

Behavior Modification after a Heart Attack: Insights from Patients and Healthcare Professionals

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Abstract

Behavior modification is important in managing and preventing recurrent cardiac events. By emphasizing lifestyle modifications and addressing psychosocial factors, healthcare providers can empower patients to take control of their cardiovascular health and improve long-term outcomes. Integrating evidence-based behavior modification programs into routine clinical practice and cardiac rehabilitation is essential for achieving optimal secondary prevention following myocardial infarction and enhancing overall patient well-being. This study explores patients' behavior modification experience and Healthcare professionals' perspectives on behavior change observed in heart attack survivors. Methods: We employed a qualitative descriptive study design to answer our research questions. Our participants were a diverse group of 38, including 20 patients who had experienced a heart attack and 18 healthcare professionals who had worked with heart attack survivors. We used a purposive sampling technique to recruit these individuals. Semi-structured in-depth interviews, lasting 40-50 minutes, were conducted with those who agreed to participate. The data were then organized and analyzed with an inductive coding approach, and thematic analysis was used to generate codes, categories, and themes.

Results: The findings of this study show various motivations that drive patients to modify their behaviors after a heart attack. Four themes emerged from participant's data: (1) Behaviour modification after a heart attack, (2) Perspectives on motivations for behavior change, (3) Unconvinced by behavior change, and (4) Challenges in behavior change.

Conclusion: The findings contribute valuable insights into individuals' challenges in adopting behavior changes after a heart attack. The identified resistance shows the need for healthcare professionals to employ personalized and comprehensive strategies to motivate individuals toward holistic lifestyle modifications.

Keywords: Behavior Modification, Coronary Artery Disease, Unconvinced behavior change, Behavior adaptation, Importance of healthy behaviors

Background

Cardiovascular diseases, particularly heart attacks, constitute a significant global health concern, demanding a multifaceted approach to prevention and rehabilitation.¹ Behavior adaptation is critical in treating and preventing cardiovascular events, particularly following a heart attack. A thorough review of the existing literature emphasizes the importance of maintaining healthy behaviors to reduce the risk of recurrent cardiac events.² Lifestyle modifications such as dietary changes, regular physical activity, smoking cessation, and stress management have been well-established as important components of secondary prevention efforts following myocardial infarction (MI). These therapies improve cardiovascular outcomes and overall quality of life and lower the healthcare burden.³

Incorporating behavior modification programs into cardiac rehabilitation has dramatically improved patient outcomes after MI. Studies have shown that planned lifestyle treatments, provided individually or in groups, result in long-term improvements in risk variables such as blood pressure, cholesterol levels, and body weight.⁴ Furthermore, behavioral therapies tailored to individual patient requirements and preferences are more likely to encourage long-term adherence, encourage favorable health behaviors, and lower the risk of recurrent cardiac episodes.⁵

Understanding the behavioral changes after a heart attack is crucial for designing effective interventions and support systems. The insights gained from participants, including their willingness to modify lifestyle habits, awareness of dietary impacts, and their challenges, form the basis for developing targeted strategies.⁶ The transition towards healthier living is not only a personal choice but is also influenced by external factors such as healthcare professionals' advice, societal perceptions, and the individual's understanding of their health condition. Therefore, this study explores substantial lifestyle changes, the adoption of healthy behaviors by participants, and the perspectives of healthcare professionals.

Methods

Reflexivity

The research team involves healthcare professionals from diverse backgrounds with different cultural affiliations. Similarly, different disciplines of healthcare professionals, such as cardiology, nursing, physiotherapy, and public health, allowed for an in-depth understanding of the participants' insights. Furthermore, the interviewers from the study team conducted the interviews where they did not know about the study setting and the people working there. This has helped researchers minimize the researcher's biases and improve reflexivity.⁷

Study design, Recruitment, and Sample

This study employed a descriptive qualitative design. The data were collected from 5 tertiary care hospitals in Karachi and Lahore, Pakistan, to cater to participants from diverse socioeconomic backgrounds. A total of 38 participants were interviewed until data saturation was achieved. This study established data saturation when no new information was received from the participants.⁸ A purposive sampling technique was employed to recruit participants of both genders (male and female) who have been dealing with heart attacks for at least the last six months and can speak and understand Urdu or Punjabi and healthcare professionals from five different healthcare institutions. This technique was used to ensure that only those participants who met the inclusion criteria and could provide in-depth data were involved in the study.

Data collection

The data were collected as part of a larger project. Qualitative exploration allows researchers to gain an in-depth understanding of multiple realities. This study utilized the interpretivist research paradigm to explore patients' perspectives.⁹ The participants were invited to conduct the semi-structured study, which lasted between 40 and 50 minutes. The research team developed an interview guide based on their experience and literature review (Table 1).

Semi-Structure Interview Guide	
1)	How heart attack has affected you?
2)	Can you tell me more about the day-to-day processes and how it has been for you?
3)	How did you manage physical activity at home?
4)	What kind of activity did your doctor suggest to you?
5)	Most people find it challenging to reduce or stay off cigarettes. Can you tell me about your experiences?
6)	Did you know about the effects of Smoking/tobacco on your heart before?
7)	Which food did you use during your recovery phase?
8)	What do you understand about your medications?
9)	How did you ensure compliance with medications?
10)	How have you been taking care of your health since you were discharged?
11)	What were your challenges in adapting healthy behaviors?
12)	What were your motivations for behavior change (if applicable).
13)	Based on your experience, what is the level of patients' awareness of heart attacks and its causes when they experience heart attacks for the first time?
14)	What are the patients' behaviors toward their health after the initial treatment has begun?
15)	Based on your experience, what challenges do patients share when modifying healthy behaviors such as diet, smoking, physical activity, medication adherence etc.
Note: Questions 1-12 were for patients, whereas 13-15 were for HCPs	

Data analysis

Two separate transcribers transcribed the data from the recorded interviews into verbatim transcripts. Afterward, the transcripts were translated into English, and the participants were asked to verify their accuracy and suggest any necessary changes. The transcripts were kept anonymous and were identified solely by a unique number. Our team members reviewed the interview transcripts to ensure the qualitative findings were accurate. Any ambiguities in the data were clarified with the participants to enhance the trustworthiness of the data. To ensure the reliability of the data, we followed Lincoln and Guba’s criteria. We used an inductive coding approach for thematic analysis. Initially, we assessed the transcripts line by line to identify codes, then grouped similar codes into categories and merged identical categories to generate themes.

