Striving for equity in eHealth: towards inclusive eHealth for people with lower socioeconomic positions

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Wrapping up

CHAPTER 8

Summary and General discussion

"We must work together to ensure the equitable distribution of wealth, opportunity, and power in our society."

– Nelson Mandela, President of South Africa, State of the Nation Address, February 9, 1996

This dissertation aimed to achieve three primary objectives: first, to identify the barriers and facilitators influencing the development, reach, adherence, implementation, and evaluation of eHealth interventions designed for individuals with a lower socioeconomic position (SEP); second, to provide insights into supporting professionals in developing accessible and effective eHealth solutions for this group; and third, to evaluate both a practical tool and an eHealth intervention tailored to patients with cardiovascular disease (CVD).

In this chapter, the main findings of the dissertation are summarized, highlighting the key insights from the conducted studies. These findings are further discussed in terms of their implications for policy, practice, and future research.

8.1 Summary of the main findings

8.1.1 Part 1: Synthesizing existing knowledge and practical insights on eHealth interventions for individuals with a lower SEP

The first part of this dissertation aimed to synthesize existing knowledge and practical insights on eHealth interventions targeting individuals with a lower SEP.

In Chapter 2, we conducted a systematic review of 59 studies, focusing on key components, barriers, and facilitators across five phases: development, reach, use, implementation, and evaluation. These interventions were predominantly delivered via internet-based platforms (websites, email, social media, smartphone applications) and, in some cases, offline methods such as text messaging and face-to-face coaching (blended care). The findings revealed that both behavioral components (e.g., social support) and technological elements (e.g., multimedia tools) were important to the success of these interventions. Stakeholder involvement, particularly in the development and evaluation phases, was a key facilitator, ensuring alignment with the needs of target populations. However, insufficient financial resources, inadequate documentation of stakeholder involvement, and limited technical expertise were common barriers. Tailoring interventions through plain language, culturally relevant materials, and visual aids improved accessibility but was often hindered by resource constraints. Active recruitment strategies, such as face-to-face outreach by healthcare professionals, were more effective than passive approaches like distributing flyers. Collaborations with local organizations enhanced accessibility, although low trust and awareness remained challenges. Technical difficulties, low digital literacy, and language barriers limited use, while user-friendly interfaces, automated reminders, culturally resonant content, self-monitoring tools, and personalized feedback facilitated engagement. Implementation was supported by interdisciplinary collaboration, staff training, and automated feedback mechanisms. However, it was hindered by vague implementation plans, financial constraints, and limited staff time. Overall, the review highlighted substantial variability in the design, adaptation, and implementation of eHealth interventions. In **Chapter 3**, these findings were expanded through Delphi research with 27 professionals from five stakeholder groups: researchers, healthcare providers, policymakers, communication experts, and eHealth developers. The study identified 48 barriers and 60 facilitators, with consensus on 34.8% of barriers and 80.0% of facilitators. Recurring barriers included limited budgets, recruitment difficulties and insufficient time for development and implementation. Key facilitators included stakeholder collaboration, structural funding, user-centered design, and cultural sensitivity. Strategies that aligned interventions with users' everyday challenges (e.g., financial constraints) or incorporated peer and family support were recognized as essential for sustained engagement. These findings highlighted gaps between the potential of eHealth opportunities

and real-world implementation, emphasizing the need for scalable, practical solutions to ensure accessibility and effectiveness for lower SEP populations.

8.1.2 Part 2: Developing a practical tool for inclusive and accessible eHealth solutions

The second part of this dissertation focused on creating a practical tool to assist professionals in designing inclusive eHealth solutions. To ensure its relevance and effectiveness, insights from individuals with a lower SEP were integrated alongside professional perspectives. In **Chapter 4**, we explored attitudes toward health, healthcare, and eHealth among individuals with a lower SEP. Using a community-based participatory approach, data were collected through interviews, surveys, and focus groups from 66 participants from a socioeconomically disadvantaged neighborhood in Rotterdam. Two primary profiles emerged: the "optimistically engaged" and the "doubtfully disadvantaged". The "optimistically engaged" group, which accounted for approximately half of the participants, expressed trust in healthcare, a positive outlook on health, and openness to eHealth adoption. They highlighted the potential for eHealth to support their health management with minimal external intervention. The "doubtfully disadvantaged" group, representing roughly a quarter of participants, expressed skepticism toward eHealth. Their concerns stemmed from a lack of trust in healthcare systems, feelings of inequity, and the perceived complexity of eHealth tools. This group stressed the importance of reducing barriers, building trust, and addressing their specific needs. These findings highlighted the diversity of perspectives within populations with lower SEP. While optimistically engaged individuals required minimal support, "doubtfully disadvantaged" participants needed tailored approaches to address their concerns. This chapter laid the foundation for developing practical tools that are inclusive, accessible, and aligned with the needs of their intended audience. In **Chapter 5**, the insights of all previous chapters informed the development of the Inclusive eHealth Guide (IeG), designed to support professionals across five key phases: development, reach, adherence, implementation, and evaluation. The guide was developed in two stages. In the first stage, findings from **Chapters 2, 3, and 4** were synthesized into a structured framework of recommendations. In the second stage, the guide was refined through participatory design, involving 11 professionals with expertise in eHealth and in working with individuals with a lower SEP. These professionals tested a prototype version of the guide using think-aloud testing, semi-structured interviews, and surveys. Feedback emphasized the importance of clear navigation, concise content, visual elements, and practical examples. Professionals highlighted the need for a jargon-free approach to improve accessibility, a balance between scientific evidence and practical applications, and an approachable yet professional tone. Additionally, they stressed the importance of long-term implementation strategies to ensure the guide remains relevant across different professional contexts. The final IeG

integrates scientific knowledge and real-world insights, offering actionable guidance for developing inclusive, accessible, and user-centered eHealth solutions.

