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Exploring timing and delivery of lifestyle advice following an acute cardiac event hospitalization: The cardiac patient's perspective

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ABSTRACT

Objective: To explore the perspective of cardiac patients regarding the timing and manner of delivering lifestyle advice following an acute cardiac event hospitalization.
Methods: Dutch cardiac patients who experienced a cardiac event hospitalization participated in a semi-structured interview (n = 14) or a cross-sectional survey study (n = 119).
Results: Our findings indicate that cardiac patients are receptive to lifestyle advice throughout the care trajectory. Advice delivered by a cardiologist had the highest self-reported impact. Furthermore, receiving advice at multiple phases during the care trajectory was associated with a greater intention to change lifestyle (B = 0.37, CI = 0.17 – 0.57). Patients favored clear-cut, feasible, and friendly but confronting advice. Moreover, they stressed the importance of advice being aligned with their identity and beliefs about the causes of their disease.
Conclusion: The period following an acute cardiac event provides a unique opportunity to offer tailored and patient-centered lifestyle advice. This "teachable window" for lifestyle change, when used wisely, may improve health outcomes for cardiac patients.
Practice Implications: Healthcare professionals should initiate lifestyle advice already during hospitalization and continue during follow-up appointments and cardiac rehabilitation. Advice should be feasible and empathy-based, as well as tailored to the patient's needs, values, and perceptions of the causes of their cardiovascular disease.

1. Introduction

Cardiovascular diseases (CVDs) are associated with high rates of morbidity and mortality. As such, they represent a significant global health burden, and thus affect not only individuals but society as a whole [1,2]. A person who has suffered an acute cardiac event is particularly susceptible to subsequent cardiac events [3]. Adopting lifestyle changes can greatly improve health outcomes, making lifestyle counseling crucial for the secondary prevention of CVDs [4–7]. The European Society of Cardiology (ESC) guidelines, therefore, recommend that patients after an acute cardiac event participate in a Cardiac Rehabilitation (CR) program [8,9]. These programs foster recovery and secondary prevention, focusing on supporting lifestyle modification, psychosocial wellbeing, and closely monitored exercise [8–10]. Numerous reviews have highlighted the benefits of CR programs for improved lifestyle outcomes, morbidity and mortality, and quality of life

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[11–17]. Nonetheless, challenges persist in the uptake and adherence to CR, as well as in sustaining long-term lifestyle changes post-CR [18,19].

Following a cardiac event, patients can experience a "teachable moment" for lifestyle change, wherein they have an increased motivation to adopt risk-reducing health behaviors [20–22]. This teachable moment is often the consequence of a continuous process whereby patients try to make sense of their recent experience [23]. Brust et al. [23] have noted that this sensemaking process commences during hospitalization and continues after hospital discharge, leading to the term "teachable window" (TW) being deemed more fitting. This TW presents an opportune opportunity for healthcare providers to offer lifestyle advice, capitalizing on patients' receptivity due to their recent experiences [24–27].

To utilize the full TW, it is important to initiate lifestyle advice during hospitalization. Patients who receive such guidance during their hospital stay are more likely to exhibit positive behavioral changes [26]. Accordingly, the ESC guidelines recommend early initiation of CR following hospitalization [8]. However, despite these recommendations, lifestyle advice during hospitalization is not consistently provided [28]. Also in the Netherlands, where CR typically begins several weeks after discharge, lifestyle counseling during hospitalization in practice remains far from standard. This underscores the urgency of prioritizing lifestyle support throughout the entire TW, from admission to the final patient contact. Additionally, the manner and timing of delivering lifestyle advice to cardiac patients should also be considered, as this can impact adherence and therefore effectiveness of the advice [12,29,30]. Integrating patient-centered care, involving understanding patients' needs and preferences, often results in more personalized and cost-effective approaches [31]. Currently, however, these needs and preferences are rarely considered when designing lifestyle support interventions post cardiac event hospitalization.

Understanding how and when lifestyle advice is effective (i.e., what works, why, in what context, and for whom [32]) is essential for a better understanding of the optimal form and timing of lifestyle advice [33]. The aim of this study was therefore to explore, from the point-of-view of the cardiac patient, optimal timing and best practices regarding lifestyle advice in secondary care shortly after an acute cardiac event hospitalization. The insights gained from this study may help improve the delivery of lifestyle advice in cardiac care, allowing a potential TW to be used optimally, leading to enhanced long-term compliance to lifestyle advice and ultimately better cardiac health outcomes.

