Cardiovascular health promotion; Cardiovascular disease prevention; Transtheoretical model

1. Introduction

Physical activity is defined as any bodily movement produced by skeletal muscles that results in energy expenditure [1]. Physical activity guidelines currently recommend at least 150 – 300 minutes of moderate-intensity physical activity per week for adults. Alternatively, 75 – 150 minutes of vigorous-intensity physical activity, or an equivalent combination of moderate-and-vigorous intensity aerobic activity per week is recommended [2]. On the other hand, physical inactivity

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is defined as the non-achievement of physical activity guidelines [3]. There is increasing evidence demonstrating that physical inactivity contributes to long-term health conditions, including cardiovascular disease (CVD), type 2 diabetes, hypertension, colon, and breast cancers [4 - 6]. All types of physical activity seem to be beneficial to health. However, lower activity level leads to higher reductions in type 2 diabetes risk than higher activity level [4].

There is increasing evidence that physical activity promotes cardiovascular health (CVH) and reduce the chances of CVD [7 - 8]. A meta-analysis [8], for example, investigated the relationship between physical activity and the risk of cardiovascular disease. The study found that high level of leisure time physical activity and moderate level of occupational physical activity have a beneficial effect on cardiovascular health by reducing the overall risk of incident coronary heart disease and stroke among men and women by 20 to 30 percent and 10 to 20 percent, respectively. High-intensity leisure-time physical activity has more obvious cardiovascular benefits than those of moderate-intensity leisure-time physical activity [7].

These findings support efforts of using physical activity for primary and secondary prevention of CVD in developed economies as well as in developing countries. Exercise is an organised form of physical activity. Research has shown that exercise prevents both the onset and development of CVD, and it is a relevant therapeutic instrument to improve outcomes for patients with CVD. Improved mitochondrial function, restoration and improvement of vasculature, and the release of myokines from skeletal muscle that preserve, or augment cardiovascular function are some of the benefits of exercise [9]. There are a few unanswered questions in relation to physical activity as a primary prevention of CVD comorbidity like hypertension, including protective benefits of physical activity in high risks individual and the optimal prescription for hypertension prevention [10].

Transtheoretical model (TTM) is widely used to facilitate physical activity [11 - 12]. The TTM has four key constructs. The four key constructs are (i) the stages of change, (ii) a series of ten independent variables known as the process of change, (iii) self-efficacy and (iv) decisional balance. The TTM uses the stages of change to integrate the most powerful principles and processes of change from leading theories of counselling and behaviour change [11, 13]. There were a limited number of studies in the literature that use TTM to facilitate physical activity with the aim to improve the CVH within urban population in Nigeria. In view of this finding, the focus of this study is to bridge the gap in knowledge in this context. The aim of this study was to determine the impacts of a complex physical activity intervention designed collaboratively with the community and tailored to the needs of individual on physical activity knowledge and behaviour with the intention to improve CVH within an urban population context.

The study involved an innovative eight-stage stages of change to facilitate physical activity within an urban population context with the aim to promote cardiovascular health. The eight-stage stages of change include pre-awareness, awareness, contemplation, and intention stages. Other stages of change are trial, adoption, maintenance, and telling others. The Ethiopian Ministry of Health, in a similar context, has selected this approach to improve health behaviour [14]. This approach was chosen because it has a systematic and detailed communication strategy to persuade, encourage, and support behaviour change.

The stages of change are briefly explained. At Pre-awareness stage, people are not aware of the health behaviour changes that they need to make. At awareness stage, the individuals have heard about the need to change their health-risk behaviour but need additional help and persuasion to start actually to bring about the health behaviour change. At contemplation stage, the individuals are thinking about changing their health-risk behaviour but needs more information and continued support and persuasion about the advantages and disadvantages of changing their health-risk behaviour.

At intention stage, individuals have understood the advantages and disadvantages of changing their health-risk behaviours but needs encouragement to overcome the challenges of undertaking the new health behaviour. At trial stage, the individuals have tried the behaviour or action required, but has faced challenges. At adoption stage, the individuals are demonstrating the new behaviour. At maintenance stage, the participants' health behaviour has changed, and they understand the benefits of the change. At telling others stage, the individuals have done the behaviour for a considerable length of time. It has become routine behaviour and now leads to the person convincing others about the benefits of their health-related behaviours.