8.1.3 Part 3: evaluating ehealth applications

The third part of the dissertation focused on evaluating the IeG and investigating predictors of engagement and adherence in eHealth interventions. **In Chapter 6,** the usability and content of the IeG were evaluated based on feedback from professionals involved in eight different eHealth interventions. The guide was widely appreciated for its actionable advice, practical examples, and emphasis on participatory design. Its step-by-step framework was particularly valued for helping professionals navigate complex processes, such as adapting interventions for populations with lower SEP. However, areas for improvement were identified. Professionals highlighted the need for more real-life case studies, particularly for complex situations encountered in settings involving individuals with a lower SEP. They also called for more detailed implementation strategies tailored to specific contexts. Experienced professionals working in these settings emphasized the gap between broad guidelines and actionable, context-specific knowledge. These findings underscore the importance of continuously further developing the IeG to enhance its relevance and adaptability across different professional contexts. **In Chapter 7**, predictors of adherence and engagement in a blended cardiac rehabilitation (CR) intervention were explored using data from the BENEFIT project—a longitudinal study involving 658 participants across seven Dutch CR centers. Motivation, self-efficacy, and digital skills emerged as predictors of adherence to fitness and psycho-educative sessions, as well as engagement with remote-guided components. Interestingly, SEP did not significantly influence adherence, suggesting that the intervention successfully reached diverse groups. In contrast to expectations, participants with higher SEP showed lower engagement with lifestyle tele-coaching, possibly due to greater self-confidence in managing their health independently. These findings highlighted the need for tailoring interventions to individual needs. The evaluation findings not only provide empirical evidence on engagement and adherence but also confirm and refine the previously identified barriers and facilitators, reinforcing the importance of tailoring interventions to user needs. In addition to the evaluation of the IeG in **Chapters 5 and 6**, **Chapter 7** provided further insights into user behavior in a blended CR program. While the context differed, the results supported earlier findings in this dissertation. Motivation, self-efficacy, and digital skills were associated with adherence, and structured support appeared particularly beneficial for individuals with a lower SEP. These results underline the relevance of inclusive design principles such as tailoring, clarity, and support. The findings suggest that the core ideas behind the IeG may also be useful in developing engagement strategies for other types of eHealth interventions.

This dissertation demonstrates how eHealth, as an established and growing part of healthcare that affects all patients, can be designed in ways that also benefit people with a lower SEP and avoid contributing to widening existing health disparities. By combining empirical research with practical tool development, this dissertation provides both theoretical insights and concrete strategies for advancing more inclusive and accessible digital health practices. Real progress will require sustained efforts that embed such solutions within broader systemic and policy frameworks.

8.2 Discussion of the main findings

In this section, we synthesize the main findings from the different studies in relation to its three aims.

8.2.1 Aim Part 1: Synthesize existing knowledge and practical insights on eHealth interventions for groups with lower SEP

The first aim of this dissertation was to synthesize existing knowledge and practical insights into the barriers and facilitators that affect the development, reach, adherence, implementation, and evaluation of eHealth interventions for individuals with a lower SEP (**Chapters 2 and 3**). Findings from both chapters highlighted recurring challenges such as financial insecurity, limited digital access, and competing life demands—issues also widely described in earlier research on structural barriers faced by people with a lower SEP [1–4]. To address these challenges, both studies stressed the value of co-creation and participatory design as ways to better align interventions with the needs and contexts of target groups (**Chapters 2 and 3**). These findings are in line with existing literature on user-centered development practices [5,6]. Although participatory approaches are not new [7], they remain highly relevant for eHealth targeting socioeconomically disadvantaged groups. At the same time, it is important to acknowledge that participatory strategies require time, continuity, and trust—conditions often lacking in short-term projects. These approaches also raise scalability concerns, as they depend on structural continuity, which is often lacking in fragmented innovation contexts**.** Broader movements in the Netherlands, such as Gezond en Gelukkig Den Haag and Citizen Science Nederland, illustrate that sustained collaboration between institutions and communities is possible, but often depends on political and structural support [8–10].

Motivation and engagement were identified as key factors in **Chapters 2 and 3**, especially regarding intervention use and adherence. Features such as personalized reminders, simplified interfaces, and accessible support helped reduce barriers for individuals with a lower SEP by lowering cognitive demands and boosting confidence—particularly when tailored to language, content, and preferences [4]. In contrast, recruitment strategies

that lacked cultural or linguistic sensitivity limited reach and engagement, echoing earlier findings that culturally and linguistically tailored interventions better resonate with underserved groups [4,11]. Elements like tone, relatable content, and concrete examples help build trust and support sustained use.