2. Method

2.1. Study design and participants

This study employed a multi-methods approach, using both qualitative (sub-study 1) and quantitative (sub-study 2) methods to address the research questions. Both sub-studies obtained ethical approval from the Medical Ethics Committee Leiden University Medical Centre and were registered under METC-nr 18–112. In sub-study 1, data were collected through interviews conducted as part of a previous study by researchers MB, WAG, MEN, and JCK, aimed to elicit the experiences of cardiac patients regarding their myocardial infarction in relation to their lifestyle [23]. Participants in sub-study 1 were cardiac patients who had experienced their first ST-elevated myocardial infarction, were hospitalized at either of two general hospitals in The Hague, aged 18 years or above, proficient in Dutch, and without severe psychiatric or neurodegenerative disorders. These participants engaged in two semi-structured interviews, approximately one and five months post-myocardial infarction.

In sub-study 2, a cross-sectional survey was employed to gather data. Participants in sub-study 2 were cardiac patients who had been hospitalized for a myocardial infarction (both ST-elevated and non-ST elevated) or an acute event related to heart failure or heart rhythm disorder, who subsequently completed the Capri CR program. A program description is provided in Supplementary Material A. Consistent with sub-study 1, participants were required to be 18 years or older, proficient in Dutch, and without severe psychiatric or neurodegenerative disorders. Based on a power calculation, we determined that to detect an estimated correlation r of 0,15 (based on previous research [34], with 95% power, $\alpha = 0.05$, we required a minimum of 75 participants for the analysis.

2.2. Procedure

Participants in sub-study 1 were recruited by cardiologists and nurse practitioners in 2019 and 2020 at hospital discharge. The first researcher (MB) contacted interested patients, obtained informed consent, and conducted the interviews. Participants received a voucher of 25 euros upon completing the second interview. The procedure has been described in more detail by Brust et al. [23].

Recruitment of participants for sub-study 2 took place in 2022. A research assistant from Capri CR identified eligible patients who had completed the program within the last year and sent invitation emails, including a participant information letter and a link to an online survey administered by Qualtrics. Participants could provide informed consent on the first page of the survey. All patients were informed that participation was voluntary and that data was collected anonymously.

2.3. Measures

We followed principles from a realist evaluation approach, i.e., a methodology used for understanding mechanisms behind interventions [35], to study the perspective of cardiac patients regarding the timing and manner of delivering lifestyle advice. To gain insight into "what works and why" regarding lifestyle advice, we used semi-structured interview data from sub-study 1 (Brust et al. [23]) that involved patient's needs, preferences, and experiences regarding lifestyle advice. Additionally, we used the survey of sub-study 2. Specifically, data of an open-ended question ("Could you describe which lifestyle advice has had the most impact on you and why?") and the 11-item validated Cardiac Lifestyle Change Intention (CardiacLCI) scale [36], which assesses lifestyle change intention due to a cardiac event. The survey of sub-study 2 also included questions regarding the preferred context of lifestyle advice, involving: a. the preferred time for receiving lifestyle advice (i.e., after admission to hospital, during hospitalization, at discharge, at home after discharge, during CR, during follow-up appointments, during a GP appointment, or never), b. the source of the lifestyle advice that had the greatest impact on the patient (i.e., cardiologist, surgeon, nurse, nurse specialist, general practitioner, other doctor, dietician, physiotherapist, social worker, lifestyle coach, or general-practice nurse specialist), c. the perceived receptiveness to lifestyle advice during four phases in their treatment journey (i.e., during hospitalization, at home in the weeks after discharge, during follow-up appointments in hospital, and during CR), and d. the patient's evaluation of the received advice on three 7-point Likert scales (ranging from unpleasant to pleasant, bad to good, and unimportant to important). The survey also included socio-demographic characteristics, including age, sex, Body Mass Index (BMI), relationship status, children, educational background, employment status, and the number of previous significant life events as assessed by the 12-List of Threatening Experiences (LTE) [37,38].

2.4. Analysis

To explore "what works and why" regarding lifestyle advice, the semi-structured interviews of sub-study 1 and the open-ended survey question of sub-study 2 were analyzed using inductive thematic analysis [39]. Patterns of responses were identified and grouped into emergent subthemes, which were further grouped into main themes. To investigate the preferred "context" for lifestyle advice, descriptive statistics