2. Materials and Methods

Ethical approval was sought and obtained from the School of Health and Life Sciences Ethics Committee, University of the West of Scotland and the Lagos State Ministry of Health, Lagos State, Nigeria. Informed consent was obtained from all participants that participated in the study. Fifty participants were recruited through convenience sampling in an urban population in Nigeria. A physical activity programme christened 'Health walks' was developed and implemented collaboratively with the community, in a participatory approach at least twice a week, and monitored at two-week intervals throughout the project. Health Walks was the brainchild of the local community where the intervention was undertaken and it aimed to promote CV health via brisk walks, jogging, running, and football every Saturday and Sunday evenings and the physical activities usually last for a minimum of 30 minutes. The physical activity intervention was monitored using questionnaires adapted from the stage-based BCC strategy. Focus group interview were used to explore the barriers and ways of overcoming barriers to physical activity among the participants. One-to-one interviews were used to explore challenges each individual encounter in trying to improve their physical activity and tailor specific advice depending on a participant's peculiar circumstances. Both one-to-one interviews and focus-group interviews were spread out across the complex public health intervention. At the end of the community-based intervention, each of the 50 participants was encouraged to share their learning and experiences with ten members of the community to pass the information across to the wider population.

The questions relating to physical activity were organised according to the eight stages of change model. There was a 5-point Likert scale for the each of the questions which ranged from strongly agree (SA) to strongly disagree (SD) in relation to physical activity as it affects CVH and behaviour. The responses to each of the statements on physical activity are shown in Figure 1a and Tables 3. Figure 1a shows the responses in a separate graph to each of the statements at two-week intervals while Figure 1b shows the responses in a separate graph for each question. The questions relating to Pre-awareness for physical activities are negative statements, while the rest are positive, and are therefore shown as the reverse score in the Figures and Table and used as the reverse score in statistical analyses. Thus, a shift from 3 (uncertain), 4 (disagree), 5 (strongly disagree) to a score of 1 (strongly agree) or 2 (agree) on the Likert scale can be regarded as a shift to self-reported knowledge/behaviour in this study and relevant from a knowledge/behaviour perspective. Qualitative data was analysed using a thematic approach to data analyses offered by Braun and Clark, 2006.

Table 1 Questions adapted from staged-based BCC strategy used to facilitate and monitor change in physical activity

Stage	Physical activity
Pre-awareness	I do not know about importance of physical activity to cardiovascular health
Awareness	I have heard about the need to spend at least 30 minutes a day doing moderate-intensity physical activity such as brisk walking, cycling, and exercising, and the need to do these activities at least five days per week
Contemplation	I am thinking about increasing my level of physical activities but need more support and information about its advantages and disadvantages
Intention	I have now understood the advantages of increasing physical activities to cardiovascular health and the disadvantages of sedentary behaviour to cardiovascular health, but need encouragement to overcome possible challenges of getting started
Trial	I had tried to do at least 30 minutes moderate-intensity physical activity per day for at least five days per week, but fail to meet up at times
Adoption	I now do at least 30 minutes moderate-intensity physical activity per day for at least 5 days per week, but still, need support and encouragement to continue with my new behaviour
Maintenance	I now do at least 30 minutes moderate-intensity physical activity per day for at least five days per week; it has become part of my behaviour, and I think I can continue with the new behaviour
Telling others	I now tell other people about the benefits of physical activity to cardiovascular health and encourage them to do at least 30 minutes physical activities for at least five days per week

In this study, the participants were assigned letter [P] and a number [1-50] as a pseudonym to protect confidentiality. Impacts of the health education intervention on knowledge around factors that influence CVD health were determined

using McNemar's test. Table 1 represents the questions adapted from stage-based Behaviour Change Communication (BCC) strategy used to facilitate and monitor change in physical activity. There was a 5-point Likert scale for the each of the questions which ranged from strongly agree (SA) to strongly disagree (SD). There was a 5-point Likert scale for the each of the questions which ranged from strongly agree (SA) to strongly disagree (SD)

3. Results

At the start of the physical activity intervention, the types of the physical activity that the participants would like to get involved in, the factors that would motivate them to get involved in the chosen physical activity, likely barriers to participating in the activity, and communication strategies used to encourage the participants to participate in the physical activity are shown in Table 2a and 2b.

Table 2a Strategies for promoting physical activity. The types of the physical activity that the participants would like to get involved in, the factors that would motivate them to get involved in the chosen physical activity, likely barriers to participating in the activity, and communication strategies used to encourage the participants to participate in the physical activity.

