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Implementation and user evaluation of an eHealth technology platform supporting patients with cardiovascular disease in managing their health after a cardiac event: mixed methods study

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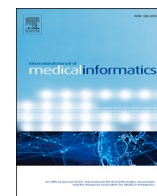
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An overview of facilitators and barriers in the development of eHealth interventions for people of low socioeconomic position: A Delphi study

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ABSTRACT

Objective: eHealth interventions can improve the health outcomes of people with a low socioeconomic position (SEP) by promoting healthy lifestyle behaviours. However, developing and implementing these interventions among the target group can be challenging for professionals. To facilitate the uptake of effective interventions, this study aimed to identify the barriers and facilitators anticipated or experienced by professionals in the development, reach, adherence, implementation and evaluation phases of eHealth interventions for people with a low SEP.

Method: We used a Delphi method, consisting of two online questionnaires, to determine the consensus on barriers and facilitators anticipated or experienced during eHealth intervention phases and their importance. Participants provided open-ended responses in the first round and rated statements in the second round. The interquartile range was used to calculate consensus, and the (totally) agree ratings were used to assess importance.

Results: Twenty-seven professionals participated in the first round, and 19 (70.4%) completed the second round. We found a consensus for 34.8% of the 46 items related to highly important rated barriers, such as the lack of involvement of low-SEP people in the development phase, lack of knowledge among professionals about reaching the target group, and lack of knowledge among lower-SEP groups about using eHealth interventions. Additionally, we identified a consensus for 80% of the 60 items related to highly important rated facilitators, such as rewarding people with a low SEP for their involvement in the development phase and connecting eHealth interventions to the everyday lives of lower-SEP groups to enhance reach.

Conclusion: Our study provides valuable insights into the barriers and facilitators of developing eHealth interventions for people with a low SEP by examining current practices and offering recommendations for future improvements. Strengthening facilitators can help overcome these barriers. To achieve this, we recommend defining the roles of professionals and lower-SEP groups in each phase of eHealth intervention and disseminating this study's findings to professionals to optimize the impact of eHealth interventions for this group.

1. Introduction

Advances in technology have introduced new ways to help people

monitor and manage their health. These advances include eHealth interventions, which use new information and communication technologies, such as tablets and smartphones, to help people change their

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lifestyle behaviours to improve their health [1–4]. Consequently, eHealth interventions have become an important instrument for empowering people with and without chronic illnesses to take charge of their health and improve their care management [5,6], while also offering more cost-effective and effective interventions [7,8]. Additionally, eHealth interventions allow healthcare professionals to deliver tailored, personalized care that can be accessed on demand [9]. However, the requirement for eHealth interventions to be dynamic, useful and easy-to use for all users is currently not being met. This poses a challenge for the adoption of such technology, especially when it comes to vulnerable individuals such as people with a low socioeconomic position (SEP) [10]. Lower-SEP groups include people with low education and/or low income levels and people living in low-income neighbourhoods [11]. Developing eHealth interventions may be especially important for people with low SEP as they are more likely to engage in unhealthy behaviours [12,13]. These behaviours can lead to increased rates of non-communicable chronic diseases such as cardiovascular disease, compared to high-SEP groups [14,15]. Additionally, health inequalities associated with low SEP are linked to a reduced life expectancy of 5 to 10 years and a reduced disability-free life expectancy of 10 to 20 years [16]. Interventions often fail to consider the characteristics of people with low SEP, as this is a complex group who face a range of challenges in daily life. For example, people with low incomes may struggle with essential needs, such as food and housing, in addition to facing difficulties paying for clothes and other goods and services, such as social activities for their children [17,18]. Therefore, they may not use eHealth interventions as intended. Moreover, people with low SEP generally exhibit low health literacy and low digital literacy skills, which altogether could influence intervention uptake [10,19,20]. Although eHealth can have major benefits for vulnerable individuals such as people with low SEP, the vast majority of current eHealth interventions are developed for people with average health and digital skills [10,21]. There is consistent evidence that eHealth interventions often do not fit the needs and skills of people with low SEP, which can cause the rejection or non-use of these interventions, exacerbating health disparities between different socioeconomic groups [10]. Thus, it is crucial to tailor eHealth interventions to the target group's skills, needs and wishes.