were computed on preferred timing, the healthcare professional who provided the most impactful advice, receptiveness to receiving advice during different phases of care, and the evaluation of received advice across the phases. One-way ANOVAs were conducted to examine whether receptiveness and the evaluation differed across phases. Linear regression analyses were performed to examine the association between received lifestyle advice and intention to change lifestyle, after checking for linearity, normality of the residuals, and absence of multicollinearity. The univariate linear regression analyses used lifestyle advice received during hospitalization, follow-up appointments, and CR (dichotomic; no or yes) and the sum score (received lifestyle advice 0 – 3 times) as independent variables, and the subscales of the CardiacLCI scale [36] as linear dependent variables. Since individuals of different age, sex, and BMI have varying risks for CVD [40], and healthcare professionals may provide advice differently based on these characteristics, we additionally adjusted for these factors in the multivariate model. Lastly, in order to explore patient characteristics associated with receptiveness to lifestyle advice, we first assessed the univariate relationship between sociodemographic characteristics and the mean score on receptiveness to lifestyle advice, followed by multivariate analysis with an enter selection strategy, including all sociodemographic characteristics simultaneously. All analysis were performed with SPSS (version 25; IBM; Armonk, NY) and p values of < 0.05 were considered significant.

3. Results

3.1. Sociodemographic characteristics

The sample in sub-study 1 involved fourteen cardiac patients who participated in the semi-structured interviews and the sample of sub-study 2 consisted of 119 cardiac patients who had completed the cross-sectional survey. Their sociodemographic characteristics are provided in Table 1.

Table 1
Sociodemographic characteristics of the samples of sub-study 1 and 2.

	Sample sub-study 1 (n = 14)		Sample sub-study 2 (n = 119)	
Characteristic	Mean (SD)		Mean (SD)	
Age	63.2 (7.1)		56.3 (9.2)	
BMI (kg/m2)	-		26.7 (4.3)	
Number of life events	-		2.75 (2.0)	
	Frequency (n)	**Percentage (%)**	**Frequency (n)**	**Percentage (%)**
Sex				
Female/male	4/10	29/71	28/91	24/77
Living situation				
Relationship/ single	12/2	86/12	96/23	81/19
Children				
Yes/no	11/3	79/21	98/21	83/18
Education*				
Low/middle/ high	4/6/4	29/43/29	29/34/50	26/30/44
Employment				
Employed/ unemployed	10/4	71/29	43/75	36/63
Myocardial infarction	14	100	46	39
Heart failure	-	-	41	34
Heart rhythm disorder	-	-	42	28

* Level of education was classified according to the International Standard Classification of Education [33] into lower education (none, elementary or vocational education), middle education (higher general and secondary vocational education), or higher education (higher professional and scientific education).

3.2. "What works and why" – sub-study 1

From the data of sub-study 1 three main themes and several subthemes could be identified regarding "what works", as presented in Fig. 1. The first main theme "Lifestyle counseling practices that facilitate patient compliance", included four subthemes. Firstly, participants expressed a preference and need for clear, practical, and feasible lifestyle advice that provides unambiguous guidance on which behaviors are beneficial or detrimental to their cardiovascular health, for instance regarding the healthiness or unhealthiness of certain food products [quote 1–2] (Supplementary Material B). Secondly, some participants noted that they were influenced by advice that increases their awareness of the consequences of lifestyle for their health. Furthermore, when healthcare professionals helped them understand the relevance of living healthy for their own personal health, their motivation to do so also increases [quote 3–4]. Thirdly, while some found post-discharge lifestyle-related information brochures helpful, efficacy varied [quote 5–7]. Finally, aligning advice with personal theories about the cause of their cardiac event was appreciated [quote 8–9].

The second main theme "Personalized lifestyle advice" emphasized the preference and need for advice that fits a patient's unique identity, circumstances, or perspective. Advice aligned with someone's values, daily routines, and life goals seemed better appreciated and easier to follow [quote 10–11]. For instance, one participant found it easy to implement advice of eat an apple a day because it suited his existing daily routine [quote 11], whilst another participant struggled with the advice to eat fewer sweet products because she regarded eating these products as part of her identity as a 'sociable, cozy' person [quote 12]. Additionally, participants sought personal feedback on health improvements resulting from lifestyle changes, such as changes in blood pressure and cholesterol [quote 13–14].

The third main theme, "Timing and opportunity to discuss lifestyle", emphasizes the importance of discussing lifestyle. Firstly, some participants were very interested in behaviors that they could adopt to improve their health status and reduce their risk [quotes 15–16]. This period of receptiveness and contemplation could be capitalized upon by healthcare providers. Secondly, many participants felt motivated by a lifestyle assessment conducted by their doctors or cardiologists right after their surgery [quote 17–18]. This underlines the importance of discussing lifestyle during this critical opportunity.