Table 2a Strategies for promoting physical activity

Types of physical activity that I would like to get involved in.	Factors that would facilitate and motivate me to get involved.	Barriers to getting involved in physical activity.	Communication strategies
<ul style="list-style-type: none"> •Walking 	<ul style="list-style-type: none"> •Want to keep fit •It is stress free •Want to be more active •Want to be alive to see my grand children 	<ul style="list-style-type: none"> •Sometimes have pains in the legs after walking for too long •Don't usually have time for walking 	<ul style="list-style-type: none"> •Encouraged to walk to their local shops •Encouraged the participants to walk part of their journey to work •Encouraged the participants to consider walking their children to school •Encouraged the participants to consider leaving their cars behind for short journeys •Emphasized the fact that walking is simple exercise that is stress free and helps to keep fit. •Encouraged the participants to walk more often •To see a doctor for walking difficulties
<ul style="list-style-type: none"> •Running 	<ul style="list-style-type: none"> •Want to exercise my muscles •Want to lose weight •Keeping fit •Want to look attractive to their spouses 	<ul style="list-style-type: none"> •Lack of time to go for running due to work schedules •Long working hours •High demanding nature of jobs 	<ul style="list-style-type: none"> •Try making out time to run during weekends when off duty •Add exercise to weekly routine •Encouraged the participants to adjust their diet to include plenty of fresh fruits and vegetables, lean meat, and whole grain cereals. Motivated to reduce intake of saturated fats, soft drinks, and sugars. •Encouraged the participants to see the impact of their losing weight on their personality •Encouraged the participants to start with brisk walking, progress to jogging and work up to running

Table 2b: Strategies for promoting physical activity (Continuation). The types of the physical activity that the participants would like to get involved in, the factors that would motivate them to get involved in the chosen physical activity, likely barriers to participating in the activity, and communication strategies used to encourage the participants to participate in the physical activity.

Table 2b Strategies for promoting physical activity (Continuation)

Types of physical activity that I would like to get involved in.	Factors that would facilitate and motivate me to get involved.	Barriers to getting involved in physical activity.	Communication strategies
•Jogging	<ul style="list-style-type: none"> • Liked jogging • Makes one to sweat and feel good • Jogging unites people of all background 	<ul style="list-style-type: none"> • No purpose-built walkways in Lagos in addition to traffic congestions on Lagos roads • No parks where people can go for jogging away from busy Lagos roads 	<ul style="list-style-type: none"> • Praise the idea that jogging makes them feel good and somewhat improves their physical wellbeing • Encouraged participants to use local facilities such as football pitches in their local schools • Encouraged participants to see jogging as a good opportunity to know our local community better and build good neighborhood relations
•Football	<ul style="list-style-type: none"> • Young and agile • Being a man • Love football • It is a hobby • A form of exercise that is good to health 	<ul style="list-style-type: none"> • Busy schedule 	<ul style="list-style-type: none"> • Pointed out that football is not just a great way to exercise but a way to promote social inclusion and reduce isolation • Reinforced the benefits of playing football as their hobby, pointing out that soccer playing burns more calories than typical workout because players switch between using the aerobic and anaerobic energy pathways • Reminded participants that constant walking, jogging, and running during football match helps keep the players heart rate up, providing excellent cardiovascular exercise
•Climbing staircase	<ul style="list-style-type: none"> • It can easily be done at home • Do not require any skills or training to do • Do not need to go outside 	<ul style="list-style-type: none"> • Do not have staircase at home. • Tiredness 	<ul style="list-style-type: none"> • Reinforced the fact that it is an easy exercise that one does not need to go outside to do but could be an ideal way to exercise the body • Emphasized the fact that stair climbing helps protect against high blood pressure, weight gain and clogged arteries. • Reiterated the fact that stair climbing lowers the risk of developing long term conditions such as diabetes, heart disease and some cancers. • Encouraged participants to turn stair climbing into a game or challenge
•Push up	<ul style="list-style-type: none"> • It can easily be done at home • Gain energy from doing it • Does not need any equipment to start 	<ul style="list-style-type: none"> • Forget to do the exercise sometimes 	<ul style="list-style-type: none"> • Writing it down in the 'to do list' • See press up as a way of keeping fit in a fun way • See press up as a way of investing in one's health without paying anything for it • It is an effective cardiovascular exercise that supports heart health and promotes the reduction of stored body fat

3.1. Change in knowledge of physical activity as it affects cardiovascular health.

The level of knowledge of the importance of physical activity on cardiovascular health increased compared to baseline. Nearly two-third of the participants either strongly agreed or agreed with the true statement that “If I’m physically active (e.g., walk for 2 hours a week), it will reduce my risk of developing heart disease” at baseline and all participants either strongly agreed or agreed with the statement at the end of the programme (P < 0.0001). This shift represents 56% of the participants that changed their views at the end of the health education intervention. Slightly higher than half of the participants that either strongly disagreed or disagreed with the statement that “If I’m physically active (e.g., walk for two hours a week), it does not reduce the risk of developing stroke” at baseline and all participants either strongly disagreed or disagreed with the statement at the end of the programme (P < 0.0001). This shift in views translate to 92% number of the participants that changed their perspectives at the end of the health education.

