

1 Development of an intervention aimed at the prevention and
2 treatment of chronic pain in breast cancer survivors: An
3 intervention mapping approach

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Abstract

Objective: Pain is prevalent among breast cancer survivors and can persist for years, impeding quality of life. Both prevention and pain treatment are important. However, this requires an interdisciplinary approach and complex models of care. We report on the design and implementation of an intervention that follows a step-wise care model, aimed at timely and adequate pain follow-up among breast cancer survivors.

Methods: We used intervention mapping to guide our planning process. The intervention was developed in co-design with relevant stakeholders, such as breast cancer survivors and healthcare providers.

Results: An e-learning training is developed aimed at changing healthcare providers' knowledge, beliefs, and interprofessional behaviour regarding pain follow-up. Second, guides are produced to empower patients in talking about pain and stimulate referral to other disciplines.

Conclusion: To achieve change in pain follow-up, multiple levels should be addressed. Additionally, the implementation and adoption of an intervention opposes challenges. Intervention mapping can serve as a theory-based and data-driven approach for decision-making during planning.

Practice Implications: This study can inform others about how to prepare for the development and implementation of an intervention. The developed intervention can also be adapted according to the target population and context, and used for other cancer populations.

Keywords: breast cancer survivors, chronic pain prevention, pain treatment, step-wise care model, co-design, intervention mapping

1. Introduction

Among cancer survivors, breast cancer survivors (BCS) represent one of the largest subgroups [1, 2]. Long-term survival is common after breast cancer treatment, with a five-year survival rate of

91,2% in Belgium [2]. However, surviving breast cancer does not necessarily mean a return to life as before the diagnosis. After ending breast cancer treatment, one of the most common symptoms is pain. About 13% to 51% of BCSs report pain complaints [3, 4]. Furthermore, pain can persist during many years and become a problem that is complex and multidimensional in nature, impeding functioning and quality of life [5, 6]. The International Association for the Study of Pain describes pain as an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage [7]. Preventing and treating chronic pain, therefore, require a biopsychosocial approach. When screening for pain, not only biological aspects should be examined, but psychological and social aspects regarding pain should also be assessed [5]. Furthermore, treating chronic pain calls for a multimodal approach with pharmacologic, as well as behavioural interventions. These interventions focus on improving function and limiting long-term adverse effects of pain and its treatment, more than they do on reducing pain [8]. Additionally, such an approach must be provided by an interdisciplinary team of healthcare providers (HCP) in an integrated manner [9]. Integrated care is defined as health services that are managed and delivered so that people receive a continuum of health promotion, disease prevention, diagnosis, treatment, management, rehabilitation, and palliative care services, coordinated across different levels and settings of care, and according to patients' needs throughout their life course [10]. In practice, it seems that such follow-up care is often still lacking for BCSs [11, 12]. Currently, there is no legal or clinical framework for follow-up care after cancer treatment available worldwide [13]. In Belgium, the necessary staff and infrastructure for organizing this support exist, but they need to be inventoried, coordinated and integrated to make them more accessible to patients [2].

Since early prevention and treatment is of utmost importance in the context of chronic pain, the literature does suggest a few guidelines that seem paramount in practice. First, a more systematic screening of pain, risk factors of pain, and accompanying psychosocial needs is necessary so that care can be more tailored to a patient's individual needs [8]. Currently, screening is not always systematically addressed, which is a barrier to early prevention of pain and providing the required

help [2]. Second, short interventions or counselling aimed at pain education and self-management of the patient are of importance. According to an individual patient's needs, more intensive and specialized interventions can be provided [14, 15] such as cognitive-behavioural interventions [16-20], acceptance and mindfulness-based interventions [21-23], and physical exercise interventions [16, 24-30]. Third, the applied prevention and treatment strategies must be monitored and adapted when needed [15]. Step-wise care is preferred because not every cancer survivor needs intensive follow-up. As healthcare resources are scarce, a step-wise care model might help to allocate resources in an efficient way by offering care to all, but the most intensive care only to those patients in highest need [31].