3.3. "What works and why" – sub-study 2

Table 2 outlines the main themes and subthemes derived from open-ended survey responses regarding "why" lifestyle advice was regarded as impactful. The first main theme is "Advice is clear, practical, and feasible", highlights that advice that was clear and simple or advice that included practical and feasible tips on how to live healthily, was helpful. Patients found it helpful when they were provided with new knowledge about lifestyle and particularly giving detailed explanations of why certain behaviors are healthy or unhealthy. The second main theme identified, "Advice is friendly and sincere", indicated that participants appreciated empathetic guidance and felt supported when healthcare providers demonstrated genuine concern. In particular, suggestions to be kind to oneself and take things gradually resonated with many participants. The third subtheme, "Advice fits with theory and person", revealed that some participants found that advice was impactful if it was aligned with their own theory regarding the cause of their acute cardiac event or with their current identity and life. For example, some participants believed that their event was due to a lack of physical activity, and receiving advice to exercise more was regarded as impactful because it aligned with this perceived behavioral cause. Similarly, for those who believed that their acute cardiac event was mainly due to stress levels, advice to better manage stress was welcomed. The fourth subtheme, "Advice is appropriately confronting", concerned participants who regarded advice as helpful when confronted with the reality of their

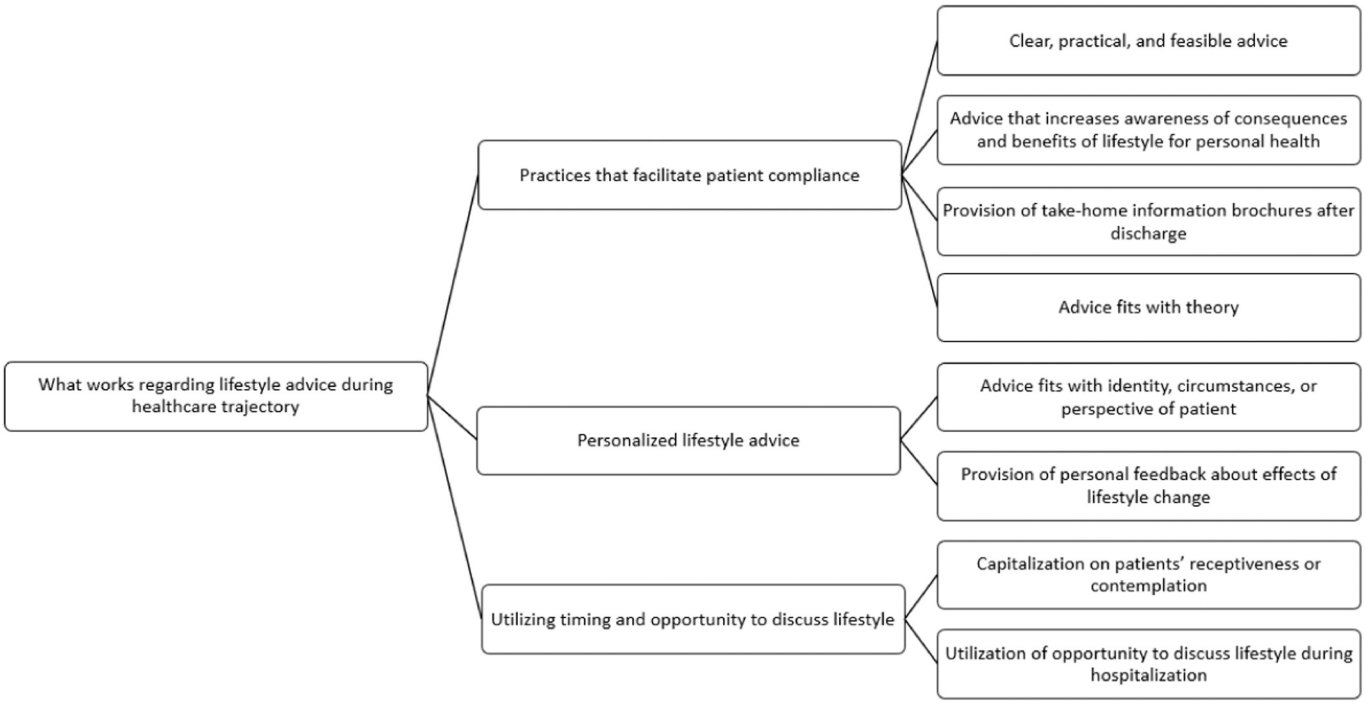

Fig. 1. Main themes and corresponding subthemes.

Table 2
Qualitative analysis of responses on the question: "Could you describe what lifestyle advice had the greatest impact on you, and why?" (n = 66).

