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Barriers and facilitators to improved sedentary behaviour in coronary heart disease patients: a scoping review

Yuting Yang , Qiao Yuan, Chen Wu, Lili Yang

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Department of Nursing, The Fourth Affiliated Hospital of School of Medicine, and International School of Medicine, International Institutes of Medicine, Zhejiang University, Yiwu, Zhejiang, China

Correspondence to
Lili Yang; 3200006@zju.edu.cn

ABSTRACT

Introduction The majority of patients with coronary heart disease (CHD) are at high sedentary levels, which severely affects patient prognosis and outcome. Despite the proven benefits of reducing sedentary behaviour (SB), intervention studies' effectiveness has been limited. Thus, the factors influencing SB change in patients with CHD need to be explored. This scoping review aimed to identify barriers and facilitators to improved SB in CHD patients and map these factors to the Capability–Opportunity–Motivation-Behaviour model.

Methods We conducted a scoping review in accordance with the Arksey and O'Malley framework. Eligibility criteria included qualitative and quantitative studies on SB in patients with CHD. Nine databases were searched (PubMed, Medline, Embase, CINAHL, Web of Science Core Collection, Scopus, CNKI, WanFang and VIP) from inception through 31 December 2023, following the scoping review methodology.

Results A total of 24 studies, including two qualitative and 22 quantitative studies, were included, with 15 847 patients. Barriers to improved SB in CHD patients included capability (eg, physical characteristics, lack of knowledge to improve SB), opportunity (eg, lack of partnership support, lack of resources to carry out activities) and motivation (eg, maintaining the habit of SB, impaired belief in activities). Facilitators included capability (eg, exercise session, improving understanding of SB), opportunity (eg, utilisation of support, tele-rehabilitation guidance, diversification of living environments) and motivation (perceived benefit).

Conclusions Patients with CHD have unique barriers and facilitators to improving SB. Future research should adequately reduce barriers and promote facilitators to increase the effectiveness of interventions.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ A broad scope of barriers and facilitators was reviewed.
⇒ The Capability–Opportunity–Motivation-Behaviour model is used as a theoretical framework to identify barriers and facilitators.
⇒ This protocol was not registered previously.
⇒ Non-English and Chinese language articles were excluded.
⇒ This review did not assess the risk of bias in the included studies.

INTRODUCTION

The Global Burden of Disease Study 2019 reported that the total number of prevalent cases of cardiovascular disease (CVD) nearly doubled from 271 million in 1990 to 523 million in 2019, and the number of CVD deaths steadily increased from 12.1 million to 18.6 million.[1] Coronary heart disease (CHD) is the leading cause of mortality and loss of disability-adjusted life years worldwide.[2] According to the World Heart Federation, the cost of CHD in the USA is close to 1%–1.5% of the Gross Domestic Product and exceeds US$5000 per case of CHD. However, in low-income and middle-income countries, the costs are even higher.[3] It has become a serious public health problem with a heavy economic burden on patients, families and society.

Sedentary behaviour (SB) is defined as any waking behaviour characterised by energy expenditure of ≤1.5 metabolic equivalents while sitting, reclining or lying posture.[4] A growing amount of epidemiological evidence indicates that the longer time spent in SB, the higher the morbidity and mortality from all-cause and CVD in adults.[5] Previous studies have assessed the benefits of improved SB for patients with CHD. A review included 25 studies that summarised the effect of physical activity (PA) and SB on physical fitness and quality of life.[6] Bull and colleagues[7] found that reducing and breaking up sedentary time may be considered a target for preventing and managing CHD. The WHO and some countries have published broad guidelines that recommend limiting the time spent being sedentary.[8–10] However, according to the National Health and Nutrition Examination Survey, the SB of CHD patients was 9.9 hours.[11] A cross-sectional study was conducted in Australia and Sweden, the result showed that patients following a percutaneous coronary intervention spent a large part of the day sedentary, accumulating 9.5 hours per day,[12] which means the

majority of waking time was spent engaged in SB among CHD patients. The experimental study was conducted by Ramadi *et al*,[13] and the result found that in patients who underwent cardiac rehabilitation (CR), sedentary time decreased from baseline to 12 weeks. However, after 6 months, it was comparable with the baseline level. These findings highlighted the difficulty of improving SB in the CHD population.