Numerous studies have highlighted barriers to eHealth interventions among professionals and eHealth users [7,9,22–24]. These barriers include a lack of incentives to use eHealth interventions, such as perceiving insufficient benefits for individuals' health and well-being, which leads to resistance in adoption [9]. Financial feasibility poses another significant obstacle, as there are often no clear financial benefits for professionals, and the responsibility for costs remains unclear [9,25]. Moreover, concerns regarding privacy and security issues [7] when sharing health or medical information through eHealth have been identified among both professionals and eHealth users [9]. However, limited knowledge exists regarding factors that hinder or facilitate eHealth uptake among people with a low SEP [19]. Addressing this challenge requires a better understanding of the key barriers and facilitators concerning the adoption and use of eHealth technology within the target group. Current guidelines for eHealth development for the lower-SEP groups primarily focus on improving usability and producing suitable content for the target group's characteristics, such as the ease of reading and use of visual aids [26]. While previous research, has primarily focused on eHealth for lower-SEP populations from the perspective of end users [27–29], few studies have collected information on barriers and facilitators concerning use of eHealth technology among this target group from professionals [30]. Additionally, no studies so far systematically examined which barriers and facilitators are encountered across the different phases of eHealth intervention uptake for people with low SEP. Despite one recent scoping review that identified large variations among studies with respect to barriers and facilitators in different phases of uptake of eHealth lifestyle interventions (e.g. development, evaluation) for people with low SEP, this area remains

underexplored [19].

1.1. The current study

In this study, we aimed to examine which barriers and facilitators anticipated and experienced by professionals (e.g., researchers, health professionals) with experience in eHealth interventions for low-SEP groups or who closely collaborate with this population across the development, reach, adherence, implementation, and evaluation phases of eHealth interventions. Identifying these barriers and facilitators is crucial for ensuring that eHealth interventions are suitable for the target group to effectively help change lifestyle behaviours to improve overall health. Insights gathered from professionals were used to establish a consensus on barriers and facilitators regarding the different phases of eHealth interventions, which can inform recommendations for eHealth interventions targeting lower-SEP groups.

2. Methods

2.1. Study design

We used a Delphi technique, which involves gathering expert opinions through anonymous sequential questionnaires or “rounds” [31], to identify barriers and facilitators in the phases of eHealth intervention uptake: development, reach, adherence, implementation, and evaluation. These five phases were selected based on prior research [19], as they are considered an umbrella for the uptake of eHealth interventions.

2.2. Design and content of the questionnaires

In this study, Online questionnaires were developed and administered using Qualtrics survey software [32]. Because of large differences between studies on barriers and facilitators identified in a scoping review [19], the first-round questionnaire (Delphi-1 inventory questionnaire) used open-ended questions to gather qualitative data. The second-round questionnaire (Delphi-2 consensus questionnaire) was used to assess the extent to which professionals agreed on the barriers and facilitators identified in the first round. The study was conducted between April 2020 and April 2021. Both questionnaires were pre-tested among a separate sample of researchers and health professionals, who provided feedback on the comprehensibility of the questions and statements. To provide participants with a better understanding of our reference to ‘eHealth interventions,’ we relied on the definition of eHealth provided by the World Health Organization [26]. Additionally, we used the following explanation: “eHealth interventions play an increasingly important role in healthcare. These interventions employ new information and communication technologies, such as tablets and smartphones, to assist individuals in making behavioural changes for improved health.

The Delphi-1 inventory questionnaire collected information about the barriers and facilitators experienced in different phases of intervention development. For example, we asked: “What do you think are the main barriers experienced in developing eHealth (lifestyle) interventions for people with low SEP?” Additionally, the questionnaire contained closed-ended questions regarding the backgrounds of the participants and their eHealth use. For example, we asked: “In what way do you work with people who have low SEP?” Non-responders received a reminder two weeks after the first questionnaire was sent.

The data collected from the first round were employed to develop the statements of the Delphi-2 consensus questionnaire (see Appendix A). Themes from the first round were incorporated into each phase, with multiple statements addressing facilitators and barriers for each theme in that phase. For example, in the theme of *engagement*, a statement read as follows: “It is particularly crucial to allow individuals with low SEP to establish short-term objectives to promote sustained use of the eHealth intervention.” Participants rated each statement on a 7-point Likert scale

(1 = *strongly disagree* to 7 = *strongly agree*) [33,34]. Additionally, they were allowed to propose new items by using an open-ended field for each theme. The second round comprised the participants from the first round. Non-responders received a reminder two weeks after the questionnaire was sent. To improve response rates during the second round, non-responders were also contacted by telephone.

2.3. Participants and procedure

To select participants, we conducted a stakeholder analysis. This analysis consisted of identifying participants via relevant scientific literature and expert recommendations (e.g., institutes for low SEP, our consortium, and people who work with low-SEP groups) and snowball sampling (i.e., asking involved professionals to name other relevant stakeholders) [19,35]. We approached selected professionals via e-mail or telephone. The selection criteria are presented in Text Box 1. Based on the stakeholder analysis, we identified five expert groups: healthcare professionals (e.g., nurses, doctors, social workers), researchers, communication experts, eHealth developers, and policy officers. From each group, we invited between three and six participants to participate in the study. All the information was processed anonymously. Identifying information was removed before coding, and participant identification codes (e.g., profession and number) were used instead. We obtained ethical approval from the Psychology Research Ethics Committee at the University of Leiden (CEP19-0909/454).