Code	Number of participants	Example quote
Main theme: Advice is clear, practical, and feasible		
Clear and simple message focused on behavior change	10	Better awareness of one's eating habits. Burn fat rather than sugar.
Practical, feasible tips: reducing salt/sugar intake, reading food labels, or differentiating between (un) saturated fats	12	Paying attention to salt intake. It was only then that I recognized how much salt you can consume without realizing it, for example via so-called spice mixes that are 75% salt.
New knowledge or good explanation	7	Actually, none of the advice was "new" but when supported by evidence all advice was useful.
Main theme: Advice is friendly and sincere		
Genuine and kind	5	It came across as genuine and sincere.
Encouraged to take easy on oneself	4	Take it easy, avoid stress, do enjoyable things and be kind to myself. It helped; the way it was said.
Main theme: Advice fits with theory and person		
Advice linked to perceived behavioral cause	5	Moderately intensive exercise five times a week, and intensive twice a week. I think a lack of physical activity was a major contributor to my heart attack.
Advice aligned to perceived necessity	6	I was in bad shape so I understand I have to make drastic improvements. I am certainly convinced that this is absolutely essential.
Advice fits who I am or what I do	5	I believe in being active and keeping busy.
Main theme: Advice is rightly confronting		
Being confronted with the urgency of behavior change	10	I am now 70 and hope to have many more years. There's not really that much time left…

situation and with the urgent need to change behavior.

3.4. *"Context", perspective of the patient, sub-study 2*

Participants' responses on preferred timing of lifestyle advice and the healthcare professional from which they received the most impactful lifestyle advice are presented in Fig. 2 and Fig. 3. As seen in these figures, the majority of participants preferred to receive lifestyle advice during CR (n = 63), followed by at discharge (n = 39), at home after discharge (n = 37), and during hospitalization (n = 37). Moreover, the majority found that the most impactful advice was given by a cardiologist (n = 45), followed by a dietician (n = 27) or a physiotherapist (n = 23).

Table 3 provides the means (SD), ranges, and medians (IQR) of the reported receptiveness to lifestyle advice and the evaluation of the received lifestyle advice. Of our participants, 56% reported to have received lifestyle advice during hospitalization, 50% during follow-up appointments, and 90% during CR. Overall, participants were found to be quite receptive to lifestyle advice throughout all four phases in treatment, with the highest reported receptiveness during CR, followed by advice at home after discharge, during follow-up appointments, and during hospitalization. A one-way ANOVA analysis indicated a significant difference in reported receptiveness across the phases ($F = 8.55$; $df = 3$; $p < 0.01$). However, no significant differences were found in reported evaluation of received advice across the phases ($F = 1.42$; $df = 2$; $p > 0.05$).

Table 4 presents the results of the univariate regression analysis of received lifestyle advice and intention to change lifestyle. The findings indicate that receiving lifestyle advice during hospitalization, follow-up appointments, and CR were significantly associated with a higher score on the Event-induced lifestyle change intention-subscale, remaining significant after controlling for age, sex, and BMI (resp. B = 0.46, CI = 0.06 – 0.87; B = 0.59, CI = 0.08 – 1.11; and B = 0.81, CI = 0.15 – 1.48). Moreover, receiving lifestyle advice at multiple phases was additionally associated with a higher increased intention to change lifestyle (B = 0.37, CI = 0.17 – 0.57). Lastly, receiving lifestyle advice at CR was negatively associated with the General Healthy Lifestyle-subscale, but this association became non-significant after adjusting for age, sex, and BMI, suggesting that the association may be reversed, indicating that

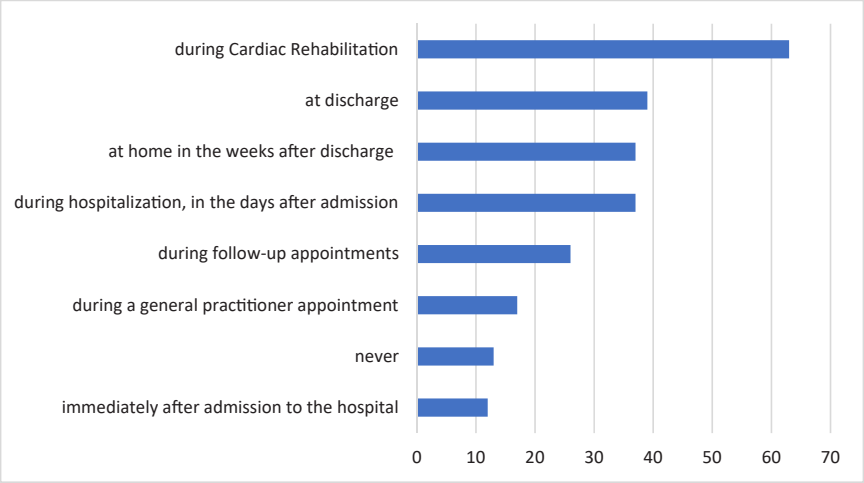

Fig. 2. Responses on question "When would you have preferred to receive lifestyle advice?".