Results

Out of 38 participants, 20 were patients (heart attack survivors) with an age range between 37-70 years and male to female ratio of 14:6 (Table 2). Out of 18 healthcare professionals, 10 were female, and 8 were males, with age and experience ranges between 28-55 and 5-25 years, respectively (Table 3). Participants’ data revealed an understanding among participants regarding the experience of behavior modification after a heart attack. Four themes emerged from the participants’ data: (1) Behaviour Modification after a heart attack, (2) Perspectives on motivations for behavior change, (3) Unconvinced by behavior change, and (4) Challenges in behavior change. Participants identified family responsibilities, financial considerations, regret over past unhealthy behaviors, and acceptance of fate as significant motivators. These motivations played a crucial role in fostering positive changes in lifestyle, diet, and smoking habits. However, the study also revealed a potential decline in motivation after the initial two months post-heart attack, emphasizing the importance of early interventions and continuous support.

Demographic Characteristics of Patients n = 20									
Sr. No.	Gender	Smoker	Diabetes	HTN	STEMI	NSTEMI	Angina	Treat ed with PCI	Treated Medically
P1	M	-	-	-	-	+	-	-	+
P2	M	+	-	-	+	-	-	+	-
P3	F	-	+	-	-	+	+	-	+
P4	F	-	+	+	+	-	-	+	-
P5	M	+	-	+	+	-	+	+	-
P6	M	+	+	+	+	-	+	+	-
P7	M	+	-	+	+	-	-	+	-

P8	M	+	+		+	-	-	+	-
P9	M	+	+	+	+	-	-	-	+
P10	M	-	-	+	-	+	-	-	+
P11	M	+	+	+	+	-	+	+	-
P12	F	-	+	-	+	-	-	+	-
P13	M	-	-	-	-	+	-	-	+
P14	M	+	+	-	-	-	+	-	+
P15	F	-	-	-	+	-		+	-
P16	F	-	-	-	-	+	+	-	+
P17	M	+	+	-	-	+	-	-	+
P18	M	+	+	+	+	-	-	+	-
P19	F	-	+		+	-	+	+	-
P20	M	+	+	+	+	-	+	+	-

Demographic Characteristics of Healthcare Professionals n=18

Sr. No	Gender	Qualification	Designation
HCP 1	F	FCPS Cardiology	Consultant Cardiologist
HCP 2	M	FCPS Cardiology	Consultant Cardiologist
HCP 3	M	FCPS Cardiology	Consultant Cardiologist
HCP 4	M	FCPS Cardiology	Consultant Cardiologist
HCP 5	M	MS Cardiopulmonary Physio	Physiotherapist
HCP 6	M	MS Physiotherapy	Physiotherapist
HCP 7	M	MS Sports Physiotherapy	Physiotherapist
HCP 8	F	MPhil Food Sciences and Human Nutrition	Clinical Nutritionist
HCP 9	F	MS Human Nutrition and Dietetics	Clinical Nutritionist
HCP 10	F	BSc in Food Sciences	Clinical Nutritionist
HCP 11	F	PhD Clinical Psychology	Clinical Psychologist
HCP 12	F	MS Clinical Psychology	Sr. Clinical Psychologist
HCP 13	F	Post RN BSN + Diploma in	Charge Nurse

		Cardiology	
HCP 14	M	MPH BSN + Diploma in Cardiology	Cardiac Nurse
HCP 15	F	BSN + Diploma in Cardiology	Cardiac Nurse
HCP 16	F	Post RN BSN	Charge Nurse
HCP 17	M	FCPS Pulmonologist	Consultant Pulmonologist
HCP 18	F	FCPS Pulmonologist	Consultant Pulmonologist

Theme 1: Behavior Modification after a Heart Attack

In this Subtheme, participants shared that they have made significant modifications in their lifestyles, which included smoking cessation, dietary changes, and physical activity to expedite recovery after a heart attack. They also made changes in managing diabetes and hypertension.

Readiness to Make Lifestyle Changes

Participants' interviews revealed that they had made significant changes in their lifestyle and adopted healthy behaviors to recover quickly after a heart attack. The data from participants indicated that they were quite ready to make lifestyle changes to prevent a second heart attack, as one participant shared, *"I should be careful about this next time, and I will make the necessary changes in my lifestyle."* (P11, M, 47, DM, HTN, Smoker, Shopkeeper)

Another nutritional expert shared that when patients experience a heart attack, they get anxious to change their behaviors, including diet: *"They are anxious and keen to alter their dietary patterns as much as possible."* Nutritionist 2

The responses by the majority of participants regarding efforts made for behavior change are supported by the cardiologist, who agreed that most patients change themselves once they experience a heart attack. The response highlights an important triggering factor for making significant lifestyle changes, such as adopting a healthy diet, quitting smoking, and remaining compliant with medicines. The fear of having another heart attack triggers them to modify themselves.

"Yeah, so post angioplasty most of my patients come back to the line and then take care of their health, and they take care of their medications and lifestyle, so most of them comply after the event." Cardiologist 3

When asked about managing hypertension at home, a few participants said they modified their diet and medicine according to the situation and knew how to monitor blood pressure. The response highlights an in-depth understanding of managing blood pressure by manipulating diet and drugs. The response indicates an effective self-management technique that the participant has adopted:

"I have had high blood pressure for many years, and when it is high, I know it is either because of my food or because I am not taking my medication. So as my BP rises, I will take my medications, and I am going to eat less meat and more vegetables." (P16, F, 43, HTN, Employed)

Quitting Smoking and an Unhealthy Diet

When asked about smoking and dietary changes, participants quit smoking and started taking healthy diets. The response highlighted an awareness of healthy foods containing fruits and

vegetables after a heart attack. It can be inferred by the reaction that the participants had been on unhealthy foods before experiencing the heart attack:

“Now, after the treatment was started years ago...I quit smoking and started eating healthy food. I avoid oily and eat more vegetables and fruits in my diet.” This indicates a significant change in the lifestyle in terms of dietary habits, which impacted the health positively as stated by participants: “After this change in my habits, I feel much better.” (P4, M, 61, DM, HTN, Teacher)

Furthermore, the acknowledgment of smoking and its effects highlights post-heart attack awareness. The response grabs the attention of the lack of public counseling and awareness before heart attacks. Following the heart attack, the recognition of unhealthy behaviors and modifying them reflects a proactive approach toward health promotion. The addition of fruits and natural juices to the dietary plan greatly benefitted the participant, as he mentioned:

“The major change I brought into my life is quitting smoking because no one had taught me to quit before I developed heart disease. I have started eating fruits and fresh juices made at home to benefit more from these natural things.” (P6, M, 70, DM, HTN, Smoker, Labour)

The response is echoed by a cardiac nurse who shared that most of the patients show a willingness to change their behavior after a heart attack, while few of them ever believe in the potential risk factor’s role in causing heart disease, as the response reads *“many patients want to change after experiencing a heart attack. At the same time, very few do not accept the risk factors that have caused the disease.” Cardiac Nurse 1*

Reluctant to Modify Dietary Habits

Similarly, responses from nutritional experts revealed that patients were initially reluctant to change their dietary habits, and they considered it difficult to change behaviors that had developed since childhood. However, when they realize the importance of a healthy diet after suffering from a heart attack, as a nutritionist shared:

“Look, if someone is coming to you with this, for example, this cardiac issue, and I am limiting their things to which we have been getting on since then, you know, childhood. So, they are initially very reluctant to do it. Still, when they went into it, and they realized the importance, you know, one can only change their habits once they are fully aware of the, you know, constant issues regarding it. When they are so initially, they tend to be reluctant, but after that. Initially, they are unwilling, but once they are, they know why it is important for them to follow.” Nutritionist 1

On the contrary, another nutritionist shared her experience that patients after heart attacks were not willing to change their dietary habits and felt a desire to eat unhealthy foods as they used to take previously. Furthermore, they share affordability issues if they are counseled to get healthy foods. *“If I share my experience, patients face difficulty changing unhealthy dietary habits. They are not willing to alter food choices and mostly crave unhealthy food items, and at the top, they will tell affordability issues.” Nutritionist 3*

Dietary Modifications Made by Participants

Regarding the influence of an unhealthy diet on diabetes, a few participants said they avoid salt and sugar: *“I try not to take salt and sugar in my food; I do not take much salt in my diet,”* soft-carbonated drinks *“I avoid food and drinks that increase my sugar, such as sweets, Pepsi, and Coke, etc.”*, and rice in their diet *“I avoid sugar and rice in food.”* It indicates positive behavior toward managing diabetes. However, the responses further highlight the rare non-

compliance in gatherings where friends insist on sharing food with them: *“I try not to take salt and sugar in my food, which has helped me a lot in maintaining these two. Sometimes friends insist on taking food with them, but that is rare.”* (P11, M, 47, DM, HTN, Smoker, Shopkeeper)

The response from the participants highlights a deeper understanding of unhealthy dietary products and diabetes management through medicines. The acknowledgment of overeating and manipulating sugar levels with extra doses reflects an unsafe intervention; however, the participant received a satisfactory response by doing so. It highlights a need for education by healthcare professionals about the safe use of medicines for diabetes:

“I avoid food and drinks that increase my sugar, such as sweets, Pepsi, and Coke, etc., and I do not take much salt in my diet. If I overeat these things, I take extra tablets for it, and it never increases after that. Sometimes, I become careless when I am with my old friends. When old friends meet, they do not take care of such things and want to spend quality time.” (P18, M, 59, DM, HTN, Smoker, Driver)

Similarly, the efforts to modify the diet as per the doctor’s suggestion showed trust in healthcare professionals and willingness to follow advice, which ultimately helped him manage diabetes with less need for monitoring. *“I avoid sugar and rice in food because the doctor told me to avoid them, and due to a good diet plan, I do not need to check them frequently.”* (P14, M, 40, DM, Smoker, Banker)

Adapting Physical Activity

The qualitative data suggested a proactive approach to health promotion even before the heart attack when he only had diabetes. The acknowledgment of smoking and reducing the number of cigarettes per day indicates a step towards the intention to quit smoking. However, this contradicts when the participant shared that he never tried to stop smoking. The smile embedded in the response highlights a low intention toward smoking cessation. Furthermore, adapting physical activity into the daily routine gradually indicates an initiative in managing disease through incorporating lifestyle changes, as the participant shared:

“Yes, I used to walk even before a heart attack due to my diabetes...I have now reduced smoking, but it is difficult to quit smoking, as I heard from my friends...but truly speaking, I never tried (smiles)...so after heart attack, I started walking on flat surfaces and gradually increased my time weekly...” (P17, M, 60, DM, Employed, Smoker)

Another participant shared that despite having low body capacity, he continued physical activity by doing a little work on the farm. The effort in the response indicated a willingness to remain physically active even with low intensity, which has several benefits for the heart. Participant further mentioned that praying to the Almighty and having faith in doctors had positively benefited him:

“We have our land and farm where I go and do a little work. However, I have been facing more health problems for 2-3 months due to my heart condition, so taking medicines as prescribed and remembering GOD can positively affect health.” (P1, M, 55, Labour)

Influence of Physical Activity on Cholesterol Management

The response signals the participant’s trust in healthcare professionals who advise them to do daily walks. Following the advice properly and walking to his maximum helped the participant maintain his cholesterol. The intention to continue the walk indicates a positive attitude towards managing cholesterol, as he mentioned:

“I follow the doctor’s instruction and try to walk as much as possible...now, after walking, the doctor says that my cholesterol is improving, and I should continue walking daily...” (P20, M, 55, DM, HTN, Smoker, Farmer)

Theme 2: Motivation for Behavior Change

In this Subtheme, Interviews revealed that the care provided by the family, the responsibility to feed the family, and regret of their unhealthy behaviors were their biggest motivations for behavior change. When asked about the biggest motivation for behavior change, participants shared that family responsibility on their shoulders had played an essential role in changing their behaviors.