The aim of this study was to fill the gap between existing evidence regarding pain interventions for BCSs and the lack of a theory-based implementation of these interventions in practice. We developed an intervention that follows a step-wise care model and aims to stimulate an integrated approach for timely assessment of pain and adequate treatment among BCSs.

2. Methods

We used intervention mapping (IM) to guide our planning process [32-37]. IM is a framework that describes different steps to undertake a theory-based and data-driven approach in developing, implementing, and evaluating an intervention [34, 35, 38]. The framework describes six steps which guide the planner from problem identification towards programme planning. These steps do not follow a linear course, but should be understood iteratively as new insights are continuously gained [35]. Reporting about this planning process informs us about the logic and theoretical foundation of a programme as well as the practical decisions, which is useful for further programme development and/or adaptation [36].

2.1 Needs assessment

The first step of IM contains a needs assessment. Therefore, focus groups were organized to identify the current needs in breast cancer follow-up care. Additionally, the barriers and

facilitators in implementing and adhering to pain interventions were explored [39]. Four focus groups with BCSs and four focus groups with HCPs involved in breast cancer follow-up took place [40-46]. A semi-structured topic guide was used (Supplemental File 1). This guide was based on a scoping search of the literature regarding existing pain interventions and gaps in pain policy [20, 32, 47-52]. Second, observations were performed in a university hospital in Flanders, Belgium (i.e. a multidisciplinary setting that offers specialised (cancer) care). Because the intervention will be implemented within a local context, the aim was to map local processes regarding pain in follow-up care [39]. Field notes were taken and served as guidelines for developing and aligning implementation with local practices [53-57]. Third, the results obtained were discussed within a steering group. This group represented the researchers, BCSs, HCPs with expertise in oncology and/or chronic pain, and professional associations that will help realize implementation [58]. The study was approved by an independent Committee for Medical Ethics affiliated with Ghent University Hospital. The participants signed an informed consent after having received a written explanation of the nature, purpose, and duration of this research.

2.2 Setting objectives

We identified the domains that influence the prevention and treatment of chronic pain in breast cancer follow-up, based on our qualitative research in step one. In analysing those data, we undertook an exploratory approach and themes were coded inductively. Afterwards, we used the Theoretical Domains Framework (TDF) as an inspiration to cluster themes into broader domains [59]. TDF synthesizes 33 theories of behaviour and behaviour change into 14 domains. It comprises cognitive, affective, social, and environmental influences on behaviour [59-61]. First, relevant domains were chosen. This selection was based on the most frequently reported factors in our qualitative research, on theories about behavioural change, and on principles of change management [62, 63]. Second, based on our needs assessment and recommended practices in the literature, the target behaviour of HCPs was described. This description followed a PDCA cycle (Plan, Do, Check, Act) [64]. Third, for every domain, change objectives were identified which describe how a domain must change to achieve the target behaviour. These change objectives

were based on the current gaps we found in our qualitative research. Additionally, we used existing competency frameworks to validate our objectives. For example, the European Pain Federation EFIC developed core competencies that describe the necessary knowledge and skills HCPs need for pain assessment, treatment planning, communication, and referral to colleagues [65-68]. Because of the importance of interdisciplinary collaboration in pain management, we also used the core competencies for interprofessional collaborative practice, developed by the Interprofessional Education Collaborative [69]. These frameworks informed the formulation of the change objectives - or in other words - the goals of the intervention.

2.3 Behavioural analysis

Methods were selected for each change objective. First, existing literature, practices, and applications informed reflection about underlying methods of behaviour change [32-37]. Second, we selected methods using the taxonomy of behaviour change methods as described within IM. This taxonomy gives an overview of effective methods to change behaviour and provides parameters and practical examples of how methods can be translated into intervention components and adapted to the study population and context [70]. Methods and intervention components were discussed among the research team until a consensus was reached, while considering relevancy, feasibility, and possibility of implementation as a cohesive intervention [71]. Finally, a first draft of the intervention components and materials was developed.