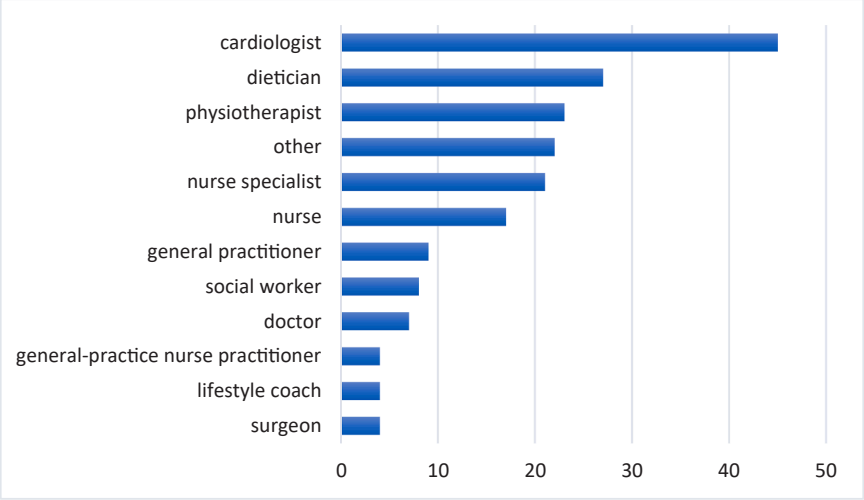

Fig. 3. Responses on question "From which healthcare professional have you find the lifestyle advice to have had the greatest impact on you?". *Note*. Open-ended answers of 'other' consisted of Capri Cardiac Rehabilitation (n = 8), family members (n = 7), or self (n = 4).

Table 3
Receptiveness to and evaluation of lifestyle advice.

Phase in treatment	Receptiveness to lifestyle advice			Evaluation of received lifestyle advice		
	Mean (SD)	Range	Median (IQR)	Mean (SD)	Range	Median (IQR)
Hospitalization	3.88 (1.69)	1 - 7	4 (3 – 5)	5.8 (0.9)	1 – 7	6.0 (5.0 – 6.7)
At home after discharge*	4.52 (1.66)	1 - 7	5 (4 – 6)	-	-	-
Follow-up appointments	4.23 (1.67)	1 - 7	4 (4 – 5.5)	5.6 (1.1)	1 – 7	6.0 (5.0 – 6.0)
Cardiac rehabilitation	4.95 (1.50)	1 - 7	5 (4 – 6)	5.9 (0.9)	1 – 7	60. (5.7 – 6.6)

* Response option "At home after discharge" was only shown at receptiveness to lifestyle advice.

patients with a healthier general lifestyle may receive fewer lifestyle advice during CR.

3.5. *"For whom": characteristics associated with receptiveness to lifestyle advice, sub-study 2*

The univariate regression analyses between sociodemographic factors (i.e. age, sex, BMI, relationship status, children, migration background, education, employment, previous life events) and receptiveness to lifestyle advice, presented in Supplementary Material D, revealed that a lower age (B = −0.04, CI = −0.07 - −0.01) and having children (B = 0.80, CI = 0.11 – 1.49) was significantly associated with an increased receptiveness to lifestyle advice. In the multivariate model, only a lower age (B = −0.05, CI = −0.09 - −0.01) remained significantly associated to a higher receptiveness to lifestyle advice.

4. Discussion and conclusion

4.1. *Discussion*

The period following an acute cardiac event is often perceived as a "teachable window" (TW) for lifestyle change, offering a unique

Table 4
Association of received lifestyle advice and intention to change lifestyle.