There was a recognised connection between the impact of exercise on overweight among the participants as slightly above two-third of the participants either strongly disagreed or disagreed with the statement that “Intense physical activity has no effect on weight” at baseline and all participants either strongly disagreed or disagreed with the statement at the end of the programme (P < 0.0002). This shift represents 47% of the participants that got the responses correct at the end of the health education session. It was recognised that there were links between physical activity and abdominal fat or increased waist circumference as almost half of the participants strongly disagreed or disagreed with the statement that “Intense physical activity has no effect on those with abdominal (stomach) fat” at baseline and all participants either strongly disagreed or disagreed with the statement at the end of the programme (P < 0.0001). This shift in views translate to 66% number of the participants that changed their perspectives at the end of the health education.

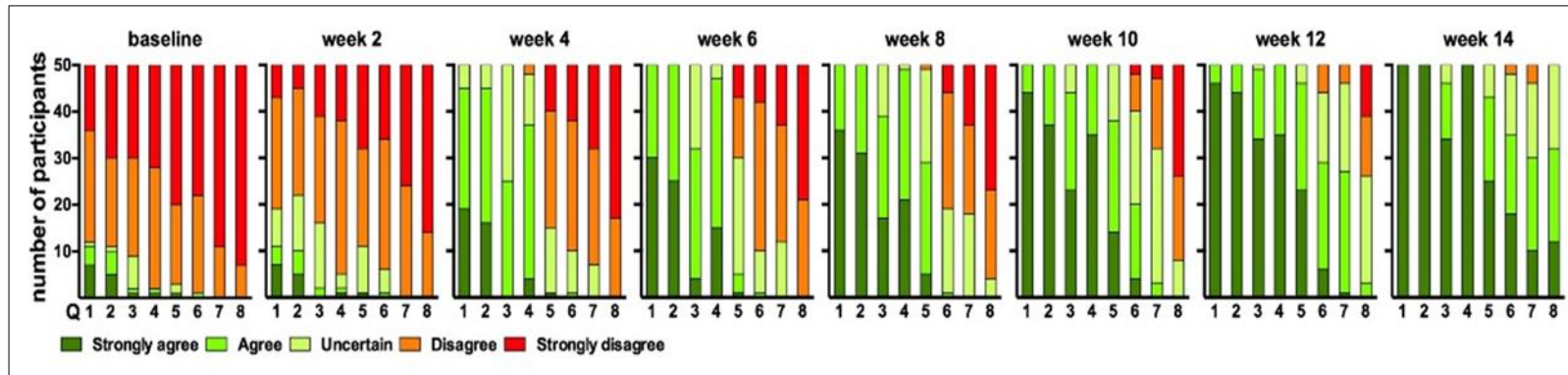
Approximately half of the participants either strongly disagreed or disagreed with the false statement that “Increased sitting does not contribute to heart disease” at baseline and all participants either strongly disagreed or disagreed with the statement at the end of the programme (P < 0.0001). This shift translates to 108% increment in the number of the participants that answered correctly at the end of the health education session. An example of the change in views resulting from improved awareness of importance of exercise to cardiovascular health which may result in change in health behaviour among the participants at the end of the health education intervention is shown below. ‘It is important that I make out more time to walk may be when going to the market if it is one of the things that it takes to improve heart health. I don’t want to die now; I want to be alive to see my grandchildren’ [P₂₀, female, graduate, 50 – 59 years].

Half of the participants either strongly disagreed or disagreed with the false statement that ‘Involving in short bouts of low-intensity physical activity such as standing, self-care activities and slow walking have no significant health benefits’ at baseline and all participants either strongly disagreed or disagreed with the statement at the end of the programme ($P < 0.0001$). This change means that an additional 100% of the participants responded correctly at the end of the health education intervention. Participants demonstrated awareness of the importance of short bouts of low-intensity physical activity to CV health at the end of the health education intervention. ‘We have now learnt that it is helpful to engage in short bouts of low-intensity physical activity when we cannot afford to engage in moderate-intensity exercises because of our health conditions and other limitations’ [P₄₅, female, high school, 50 – 59 years].