2.4. Data analysis

A Microsoft Excel spreadsheet and a qualitative analysis program, NVivo software [36], were used to analyse and code the qualitative data of first-round questionnaire (Delphi-1 inventory questionnaire). We applied thematic analysis to code the responses to the open-ended questions [37]. First author (IA) performed the initial coding, and another author (TR) reviewed the codes; differences in interpretation were discussed to reach a consensus. Next, in different rounds, IA and TR grouped the codes into themes related to barriers and facilitators. Then, the themes were organized in a structured approach under the five phases of eHealth intervention uptake: development, reach, adherence, implementation, and evaluation.

To assess whether there was a consensus on a specific statement in the Delphi-2 consensus questionnaire, we calculated the level of consensus using interquartile range (IQR) deviations [33,34]. A consensus was recognized if the IQR was 1 or below on a 7-point Likert scale [33,34,38]. An IQR of 1 or less indicates that over 50% of all opinions fell within 1 point on the scale.

To assess the importance of barriers and facilitators, we calculated the percentage of participants who rated each statement regarding the importance of barriers and facilitators as either 'agree' or 'strongly agree.' If a barrier or facilitator was deemed important to at least 50% of all professionals, we considered the barrier or facilitator as being important.

3. Results

3.1. Participants

In the first round, the 27 participants represented five types of professionals (see Table 1). The majority (92.6%) worked to improve the health of people with low SEP. The second round comprised 19 of these participants (70.4% retention rate).

3.2. Round 1 findings: Qualitative data

Participants were asked to briefly describe their understanding of the term "low socioeconomic position". The most common responses cited a low income and low education level (73.0%). Another noted factor was low health literacy (19.1%). One participant believed that people with low SEP are vulnerable because of factors that include their ethnicity, living environment, education level, skills, and support network. The qualitative data provided in the first round is presented in Tables 2.

3.3. Round 2 findings: Consensus and importance

After reviewing the qualitative results of the first round, 108 statements were formulated for the second round to provide insight into the level of professionals' consensus, indicated by an IQR of ≤ 1 [33], and importance rating indicated by $> 50\%$ (totally) agreement on importance. A consensus was found for 34.8% of the 48 items related to barriers and 80% of the 60 items related to facilitators (see Appendix A). Professionals rated 12 barriers as highly important, with 7 lacking consensus, and identified 53 facilitators as highly important, with 8 lacking consensus (see Appendix A).

Several of the identified themes (e.g., *everyday life, involving low-SEP groups*) emerged in more than one phase. Therefore, the results are not discussed per phase but according to the theme content, focusing on the barriers and facilitators that reached consensus. A detailed summary of

Table 1
Demographic information of participants who completed round 1 ($n = 27$).

Professional characteristics	Working with low SEP ($n = 25$) n (%)	Applying (eHealth) lifestyle interventions to people with a low SEP ($n = 14$) n (%)
Current employment role(s)*,		
Researcher**	7 (28)	2 (14)
Health professional***	13 (52)	8 (57)
Policy officer (management)	7 (28)	6 (43)
Communications expert	1 (4)	
eHealth developer	1 (4)	1 (7)

* Some participants reported multiple roles.

** Such as researcher, university professor.

*** medical specialist, general practitioner and nurse, paramedic (social worker and dietitian), and psychologist.

Text Box 1

Stakeholder identification criteria.

- Option 1: A stakeholder can be a person who has experience in the development, use, or implementation of eHealth interventions, including eHealth low-SEP groups.
- Option 2: A stakeholder does not need to be an expert or have a great deal of knowledge in the field eHealth. People who are interested in lower-SEP groups, people who develop, implement, or make policy regarding lower-SEP groups, or professionals who work with these target group can be considered stakeholders. For example, a start-up or eHealth company that offers a suitable product for lower-SEP groups (but without much knowledge or expertise in this area) can be considered a stakeholder.

Table 2

Identified themes in eHealth intervention development, reach, adherence, evaluation, and implementation.