Disease as a Matter of Fate

Acknowledging destiny and accepting disease as a matter of fate has indicated an emotional balance. The response highlights the financial responsibilities on the participant’s shoulders for the family, which provided great strength toward recovery and helped manage daily activities soon after a heart attack:

“I accepted that GOD wrote it in my life and dealt with it patiently. Having family members who care for me, and my sons and daughters gives me the strength to forget about the worries of my disease.” (P1, M, 55, Labor)

Financial needs as Motivation for Behavior change

The financial needs of the family have been indicated to be a strength to the early resumption of work and simultaneously an effective way to manage physical activity alongside, as the participant shared, *“I have come out of that phase because I am the only earning member of the family...I run a shop to feed my family.” (P11, M, 47, DM, HTN, Smoker, Shopkeeper)*

Similarly, caring for the family and children strengthened the participant’s ability to avoid risk factors and adopt healthy activities to remain with them longer:

“I have changed a lot, not only for me but also for my family...I have three daughters and two sons, and they need me at this time...they have not seen this world yet and are not so much aware of people, so I have to be with them.” (P20, M, 55, DM, HTN, Smoker, Farmer)

Past Regrets as a Source of Motivation

Additionally, participants’ interviews revealed that most of the participants had regrets about their unhealthy eating habits and behaviors, which caused them heart disease. This regret became the source of motivation for them to change, as participants shared, *“I did not focus on risk factors and used to eat fatty food and barbeque meat... I used to eat everything and did not change my lifestyle...that is what I regret today...” (P8, M, 49, DM, Smoker, Carpenter)*

Similarly, the regret of smoking in the past has enabled participants to quit smoking after experiencing its negative effects on the heart. The response highlights a reflective past habit and its consequences, which could have been different without smoking: *“I regret now that If I had quit smoking, I would have experienced different consequences.” (P9, M, 50, DM, HTN, Smoker, self-employed)*

Similarly, another participant expressed concerns over his expenses for his previous unhealthy activities. The recent realization of the damage that smoking has done shows the readiness for

behavior change, and acknowledgment of his parents and family's concerns over his smoking habit has made him understand their care for him:

"Smoking has a devastating effect on me...you know, daily two packs of cigarette and what I get out of it...now, I regret that instead of buying cigarettes, I might have bought some other important thing or just kept the money aside, but now, what I earn at the end of this disease. I need to spend more or to stay healthy...one day, I calculated the amount I spent on cigarettes, and you will not believe the amount was in millions. I did not realize this, but now I regret that my parents and family kept telling me to stop. but I took it wrong...but they were correct...I must admit that." (P18, M, 59, DM, HTN, Smoker, Driver)

Transient Enthusiasm for Behavior Change in Early Days

The initial two months are a more critical window for adopting healthy behavior, and they experience a significant change in this period. However, after two months, patients opt to engage with previous habits, and it becomes difficult to change behavior if the early intervention was not received in the initial two months, as participants shared, *"I think in the initial two months, I was more enthusiastic about bringing change in my lifestyle than now..."* (P7, M, 37, HTN, Smoker, Banker) another stated that *"Initially, when I was discharged home, I was very keen to manage myself quickly..."* (P15, F, 51, Employed)

Similar insights were witnessed by a cardiologist regarding patients' transient lifestyle changes because, in the early days, most patients felt ready and motivated to modify their health choices. However, as the days pass, their motivation gets reduced, and they try to live without any medical support; they stop taking medicines, which puts them in danger. Therefore, conducting periodic counseling with patients and reminding them of the lethal risk factors to avoid is important. Based on the cardiologist's response, different patients have different perceptions about their disease severity and make changes in their lifestyles. However, most of them bounce back to their unhealthy practices after some time, as shared by a cardiologist:

"Well, for this, I would like to say a few lines about human nature and human nature. In the beginning, human nature was very much concerned about what was ongoing and happening. Moreover, they realize it's not a big problem after a few days or weeks. Furthermore, they like to rationalize. That is OK, we have to live with that. So, the attitude changes, but it depends upon the patient's personality. If the patient has an "A" personality, he is more concerned and takes more stress regarding the disease. When the doctors advise compliance with the medicine, patients mostly lose their compliance with it and doctors' advice after a year or two. They feel they are all right now and what they take, so they are not so much into preventing this disease. The other factor we discussed is financial; it is difficult for most of Pakistan's public to purchase medicine from medical stores because of their limited income." Cardiologist 2

Another cardiologist shared his experience with male patients who were enthusiastic for only a few days about changing their lifestyle and health behavior; however, they bounced back after one month. However, female patients were not witnessed to make changes in their lifestyles, and they did not walk after getting discharged home:

"For patients, diet modification, salt reduction, smoking, and walking can be 100% compliant in only one month, and after that, they will return to their previous routine. Moreover, majorly, they bounce back on their smoking cessation habit. Male patients again start smoking after a month; however, in females, no life modification is witnessed, and the reasons behind it are our social norms. We live in an eastern country, and in our context, it is difficult for females even to walk, and they cannot make modifications in their lives, which males opt for easily. On the other hand, if we see the smoking ratio in our context, then females have a relatively low

ratio of smoking in any form, such as hukka, etc. However, if you see females perfectly stop such habits and give up to 100% compliance with such habits compared to males who do not stop easily,” Cardiologist 4

The response from another cardiologist revealed that male patients show more compliance towards change in behavior than females, *“If I will say when I Treat the male patients, I see Like more early response or to the treatment and like better compliance? Most of the time, males are more compliant than females.” Cardiologist 1*

Perceived Safety Leading to Medication Adherence

The participants expressed a positive attitude towards health with a recent change in dietary plan. However, taking medicines daily has made him concerned, but the expression of a smile gives a sense of security with the medicine, which he cannot avoid. *“I try and avoid oily food now, and I do not like taking medicine daily, but I have to...I am helpless (smiles).” (P11, M, 47, DM, HTN, Smoker, Shopkeeper)*

Theme 3: Unconvinced by Behavior Change

In this Subtheme, data indicated that some participants were not convinced by behavior change because they felt no comparable benefit to their health; it was also apparent from the interviews that few participants did not change their behaviors even after experiencing a heart attack.