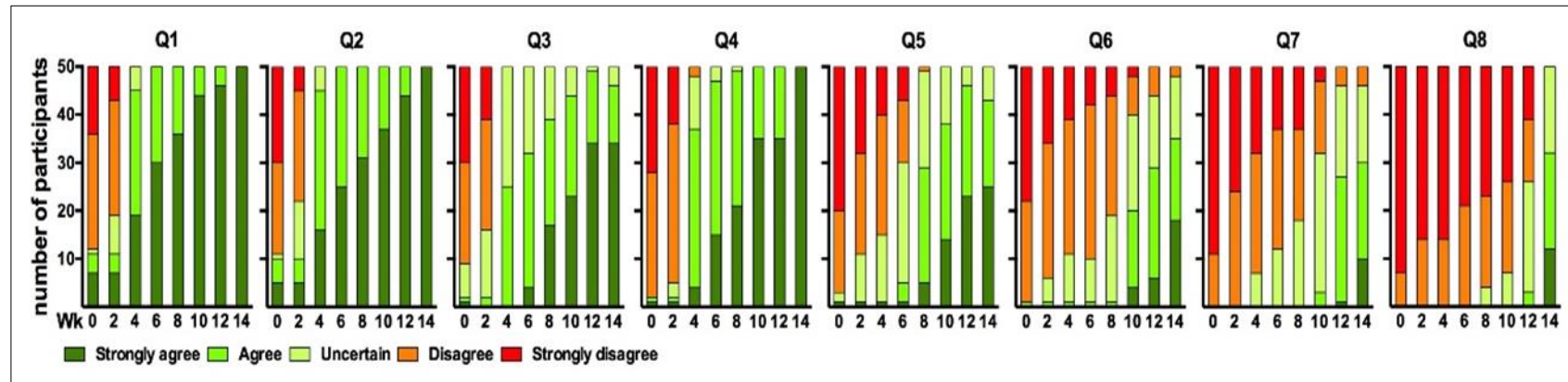
Two-third of the participants either strongly agreed, agreed, or uncertain with the statement that “If I am physically active (e.g., walk for 2hours a week), it does not reduce my risk of developing type 2 diabetes” at baseline and no participant either strongly agreed or agreed with the statement at the end of the programme ($P < 0.0001$). This change means that an additional 66% of the participants responded correctly at the end of the health education intervention. Slightly above two-fifth of the participants either strongly agreed or agreed with the true statement that ‘Overweight contributes to diabetes’ at baseline and all participants either strongly agreed or agreed with the statement at the end of the programme ($P < 0.0001$). This shift represents 72% of the participants that got the responses correct at the end of the health education session. There were cultural factors that were identified that motivated the participants in their choice of exercise to lose weight. ‘I want to get involved in running because I need to lose weight, I think I’m putting on a lot of weight recently. It is important that I look attractive to my husband. You know some men you don’t want to give them a reason to start looking outside (dating other women)’ [P₁₉, female, 30 – 39 years].

Above two-fifth of the participants either strongly disagreed or disagreed with the false statement that ‘Intense physical activity has no effect on systolic blood pressure’ at baseline and all participants either strongly disagreed or disagreed with the statement at the end of the programme ($P < 0.0001$). The programme increased the recognition of links between physical activity and blood pressure with 150% of the participants responding correctly at the end of the health education intervention. One-third of the participants either strongly agreed or agreed with the true statement that ‘Intense physical activity has effect on diastolic blood pressure’ at baseline and all participants either strongly agreed or agreed with the statement at the end of the programme ($P < 0.0001$). Additional 194% of the participants understood the link between physical activity and diastolic pressure at the end of the health education intervention.

It was understood that physical activity reduces the impact of diabetes with above one-third of the participants strongly agreeing or agreeing with the statement that ‘increased physical activity minimises the impact of diabetes on heart health’ at baseline compared with all the participants that either strongly agree or agree with the statement at the end of the programme ($P < 0.0001$). And those with diabetes should participate in physical activity, with two-fifth of the participants strongly disagreeing or disagreeing with the statement “people who have diabetes should be involved in decreased physical activity”, at baseline compared with all participants strongly disagreeing, at the end of the programme ($P < 0.0001$). The responses to each of the statements on physical activity are shown in Figures 1a and 1b as well as Table 3. Figure 1a shows the responses in a separate graph to each of the statements at two-week intervals while Figure 1b shows the responses in a separate graph for each question side by side.



a



b

Figure 1 Impacts of physical activity intervention on knowledge and health behaviour at two-week intervals. The questions were repeated every two-weeks up until the end of health education intervention, and the number of participants in each Likert category are shown. The responses are shown week-by-week (a) and to each other (Q). Q1 is a negative statement, while the rest are positive, and is therefore shown as reverse score.

The questions were repeated every two-weeks up until the end of health education intervention, and the number of participants in each Likert category are shown. The responses are shown to each other (Q). Q1 is a negative statement, while the rest are positive, and is therefore shown as reverse score. The knowledge of association between physical activity and cardiovascular health and intention to improve physical activity increases from Week 0 to Week 14. Majority of participants reported trial of 30 minutes physical activity at week 8, adopting of the health behaviour at week 12, and telling others about the new behaviour at week 14.