The unsuccessful intervention may be due to many reasons, thus, it is crucial to identify the relevant factors influencing the targeted behaviour for the success of the intervention. The Capability–Opportunity–Motivation-Behaviour (COM-B) model is the core layer of the Behaviour Change Wheel (BCW) theory, which illustrates that people need COM to achieve behaviour,[14] and helps to understand SB in CHD patients. Capability refers to the individual's physical and psychological capabilities to engage in the behaviour change concerned; opportunity refers to the social and physical opportunities for behaviour change provided by external factors that make the behaviour change possible or prompt it; and motivation refers to all brain processes that energise and direct behaviour change, not just goals and conscious decision-making, including automatic and reflective motivation.[15] Behaviour only occurs when these components are present simultaneously. Although the COM-B model is commonly applied to intervention design, it also provides a useful framework for synthesising evidence in scoping reviews, and can also be used to systematically identify barriers and facilitators related to behaviour,[16 17] which is an important first step in developing interventions to reduce SB in patients.

OBJECTIVES OF THE REVIEW

Limited attention has been paid to the factors that impact the improvement of SB among CHD patients. There is no relevant review on barriers and facilitators of SB. To address this gap, the purpose of this scoping review is to collect and identify barriers and facilitators to improved SB in general practice for CHD patients, report the frequency of these factors and map them to the COM-B model. The results may ignite future research to develop interventions that patients with CHD can easily adopt to improve SB.

MATERIALS AND METHODS

This study employed a scoping review methodology to comprehensively summarise the literature on the barriers and facilitators of improved SB in patients with CHD. We used the five-stage methodological framework designed by Arksey and O'Malley to complete this review, including (1) identifying the research question; (2) identifying relevant studies; (3) selecting studies; (4) charting the data and (5) collating, summarising and reporting the results.[18] The reporting of this review followed the Preferred Reporting Items for Systematic reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) recommendations.[19]

Stage 1: identifying the research question

The research question that guided the review was: 'What are the barriers and facilitators to improved SB in CHD patients?'

Stage 2: identifying relevant studies

We searched nine databases, including PubMed, Medline, Embase, CINAHL, Web of Science Core Collection, Scopus, CNKI, WanFang and VIP (The last three are Chinese databases), from inception to 31 December 2023. Some search terms reflecting the key concepts were used: 'Sedentary Behavior OR Sedentary Time', 'Coronary Heart Disease OR Coronary Artery Disease' and 'Barrier* OR Facilit*'. The search strategy is shown in online supplemental material.

Stage 3: selecting studies

Literature inclusion criteria for this review were as follows: (1) patients diagnosed with CHD and aged ≥18 years old; (2) studies involved barriers and/or facilitators to improving SB; (3) the types of studies included quantitative, qualitative and mixed studies, and quantitative studies included experimental and observational studies; (4) the language limited to English and Chinese. Exclusion criteria were: (1) studies with duplicated content in English and Chinese, and studies for which the full text was not available or the information was incomplete; (2) the type of publication was a review, protocol, conference abstracts. The search results were imported into Endnote X9, after using the 'Find Duplicates' function, two of the authors (YY and QY) independently screened the title, abstract and full text for selection. A manual search of references from selected studies was conducted to further identify potential studies for inclusion. Any disagreements were addressed through discussion with a third author (LLY). We did not screen for methodology or levels of evidence.

Stage 4: charting the data

The abstracted data included author(s), year of publication, country, type of study, sample size, age, main findings, barriers and facilitators. The first draft of the data charts of five randomly selected studies was completed independently by two reviewers (YY and CW). The chart form was revised through discussion among the research team to extract information from all the included studies. The data were extracted by two authors and checked by another author (QY). Any disagreements were resolved by discussion among the whole team.