The Perceived Detrimental Effect of Behavior Change

Participants verbalized that despite following the instructions given by doctors, they feel no difference in their condition. This highlights a need for understanding multiple risk factors behind heart disease, which healthcare professionals should take care of during the treatment: *“Doctors say that do not smoke cigarettes. I stopped smoking cigarettes a long time ago. I feel my condition is the same as when I used to and now when I stopped it.”* He further said that smoking cessation has never benefitted him: *“I never feel relieved after stopping smoking. I used to smoke not more than 4 to 5 cigarettes a day. I was told to quit smoking, but it has not benefited me.” (P2, M, 66, Smoker, Police Officer)*

As indicated in the response, the adaptation of dietary modifications per the doctor’s suggestion has provided no benefit to the participant. This shows a need for further education about variations in responses to nutritional modifications to different individuals and healthcare professionals: *“I changed my diet based on doctors’ suggestions, such as avoiding yogurt, cold things, and fried bread. I adopted these changes on doctors’ suggestion but never got benefitted.” (P7, M, 37, HTN, Smoker, Banker)*

Poor Perception of Health and Disease

Furthermore, participants tend to believe that their unhealthy behaviors have nothing to do with their disease because they are taking medicine for its cure. Many participants possessed risky behaviors that can cause them to have a second heart attack, as a few participants shared, *“I am taking medicine for my heart problem, and I smoke as well.” (P5, M, 59, HTN, Smoker, Shopkeeper)* another participant shared *“Because I thought I could not have another heart attack and continued smoking with all other previous activities...” (P8, M, 49, DM, Smoker, Carpenter)*

The responses by participants expressed no need to modify their lifestyles: *“I did not do anything to change my lifestyle...because I do not need to...”* and highlights ignoring all the significant risk factors such as diabetes, hypertension, smoking, and physical activity. This

needs a dire exploration of negative perceptions towards health and should be addressed by healthcare professionals in day-to-day care:

“I stay at home all the time and have sugar, blood pressure, back pain issues...since I am retired and do not work...all the time sit and watch TV and eat whatever is offered.... I smoke cigarettes very frequently, but it is not the cause. The main cause is inactivity...” (P18, M, 59, DM, HTN, Smoker, Driver)

Theme 4: Challenges in Behavior Change

Limited Counselling and Information Uptake

The response from P6 is consistent with the thoughts of a cardiologist who shared that Patients are being under-counseled at the time of discharge about the resumption of healthy activities after a heart attack. The response further highlights the lack of interest from the patient's end as well because of a lack of awareness, even suffering from a heart attack, as they show a blank response when asked about important lifestyle changes such as smoking cessation and physical activity. The response further shows that female patients who get heart attacks are more concerned about their health, and they have fewer resources for activities such as time for walking and exercising. The major barrier for them is the culture at home, where women hesitate to perform physical activities in front of others. Due to this culture, they tended to be diagnosed late and became more complicated as compared to males because comparatively, males are more dominantly active physically in Pakistani culture, and females are bound to homes to do house chores due to low physical bodily demands they develop fewer symptoms and diagnosed late, as cardiologist shared:

“They do not know what to do. I mean, they are not being taught at the time of the discharge or maybe during the clinics. They usually hear about it from me at the office or when I am discharged for the first time. Females are more worried about their health but get fewer chances and fewer resources, and therefore, they are diagnosed late, so they are more complicated.” Cardiologist 1

Combating with Societal Perception of Maximize Rest

In addition to the efforts for behavior change, many participants shared that they have changed their lifestyle and adopted physical activity despite discouragement from people. The response highlights the perception in society associated with the heart attack that a person should take more rest and avoid physical activity after a heart attack. It indicates a dilemma in almost every family where patients are forced to rest. However, participant response reflects a deep understanding of the importance of physical activity after a heart attack:

“People meet and say since you have a heart attack, you should take more rest, but you know I cannot rest. I have so many things to do. I think people should encourage heart patients to come back to normal life. Heart patients should not take a rest. So much rest is bad for the heart.” (P14, M, 40, DM, Smoker, Banker)

Mixed Insights on Knowledge about Disease

When the participant was asked about the influence of diet on diabetes and hypertension, he exhibited no knowledge and said, *“I do not know.”* However, the *“I think”* response indicates uncertainty about foods good for heart health. Moreover, the expression of understanding

about simple foods and avoiding oily foods from the outside highlights an intricate connection to the prevention of heart disease by adding these foods into the dietary plan:

“I do not know, but I think we should eat simple foods made at home and avoid oily foods and foods made outside homes because adopting only these things can prevent the person from getting the disease.” (P1, M, 55, Labour)

On the contrary, the response about lack of knowledge is inconsistent with a cardiologist who shared that patients do not know about their disease and risk factors; however, the knowledge is better in males who have had a second or third heart attack as compared to those who experienced it for the first time and in females. On the other hand, female patients are more accepting of the treatment options as compared to males, who are not allowed to treat themselves, and many times, they leave against medical advice (LAMA).

“Additionally, there is variability in awareness among male and female patients. Male patients have more understanding than female patients. If you see the difference in treatment acceptance, it is the opposite; females do not refuse treatment and will say whatever they do is fine. However, when they have some knowledge, male patients become very good patients with compliance but will not agree to the procedure easily compared to females. So, I have seen male patients refusing the procedure and getting LAMA. So, these patients are 20%, and most males come to the emergency room.” Cardiologist 4

Another participant shared a different perspective on blood pressure awareness. The response highlights a lack of awareness about the warning symptoms associated with hypertension. She could monitor her blood pressure by digitally monitoring herself. However, the acknowledgment of device accuracy in telling the reading was appraised with the concern of price involved in purchasing it:

“I was not aware of my high blood pressure’s warning symptoms. I trusted the monitor to tell me that because it is digital. I have trust and can monitor it as effectively as experts can since it tells you the numbers, but it is not inexpensive.” (P3, F, 45, DM, Housewife)

Influence of Occupation on Health

Data from participants’ interviews also indicated that their occupation and nature of work affected them significantly. The responses further highlight the efforts made for physical activity, such as walking in a nearby park with family members and gradually increasing the intensity, was helpful in capacity building, as one participant shared:

“Due to driving as my profession, I gain weight...I have left driving and do not do anything to earn...I try walking daily with my wife in the nearby park in the evening...I never watch how much I am walking or should walk, but slowly, I start walking, and when I feel lethargic, I sit there for a few minutes, and then I start...I do it two to three times daily...” (P18, M, 59, DM, HTN, Smoker, Driver)

Fear Associated with Physical Activity

The patients’ responses are congruent with the experience shared by an expert physiotherapist who witnessed patients with varying levels of adherence to physical activity, which few patients follow to their maximum. In contrast, others are reluctant to do it due to fear associated with physical activity, which should be addressed with a tailored rehabilitation program. However, it also depends on the patient’s preferences and attitudes toward behavior change, as a physiotherapist shared:

“Patients vary in their adherence to physical activity after a heart attack. Some show a strong commitment, diligently engaging in prescribed exercises and recognizing the importance of cardiac rehabilitation. Others may exhibit reluctance due to fear, uncertainty, or lifestyle challenges, necessitating tailored support and education to foster a sustainable commitment to post-heart attack physical activity. Individual motivations and attitudes play a crucial role in shaping patients’ behaviors during this critical phase of cardiac recovery.” Physiotherapist 2

Another physiotherapist shared that most resistance usually comes from elderly patients who show reluctance for physical activity and exercise; however, young patients understand the benefit of being active and need to incorporate exercise into their daily routine. *“The patient with a history of cardiac attack in old age shows resistance and is not willing to do physical activity or any exercises; young patients with a history of cardiac attack easily understand, and they should adopt all exercises.”* Physiotherapist 3

Discussion

The qualitative findings from participants’ interviews reveal the diverse experiences and behaviors individuals exhibit following a heart attack. The study explores participants’ readiness for behavior change, particularly regarding lifestyle modifications, smoking cessation, dietary changes, and physical activity. The discussions below integrate the study findings with existing literature, highlighting similarities and differences.