Professionals also faced barriers, including insufficient training in digital tools and limited capacity to integrate eHealth into existing workflows (**Chapter 3**). These findings align with previous research emphasizing the need for practical training and support [12–14]. Facilitators, such as the early involvement of professionals in the design process and targeted training programs, showed promise in addressing these gaps. However, scalability remains a concern due to resource constraints in healthcare systems. Fragmented knowledge on eHealth, identified in the scoping review (**Chapter 2**) and confirmed in **Chapters 5 and 6**, highlights the need for comprehensive, actionable frameworks to support the development and implementation of effective eHealth interventions.

8.2.2 Aim Part 2: Developing a practical tool to support professionals in creating more inclusive and accessible eHealth solutions

The second aim of this dissertation was to provide insights into how professionals can be supported in developing inclusive and accessible eHealth solutions for individuals with a lower SEP. **Chapters 2 and 3** highlighted a lack of practical, context-specific resources to support this. While several frameworks exist (e.g.,[15,16], they often lack the specificity needed for implementation in socioeconomically diverse settings (**Chapter 2**). The IeG was developed in response to this gap, using a dual-perspective approach that combined findings from the literature and professional input (**Chapters 2 and 3**) with user perspectives from individuals with a lower SEP (**Chapter 4**). The profiling of subgroups, such as the optimistically engaged, doubtfully disadvantaged, and complexly challenged [17], provided concrete insight into the diversity of attitudes, capacities, and digital readiness within this population. Tailoring interventions based on these profiles aligns with segmentation approaches in behavior change theory, which emphasize personalization to increase engagement and relevance [18,19].

Findings from **Chapter 5** showed that professionals require differentiated support, reflecting needs previously described in the literature. For example, developers benefit from flexible guidance across design phases [20], healthcare providers need practical tools for use in clinical settings [13], researchers face fragmented evidence landscapes [21], and policymakers value concise, accessible summaries [22]. Improving the IeG for different professional users may require adding modular content and tailored examples to better reflect these varying needs. Although professionals (**Chapter 6**) emphasized the guide's usability, clarity, and relevance, individuals with a lower SEP, the intended beneficiaries, were not directly involved in its evaluation. Their perspectives were integrated

earlier in the research (**Chapter 4**), but they did not assess the final product. This reflects a broader critique in inclusive design research: direct user engagement is essential to ensure contextual fit, trust, and real-world adoption [23]. Future refinement cycles should therefore include usability testing with both professionals and representatives of lower SEP groups to strengthen alignment with users' lived realities.

8.2.3 Aim Part 3: Evaluating practical eHealth applications

The third aim of this dissertation was to evaluate two applications: the IeG, (**Chapter 6**), developed to support professionals, and a CR program (**Chapter 7**), aimed at patients with varying socioeconomic backgrounds. Together, these evaluations provide complementary insights into usability, implementation, and engagement in both professional and end-user contexts. The evaluation of the IeG (**Chapter 6**) confirmed its relevance for professionals involved in inclusive eHealth development. Participants valued the guide's structured layout, phase-specific guidance, and alignment with challenges in practice. Suggested improvements—such as clearer categorization and more examples—emphasized the need for ongoing refinement and contextual adaptation. Several strategies, including simplified language, multimedia formats, and onboarding protocols, have since been applied in practice. For example, the CapriXpress intervention used these elements to enhance accessibility for individuals with a lower SEP [24]. This alignment demonstrates the practical transferability of IeG recommendations in real-world design. While the IeG and DigiPHrame [16] differ in scope and function—the former as a practice-oriented design tool, the latter as a strategic evaluation framework—both emphasize iterative development, usability, and multidisciplinary collaboration. DigiPHrame focuses primarily on ethical and public health dimensions at a policy level, whereas the IeG addresses practical challenges in everyday implementation. Together, they highlight complementary pathways for bridging the gap between theoretical frameworks and real-world inclusive eHealth design. This creates opportunities for synergy between design and evaluation approaches in digital health innovation. A critical lens from Science and Technology Studies (STS) adds further nuance. Dijkstra and Horstman [25] argue that digital health tools may reinforce reductive portrayals of individuals with a lower SEP, depicting them as passive or digitally incapable. This dissertation addresses such concerns by incorporating user profiles based on subgroup differences (**Chapters 3 and 4**), and by embedding participatory, context-sensitive strategies in the IeG. Rather than treating users as a homogeneous group, the guide's approach aimed to reflect diversity and counter design assumptions. Future versions should continue to examine how representations shape both design and user experience.

Chapter 7 provided a complementary end-user perspective. Motivation, digital skills, and self-efficacy were key predictors of engagement. These findings are consistent with prior research indicating that self-confident individuals often prefer more autonomous health

management approaches [26,27]. In our study, participants with higher SEP tended to engage less with structured digital support, while those with lower SEP benefited more from guided elements such as onboarding and reminders. This supports the idea that blended delivery models combining digital and human-guided components can help address diverse needs across SEP groups [28]. Although the CR program was not directly based on the IeG, the observed engagement patterns align with several principles emphasized in the guide, including the value of structured support and accessible design. Digital literacy also proved to be an enabling factor, reinforcing the guide's focus on usability, clarity, and layered support strategies. While these connections remain exploratory, they suggest the potential for broader application of the IeG's recommendations beyond professional tools. Future research could examine how these principles might be adapted to strengthen engagement and equity in blended care programs for socioeconomically diverse populations.