2.4 Programme theory

A programme theory was developed based on findings from our qualitative research and the behavioural analysis. This theory outlines a testable hypothesis proposing configurations between context-related factors, mechanisms, and outcomes (CMO). A CMO hypothesis was described with context representing the circumstances in which the intervention is situated, mechanisms explain how the intervention contributes to benefits, and outcomes are the intended consequences of the intervention [49, 72, 73].

2.5 Testing feasibility of intervention components and materials

The first draft was presented to relevant stakeholders [37, 41, 43, 49, 74, 75]. They were asked to review the intervention and materials by filling in an online questionnaire. This questionnaire was based on the FAME (feasibility-appropriateness-meaningfulness-effectiveness) framework and included nine items: content, layout, clarity, usability, comprehensibility, meaningfulness, consistency, user-friendliness, and achievability [50, 76]. A five-point Likert scale was used ranging from 'very dissatisfied' to 'very satisfied', and open blanks were available to note further observations and suggestions (Supplemental File 2). Additionally, some of the stakeholders participated in a focus group to get a more in-depth discussion about the previously given feedback [76, 77].

2.6 Planning for intervention implementation

Finally, an execution plan that would allow implementation and intervention fidelity was developed [78]. This plan was inspired by existing frameworks and models such as the TDF, the Consolidated Framework For Implementation Research, and the Sustainability Model [59, 79, 80]. Additionally, data from the focus groups in step one (i.e. the needs assessment) supported our decision-making while planning implementation. Potential implementers (e.g. department heads of involved hospitals) and certain members of the steering group were also involved during this stage to ensure sustainability when implementing the intervention [58]. The evaluation of the intervention will be reported elsewhere.

3. Results

3.1 Needs assessment

To summarize, we identified that pain after breast cancer treatment is not always managed optimally, as confirmed by existing literature. Some of the major themes were described in Table 1. The results from our focus groups will also be reported in more detail elsewhere [81].

172 **Table 1.** Themes from the observations and focus groups with breast cancer survivors and
173 healthcare providers.

Focus groups with BCSs (n=31)	Focus groups with HCPs (n=22)
• Lack of information about possible pain problems • Pain is not standardly and actively questioned during follow-up • Lack of structured follow-up care for pain and no central contact point • Different ways of coping with pain, i.e. ignoring pain/not seeking support, looking for solutions to reduce pain, and accepting pain and its impact • Coping is influenced by the beliefs, emotions, and behaviour of others (e.g. HCPs, family, friends, colleagues, and society) • Prejudices and a lack of knowledge about chronic pain among HCPs, their close environment, and society	• Lack of knowledge about chronic pain prevention and treatment • Biomedical beliefs and prejudices about chronic pain after breast cancer • Underestimation of the seriousness and impact of pain • Feelings of frustration and powerlessness among HCPs • Communication with other disciplines is too brief • Lack of shared values among HCPs regarding chronic pain prevention and treatment • Lack of knowledge about each other's roles and capabilities • Underestimation of the added value and/or necessity of referral to other disciplines • Lack of knowledge about possible referral options • Referral to other disciplines does not happen or happens too late
Observations in a hospital	
• Unavailability of appropriate hospital-based services during breast cancer follow-up • Limited involvement of allied health professionals during follow-up consultations in the hospital, BCSs return to the hospital every three to six months for a follow-up consult with one of their medical specialists • Outpatient consultations with allied health professionals are possible, but are not part of standardized care or can be limited in time • Primary health care could act as an alternative to hospital-based care, but there are no guidelines in place to assure continued care between these two settings • Need for a shift towards more outpatient and ambulatory care while keeping a right balance between primary health care, specialized outpatient care, and hospital inpatient care • After screening for pain, hospital-based HCPs must consider their abilities in assessing and treating pain and determine if referral is necessary	

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3.2 Setting objectives

Pain prevention and treatment in follow-up care require an adequate response from HCPs, described in Figure 1 and Figure 2.