Stage 5: collating, summarising and reporting the results

We used a quantitative and distributional format to describe the included studies. Two authors (YY and CW) independently entered barriers and facilitators from each study into Excel and coded the factors according to the theme. The themes were reviewed by all team members

and all disagreements were resolved through discussions between the entire team. The framework for coding used the COM-B model based on book by Michie with the following components:[20] (1) C—capability refers to physical capability-physical skill, strength or stamina, that is, patients had the physical strength or skills to improve SB and psychological capability-knowledge or psychological skills, strength or stamina to engage in the necessary mental processes, that is, patients were psychologically able to improve SB, which included knowing what to do and understanding its importance. (2) O—opportunity means social opportunity and physical opportunity. Social opportunity means the opportunity afforded by interpersonal influences, social cues and cultural norms that influence how we think about things, that is, patients had the chance to reduce SB due to interpersonal influence, social cues and cultural norms. The physical opportunity was afforded by the environment involving time, resources, locations, cues and physical 'affordance', that is, patients had the chance to reduce SB due to environmental factors such as physical space, resources and time. (3) M—motivation included automatic motivation and reflective motivation. Automatic motivation refers to automatic processes involving emotional reactions, desires, impulses, inhibitions, drive states and reflex responses, that is, patients were motivated to improve SB through automatic processes including reactions, desires (wants and needs), impulses, inhibitions, reflex responses and habits. Reflective motivation indicates the reflective processes involving plans (self-conscious intentions) and evaluations (beliefs about what is good and bad), that is, patients intended to improve SB responsively after a process of reflection, planning and evaluation.

Moreover, these initial codes were subsequently categorised into barriers and facilitators within the COM-B framework adopting the method of thematic analysis.[21] The concepts were re-examined and synthesised into ultimate barriers and facilitators. Throughout the process, the disagreement was resolved by the whole team through discussion and negotiation. The main purpose of this scoping review was to map the existing literature on this topic and identify potential gaps in service provision within the subject area. Consequently, we did not complete an assessment of the quality of evidence, nor did we determine whether particular studies provide robust or generalisable findings.

Patient and public involvement

Patients and/or the public were not involved in the design, or conduct, or reporting or dissemination plans of this research.

RESULTS

A total of 4352 studies were searched through the database, and 3049 remained after removing duplicate studies. According to the inclusion and exclusion criteria, 84 studies were reminded after screening the titles and abstracts for full-text reading, of which 60 studies were excluded due to the following reasons: the study population was not patients with coronary artery disease (n=12), barriers and facilitators to improving SB were not involved (n=36) and the type of study was a review (n=13). Therefore, 24 studies were finally included and the literature screening process is shown in figure 1.

Characteristics of the included studies

Twenty-four studies included in this scoping review were published between 2003 and 2023. The most common countries in which studies were conducted were China (n=6),[22–27] the Netherlands (n=4),[28–31] the USA (n=3),[32–34] Canada (n=3),[13 35 36] the UK (n=1),[37] Belgium (n=1),[38] Italy (n=1),[39] New Zealand (n=1),[40] Australia (n=1),[41] Brazil (n=1),[42] Korea (n=1)[43] and one study covered 24 countries in Europe.[44] The types of studies included qualitative (n=2) and quantitative (n=22). Of the 22 quantitative studies, 11 utilised a cross-sectional design, one utilised a cohort design and 10 were experimental or pilot trials. The characteristics of the included studies are described in detail in online supplementary material.

In two qualitative studies,[25 35] 14 and 15 patients were interviewed based on the ecological framework and cross-theoretical model, respectively. For the intervention, the sample size ranged from 32 to 710, the duration ranged from 6 weeks to 6 months and the majority of the studies used CR (n=8),[13 28 31 36–40] which centred on exercise sessions and educational sessions about the medical background and lifestyle improvement advice. A few studies focused on interrupting SB to make patients' sedentary time more fragmented with more breaks and shorter periods.[28 31]

Tables 1 and 2 present the barriers and facilitators to improved SB in CHD patients based on the COM-B model.

Barriers

Barriers to improved SB in CHD patients included personal characteristics, physical characteristics, lack of knowledge to improve SB, poor patient adherence, lack of partnership support, lack of guidance from healthcare professionals, high level of objective support, fewer family responsibilities, lack of resources to carry out activities, lack of time to improve SB, depression, anxiety, maintaining the habit of SB, lack of interest, exercise fear, improving SB not being a priority and impaired belief in activities.