The key contributions of this dissertation are presented in Box 1 at the end of this chapter.

8.2.4 Strengths and limitations

This dissertation makes a distinctive contribution to the development, implementation, and evaluation of eHealth interventions tailored to individuals with a lower SEP. By applying a systematic, multi-method approach—including a scoping review (**Chapter 2**), a Delphi study (**Chapter 3**), a community-based participatory study (**Chapter 4**), the development of the IeG (**Chapter 5**), a usability evaluation (**Chapter 6**), and an empirical study of engagement and adherence in a blended intervention (**Chapter 7**)—this dissertation addresses the persistent gap between theoretical frameworks and real-world application in eHealth. A notable strength is the application of participatory design principles during the development of the IeG (**Chapter 5**), in line with established multidisciplinary approaches for user-centered eHealth development [29]. Professionals were actively involved not only in the initial design but also in the iterative refinement and evaluation phases (**Chapter 6**). Although individuals with a lower SEP were not directly involved in the guide's development, the design was informed by insights from earlier studies focused on this group (**Chapters 2, 3, and 4**), ensuring relevance to practice. Another strength lies in the creation of a structured, actionable tool tailored to the needs of professionals. Unlike broader guidelines such as those from the WHO, the IeG provides concrete, phase-specific recommendations to support inclusive eHealth development. In addition, **Chapter 7** provides relevant insights into predictors of engagement and adherence, including SEP, digital skills, and psychological factors. These findings contribute to a better understanding of how sustained use of digital interventions might be promoted in disadvantaged populations. Together, these elements illustrate how this dissertation combines theoretical rigor with practical applicability.

While this dissertation provides valuable insights into the development, reach, implementation, and evaluation of eHealth interventions for individuals with a lower SEP, several limitations should be acknowledged. First, the scope of the scoping review in **Chapter 2** was limited to lifestyle interventions, excluding other important areas such as mental health, medical issues, and financial barriers. Including these topics might have offered broader insights into the barriers and needs of individuals with a lower SEP, especially given the well-documented link between socioeconomic conditions and health. Furthermore, the review did not assess the quality of the included studies or distinguish between subgroups within populations with lower SEP, such as ethnic minorities, potentially overlooking significant contextual differences [30,31], limiting the broader applicability of the findings. Second, the Delphi study (Chapter 3) included only a small number of participants within each professional group, which limited the ability to explore differences in experiences between roles. As a result, the findings primarily reflect overarching consensus rather than role-specific insights, which could be crucial for tailoring eHealth strategies to different professional perspectives. This limitation also affected the IeG, as role-specific recommendations for different user groups could not be fully developed. Additionally, as the study was conducted within the Dutch context, the generalizability of the findings to other countries with different healthcare systems or eHealth policies is limited. Third, participant recruitment in the CBPR study may have introduced selection bias, favoring individuals with relatively higher digital skills or motivation. As a result, subgroups experiencing greater disadvantage, such as individuals facing financial hardship or with a migration background, may have been underrepresented, potentially limiting the generalizability of the findings. Fourth, while the guide's recommendations (**Chapters 5 and 6)** are rooted in practical relevance, its applicability beyond the Dutch context is uncertain. Additionally, the guide was based on relatively small-scale studies, requiring further evaluation in real-world applications to assess its broader impact. Fifth, the selection of participants for **Chapters 5 and 6** might have introduced bias in the results, as the study predominantly included professionals with a positive view of eHealth. Individuals with lower SEP were not included in the guide evaluation process because the guide was explicitly developed for professional end-users. Consequently, insights into the guide's accessibility from the perspective of lower SEP groups remain limited. Evaluating the guide based on hypothetical scenarios rather than real-world applications further restricted the ability to assess its practical relevance, and socially desirable responses may have influenced the findings. Sixth, the blended CR program study (**Chapter 7**) faced limitations regarding the evaluation of adherence. While criteria were clearly defined for human-guided components—such as fitness and lifestyle-stress management sessions—there were no such benchmarks for remote-guided digital elements like tele-coaching. As a result, it was not possible to determine optimal usage levels for these components. Furthermore, incomplete log data further restricted the ability to analyze participation in digital elements such as lifestyle interventions. Finally, sample

characteristics may also have influenced the findings. The gender imbalance (70% men, 30% women) [32] and the high digital proficiency of participants may limit the generalizability of findings to more diverse populations or settings with lower digital literacy [33]. Furthermore, models explaining only a small portion of adherence and engagement variance suggest that unmeasured factors, such as external incentives, cultural barriers, or health-related characteristics, could have played a role. Future research should explore these influences to improve the design and evaluation of inclusive eHealth interventions.

8.3 Implications for practice and research

The findings of this dissertation offer significant implications for professionals involved in the development, reach, implementation, and evaluation of tailored eHealth interventions for individuals with a lower SEP. This section highlights practical applications and outlines future research directions, grounded in the themes explored throughout the dissertation. Implications are addressed across three interrelated phases: designing inclusive and accessible eHealth interventions, implementing and supporting these interventions in real-world practice, and sustaining their long-term integration within broader health systems and policy structures.