Phase	Description	Quote
Development		
Involving people with a low SEP	Involving people with a low SEP in the development phase	“Co-creation: involving people from the target group in thinking, decision-making, and working on the intervention, for example through ambassadors” (Researcher 2)
Involving professionals	Involving experts in the development stage	“Engaging experts, such as knowledge institutions on low literacy and low health literacy.” (Health Professional 3 and Policy Officer 7)
Everyday life of people with a low SEP	Considering the everyday lives of people with a low SEP	“The intervention fits into the daily life of the target group and aligns with what is already being done in their daily lives.” (Health Professional 1)
Knowledge of professionals	Professionals may benefit from acquiring further knowledge regarding the everyday life of people with low SEP, or the technological equipment used by this target group.	“To gain insight into people’s living environments, developers can participate in focus groups with individuals from a low socio-economic status (SES) and healthcare professionals/stakeholders, or literally walk and live with people from a low SES” (Health professional 1)
Rewards	Rewarding people with a low SEP to encourage their participation	“... reimbursement of expenses (e.g. travel costs) if participants have to go to a certain location for a research session/measurement.” (Policy officer 4)
Time and financial resources	Resources needed to develop the intervention	“Make sure to discuss with financiers in advance what is needed to qualify for reimbursement (via health insurance, via municipal insurance, via healthcare organizations, etc.).” (Policy officer 6)
Reach		
Communication	Verbal and written communication level that matches low SEP groups and reaches them	“It is important to tailor the communication to the educational level” (Communications Expert 2). “Don’t patronize” (Health professional 1) “Respectful approach towards participants” (Health Professional 2 and Researcher 2)
Engagement	Factors that can sufficiently motivate people with a low SEP	“Game elements can certainly help, but it depends on age” (Health Professional 4)
Involving professionals	Involving professionals in the development phase	“Get informed by people who have expertise on the subject.” (Health Professional 1)
Everyday life	Understanding the everyday lives of people with a low SEP to devise a suitable intervention	“Connecting with the target audience where they already are is key, and sometimes a health-focused approach may not be the most logical. In these cases, thinking broadly or rephrasing can be effective strategies to

Table 2 (continued)

Phase	Description	Quote
Finding people with low-SEP	Reasons professionals are unable to reach people with a low SEP	increase engagement and connect with the audience in a meaningful way” (Researcher 5) “Using physical locations in neighbourhoods to reach the target group” (Researcher 5) “Visit locations ourselves and explain our intentions face-to-face. For instance, we visit community centres every so often and have recruited people through a personal presentation at a patient meeting in a hospital” (Researcher 2)
Reach strategies	Strategies that can be used to reach people with a low SEP	“Low-threshold titles (e.g. coach instead of psychologist), simple language (using dialects can be very accessible and I personally receive positive feedback, and it is a direct icebreaker). (Paramedic 2) “Using social media.” (Researcher 3 & Policy officer 6) “Find the right approach for this target group. Where is the existence of this eHealth intervention communicated best, at the general practitioner’s office, in a shopping centre, at the subway station, or at community centres?” (Communications Expert 2).
Knowledge of professionals	Professionals knowledge about how to reach the target group	“More education about health literacy and low literacy levels in training” (Policy Officer 4)
Rewards	Rewarding people with a low SEP to encourage their participation	“Use a playful approach with rewards” (Policy Officer 6)
Social environment	Using the social network to reach the target group	“Involve people in the target group’s environment, such as individuals in the neighbourhood or trusted individuals like a general practitioner (although they may have limited time) or a social worker” (Policy officer 3)
Time and financial resources	Resources needed to successfully reach the target group	“Make it easily accessible at low cost” (Health Professional 4)
Usability	Factors that help people with a low SEP use eHealth interventions	“Don’t make the application too difficult or complex” (Paramedic 4)
Adherence		
Communication	Different forms of communication that can be used to reach people with a low SEP	“Use simple language and avoid English terms” (Policy officer 6)
Engagement	Factors that can sufficiently motivate (continued) use	“Incorporating more playful/game elements into the intervention, but keep in mind that their effectiveness may depend on the age of the participants.” (Paramedic 2 & Health Professional 4) “Motivating to use (reminders, indicating the added value of use to the target audience).” (Researchers 3)

(continued on next page)

Table 2 (continued)