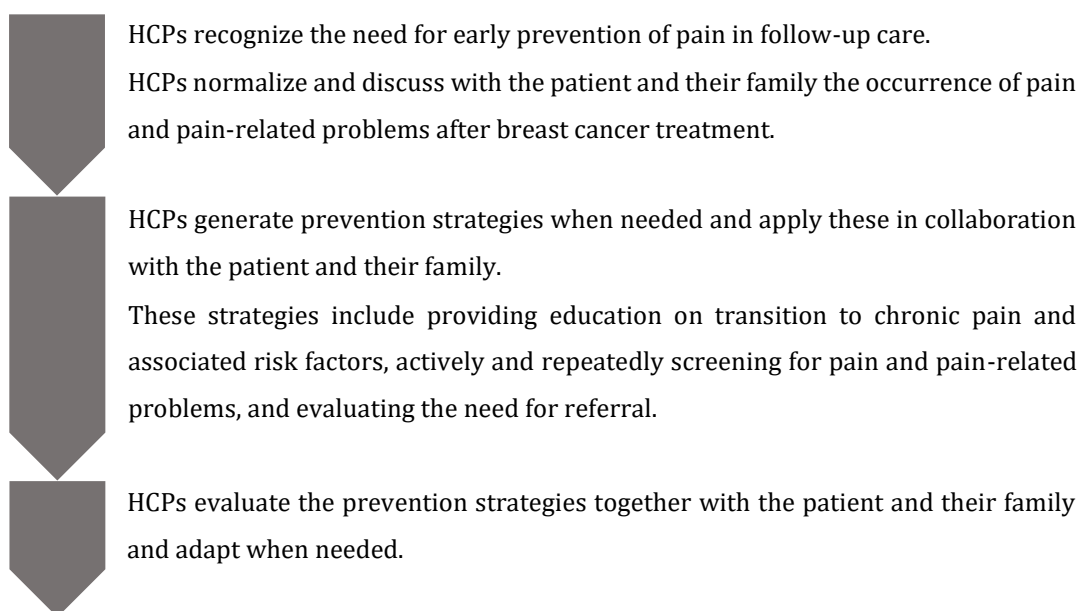


Figure 1. Target behaviour and steps in preventing pain.