8.3.1 Designing inclusive and accessible eHealth interventions

8.3.1.1 Developing and evaluating inclusive eHealth interventions

Chapters 2, 3, and **4** highlight the importance of aligning eHealth interventions with the needs and lived experiences of individuals with a lower SEP. This research emphasizes the value of collaborative approaches, moving away from top-down strategies that impose solutions on users. Iterative and inclusive methods, such as Human-Centered Design (HCD), help address barriers like limited digital literacy, financial constraints, and competing life demands [4,24].

Participation in eHealth interventions depends on broader social determinants, including education, social cohesion, and living conditions [34,35]. However, engaging groups with lower SEP remains challenging. Some subgroups, such as the "Complexly Challenged" (**Chapter 4**) [17], experience significant time, energy, and resource constraints, making alternative engagement methods, such as interviews or observations, more effective than traditional surveys. Similarly, individuals in the "Doubtfully Disadvantaged" group [36] struggle with abstract tasks, requiring structured and simplified activities for meaningful participation. Researchers and developers must balance effective engagement with practical feasibility, ensuring that participation does not place additional burdens on these groups. Developing successful eHealth solutions for populations with lower SEP requires

combining scientific knowledge with practice-based insights. Academic research provides insights into behavioral mechanisms and intervention effectiveness, while practice-based sources, such as WHO reports, offer lessons from real-world implementation [37]. These lessons highlight strategies for overcoming common barriers, including low digital literacy, distrust in digital tools, and competing life priorities.

Iterative feedback mechanisms, such as those in the CEHRES Roadmap, enable professionals and researchers to continuously refine guidelines based on real-world experiences [20]. Another key insight from this dissertation, supported by the human factors approach [38,39], is the need for interventions to adapt to users' realities rather than expecting users to adapt to rigid systems. This adaptability is particularly important for individuals with low digital literacy or limited resources. Findings from **Chapters 2 and 3** emphasize that streamlined designs, including intuitive interfaces, visual aids, and simplified text, reduce cognitive and practical barriers, improving engagement and sustained use. Iterative feedback processes, as outlined in the CEHRES Roadmap, ensure that interventions remain relevant and adaptable to users' evolving needs [20].

8.3.1.2 Reaching populations with lower SEP

Reaching individuals with lower SEP in eHealth interventions presents unique challenges. While it is often assumed these groups are particularly difficult to reach (**Chapter 2)**, the findings of this dissertation offer an alternative perspective. **Chapters 2 and 3** demonstrate that traditional, passive recruitment strategies, such as flyers, online advertisements, and email invitations, often fail to build the trust needed to engage these groups [40]. These findings underline the value of community-based, proactive approaches. **Chapters 3 and 4** show how trusted intermediaries, such as community leaders, peers, or family members, can overcome communication barriers and align interventions with the realities of populations with lower SEP. These approaches build trust and ensure cultural relevance [41,42]. One example is the use of personalized communication through local channels. A recent study found that municipal invitation letters led to the highest response rate among strategies for reaching older adults with low SEP, although this method required more time and investment than digital approaches [43]. Embedding outreach efforts in familiar community spaces, such as schools, healthcare facilities or community centers, can also improve accessibility and engagement [44]. Beyond these targeted strategies, structural inequalities, including limited education, digital infrastructure, and unstable housing, exacerbate barriers to eHealth participation, highlighting the importance of recruitment strategies that proactively reach and engage individuals with a lower SEP [34]. Sustained outreach and long-term communication are critical for fostering trust and ensuring meaningful participation, making eHealth interventions more inclusive and equitable.

8.3.1.3 eHealth intervention components

A central challenge identified in this dissertation is the lack of detailed reporting on the specific components of eHealth interventions, which affects their long-term sustainability and practical implementation. **Chapter 2** reveals substantial variability in crucial elements, such as behavior change techniques (BCTs) and reminder features. For example, uncertainties persist regarding the optimal frequency, timing, and delivery of reminders, particularly for individuals with a lower SEP. Such inconsistencies hinder the ability to determine which components most effectively drive intervention success across diverse contexts. Recent studies [45,46] emphasize the difficulties in linking intervention components to measurable outcomes. This gap points to a pressing need for systematic approaches to evaluate and refine these components. The Multiphase Optimization Strategy (MOST) offers a promising framework for addressing this challenge [47]. Through factorial trial designs, MOST enables researchers to identify optimal combinations of intervention features, such as BCTs and reminder systems, tailored to the specific needs of individuals with a lower SEP. By adopting such structured methodologies, future research can generate robust evidence to guide the development of effective, scalable eHealth interventions. Improved transparency and consistency in reporting are essential for translating research findings into actionable practices. Without standardized descriptions of intervention components and their contextual application, it becomes difficult for practitioners and policymakers to implement eHealth solutions effectively. Future efforts should prioritize comprehensive reporting frameworks to ensure that interventions remain both evidence-based and practically applicable in diverse real-world settings.