Physical capability

Physical capability includes personal characteristics and physical characteristics. Personal characteristics included old age and a high level of education.[27 35] Physical characteristics included low left ejection fraction,[34 43] high number of coronary artery lesions,[22] high degree of coronary artery disease,[22] high plasma D-dimer level[26] and Body Mass Index (BMI) level above normal.[29 43] Additionally, frailty and limited physical conditions were barrier

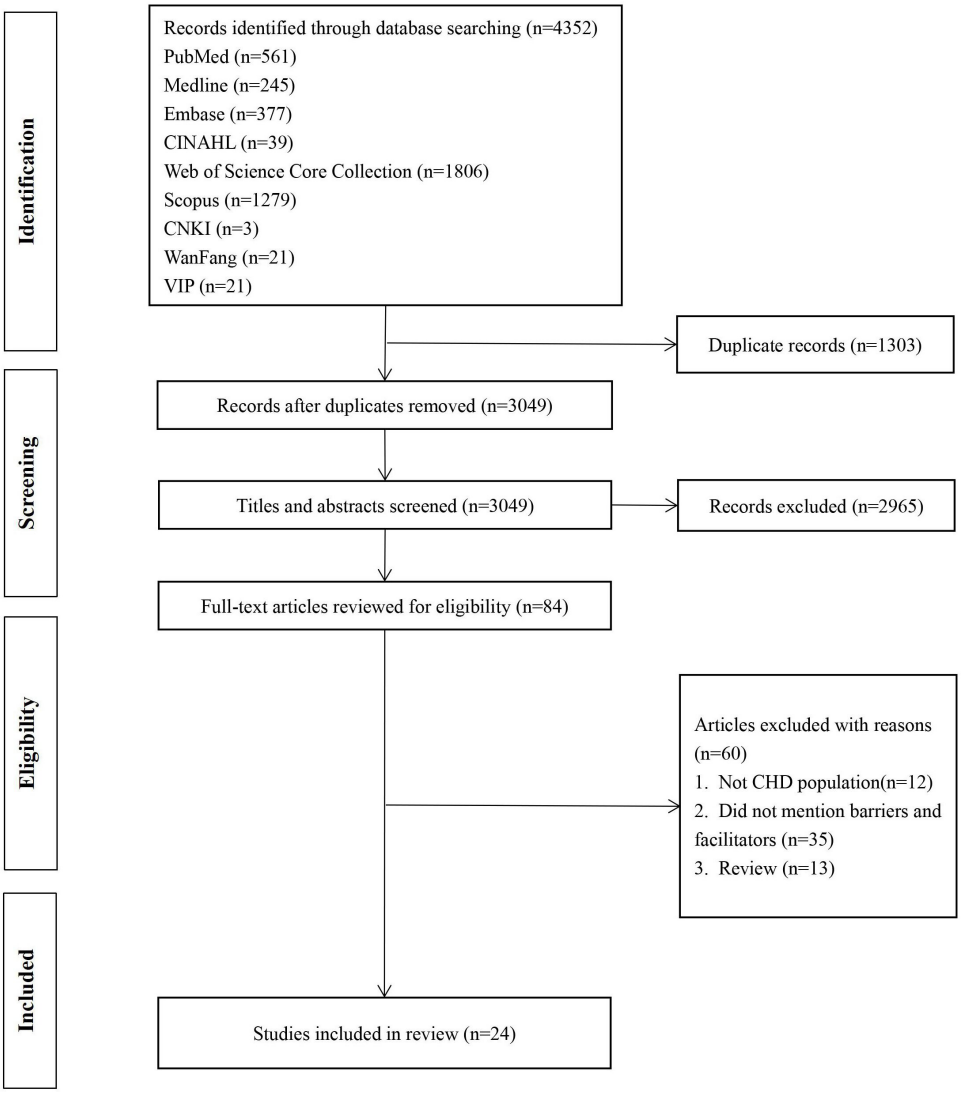

Figure 1 PRISMA flowchart showing a selection of articles for scoping review. CHD, coronary heart disease; PRISMA, Preferred Reporting Items for Systematic reviews and Meta-Analyses.

factors, such as pain, disability and other disease-related issues.[24 35]

Psychological capability

Lack of knowledge to improve SB[25 35 42] and poor patient adherence[13 35] were identified as psychological capability-related barriers.