After experiencing a heart attack, participants demonstrated a strong willingness to make lifestyle changes to prevent a second cardiac event. This response aligns with existing literature that emphasizes the pivotal role of motivation in promoting positive health behaviors following a cardiac event.³ Patients who had suffered a heart attack reported making significant lifestyle changes, such as quitting smoking and adopting healthier diets. This aligns with previous research that suggests behavioral interventions, such as smoking cessation programs and dietary counseling, can lead to better cardiovascular outcomes.⁵

The role of healthcare professionals like cardiac nurses and nutritionists in behavior modification was crucial. Studies have shown their impact on lifestyle changes after a heart attack.¹¹ Initially, some of the participants were unwilling to change their dietary habits. They cited the difficulty of altering behaviors that they had developed since childhood. This reluctance to change aligns with previous studies recognizing individuals’ challenges when modifying long-standing nutritional habits.¹² Additionally, the role of affordability issues as a barrier to healthier food choices is consistent with previous research.¹³

In addition, recognizing the harmful effects of smoking and taking proactive steps to promote health after a heart attack is in line with the literature that emphasizes the importance of raising public awareness and providing counseling to individuals both before and after a cardiac event.¹⁴ The study reveals gender differences in post-heart attack care, with female patients facing difficulties due to cultural norms that limit physical activity. This is consistent with existing literature that highlights gender-specific barriers to post-cardiac rehabilitation and emphasizes the need for tailored interventions.¹⁵

Participants with diabetes have demonstrated a proactive approach to health promotion, even before experiencing a heart attack. This supports existing literature emphasizing the importance of primary prevention strategies for individuals at risk of cardiovascular diseases.¹⁶ Participants also highlighted a societal perception that individuals should take excessive rest after experiencing a heart attack, which contradicts guidelines promoting early resumption of physical activities. Previous studies have documented similar misconceptions.¹⁷

Certain participants demonstrated effective self-management techniques for managing diabetes and hypertension. These results align with the literature on patient empowerment and self-management strategies in chronic disease care.¹⁸ The participants acknowledged the impact of their occupation on their health and emphasized the need for customized interventions based on their work nature. Previous studies have shown that occupational factors can affect cardiovascular health.¹⁹ The participants also identified inconsistencies in their knowledge about the disease and risk factors. This finding aligns with the literature indicating variations in patient knowledge and awareness levels, highlighting the importance of targeted education.²⁰

The study's findings indicate several factors that motivate patients to change their behaviors after experiencing a heart attack. The main motivators are family responsibilities, financial considerations, regret over past unhealthy behaviors, and acceptance of fate. These factors played a vital role in promoting positive changes in lifestyle, eating habits, and smoking cessation. However, the study also revealed a potential decline in motivation after the initial two months post-heart attack, highlighting the importance of early interventions and continuous support to maintain the positive changes.

Many participants mentioned that their family responsibilities were a big reason for changing their behavior. This is consistent with previous research that has identified family support as a crucial factor in the recovery process after a heart attack and making lifestyle changes.³ Participants felt a strong sense of responsibility towards their family members, which motivated them to develop healthier habits.

Participants were strongly motivated to quit smoking and adopt healthier dietary practices due to their regret over past unhealthy behaviors, such as smoking and poor dietary choices.²¹ Studies have emphasized the role of emotions in behavior change, and the emotional impact of regret played a significant role in this case.

Participants who acknowledged their destiny and accepted their disease as a matter of fate showed emotional resilience. This aligns with literature highlighting the importance of psychological aspects in chronic illness management.²² Emotional balance and belief in fate seemed to have given the participants the strength to face their health challenges.

Participants in a study showed that financial responsibilities were a strength in motivating them to resume early work and physical activity after an illness or injury. This finding is consistent with previous studies that emphasized the impact of socioeconomic factors on health behaviors and recovery.²³ The participants recognized their role as primary earners and used their financial responsibilities to motivate behavior modification.

One important finding from the study was that motivation tends to decrease after the initial two months of post-heart attack. This supports existing research that suggests it can be difficult to maintain behavior change over the long term.²⁴ The cardiologists involved in the study also noted that male patients, in particular, tend to become less compliant with treatment after the initial period of enthusiasm.

It was observed that there were differences in motivation between male and female heart attack patients. Male patients initially showed enthusiasm for lifestyle changes but declined in compliance. On the other hand, female patients exhibited lower compliance, possibly due to cultural norms and restrictions on physical activities. This aligns with other studies that emphasize the influence of gender roles on health behaviors.²⁵ It is important to understand the dynamic nature of motivation after a heart attack to design effective interventions. Providing early and continuous support tailored to individual needs and socioeconomic factors

may enhance long-term behavior change. Interventions could also focus on the emotional impact of regret and involve family members for better outcomes.