8.3.1.4 Addressing diverse subgroups

This dissertation highlights the importance of recognizing the heterogeneity within lower SEP populations. Findings from **Chapters 2, 3, and 4** reveal that distinct subgroups—such as migrants, individuals with low literacy, and older adults—face unique challenges that affect their ability to engage with eHealth interventions. This includes individuals whose social, cultural, or economic background may not align with the dominant frameworks through which lifestyle interventions are typically developed and implemented. For example, migrants often encounter linguistic and cultural barriers that necessitate multilingual resources and culturally sensitive communication. The WHO highlights that addressing cultural and linguistic barriers is most effective when integrated into broader social policies that also consider education, housing, and economic support [48]. Future research should explore subgroup-specific strategies, recognizing the limitations of one-size-fits-all approaches. Adaptive research methodologies, which prioritize continuous feedback loops and real-time adjustments over traditional longitudinal frameworks, should be considered [49]. Embedding iterative testing and evaluation cycles into eHealth development allows researchers to create solutions that are both dynamic and sustainable. By prioritizing subgroup-specific strategies and adaptive designs, future

interventions can better address the diverse needs of socioeconomically disadvantaged groups and promote equitable access and outcomes. While HCD shows promise for tailoring eHealth interventions [50], it remains unclear whether sustained involvement of these groups ensures long-term engagement and impact. Future research should investigate the optimal frequency and stages of HCD application to engage underserved populations while maintaining feasibility.

8.3.1.5 Enhancing engagement and adherence

Our findings from **Chapter 7** suggest that multiple factors influence adherence and engagement in blended CR programs. From a practical perspective, enhancing engagement through personalized strategies appears to be key. Motivation consistently emerged as a major predictor of adherence, which is consistent with existing literature on the role of motivation in health interventions [26]. Specifically, interventions that integrate personalized goal setting, self-monitoring, and motivational interviewing are more likely to promote sustained engagement [51]. Tailored motivational strategies could help participants remain committed to both fitness sessions and lifestyle changes. Moreover, digital skills were found to be a predictor of engagement, highlighting the need for targeted digital literacy support, especially for older adults and those with limited prior experience with technology [52]. Our findings indicate that individuals with lower SEP **(Chapter 7)** can benefit substantially from structured support in blended CR programs. While participants with higher SEP were found to engage less with certain support components, those with lower SEP responded favorably. When supported, individual with a lower SEP can engage well with eHealth interventions [4], challenging the assumption that they inherently struggle with digital tools [51]. Ensuring equal access requires actively addressing differences in digital competence and access to technology. Experience from public libraries suggests that even accessible settings require collaboration with social and health organizations, as well as personalized outreach, to better reach digitally excluded groups [53]. Continued efforts to improve accessibility and inclusivity are essential to ensure that all individuals, regardless of their SEP or technological skills, can benefit equally from eHealth interventions.

8.3.2 Implementing and supporting eHealth in practice

8.3.2.1 Strengthening the role of healthcare professionals

Healthcare professionals are pivotal in ensuring that eHealth interventions effectively address the needs of lower SEP populations. As described in **Chapters 3 and 5**, they serve as essential mediators between technological solutions and the lived realities of their users. Their engagement is indispensable throughout the lifecycle of interventions, from the initial design phase to implementation and evaluation. However, this dissertation highlights several challenges professionals face, such as limited training in selecting and

applying eHealth interventions, a lack of resources, and difficulties engaging individuals with digital literacy challenges or environmental stressors. These findings align with earlier research indicating that professionals often feel insufficiently equipped to support individuals from socially or economically disadvantaged backgrounds due to limited cultural competence and a lack of practical tools [12,13].

To address these challenges, training programs should offer practical, hands-on skills that professionals can apply directly in their daily work. Training should focus on specific techniques, such as motivational interviewing to improve communication, digital communication strategies to navigate eHealth tools, and cultural competence to better connect with individuals from diverse backgrounds [14,54]. **Chapter 3** illustrates how these skills can help professionals build trust and tailor interventions to users' needs more effectively. Additionally, organizations should support professionals with accessible resources, including guidelines, peer-learning opportunities, and ongoing supervision. Future research could examine how these training programs can be scaled to different healthcare settings and how structural factors, such as workload and team collaboration, influence professionals' success in delivering tailored eHealth interventions.

8.3.2.2 Interdisciplinary collaboration

The development, implementation, and evaluation of effective eHealth interventions, particularly for individuals with lower SEP, require collaboration across disciplines. This collaboration is crucial not only for integrating different perspectives but also for facilitating knowledge exchange between professionals. Researchers, healthcare professionals, psychologists, ICT experts and policymakers each contribute unique insights into the challenges and opportunities of eHealth implementation. By working together, teams can better anticipate potential barriers and co-create interventions that align with the realities of their target populations. The integration of scientific knowledge with practice-based evidence plays a key role in this process. While theoretical frameworks provide structure, practice-based sources—such as reports from the World Health Organization (WHO)—offer insights into real-world challenges, including digital literacy gaps, mistrust in technology, and competing life demands. As highlighted in **Chapters 2 and 6**, combining these perspectives leads to interventions that better reflect users' lived experiences and, therefore, have a greater chance of successful implementation. Practical insights from healthcare professionals are particularly valuable in identifying barriers that may be overlooked in controlled research settings, such as psychosocial, financial, and logistical constraints (e.g., scheduling conflicts, limited digital access, or transportation difficulties), which disproportionately affect lower SEP groups.

The development of the IeG, as described in **Chapters 5 and 6**, exemplifies how interdisciplinary collaboration enhances the accessibility and usability of eHealth tools for both

professionals and individuals with lower SEP. The guide's recommendations were shaped by input from professionals across various domains, ensuring its content was both evidence-based and practically applicable. By incorporating multiple disciplines throughout the design process, the guide was better positioned to address the day-to-day challenges faced by healthcare providers and individuals with lower SEP.