Social opportunity

The most frequent barrier related to social opportunity was a lack of partnership support,[25 26 34 35] whether from friends or family, especially for those patients who were divorced or widowed. Lack of guidance from medical personnel and fewer family responsibilities were also barrier factors.[25] However, in Yao's study,[27] patients with higher levels of objective support were more sedentary.

Physical opportunity

Lack of resources to carry out activities (eg, places, scenarios),[25 35 42] and lack of time to improve SB were identified as physical-related barriers.[35]

Automatic motivation

Depression, anxiety, maintaining sedentary habits, lack of interest and exercise fear were recognised as barriers related to automatic motivation.[25–27 32 35 42 44]

Reflective motivation

Improving SB not being a priority and impaired beliefs about activity were barriers to reflective motivation.[25 35 42]

Facilitators

Facilitators to improved SB in CHD patients included exercise training, improving understanding of SB, self-monitoring, perceived social support, utilisation of support, tele-rehabilitation guidance, sedentary prompts from devices, diversification of living environments, and perceived benefit.

Physical capability

Exercise training was identified as a physical capability-related facilitator.[13 28 31 36–40]

Table 1 Barriers to improved sedentary behaviour in CHD patients

	Frequency	Article citation
Capability		
C1 Physical capability		
C1.1 Personal characteristics		
C1.1.1 Old age	1	35
C1.1.2 High level of education	1	27
C1.2 Physical characteristics		
C1.2.1 Low left ventricular ejection fraction	2	34 43
C1.2.2 High number of coronary artery lesions	1	22
C1.2.3 High degree of coronary artery disease	1	22
C1.2.4 High plasma D-dimer level	1	26
C1.2.5 BMI level above normal	2	29 43
C1.2.6 Frailty	1	24
C1.2.7 Limited by physical conditions	2	25 35
C2 Psychological capability		
C2.1 Lack of knowledge to improve sedentary behaviour	3	25 35 42
C2.2 Poor patient adherence	2	13 35
Opportunity		
O1 Social opportunity		
O1.1 Lack of partnership support	4	25 26 34 35
O1.2 Lack of guidance from healthcare professionals	1	25
O1.3 High level of objective support	1	27
O1.4 Fewer family responsibilities	1	25
O2 Physical opportunity		
O2.1 Lack of resources to carry out activities	3	25 35 42
O2.2 Lack of time to improve sedentary behaviour	1	35
Motivation		
M1 Automatic motivation		
M1.1 Depression, anxiety	2	32 44
M1.2 Maintaining the habit of sedentary behaviour	2	25 35
M1.3 Lack of interest	2	25 42
M1.4 Exercise fear	2	26 27
M2 Reflective motivation		
M2.1 Improving sedentary behaviour not being a priority	1	35
M2.2 Impaired belief in activities	3	25 35 42

BMI, Body Mass Index; CHD, coronary heart disease.

Table 2 Facilitators to improved sedentary behaviour in CHD patients

	Frequency	Article citation
Capability		
C1 Physical capability		
C1.1 Exercise training	8	13 28 31 36–40
C2 Psychological capability		
C2.1 Improving understanding of sedentary behaviour	2	23 31
C2.2 Self-monitoring	2	31 36
Opportunity		
O1 Social opportunity		
O1.1 Perceived social support	1	33
O1.2 Utilisation of support	1	27
O2 Physical opportunity		
O2.1 Tele-rehabilitation guidance	5	37–41
O2.2 Sedentary prompts from devices	3	31 35 36
O2.3 Diversification of living environments	2	30 35
Motivation		
M1 Automatic motivation	None	
M2 Reflective motivation		
M2.1 Perceived benefit	1	35

CHD, coronary heart disease.