Phase	Description	Quote
Involving low SEP groups	Involving people with a low SEP in every step	"Find out what people need to achieve behavior change (engage in conversation!)" (Policy Officer 4)
Everyday life	Professionals having the necessary communication skills to reach people with a low SEP	"Do not only focus on lifestyle, but also on other issues that are at play" (Health Professional 1)
Modes of delivery	Technology that fits the skill levels of people with a low SEP	"Consider making advice available for the eHealth intervention, even though it may be a costly solution" (Policy Officer 2)
Social environment	Social environments of people with a low SEP	"Use key figures/contact persons or hostesses to ensure good communication and relationship building" (Researcher 5) "Involve partners/loved ones and other people with similar experiences" (Paramedic 2)
Knowledge of people with low-SEP	Knowledge of people with a low SEP about their health.	"Encourage people to consciously consider the benefits they have experienced since using it" (Researcher 3)
Motivation of people with low-SEP	Different factors that influence the motivation of people with a low SEP.	"Ensure that professionals have the necessary skills (motivational interviewing)" (Policy Officer 4)
Rewards	Rewarding people with a low SEP to enhance their participation	"Implement a reward system based on performance" (Health professional 6)
Usability	Factors that promote the user-friendliness of eHealth interventions	"Provide simple instructions" (Policy Officer 4) "Make it as simple as possible" (Researcher 7 and eHealth developer)
Evaluation Engagement	Engaging people with a low SEP during and after the evaluation	"Consider what could make participation in the evaluation more interesting" (Researcher 2) "Always provide feedback to participants on what has been done with their feedback, and if applicable, why it was not acted upon" (Policy officer 4) "Explain to people why participating is important, for example: by participating, you are helping to make your neighbourhood safer for your children, or you are helping to ensure that people with the same blood type as you can also receive blood if needed after surgery" (Policy officer 4)
Evaluation methods	Simple evaluation methods	"Feedback rounds in a game format" (Researcher 2) "Use of emoticons for evaluation" (Communications Expert 2)
Everyday life	Alignment of evaluations with the everyday lives of people with a low SEP	"Ensure that the intervention aligns well with the target group's needs" (Researcher 3)
Planning evaluation	Facilitators to plan the evaluation	"Shorter evaluation studies" (Researcher 3) "Manage expectations (not everything can be changed/adapted to the participants"

Table 2 (continued)

Phase	Description	Quote
Time and financial resources	Time and financial resources of professionals that is needed for evaluation	preferences, but there may be room for compromise) " (Policy officer 4) "Let these people test what you are creating and ensure that you have the financial resources and time for adjustments." (Policy officer 4)
Implementation	Effect of the intervention	Exiting knowledge about the effectiveness of the eHealth intervention
Implementation planning	Facilitators to plan the implementation	"Design effective interventions" (Health professional 1) "Assign someone to the eHealth project with knowledge of eHealth" (Paramedic 1)
Time and financial resources	Resources needed to successfully implement the eHealth intervention	"Structural funding would definitely help and make knowledge more easily accessible. It is not necessary to demand 100% immediately, but start with the low-hanging fruit" (Researcher 7 and eHealth developer)
Involving professionals	Collaboration with other professionals	"Cooperation from all levels within a supporting organization/institution" (Researcher 7 and eHealth developer)
Privacy	Considering participants' privacy	"Providing privacy and safety" (Researcher 6 and Paramedic 6)

all results is available in the [supplementary material](#).

3.3.1. Individual and social context

The overarching *individual and social factors* theme comprises various sub-themes, which include *involving people with low SEP*, *everyday life*, *knowledge of people with low SEP*, and *social environment*. Within the sub-theme of *involving people with low SEP*, recruiting people with low SEP was deemed an important barrier, while involving them from the beginning was identified as a facilitator (rated important by 84.2%). In the *everyday life of people with low SEP* sub-theme, the misalignment of eHealth content with the daily challenges faced by people with low SEP, such as unemployment and housing issues, was identified as a barrier to reach the target group and sustained use (e.g., with an importance rating of 57.9%). To overcome these barriers, the participants suggested aligning eHealth interventions with the everyday lives of people with low SEP and addressing their specific problems (e.g., financial constraints).

Furthermore, in the *social environment* sub-theme, participants recognized the integration of key individuals, such as peers, partners, and relatives of people with low SEP, into an eHealth intervention as a facilitator to reinforce sustained use (rated important by 63.1%).

However, certain barriers and facilitators were still considered important, even in the absence of consensus among professionals. For example, in the sub-theme of *social environment*, professionals emphasized the importance of consulting experts with lived experience and peers to reach people with a low SEP, with 63.2% of professionals agreeing on its importance.

3.3.2. Motivation and engagement

The overarching *motivation and engagement* theme comprises several sub-themes, such as *rewarding the target group*, *engagement*, *motivation of people with low SEP*, *communication*, and *usability*. Rewarding the target group can facilitate the development, implementation, and adherence

phases. Incentives, such as travel allowances or group cooking sessions, can stimulate participation in eHealth interventions, and rewarding this target group for contributing ideas to intervention development can also be helpful. Moreover, professionals deemed the provision of appropriate rewards important to encourage participation in evaluation studies, with an importance level of 68.4%, despite lacking consensus among professionals.