A similar approach was applied in the blended CR program described in **Chapter 7**, where medical specialists, psychologists, and ICT professionals collaborated to integrate clinical and technological insights into routine care. However, this constellation of expertise represents only part of the broader field. Future development efforts should also include stakeholders such as health insurers, community workers, or communication experts, whose perspectives are essential for ensuring financial feasibility, cultural resonance, and effective outreach.

Effective interdisciplinary collaboration relies on clearly defined roles, open communication, and aligned implementation goals, while the absence of these elements can create barriers [55]. To support this process, structured collaboration frameworks have been suggested, including role clarification, shared objectives, and regular feedback loops; multidisciplinary meetings and shared digital workspaces may further facilitate alignment throughout development [56]. Future research could examine how to enhance knowledge exchange between disciplines, as strengthening collaboration across intervention phases may improve the integration of practice-based and scientific knowledge, ultimately leading to more accessible, relevant, and effective eHealth interventions.

8.3.3 Scaling and sustaining eHealth innovations

8.3.3.1 Systemic and financial barriers to implementation

Systemic barriers present significant challenges to the development, implementation, and long-term success of eHealth interventions, particularly for individuals with lower SEP. These barriers may undermine the effectiveness of even well-designed interventions, especially when they remain unaddressed during the early stages of development. Financial limitations frequently emerge as a primary constraint, potentially affecting the ability to conduct essential preparatory activities, such as pilot studies, stakeholder engagement, and co-creation processes. As highlighted in **Chapters 2 and 3** of this dissertation, resource constraints often force compromises that may diminish the relevance and impact of interventions. For example, the IeG project experienced delays due to difficulties in securing long-term funding, which appeared to hinder the project's broader implementation and sustainability. Short-term, project-based funding models may contribute to this issue by prioritizing immediate deliverables over sustained impact, resulting in fragmented efforts that limit long-term engagement [57]. To address these

challenges, future projects could benefit from integrating sustainability strategies into the initial planning phases, including the development of robust funding plans, shared ownership models, and early stakeholder involvement. Promising pathways for bridging resource gaps include public-private partnerships, targeted grants from health organizations, and integrated funding frameworks [58–60]. However, the success of these models depends on continuous evaluation to assess their feasibility and scalability across diverse healthcare settings. As Lau et al. [61] suggest, ongoing investments in digital infrastructure, technical support, and professional training may be necessary to prevent promising interventions from becoming obsolete.

8.3.3.2 Policy alignment and long-term integration

Beyond financial barriers, broader systemic challenges can further complicate the effective implementation of eHealth interventions. As discussed in **Chapter 3**, misalignment between digital tools and existing healthcare workflows may increase the administrative burden for professionals, potentially reducing their willingness to adopt new systems [59]. This misalignment can disrupt established practices and may reduce trust in the potential of digital innovations. Disparities in digital infrastructure, such as limited internet access and inconsistent software compatibility, may also exacerbate these difficulties, particularly for populations with lower SEP [52]. These infrastructure challenges might contribute to digital inequality, reducing access to health information and services for those at greater risk of exclusion.

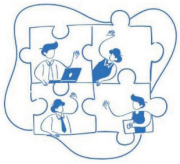
Additionally, fragmented policy frameworks may contribute to inconsistent adoption and scalability, as highlighted by Coetzer et al. [62], who critiques the prevailing focus on individual-level behavior while overlooking structural determinants like policy and infrastructure. This fragmentation may result in duplicated efforts, confusion about responsibilities, and inconsistent implementation across healthcare settings, ultimately complicating the scalability of eHealth innovations. Addressing such challenges requires more than well-designed technology. While this dissertation highlights the potential of eHealth to reduce disparities, it also underscores the need for a careful, context-specific approach. Structural inequities cannot be resolved by technology alone but require systemic change and long-term commitment [14,63]. As emphasized in **Chapter 6**, a systems-thinking approach, supported by inclusive policy frameworks that align with national healthcare priorities, could help to address these challenges [64]. Cross-sector collaboration is likely to play a key role in this process, as partnerships between policymakers, researchers, and healthcare professionals may foster a more integrated, adaptive, and sustainable eHealth landscape. Future research should continue exploring these collaborative strategies to better understand how these approaches can contribute to the effective and equitable implementation of eHealth interventions.