Psychological capability

Improving understanding of SB and self-monitoring were identified as psychological capability-related facilitators.[23 31 36]

Social opportunity

Perceived social support and utilisation of support were recognised as facilitators associated with social opportunity.[27 33]

Physical opportunity

Tele-rehabilitation guidance,[37–41] sedentary prompts from devices[31 35 36] and diversification of living environments were recognised as facilitators associated with physical opportunity.[30 35]

Reflective motivation

Perceived benefit identified as a facilitator of reflective motivation. Patients believed that reducing SB improved disease outcomes as well as positively impacted lifestyle and health.[35]

DISCUSSION

To the best of the authors' knowledge, despite the steadily increasing number of studies and articles on SB in recent years, there are still no reviews addressing barriers and

facilitators to improving SB, and a lack of standardised guidelines for SB interventions in patients with CHD. In order to effectively reduce SB in patients with CHD, identifying the influencing factors is the foremost step. Therefore, more insight is needed on the barriers and facilitators. This scoping review integrated evidence on the barriers and facilitators to improving SB in CHD patients and mapped these factors to the COM-B model.[14]

One critical and common finding is that barriers related to physical capability majorly limited the reduction of SB in patients. These included age,[35] level of education,[27] left ventricular ejection fraction,[34 43] number of coronary artery lesions,[22] degree of coronary artery disease,[22] plasma D-dimer levels,[26] BMI,[29 43] frailty[24] and restricted physical conditions.[25 35] It is undeniable that, except for the patient's age, which cannot be changed, other factors still have the potential for improvement. In Medical Subject Heading of PubMed, 'Coronary Disease' is defined as 'An imbalance between myocardial functional requirements and the capacity of the coronary vessels to supply sufficient blood flow'. Hence, CHD patients have reduced exercise capacity and quality of life due to myocardial ischaemia and impaired cardiac function.[45] Interestingly, included in the review were mostly patients involved in CR, which as a secondary prevention programme, aims to provide exercise training and lifestyle counselling and is associated with decreased mortality and rehospitalisation rates.[46] Some trials found that exercise training with a strength and aerobic programme could reduce patient's SB and improve cardiorespiratory fitness and skills.[28 36] However, despite the SB improvements, time in SB was still long. It is important to tailor individualised CR programmes to improve SB for patients with different physical capabilities.

Psychological capability manifests primarily through the lack of knowledge to improve SB[25 35 42] and poor patient adherence.[13 35] For example, some patients believe that SB is equivalent to physical inactivity, that there are no health benefits to reducing sedentary and that excessive, irrational fear of exercise as well as lack of knowledge of what to do acted as barriers to behaviour change in this review. In addition, there is confusion regarding the influence of SB and physical inactivity in patients with CHD. It is important to clarify that these are two distinct concepts; a person can meet WHO PA recommendations and still have 8 hours of SB per day. According to Hu's study,[23] enhancing patients' awareness of SB mainly involves reducing daily television viewing time; breaking long periods of sitting with activities such as standing or walking; suggesting 30 min as the maximum limit for sedentary time; recommending the adoption of active SB instead of passive one, such as replacing television watching with mentally engaging activities like learning or reading. In addition, in another randomised controlled trial, participants in the intervention group were equipped with a VTAP monitor that provided real-time feedback via an alarm once the wearer had been sedentary for 30 consecutive minutes and required 2 min of standing/movement to reset.[36] The results of the above two studies showed a reduction in patients' sedentary time. There appears to be a need to educate patients on how to reduce SB and advise them to apply their knowledge to practice and improve adherence through self-monitoring.

Our review found that objective support in social opportunity is both a barrier and a facilitator to improving SB. Two social barriers were found to improving SB; with family support, patients are overprotected and assume fewer family responsibilities, leading to the accumulation of high SB.[27] In addition, healthcare professionals' lack of guidance is another barrier. First, healthcare professionals do not give enough attention to SB and underemphasise it, and second, healthcare professionals do not specifically inform which behaviours are SB and specific behavioural change techniques.[25] Therefore, healthcare professionals should receive more education and training to understand the benefits of improved SB better and communicate this information to CHD patients. On the contrary, perceived social support was negatively associated with SB and considered a facilitator in improving SB.[33] Unfortunately, the source of the social support was not explicitly indicated. However, Song reported that patients feel that partnership support from family and friends can monitor and keep them from slacking off and withdrawing.[25] Therefore, family is a potential great social support for improving the SB of the patients. Nevertheless, other sources of social support, such as family, peers and health professionals, for improving SB will be investigated in the future.