Table 3 Physical activity and cardiovascular health

Question Stage	Week 0	Week 2	Week 4	Week 6	Week 8	Week 10	Week 12	Week 14
1	4	4	2	1	1	1	1	1
Pre-awareness	3.7 (3.3-4.1)	3.4 (3.0-3.8)	1.7 (1.4-1.9)	1.4 (1.3-1.5)	1.3 (1.2-1.4)	1.1 (1.0-1.2)	1.1 (1.0-1.2)	1.0 (1.0-1.0)
(reversed score)			0	0,2	0,2	0,2	0,2	0,2,4
2	4	3	2	1.5	1	1	1	1
Awareness	3.9 (3.5-4.3)	3.4 (3.0-3.7)	1.7 (1.4-1.9)	1.0 (1.4-1.6)	1.4 (1.2-1.5)	1.3 (1.1-1.4)	1.1 (1.0-1.2)	1.0 (1.0-1.0)
			0	0,2	0,2	0,2	0,2	0,2,4
3	4	4	2.5	2	2	2	1	1
Contemplation	4.2 (3.9-4.4)	3.9 (3.6-4.1)	2.5 (2.4-2.6)	2.3 (2.1-2.5)	2.3 (2.1-2.5)	1.7 (1.5-1.9)	1.3 (1.2-1.5)	1.4 (1.2-1.6)
			0	0,2	0,2	0,2,4	0,2,4,6	0,2,4,6
4	4	4	2	2	2	1	1	1
Intention	4.3 (4.1-4.5)	4.1 (3.7-4.3)	2.2 (2.0-2.4)	1.8 (1.6-1.9)	1.6 (1.4-1.8)	1.3 (1.2-1.4)	1.3 (1.2-1.4)	1.0 (1.0-1.0)
			0,2	0,2	0,2	0,2,4	0,2,4	0,2,4,6
5	5	4	4	3	2	2	2	1.5
Trial	4.5 (4.3-4.7)	4.1 (3.9-4.3)	3.9 (3.6-4.1)	3.4 (3.2-3.7)	2.3 (2.1-2.5)	2.0 (1.8-2.2)	1.6 (1.4-1.8)	1.6 (1.4-1.9)
					0,2,4	0,2,4,6	0,2,4,6	0,2,4,6
6	5	4	4	4	4	3	2	2
Adoption	4.5 (4.3-4.7)	4.2 (4.0-4.4)	4.0 (3.8-4.2)	3.9 (3.8-4.1)	3.7 (3.5-3.9)	2.8 (2.5-3.0)	2.4 (2.2-2.7)	2.0 (1.7-2.2)
						0,2,4,6	0,2,4,6,8	0,2,4,6,8
7	5	5	4	4	4	3	2	2
Maintenance	4.8 (4.7-4.9)	4.5 (4.4-4.7)	4.2 (4.0-4.4)	4.0 (3.8-4.2)	3.9 (3.7-4.1)	3.4 (3.2-3.5)	2.5 (2.3-2.7)	2.3 (2.0-2.5)
					0	0,2,4	0,2,4,6,8	0,2,4,6,8
8	5	5	5	5	5	4	3	2
Telling others	4.9 (4.8-5.0)	4.7 (4.6-4.9)	4.7 (4.5-4.8)	4.6 (4.4-4.7)	4.5 (4.3-4.6)	4.3 (4.1-4.5)	3.6 (3.4-3.9)	2.1 (1.9-2.3)
							0,2,4,6	0,2,4,6,8,10

Table 3. Physical activity and cardiovascular health: Responses to each question are the median and mean (95%CI) values, treating the Likert scale data as a continuous variable. The differences between weeks for each question was compared by one-way ANOVA, taking into account repeated measures (Friedman's test) and significant difference between groups are shown in italics (0 compared to week 0, 2 compared to week 2, etc. for the same question; significance set at $P < 0.001$; Dunn's multiple comparison test)

Change in response to each question across the study period is illustrated in Figure 1. The baseline period (designated week 0) represents the period participants were recruited and completed the first questionnaires (during a two-week). Most participants reported that they were not aware of the importance of physical activity to CV health at baseline and week 2. There was a significant shift to self-reported Pre-awareness, Awareness, Contemplation, and Intention at week 4. This shift coincided with planning the complex public health intervention with community members and discussions about various ways to improve physical activities. Being aware of importance of physical activity at week 4 may have influenced the participants to start thinking about improving their physical activity level and making plans towards it. However, they did not try the behaviour until week 8. They reported adopting and maintaining the behaviour at week 12 and only told others about their new behaviour at week 14.