8.4 The future of the IeG

In developing the IeG, this dissertation has taken a significant step towards making eHealth interventions more inclusive. The IeG provides a comprehensive, user-friendly platform that helps professionals develop, implement, and adapt interventions that are both inclusive and effective. By bridging the gap between theoretical knowledge and practical application, the IeG offers actionable guidance supported by real-world examples. This ensures that interventions address the needs of populations with lower SEP in a practical and impactful way. The IeG supports professionals at every stage of intervention development, from ideation to evaluation, by offering case studies, tools, and best practices. Different professionals within the eHealth ecosystem have varying information needs. Developers require phase-specific guidance during design and implementation. Healthcare professionals need practical strategies to address digital barriers in patient interactions. Policymakers rely on evidence-based frameworks to align eHealth interventions with public health goals [20,22]. However, existing guidelines from organizations such as WHO and NHS are often too broad and lack the specificity needed for populations with lower SEP. This highlights the need for detailed, step-by-step instructions supplemented with practical examples and case studies. By addressing these role-specific needs through tailored resources and examples, the IeG provides a structured approach that enhances real-world implementation and helps tailor interventions to the specific challenges faced by populations with lower SEP [49]. Additionally, the guide provides strategies to overcome barriers such as limited digital literacy and mistrust in digital tools, promoting sustained participation and engagement over time. By equipping professionals with tools to assess the impact of their interventions, the IeG facilitates iterative improvements, ensuring that eHealth solutions remain effective and adaptable to the evolving healthcare landscape [51]. The IeG, as discussed in **Chapter 7**, represents a significant advancement in addressing the digital divide between socioeconomic groups. However, its long-term success hinges on regular updates informed by new evidence, user feedback, and technological advancements. Given the dynamic nature of eHealth, the guide must remain flexible to ensure its relevance and utility over time. Partnerships between academic researchers and practical organizations are essential for achieving this. Such collaborations enable the guide to incorporate diverse perspectives and respond to emerging trends, ensuring that it remains a dynamic and cutting-edge resource capable of addressing complex challenges while meeting the needs of professionals and communities. Expanding the guide's reach through complementary communication methods, such as workshops, instructional videos, and educational programs, can further enhance its usability and adoption. These supplementary tools could not only increase awareness but also integrate the IeG into broader implementation strategies, ensuring its continued impact in diverse healthcare settings. To secure the IeG's sustained success, systematic evaluation of its real-world application is indispensable. Frameworks like RE-AIM (Reach,

Effectiveness, Adoption, Implementation, and Maintenance) offer structured approaches to assess the guide's scalability and sustainability [65]. Such evaluations ensure that the IeG evolves to meet future healthcare challenges while maintaining its focus on equity and inclusion. By integrating ongoing updates, fostering cross-sector collaboration, and utilizing diverse dissemination methods, the IeG can remain a vital tool for advancing eHealth solutions. These efforts could bridge the gap between theory and practice, ensuring that eHealth interventions effectively address the needs of populations with lower SEP while contributing to equitable health outcomes.

Box 1. Key Contributions of this Dissertation

	Contribution	Description
	Insights into Barriers and Facilitators	This dissertation identifies various barriers that individuals with lower SEP face in engaging with eHealth applications, such as digital literacy challenges and financial constraints. It also highlights key facilitators for professionals, including the role of trusted community figures and the importance of co-creation with users. These insights can enhance the development, reach, adherence, implementation, and evaluation of eHealth interventions for disadvantaged populations.
	Context-Specific Solutions	The findings emphasize the need for eHealth interventions tailored to the socioeconomic, cultural, and linguistic contexts of groups with a lower SEP. Unlike generic approaches, tailored solutions are more likely to align with users' daily lives, improving access, engagement, and adherence, and help prevent the widening of existing health disparities.
	Human-Centered Design (HCD) Approach	The HCD principles applied in this dissertation ensure that the Inclusive eHealth Guide (IeG) is user-centered, feasible, and effective. HCD emphasizes the involvement of stakeholders, including healthcare professionals and end users, to assess their needs, preferences, capabilities, and contexts. This approach ensures that eHealth solutions align with real-world conditions, supporting both adoption and long-term use.
	Interdisciplinary Collaboration	This dissertation underscores the importance of interdisciplinary collaboration among researchers, healthcare providers, eHealth developers, and policymakers. By working together, these stakeholders can ensure that interventions are both scientifically robust and practically feasible.
	Inclusive eHealth Guide (IeG)	A key output of this dissertation is the IeG: a comprehensive guide designed to support professionals in the development, implementation, and evaluation of eHealth interventions for groups with a lower SEP. The guide provides practical insights based on academic research and real-world applications, making it a valuable resource for inclusive digital health design.

8.5 Conclusion

This dissertation aimed to contribute to more inclusive and impactful eHealth interventions for individuals with a lower socioeconomic position (SEP), by identifying key barriers and facilitators across the lifecycle of interventions, from the initial design phase to implementation and evaluation, by supporting professional practice, and by evaluating both a practical guide (the Inclusive eHealth Guide, IeG) and a blended care intervention. The findings showed that individuals with a lower SEP often face a combination of digital, financial, and contextual barriers that limit their ability to engage with eHealth interventions. This underscores the need for interventions that are aligned with the realities of daily life and for equipping professionals with practical tools to support inclusive practice. Insights from individuals with lower SEP themselves further enriched the understanding, revealing valuable nuances in how eHealth can be made more meaningful, accessible, and relevant to diverse users. To address this, the IeG was developed and evaluated. The guide provides structured, phase-specific recommendations for professionals and was positively received within the Dutch healthcare context. While the guide offers a promising foundation, further validation in diverse settings is needed to strengthen its practical relevance and broader applicability. This dissertation also emphasizes that design alone is not enough. Long-term viability requires early planning, ongoing collaboration with stakeholders, and attention to implementation conditions such as professional workload and resource availability. These findings suggest that inclusive digital health depends as much on context and structure as on the intervention itself. While this dissertation marks an important step in promoting inclusive eHealth interventions, ongoing research and collaboration are essential to ensure that these tools become scalable, sustainable, and have lasting impact. This is key to achieving health equity and avoiding further disparities among socioeconomically disadvantaged groups.

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