Within the *engagement* sub-theme, sending reminders to users emerged as an important facilitator for continued usage of eHealth intervention, as rated important by 79% of professionals. In the *usability* sub-theme, professionals reached a consensus on several highly rated facilitators, such as making eHealth interventions accessible to end-users (rated important by 94.7%) and providing technical support during installation and use (rated important by 79%). Furthermore, sending reminders to users emerged as an important facilitator for continued usage of eHealth intervention. In the *usability* sub-theme, a consensus was found on several facilitators, such as making eHealth interventions accessible to end-users and providing technical support during installation and use. This support can be achieved by providing channels to request help. However, professionals rated the facilitator emphasis on making the evaluation process enjoyable for people with low SEP, with 68.4% considering it important, despite lacking consensus among professionals.

In the *communication* sub-theme, the identified barriers include inadequate communication and unsuitable recruitment materials. Facilitators for reaching the target group include developing materials in different languages and using positive approaches (including compliments and respect).

3.3.3. Professionals' resources

In the overarching theme of *professionals' resources*, several sub-themes were identified, including the *knowledge of professionals*, *involving professionals*, and *resources*. In the *knowledge of professionals* sub-theme for instance, professionals often lack awareness of the technological devices used by people with low SEP, such as PCs or smartphones. However, the importance level of this barrier was rated low by professionals (21.1%).

Moreover, in the *involving professionals* sub-theme, professionals agreed that collaborating with experts from the outset of the development phase, using the expertise of institutions or eHealth practitioners with experience with low-SEP groups for reach (rated important by 89.5%), and involving professionals and project staff in intervention development, are important facilitators (rated important by 78.9%). Furthermore, professionals stressed the importance of enthusing professionals to use eHealth, with an importance level of 62.9%, despite lacking consensus.

In the overarching *financial resources of professionals* theme, insufficient budgets and limited time to establish trust with potential participants were identified as barriers to reaching the target group. The lack of structural funding is a barrier to the sustainable implementation of eHealth interventions (rated important by 57.9%). Important facilitators include funding for developing eHealth interventions for people with low SEP (rated important by 84.2%) and resources for training professionals to reach the target audience and implement eHealth interventions (rated important by 63.2%).

3.3.4. Development evaluation and implementation of eHealth interventions

The overarching theme of *evaluation and implementation of eHealth interventions* encompasses several sub-themes, including *communication*, *modes of delivery*, *evaluation methods*, *planning evaluation*, and *implementation*. In the *modes of delivery* sub-theme, combining eHealth interventions with face-to-face guidance and providing (free) necessary devices for the target group were identified as effective facilitators. In the *planning evaluation* sub-theme, professionals' insufficient knowledge regarding best practices, including inadequate skills to assess target group needs and lengthy questionnaires, posed a barrier. However, an

important facilitator identified was the adoption of a user-centred design approach that involved end-users and professionals, along with the assessment of the eHealth intervention with target groups at different stages, which received a high level of importance (e.g., 84.2%). Regarding the *evaluation methods* sub-theme, professionals perceived the barrier of limited knowledge regarding the best approach and timing for evaluating eHealth interventions as having a low level of importance (rated important by 15.8%).

In the *implementation planning* sub-theme, inadequate preparation by professionals was identified as a barrier, but examining long-term implementation from the start can be helpful. In the *implementation execution* sub-theme, participants agreed that misalignment with daily practices or values of professionals offering the intervention can hinder successful implementation. A facilitator in this theme is the training of professionals in eHealth, including assessing patients' digital and health literacy levels. Appointing an eHealth implementation expert as a project manager was also found important.

4. Discussion

This Delphi study aimed to identify the barriers and facilitators encountered by professionals employing eHealth interventions for people with low SEP across five phases: development, reach, adherence, implementation, and evaluation. The findings indicate that some barriers and facilitators are related to the target group of people with a low SEP, including their daily lives and social environments, while others are linked to professionals, such as their knowledge, resource availability, and involvement. Additionally, several barriers and facilitators were associated with the eHealth intervention methods, including the delivery mode (e.g., combining eHealth interventions with face-to-face sessions). The study thereby provides a real-world perspective on the challenges faced by researchers, health professionals, and policy officers when employing eHealth interventions for people with low SEP. The diversity of barriers related to people with low SEP is determined by individual and contextual factors. On the other hand, applicable solutions (facilitators) are more universal. Therefore, prioritizing targeted solutions is necessary to effectively align eHealth interventions with people with low SEP and maximize their impact on improving health outcomes. The study also identified previously overlooked barriers and facilitators, providing valuable insights and concrete recommendations to guide professionals in developing eHealth interventions for this population.