There was a significant shift to agree with the questions in relation to Contemplation and Intention of being physically active at week 4. In this study, the participants' intention to perform the behaviour and perceived behavioural control were explored by asking them to identify the kinds of physical activity, they would like to get involved in and the reason for making such a choice. The participants used decisional balance worksheet to outline the pros and cons of changing health-risk behaviours and not changing, respectively. Physical activities such as walking, jogging, football, push up, gymnastics, and running were identified, and an example of a participant's intention to perform the behaviour is shown below. 'I want to get involved in running because I need to lose weight, I think I'm putting on a lot of weight recently. It is important that I look attractive to my husband. You know some men you don't want to give them a reason to start looking outside (dating other women)' [P19, female, graduate, 30 – 39 years].

This view suggests that issues around maintaining stability in their matrimonial homes through reducing the possibility of infidelity by one's spouse by being fit and attractive are important to some participants. Stress reduction associated with work may be paramount in some participants agenda for joining the physical activity session. 'I joined in the jogging because it provided a platform to socialise and it helped to reduce stress related to my job' [P4, male, secondary education, 40 - 49years]. Using decisional balance sheet helped the participants to identify the pros of getting involved in the community health walk which helped the participants to move to the intention stage.

Some of the participants that do white collar jobs like banking which is time intensive saw an opportunity to reduce stress through socialising with other people in a friendly environment free from stress. Some young people - especially men joined the physical activity intervention as it provided them an opportunity to play their favourite game (football) and involve in research. 'Football is a hobby for most young people. It keeps you agile and energetic – it is a way to show your manhood' [P30, graduate, male, 20 – 29 years]. For most young men, doing something they love which equally enable them to show their strength and skills could be a motivating factor for choosing football.

The health education session at week 3 and the interpersonal communication strategies used to encourage the participants to choose the type(s) of physical activity they would like to get involved in at week 4 may have contributed to the significant change that were reported within the week. Factors that would motivate the participants to get involved in the physical activity and the potential barriers to getting involved were discussed and solutions proffered. Continuous support and verbal persuasion on the need to change sedentary behaviour may have contributed to the shift to 'agree' reported at week 8 with respect to the question relating to Trial stage of physical activity. A few participants were not able to participate in all the organised community physical activity sessions due to work-related issues. The various options, the participants can use to overcome the challenges posed by work busy schedule were negotiated and the participants were able to make out time at their convenience time to exercise.

There was a shift in response to 'agree' at week 12 with respect to the question about adopting physical activity as a new lifestyle. Challenges encountered by the participants in improving their physical activity level were raised, discussed and solutions proffered. Some of the barriers identified by the participants that were likely to impede their physical activity level include attending to the family needs, structural barriers, and medical issues. 'I go to work, go to the market to get most of the things my family need and still have to take care of my children. You can see I have got a lot to do and sometimes it can be quite challenging to make out time to exercise' [P5, female, graduate, 40 – 49 years].

The various options that the participants may use to overcome the identified challenges were negotiated in the one-to-one interview setting. For example, the participants were encouraged to walk part of their journey to work. Some

participants identified other issues related to structural barriers. 'It is challenging to go for a long walk in Lagos because of lack of purpose-built walkways in the city and traffic congestion on Lagos roads is terrible...you wouldn't want a bus or bike (motorcycle) to knock you down' [P₄₀, graduate, male, 30 – 39 years]. Continuous discussion of the benefits of physical activity was undertaken. Participants were always supported to find ways to improve their physical activity level on a daily basis no matter how little. At this stage, most participants reported engaging in more physical activity. Encouraging and praising the participants and emphasising the importance of moderate-intensity aerobic physical activity to cardiovascular health was helpful in sustaining the morale of the participants.

In the Maintenance stage, a similar pattern of behaviour change in the Adoption stage was reported. Towards the end of the complex intervention, many participants changed their responses to 'strongly agree'. During this time, the reason for the change in responses might be connected to the fact that participants were provided with various support mechanisms, including CV health information, and opportunities to discuss benefits of improving physical activity to CV health, which in turn, may have contributed to improving awareness among the participants.

The techniques and approaches that were employed to motivate participants in the pre-awareness and awareness stage (precontemplation stage) to change their health behaviour is different for those in action or maintenance stage. For the participants in pre-awareness, awareness or contemplation stage, the education materials explained the cons of physical inactivity as it relates to cardiovascular health, benefits of physical activity in the context of reducing the chances of cardiovascular disease, and tips on how to move through the stages of change and become more physically active. For the participants who are at the intention stage, the health education materials reiterated the pros of becoming more active and provided tips on how to inculcate physical activity into our daily routine like stopping a few stops before one's destination when using a public transport. The education materials for those in maintenance stage focused on how to avoid relapse like having an exercise schedule.