The results of the study indicate that even after suffering a heart attack, some participants are hesitant to make necessary lifestyle changes to improve their health. They believe such changes will not benefit them in any concrete way, and they lack confidence in the effectiveness of suggested modifications. These findings offer a valuable perspective that should be explored further in the context of existing research on behavior change following a heart attack.²⁶

As per the current study, participants said that they did not feel any benefit from quitting smoking even though they followed their doctors' advice. One of the participants expressed disappointment by mentioning that quitting smoking did not improve his health condition. This finding contradicts the previous research, which highlights the positive impacts of smoking cessation after a heart attack.²⁷

According to the study's participants, following dietary modifications as suggested by doctors did not bring any significant improvements. However, this finding contradicts previous research highlighting individual variability in response to dietary changes and the importance of personalized nutritional interventions.²⁸

It is worth noting that participants in the study believed that taking medication alone was enough to manage their heart condition, even if they continued to engage in risky behaviors. This attitude is consistent with existing research, which shows that it can be difficult to convince individuals to make comprehensive lifestyle changes in addition to taking medication.²⁹

Some participants in the study also expressed a lack of motivation to modify their lifestyles and neglected important risk factors like diabetes, hypertension, smoking, and physical inactivity. This finding aligns with previous research emphasizing the need to address negative attitudes toward health and encourage individuals to recognize the importance of addressing all risk factors.³⁰

The study reveals that participants identified inactivity as the primary cause of their health problems. This highlights the need for healthcare professionals to address sedentary lifestyles. The findings are consistent with studies advocating for physical activity interventions to improve cardiovascular health.¹ It is essential for healthcare professionals to recognize and address negative perceptions toward behavior change. Tailored educational interventions should focus on elucidating the benefits of smoking cessation, dietary modifications, and a comprehensive approach to managing multiple risk factors.

Conclusion

The qualitative findings explain behavior modifications after a heart attack. While participants demonstrated a readiness for change and embraced healthier behaviors, various challenges, including societal perceptions, gender disparities, and knowledge gaps, were evident. These findings emphasize the need for tailored interventions, comprehensive education, and culturally sensitive approaches to promote sustained behavior modifications for patients with coronary artery diseases.

Recommendations

- Using patients' and HCPs' insights can enhance the acceptability of interventions among the CAD population.

- Future studies can be conducted to design and validate targeted interventions on physical activity and diet.
- Smoking cessation interventions need to be developed for patients in the Pakistani context.
- Counseling sessions for CAD patients can enhance the adoption of healthy behaviors while reducing unhealthy ones, resulting in better patient outcomes.

Strengths and Limitations:

- The findings present rich qualitative data collection through in-depth interviews with participants and healthcare professionals, including nutritionists, cardiologists, physiotherapists, and nurses. This diversity in data sources enhances understanding regarding behavior modification after a heart attack.
- The study includes participants from various occupations and backgrounds, providing diverse perspectives.
- These expert opinions add credibility and context to the participants' narratives, providing a more comprehensive understanding of the behavior change process.
- These findings can help future researchers develop behavioral interventions as part of cardiac rehabilitation.
- The findings capture participants' behaviors and attitudes at a specific time. Longitudinal data could provide a more dynamic understanding of how behavior change evolves over time and whether it is sustained or regresses.

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Author contributions

Conceptualization: AY, RB, LL, AHK, Methodology: AY, RB, LL, Formal analysis: AY, RB, Writing—original draft preparation: AY, Writing—review and editing: RB, LL, AHK, FYP all authors have read and agreed to the published version of the manuscript.

Data sharing statement

The data collected and presented in the study cannot be made available due to privacy and ethical concerns.

Declaration of conflicting interests

The authors declared no potential conflicts of interest.

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Ethics Approval

Ethical Approval for this study was obtained from the Ethics Review Committee of Aga Khan University on 02-Mar-2023 (Ref # 2023-8282-24191) and administration of study

setting.

Informed Consent

Before participating in the study, participants were informed about the voluntary nature of the interview and told they could decline to answer any questions or withdraw from the study at any time. The patients gave their written consent to participate in the study, while healthcare professionals gave oral consent. Additionally, permission to audiotape the interview was requested and granted before starting the interview.

REFERENCES

- 1) Roth, G, Mensah, G, Johnson, C. et al. (2020). Global Burden of Cardiovascular Diseases and Risk Factors, 1990–2019: Update From the GBD 2019 Study. *J Am Coll Cardiol.* 76 (25) 2982–3021. <https://doi.org/10.1016/j.jacc.2020.11.010>
- 2) Kaminsky, L. A., German, C., Imboden, M., Ozemek, C., Peterman, J. E., & Brubaker, P. H. (2022). The importance of healthy lifestyle behaviors in the prevention of cardiovascular disease. *Progress in Cardiovascular Diseases*, 70, 8-15. <https://doi.org/10.1016/j.pcad.2021.12.001>
- 3) Gaudel, P., Neupane, S., Koivisto, A., Kaunonen, M., & Rantanen, A. (2022). Effects of intervention on lifestyle changes among coronary artery disease patients: A 6-month follow-up study. *Nursing Open*, 9(4), 2024–2036. <https://doi.org/10.1002/nop2.1212>
- 4) Ghodeswar, G. K., Dube, A., & Khobragade, D. (2023). Impact of lifestyle modifications on cardiovascular health: A narrative review. *Cureus*. <https://doi.org/10.7759/cureus.42616>
- 5) Zaree, A., Dev, S., Yaseen Khan, I., Arain, M., Rasool, S., Khalid Rana, M. A., Kanwal, K., Bhagat, R., Prachi, F., Puri, P., Varrassi, G., Kumar, S., Khatri, M., & Mohamad, T. (2023). Cardiac rehabilitation in the modern era: Optimizing recovery and reducing recurrence. *Cureus*. <https://doi.org/10.7759/cureus.46006>
- 6) Mattei, J., & Alfonso, C. (2020). Strategies for healthy eating promotion and behavioral change perceived as effective by nutrition professionals: A mixed-methods study. *Frontiers in Nutrition*, 7. <https://doi.org/10.3389/fnut.2020.00114>
- 7) Olmos-Vega, F. M., Stalmeijer, R. E., Varpio, L., & Kahlke, R. (2022). A practical guide to reflexivity in qualitative research: AMEE guide No. 149. *Medical Teacher*, 45(3), 241-251. <https://doi.org/10.1080/0142159x.2022.2057287>
- 8) Naeem, M., Ozuem, W., Howell, K., & Ranfagni, S. (2024). Demystification and actualisation of data saturation in qualitative research through thematic analysis. *International Journal of Qualitative Methods*, 23. <https://doi.org/10.1177/16094069241229777>
- 9) Mustofa, M. (2024). Epistemology of paradigms for positivism, Interpretivism, and action research in educational research: A literature review. *Journal of Office Administration : Education and Practice*, 3(3), 214-224. <https://doi.org/10.26740/joaep.v3n3.p214-224>
- 10) Wang, J., Yu, Q., Liu, N., Nie, K., Sun, X., & Xia, L. (2023). Trends in research on dietary behavior and cardiovascular disease from 2002 to 2022: A bibliometric analysis. *Frontiers in Nutrition*, 10. <https://doi.org/10.3389/fnut.2023.1147994>