Our findings suggest that the daily challenges faced by people with a low SEP can pose important barriers to the development, implementation, reach, evaluation, and adherence of eHealth interventions, which is consistent with previous research [19,39–41]. Financial instability is one such challenge that may impede their willingness to engage with eHealth interventions to improve their health. Involving end-users in all phases of the process can facilitate the success of eHealth interventions, as indicated by extensive research [19,35,42,43]. This can be achieved through various approaches, such as co-creation, focus groups, and interviews, which ensure that interventions are aligned with the target group's cultural backgrounds, daily lives, needs, and preferences. Our results emphasize that establishing respect, trust, and a non-stigmatizing environment are crucial for effectively involving people with low SEP in an eHealth implementation. Collaborations with healthcare professionals and key community representatives of the target group can motivate end-users to adopt an eHealth intervention.

The study's findings emphasize the importance of using suitable methods to gather information from people with low SEP, especially during the development and evaluation phases, as recommended by participants and supported by previous research [40,44]. Participants expressed that lengthy and complex questionnaires are unsuitable and act as a barrier in the evaluation phase. Instead, concise questionnaires, verbal interviews, and visual aids, such as emoticons, are recommended. Using suitable communication methods and collaborating with experts

experienced in working with this population to create effective content can improve the uptake and adherence of eHealth interventions.

Another important finding of our study reveals that the social environment can be a crucial facilitator during the development, reach, and adherence phases. A recent study found that people with low SEP who lack access to technological tools or have doubts about using eHealth can be motivated by enthusiastic social networks [29]. Mayberry et al. [45] found that both receiving text-message support and inviting a support person to receive messages increased the motivation to discuss diabetes. Moreover, Faber et al. [29] indicated that people with low SEP and low digital skills can access technological knowledge and skills to use eHealth by involving their social environment. Nevertheless, not all people with low SEP want to involve their network in an eHealth intervention. Therefore, it is crucial to tailor an eHealth intervention to the target group and assess from the start whether users wish to engage their social environment. Further research should explore the role that social networks could play in the uptake of eHealth interventions.

In addition, the limited knowledge of professionals about people with low SEP emerged as an important barrier to reaching this target group and developing interventions. Possible explanations for this finding include biases held by health professionals about people with low SEP and their use of eHealth, as well as insufficient digital skills, knowledge, and experience among professionals to introduce and guide the targeted group through eHealth interventions [46]. The eHealth Monitor 2021 survey results suggest that health professionals may view eHealth as less suitable for people with low SEP because of their lower levels of digital literacy [47]. Moreover, the insufficient confidence of professionals in using or recommending eHealth can hinder their encouragement of end-users, which may particularly affect people with low SEP who rely on the advice of healthcare professionals [29]. Several studies have emphasized the need for eHealth education and support for healthcare professionals [48,49]. These findings suggest that researchers and policymakers should prioritize increasing the knowledge (e.g., be aware of the cultural differences) and skills (e.g., motivational interviewing) of health professionals about the needs and characteristics of people with low SEP and eHealth through targeted training programmes.

An overarching concern that we have found is that limited financial resources pose important challenges in the development, reach, implementation, and evaluation of eHealth interventions. This can cause a domino effect that hinders different phases throughout the intervention process. For instance, insufficient funding can lead professionals to seek cost-effective solutions that may compromise important intervention preparation, such as interviews with target groups. To address this challenge, funders must recognize the importance of the activities necessary for developing interventions for the intended audience and provide adequate resources. Researchers must also be mindful of the required tasks and effectively communicate them to funders. It is crucial for researchers to develop a comprehensive plan for evaluating and implementing an intervention during the development phase [50–52]. This approach facilitates cost estimation, enables the efficient allocation of resources, and ensures the sustainability of the eHealth intervention.

Furthermore, this study identified various barriers and facilitators related to implementing eHealth interventions. Notably, these findings are not limited to low-SEP groups, but impact all users. One important barrier identified in this study is the mismatch (i.e., difficulty providing continuous technical support to patients due to a lack of resources and training) between the intervention and the needs and daily practices of healthcare professionals responsible for administering the intervention. This misalignment can lower the intervention's efficacy and limit its scalability because of professionals' resistance to adopt and integrate it. To address this issue, involving both end-users and professionals in the eHealth intervention's development phase is critical for increased adoption and successful implementation. Our study aligns with previous research that emphasizes involving key stakeholders in decision-making during the entire implementation process, including pre-delivery [51].

Murphy et al. [50] found that engaging stakeholders based on their unique context and roles can improve intervention commitment, adherence, and ownership. Therefore, collaboration among researchers, policymakers, and healthcare providers is crucial to enhancing implementation success.