In the Telling others stage, there were significant shift in responses to 'agree' at week 14. The participants were encouraged to share their experiences with others. A combination of factors may have influenced the significant changes observed at this stage, including the knowledge gained, friendship established, social inclusion, exercising together, trust built, participants' sense of ownership of the project, and appreciating the efforts of the participants in making a positive health change. Benefits of physical activity to CV health were reiterated while practical supports were offered as well to the participants to remain in their positive health behaviour. Verbal persuasion - the use of verbal encouragement to emphasise the benefits of physical activity to CV health and wellbeing and acknowledgement of the progress participants made towards achieving behaviour change may have contributed to the change in CVH knowledge and behaviour among the participants. Every participant in the physical activity intervention was awarded a certificate at the end of the programme.

4. Discussion

Consciousness raising is one of the processes of change of TTM which entails increasing awareness about the cause, consequences, and cures for a particular health issue [13, 15]. During the public health intervention, raising awareness about the importance of physical activity to cardiovascular health may have helped some participants to move from pre-awareness stage through the awareness stage to contemplation stage of stages of change. Awarding every participant with a certificate at the end of the programme aligns with the principle of reinforcement management - a construct of processes of change of TTM. The certificate serves as a form of an acknowledgement or a reward to the participants for taking steps in improving their physical health knowledge and behaviour in the context of improving cardiovascular health. Reinforcement management may include the use of punishment; however, self-changers rely on rewards much more than punishments. Consequently, reinforcement is emphasised since a philosophy of the stage model is to work in harmony with how people change naturally. Contingency contracts, overt and covert reinforcement, positive self-statements and group recognition are procedures for increasing reinforcement, and the probability that healthier responses will be repeated [13, 15].

A study that investigated agreement/disagreement with seven physical activity motivators and fourteen physical activity context preferences in Australia [16], found that the leading motivating factor for physical activity for both women and men were to prevent health problems. The social motivating factors 'spend time with others' and 'meet new friends' were endorsed by fewer respondents than health and wellbeing-related factors. Women are more likely to be motivated to get involved in physical activity by social factors while young older men are more likely to engage in vigorous, competitive, and outdoor sports-based physical activity options [16]. This may have explained the reason many men in this project choose to engage in football while some women in this study identify keeping fit for their spouses (social factor) as a reason for participating in the organised physical activity.

The primary purpose of joining the physical activity intervention as highlighted by the participants, including the desire to lose weight and reduce work-related stress, aligned with one of the principles of social cognitive theory known as outcome expectancy (expectation). Outcome expectancy reflects one's belief that performing a particular behaviour will result in a particular consequence [17]. In this study, outcome expectations may have played an important role in influencing initial motivation and decisions to change health behaviours and this is consistent with the evidence in the literature [18]. In a similar context, the theory of reasoned action suggests that a person's behaviour is determined by the person's intention to perform the behaviour, and that this intention is in turn, a function of the person's attitude towards the behaviour, the person's subjective norm, and their perceived behavioural control [19]. Perceived behavioural control refers to people's perception of their ability to perform a given behaviour. Participants in this study were motivated to improve their physical activity level as a means to improve their CV health and reduce the chances of developing CVD. On the other hand, there is increasing evidence that lack of knowledge, low perceived benefits, low self-efficacy, and high perceived barriers towards physical activity could lead to lower level of physical activity [20].

5. Conclusion

In conclusion, CVD is the key contributor to morbidity and mortality in developing countries, particularly in urban contexts [21]. There is evidence that this issue needs to be tackled at a community-level in ways that promote personal, organisational, and social change. This research expands current knowledge by providing useful insights into designing interventions to improve physical activity in an urban population context. The intervention was designed collaboratively with the community and effected behaviour changes that have relevance to reducing the risk of a variety of health concerns, especially, CVD. Programmes such as this can have a significant impact on awareness within a few weeks, and many participants reported that they are maintaining a change in behaviour, that might impact on future health, after three months.

A convenience sampling method was used to ensure a participant group of reasonable size that would be available and motivated to complete the study. An important limitation, therefore, is that the results may not be generalisable to the wider community. Also, there is a possibility that some participants may have expressed some views that were not truly representative of the entire population studied [22]. Lifestyle changes were self-reported. The claims of those who reported increment in physical activity could not be verified. While it was hoped that the participatory approach would result in sustainability of the community activities, further study would be required to determine the long-term health outcome. Challenges to sustaining health behaviour change and using community development approaches to re-engage the community members in similar setting is recommended for further exploration.

Compliance with ethical standards

Disclosure of Conflict of interest

No conflict of interest reported.

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