	Univariate analysis B	95% CI	Multivariate analysis B	95% CI
Event-induced LCI-subscale				
Hospitalization (no, yes)	0.62 * **	0.23 – 1.0	0.46 * *	0.06 – 0.87
Follow-up appointments (no, yes)	0.71 * **	0.19 – 1.23	0.59 * *	0.08 – 1.11
Cardiac rehabilitation (no, yes)	-1.0 * **	0.38 – 1.70	0.81 * *	0.15 – 1.48
Sum score (received advice 0 – 3 times)	0.43 * **	0.23 – 0.63	0.37 * **	0.17 – 0.57
General Healthy Lifestyle-subscale				
Hospitalization (no, yes)	-0.19	-0.58 – 0.20	-0.13	-0.52 – 0.26
Follow-up appointments (no, yes)	-0.21	-0.73 – 0.32	-0.07	-0.58 – 0.44
Cardiac rehabilitation (no, yes)	-0.84 * *	-1.48 – −0.20	-0.80	-1.43 – −0.17
Sum score (received advice 0 – 3 times)	-0.19	-0.39 – 0.15	-0.15	-0.35 – 0.05

*$p < .10$ **$p < .05$, ***$p < .01$. Multivariate analysis are adjusted for age, sex, and BMI.

opportunity for timely behavioral advice [20,21,23]. However, there remains a lack of clarity regarding when lifestyle advice after a cardiac event hospitalization is effective, how patients perceive such advice, and how healthcare professionals can best support patients in making lifestyle changes [33]. We therefore used realist evaluation principles [35] to uncover best practices and optimal timing of lifestyle advice from the perspective of cardiac patients. Our findings indicate that patients are generally receptive to lifestyle advice across all phases of the cardiac care trajectory, and evaluate it positively when offered, suggesting the presence of a potential TW [21]. This underscores the importance of delivering lifestyle advice at the right moments during the cardiac care trajectory. These findings resonate with prior research demonstrating the acceptability of advice during potential teachable moments [22, 41–43].

We additionally discovered that patients who received lifestyle advice demonstrated a greater intention to adopt healthy lifestyle changes, particularly when the advice was provided at multiple points during the care process. These findings contribute to the ongoing conversation surrounding the efficacy of brief lifestyle advice. While they align with prior research demonstrating positive outcomes of brief lifestyle advice in secondary care [33,44–46], they stand in contrast to many studies conducted in primary care, where such effects have been less pronounced [47]. One potential explanation could be that patients in a primary care setting may perceive less urgency to act upon the advice, as they may lack the heightened receptivity associated with a strong TW.

Our study revealed important insights into patients' preferences regarding the manner of lifestyle advice, complementing previous research findings. Similar to our findings, previous research also underscored the importance of providing clear information on healthy diets and practical and feasible tips for modifying daily habits [30,48, 49]. Our results reinforce that *how* healthcare providers present educational content, influences engagement with lifestyle change [30, 50]. Also, similar to previous research, we found that tailoring advice to each patient's unique identity and context is crucial, as behavior changes that align with one's identity are easier to maintain [51,52]. Therefore, cardiac healthcare providers should adopt patient-centered principles, engaging in open conversations and collaboratively setting personalized behavior change goals with their patients; a strategy linked to improved outcomes [27,50,53,54]. Additionally, our finding that patient preferred genuine, non-judgmental, and empathetic conversations about cardiac disease management, reiterates previous findings [30,55]. Furthermore, in a review towards identifying effective behavioral change techniques, risk communication emerged as one of the most effective strategies [56]. Similarly, we found that patients prefer raising their awareness of how lifestyle impact theirs health. However, the review also highlighted the efficacy of self-monitoring of behavior and the use of social support, strategies that we did not specifically uncover but are nonetheless valuable to consider.

Our finding that nearly half of our participants reported not receiving any lifestyle advice during their hospital stay or follow-up appointments underscores an important missed opportunity. While it is possible that some patients did receive advice but not perceive it as such, the relatively low numbers are generally comparable to previous studies in cardiometabolic care [28,57,58]. Additionally, similar instances of missed opportunities have been noted in other healthcare settings [59,60]. Considering that patients are most receptive during the early recovery phase, possibly due to an increased readiness to regain control of their health [48,61], it is crucial to provide lifestyle advice already in the hospital setting. Although receptiveness persisted across all phases, there was a preference for receiving lifestyle information during CR, potentially influenced by the majority of advice being offered during that period. Patient preferences for the timing of health information vary across studies as well [30,62].

Our results also indicated that patients perceived lifestyle advice from cardiologists as having the greatest self-reported impact, followed by other healthcare professionals involved in CR such as dieticians and physiotherapists. These findings align with a previous study by O'Higgins et al. [63] and emphasize the crucial role of these physicians in providing lifestyle advice during cardiac care. However, differences in the self-reported impact across the various healthcare professionals were relatively minor. It is plausible that patients' perceptions of the trustworthiness and knowledgeability of their healthcare providers have a greater influence on the impact of lifestyle advice [51]. Overall, patients see physicians as their primary source of health information and consider it their responsibility to offer advice [64]. They regard lifestyle advice as an expression of care and responsibility, particularly when tailored to their unique life circumstances [65].