Notably, there is a stronger consensus on facilitators compared to barriers. It is possible that professionals largely agree on the solutions while facing diverse challenges, which might be specific to different phases or interventions. Furthermore, although some barriers and facilitators achieved consensus, professionals' perspectives varied regarding their importance. It is thus important to note that, the lack of consensus among participants on certain barriers and facilitators identified in the second round does not suggest that they are less important than those that revealed a consensus, as still a large number (>50%) of professionals found them of high importance. For instance, there was no agreement on whether the motivation of people with low SEP presents a barrier to reaching them (rated important by 57.9%) or on using rewards as a facilitator for evaluation participation (rated important by 68.4%). The lack of consensus can be attributed to the varied professional backgrounds of the participants, who may have encountered different barriers and facilitators in their work. Additionally, not all participants had experience with all five stages of eHealth intervention development; policy officers and health professionals encounter different challenges when working with lower-SEP users.

5. Strengths and limitations

This Delphi study gathered consensus on various topics from a diverse group of professionals. The topics discussed are highly relevant to professionals who work with people with low SEP and contribute to the knowledge about this target group. The findings can be translated into actionable recommendations, which can guide professionals in their work with this population. The high response rate (70.4%) in the second round indicates that the online Delphi technique is a suitable tool and that the importance of this subject is recognized.

In addition to its strengths, this study also has limitations. Due to the limited number of participants within each group, we did not analyse possible differences between types of professionals. Therefore, we cannot determine whether certain professionals experience other barriers or facilitators. Furthermore, while the categories discussed were broad, some categories may be missing. For example, there was little emphasis on behavioural theories or other theories in the development and implementation of behaviour change techniques to promote adherence.

Additionally, not all participants had experience with all five stages of eHealth intervention development; policy officers and health professionals encounter different challenges when working with lower-SEP users. While some facilitators, such as rewards, may be effective for people across all SEP levels, further research is necessary to determine if certain factors are more successful for lower-SEP groups than higher-SEP groups. Furthermore, we did not differentiate between experienced and potential barriers and facilitators in the first round, as we asked participants in the second round to what extent they considered the listed obstacles and facilitators important.

Although the methods used in this study can be replicated, some results may not be representative of countries other than the Netherlands. The Dutch government encourages using eHealth and improving the digital skills of healthcare professionals and public access to eHealth interventions [53] and numerous studies are conducted focussing on low-SEP groups and many initiatives are launched for this population [42,54]. Therefore, it is important to consider the context of different countries and their initiatives when generalizing these findings.

6. Conclusion

This study provides a broad overview of the key barriers and facilitators perceived by different professionals in the reach, development, implementation, and evaluation phases of eHealth interventions for people with a low SEP. Knowledge from these barriers and facilitators can be used to inform eHealth developers, researchers, policymakers, and health professionals. By strengthening the facilitators, we can bridge the gap between the actual uptake and use of eHealth interventions and their intended use among people with low SEP. All professionals must recognize their responsibility to make eHealth interventions accessible to people with low SEP and consider their roles in achieving this goal. The next step would be to make these results practically applicable for professionals, for example by developing an interactive manual to help professionals overcome some of the barriers and challenges for this target group. Additionally, conducting research to determine whether eHealth (lifestyle) applications developed using this knowledge lead to improved health behaviour.

Summary table

What was already known on the topic

- People with a low socioeconomic position (SEP) with unhealthier lifestyle can benefit from eHealth interventions.
- eHealth interventions are not always suitable for this target group, which can exacerbate health inequalities.
- It is important to gain insight into the barriers and facilitators to reach the target group and develop, implement and evaluate tailored eHealth interventions.

What this study added to our knowledge.

- Barriers and facilitators occur during all phases of eHealth intervention uptake and impact a wide range of professionals, with factors related to people with low SEP, professionals, and the intervention methods.
- Strengthening facilitators who were previously overlooked can be an effective strategy for overcoming the barriers that occur during different phases of eHealth interventions for people with low SEP.
- It is important that all involved stakeholders are aware of their role and contribution to overcoming these barriers.
- Providing insights that can help reduce the digital gap for people with low SEP.

Author Statement

Study design (IA,TR, AE, NC); data collection (IA); data analysis and interpretation (IA, TR, JF, AE, LB, and all listed authors were involved in the interpretation of the data); drafting the manuscript (IA, LB, TR); manuscript revision (IA, LB, JF, RV, VJ, RK, VV, RvB, NC, AE). All authors gave final approval and agreed to be accountable for all aspects of the work ensuring integrity and accuracy.

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. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ijmedinf.2023.105160>.

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