The barriers related to physical opportunity are lack of resources and time.[25 35 42] Lack of activity places as well as available facilities in the community reduces the number of times patients go out. Additionally, younger patients are usually busy with various work, who are sedentary in the workplace believe that sitting for long periods is an inevitable part of the job, and even feel that reducing SB at work will affect productivity. Nowadays, with the rapid development of technology, remote rehabilitation platforms and mobile applications have shown unique advantages, providing a 'bridge' between patients and healthcare professionals.[47] Breaking through the constraints of space and time, workplace and home-based interventions should be utilised more in future studies.

The automatic motivation-related barriers are depression, anxiety, maintaining the habit of SB, lack of interest and exercise fear.[25–27 32 35 42 44] Previous studies found that in the first 12 months after an acute cardiac event, the percentage of patients affected with anxiety and depression was elevated to 15%–43%,[48] but these conditions are undertreated. The reduction in activity and social interactions can exacerbate feelings of isolation and hopelessness, further prolonging the vicious cycle of depression and SB. Therefore, it is essential to actively address the mental health of patients, which subsequently has a positive effect on improving their SB. Exercise fear is another risk factor for SB.[26 27] Due to their fear of potential harm from PA, such as panic attacks, chest tightness

and falls, these fears make patients tend to avoid exercise altogether, instead adopting a more sedentary lifestyle. However, prolonged periods of inactivity increase the risk of developing more health complications, which in turn exacerbates the fear of exercise and maintains the sedentary pattern. To addressing mental health issues (such as depression and anxiety) and fear of exercise, healthcare professionals should help patients break the vicious cycle of SB and provide praise, even for even small achievements, to increase their motivation.

In addition, improving SB not being a priority and impaired beliefs in activities are barriers related to reflexive motivation.[25 35 42] SB is seen as a less critical risk factor than other health behaviours such as diet and stress management. Many patients are aware that exercise is important for health, but achieving the guideline-recommended weekly completion of moderate to vigorous PA is challenging for patients with CHD. And having suffered negative consequences from PA can lead to increased perceptions of PA disadvantage, with some patients giving up activity and choosing to be sedentary as a result. Perceived benefits are identified as reflective motivation-related facilitators.[35] The studies reported benefits for CHD patients, including physical, mental and social health, which contribute to their reduction in SB.[49] Excessive and prolonged SB leads to insulin resistance, loss of muscle mass and bone loss and increased total body fat mass, blood lipid concentrations and inflammation.[50] Therefore, it is vital that patients perceive the benefits of improved SB and the wide range of effects it has on their health throughout life.

Limitations

Some limitations emerge from this review. First, this review protocol was not registered previously. Second, studies published in English and Chinese were only included in specific databases, thus some relevant studies published in other languages might have been omitted. Third, this review did not assess the quality of the included studies. Finally, the results only covered the perspectives of CHD patients and did not include the views of other stakeholders like healthcare professionals and policymakers.

CONCLUSION

CHD is a chronic disease requiring long-term treatment and surveillance. The majority of patients with CHD experience high levels of SB, the harm of which should not be underestimated. This scoping review used the COM-B model as a framework for identifying barriers and facilitators that impeded and promoted improvement in SB in patients with CHD. The findings of this review may help guide the development of new theory-oriented SB interventions for this patients population. Given the current state of knowledge, it may not yet be sufficient to directly apply the BCW to develop comprehensive, theory-informed interventions for CHD patients. While the COM-B model provides a useful foundation for understanding behaviour, further research is required to fully map the specific barriers and facilitators within this context and to understand how these elements can be integrated into a behaviour change intervention. Future studies should not only focus on reducing barriers and enhancing facilitators, but also aim to better define and refine these factors in order to inform the development of evidence-based interventions. Additionally, training and education on SB should be provided to healthcare professionals to equip them with the tools to effectively communicate and support behaviour change in patients. In conclusion, future studies can build on the findings of this scoping review by using the COM-B model to explore additional influencing factors and by leveraging the BCW to design more targeted and effective SB interventions.

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Contributors Two authors (YY and LY) designed the review. Two authors (YY and QY) reviewed the full text of the studies after screening the title and abstract. Two authors (YY and CW) completed data extraction. YY drafted the manuscript. LY critically revised the manuscript for important intellectual content. All authors reviewed and approved the final version. LY is the guarantor.

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ORCID iD

Yuting Yang http://orcid.org/0000-0002-9367-9942

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