- 11) Subramaniam, M., Devi, F., AshaRani, P. V., Zhang, Y., Wang, P., Jeyagurunathan, A., Roystonn, K., Vaingankar, J. A., & Chong, S. A. (2022). Barriers and facilitators for adopting a healthy lifestyle in a multi-ethnic population: A qualitative study. *PLOS ONE*, 17(11), e0277106. <https://doi.org/10.1371/journal.pone.0277106>
- 12) Okorare, O., Evbayekha, E. O., Adabale, O. K., Daniel, E., Ubokudum, D., Olusiji, S. A., & Antia, A. U. (2023). Smoking cessation and benefits to cardiovascular health: A review of literature. *Cureus*. <https://doi.org/10.7759/cureus.35966>
- 13) Brust, M., Gebhardt, W. A., Van Bruggen, S., Janssen, V., Numans, M. E., & Kiefte-de Jong, J. C. (2023). Making sense of a myocardial infarction about changing lifestyle in the five months following the event: An interpretative phenomenological analysis. *Social Science & Medicine*, 338, 116348. <https://doi.org/10.1016/j.socscimed.2023.116348>
- 14) Khadanga, S., Gaalema, D. E., Savage, P., & Ades, P. A. (2021). Underutilization of cardiac rehabilitation in women. *Journal of Cardiopulmonary Rehabilitation and Prevention*, 41(4), 207-213. <https://doi.org/10.1097/hcr.0000000000000629>
- 15) Rippe, J. M., & Angelopoulos, T. J. (2019). Lifestyle strategies for risk factor reduction, prevention and treatment of cardiovascular disease. *Lifestyle Medicine*, 19-36. <https://doi.org/10.1201/9781315201108-2>
- 16) Coull, A., & Pugh, G. (2021). Maintaining physical activity following myocardial infarction: A qualitative study. *BMC Cardiovascular Disorders*, 21(1). <https://doi.org/10.1186/s12872-021-01898-7>
- 17) Masupe, T., Onagbiye, S., Puoane, T., Pilvikki, A., Alvesson, H. M., & Delobelle, P. (2022). Diabetes self-management: A qualitative study on challenges and solutions from the perspective of South African patients and health care providers. *Global Health Action*, 15(1). <https://doi.org/10.1080/16549716.2022.2090098>
- 18) Liu, M., Chang, C., Hsueh, M., Hu, Y., & Liao, Y. (2020). Occupational, transport, leisure-time, and overall sedentary behaviors and their associations with the risk of cardiovascular disease among high-tech company employees. *International Journal of Environmental Research and Public Health*, 17(10), 3353. <https://doi.org/10.3390/ijerph17103353>
- 19) Alshakarah, A., Muriyah, D., Alsaghir, F., Alanzi, R., Almalki, S., Alsadon, S., Alotaibi, A. B., Alshaalan, R., & Albrahim, T. (2023). Awareness and knowledge of cardiovascular diseases and its risk factors among women of reproductive age: A scoping review. *Cureus*. <https://doi.org/10.7759/cureus.49839>
- 20) Muhammad, S., Ahmadi, H., Mortimer, G., Sekhon, H., Kharouf, H., & Jebarajakirthy, C. (2020). The interplay of positive and negative emotions to quit unhealthy consumption behaviors: Insights for social marketers. *Australasian Marketing Journal*, 28(4), 349-360. <https://doi.org/10.1016/j.ausmj.2020.07.004>
- 21) McTavish, F. J. (2016). Suffering, death, and eternal life. *The Linacre Quarterly*, 83(2), 134-141. <https://doi.org/10.1080/00243639.2016.1166338>
- 22) Andersen, E. B., Kristiansen, M., & Bernt Jørgensen, S. M. (2023). Barriers and facilitators to return to work following cardiovascular disease: A systematic review and meta-synthesis of qualitative research. *BMJ Open*, 13(1), e069091. <https://doi.org/10.1136/bmjopen-2022-069091>

- 23) Michaelsen, M. M., & Esch, T. (2023). Understanding health behavior change by motivation and reward mechanisms: A review of the literature. *Frontiers in Behavioral Neuroscience*, 17. <https://doi.org/10.3389/fnbeh.2023.1151918>
- 24) Lauderdale, M. E., Yli-Piipari, S., Irwin, C. C., & Layne, T. E. (2015). Gender differences regarding motivation for physical activity among college students: A self-determination approach. *The Physical Educator*. <https://doi.org/10.18666/tpe-2015-v72-i5-4682>
- 25) Eshah, N. F. (2019). Readiness for behavior change in patients living with ischemic heart disease. *Journal of Nursing Research*, 27(6), e57. <https://doi.org/10.1097/jnr.0000000000000336>
- 26) Manns, A., Mahdjoub, S., Ibanez, G., Jarrier, E., Daeipour, A., Melchior, M., & El-Khoury, F. (2023). Health professional's perception of a smoking cessation intervention among disadvantaged patients participating in a pragmatic randomized trial. *BMC Health Services Research*, 23(1). <https://doi.org/10.1186/s12913-023-09950-2>
- 27) Firth, J., Marx, W., Dash, S., Carney, R., Teasdale, S. B., Solmi, M., Stubbs, B., Schuch, F. B., Carvalho, A. F., Jacka, F., & Sarris, J. (2019). The effects of dietary improvement on symptoms of depression and anxiety: A meta-analysis of randomized controlled trials. *Psychosomatic Medicine*, 81(3), 265-280. <https://doi.org/10.1097/psy.0000000000000673>
- 28) Verplanken, B., & Orbell, S. (2022). Attitudes, habits, and behavior change. *Annual Review of Psychology*, 73(1), 327-352. <https://doi.org/10.1146/annurev-psych-020821-011744>
- 29) Lutala, P., Nyasulu, P., & Muula, A. (2022). Salient beliefs about modifiable risk behaviours among patients living with diabetes, hypertension or both: A qualitative formative study. *African Journal of Primary Health Care & Family Medicine*, 14(1). <https://doi.org/10.4102/phcfm.v14i1.3327>
- 30) Park, J. H., Moon, J. H., Kim, H. J., Kong, M. H., & Oh, Y. H. (2020). Sedentary lifestyle: Overview of updated evidence of potential health risks. *Korean Journal of Family Medicine*, 41(6), 365-373. <https://doi.org/10.4082/kjfm.20.0165>