Younger cardiac patients seemed more receptive to lifestyle advice, consistent with Alsaqri et al. [61]'s findings. Possibly, younger CVD patients exhibit less healthy lifestyle behaviors compared to their older counterparts [66], potentially making them feel more vulnerable and motivated to take action to reduce their risks. Interestingly, we found no other demographic characteristics significantly linked to receptiveness to lifestyle advice. This differs with studies on the acceptability of advice during cancer screening, which identified factors such as non-white ethnicity, higher education, and being female as influencing higher acceptability [43,67]. Our findings suggest that lifestyle advice should be targeted to all patients following a cardiac event, regardless of their sociodemographic characteristics. It is worth tailoring the content of advice based on various characteristics, however, as patient preferences for the type of health education may differ across various groups [68]. For instance, younger patients might be more inclined to prefer online education [69,70].

The present study had several strengths, including the use of a realist evaluation approach that incorporates the patient perspective when seeking to understand how lifestyle advice should be delivered [35]. Furthermore, the use of both qualitative and quantitative measures provide a comprehensive understanding of the subject matter [71]. In addition, the study's results have immediate practical implications, with especial relevance to cardiac care settings. Several limitations should also be acknowledged. The retrospective nature of the study and the use of self-reported data introduce potential recall and self-report biases [72], as participants may not accurately remember the content and manner of delivery of lifestyle advice, the healthcare provider from

whom they received it, or their original preferences concerning advice. Additionally, selection bias may have led participants with the most interest in lifestyle advice to participate in the study. Furthermore, the study did not consider demographic or provider characteristics of healthcare providers, such as their age, gender, or years of working experience, which may have impacted patients' willingness to comply with advice. This is a worthwhile subject for future research. Finally, the study's cross-sectional design precludes the determination of the most effective approach to sustaining a healthy lifestyle over the longer term. Therefore, future studies should employ a prospective approach with objective lifestyle measures to validate these findings.

4.2. Conclusion

In conclusion, this study provides useful insights concerning the optimal use of the teachable window (TW) that occurs following an acute cardiac event. Cardiac patients are open to receiving lifestyle advice throughout their treatment journey, and receiving advice at various phases in this journey can have a positive impact on their willingness to make healthy lifestyle changes. Healthcare professionals in cardiac care should take advantage of the TW by providing feasible, patient-centered, and tailored lifestyle advice at the appropriate time to motivate and inspire patients to adopt healthier lifestyle habits.

4.3. Practice implications

This study has important implications for the timing and delivery of lifestyle advice following an acute cardiac event. To optimize impact, lifestyle advice should be initiated immediately after hospital admission, preferably by a cardiologist, and continued during follow-up appointments and CR. Healthcare providers working in cardiac care may benefit from training in effective methods and timing of lifestyle education, with skill training known to yield positive results [50]. To promote the formation of positive behavioral habits, advice should be emphatic, tailored to individual needs and values, and include simple and feasible behavioral suggestions [73]. Furthermore, understanding patients' perceptions of the causes of their CVD can help healthcare providers enhance their impact. Short questionnaires can be utilized to assess perceptions and align advice accordingly. Moreover, given that patients tend to underestimate the contribution of modifiable risk factors and the discrepancy between the views of physicians and patients concerning risk factors [74], patient education about these risk factors may also be valuable. Our study also highlights an unfilled need for lifestyle support during the time gap of several weeks between hospital discharge and start of CR, a problem identified previously [75]. This underscores the potential for (eHealth) support interventions during this gap [70,76,77]. To optimally exploit the TW, future studies should investigate barriers and facilitators experienced by healthcare providers when providing lifestyle advice in cardiac care, using approaches such as the Theoretical Domains Framework [78]. Finally, understanding healthcare providers' needs and perceptions of best practices can inform the development of new approaches to provide lifestyle advice in the most effective manner.

CRediT authorship contribution statement

Nienke Ter Hoeve: Writing – review & editing. **Mattijs E Numans:** Supervision, Writing – review & editing. **Winifred A Gebhardt:** Writing – review & editing, Methodology, Formal analysis, Conceptualization. **Michelle Brust:** Writing – original draft, Methodology, Investigation, Formal analysis. **Jessica C Kiefte-de Jong:** Writing – review & editing, Supervision, Project administration, Methodology, Conceptualization, Formal analysis, Funding acquisition.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.pec.2024.108279.

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