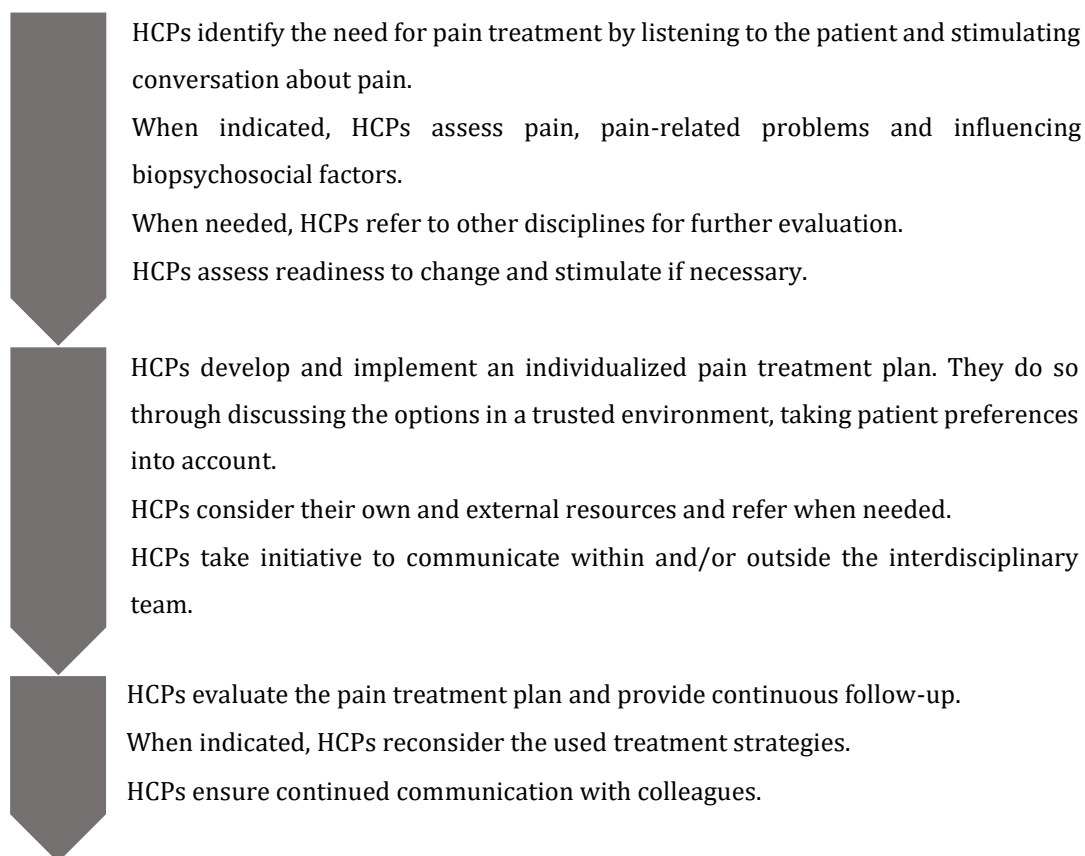


Figure 2. Target behaviour and steps in treating pain.

Figures 1 and 2 follow a step-wise care model, which allows the care offered to be determined on the basis of observed outcomes. The intensity and/or complexity of care is increased or the kind of care is changed until a desired outcome for the patient is achieved. To achieve this behaviour in HCPs, we focused on the following domains of TDF, i.e. awareness/knowledge, beliefs, professional confidence, outcome expectancies, and professional role/identity. A matrix was developed, showing the chosen domains and associated change objectives (Supplemental File 3).

3.3 Behavioural analysis

Methods were selected to answer the question of how objectives could be changed. A matrix was developed, showing the chosen methods, a description of the methods, the underlying theories of the methods, and the used intervention components and materials (Supplemental File 4). We developed an intervention that includes multiple components and targets the level of HCPs, as well as the level of BCSs. The developed intervention consists of a training for HCPs and guides that can be used by HCPs and BCSs in practice.

Regarding the training for HCPs, we opted for asynchronous e-learning within an interdisciplinary group. We speak of interdisciplinary learning when two or more disciplines learn with, from and about each other to improve collaboration and quality of care [69]. An interdisciplinary e-learning approach was chosen because existing literature suggests this approach is effective in improving communication between HCPs, coordination, and understanding of each other's professional roles and tasks [82]. Additionally, asynchronous e-learning is a learner-centred approach that allows participation at a time and location that is convenient for the HCP. This makes it more accessible to combine professional development with private and work commitments [83, 84]. It is an ideal approach for a target audience with a high workload such as HCPs [85]. Especially, during a time when HCPs were overloaded with work due to the COVID-19 pandemic.

Consequently, the chosen behaviour change methods had to be translated into applications that could be offered digitally and asynchronously without compromising the effectiveness, attractiveness, and accessibility. The most used methods were active learning, consciousness

raising, verbal persuasion, modelling, discussion, feedback, and enablement. These methods were then translated into didactic (e.g. informative text, videos, models, graphics, and testimonials) and interactive (e.g. group discussions, quizzes, and reflection exercises) formats. For each method, a screenshot of an application in our e-learning training was presented in Supplemental File 5.

In total, the e-learning training consisted of two modules and two case-based exercises. The content that was covered by each part, was described in Table 2. This content was tailored to the results of our needs assessment.

Table 2. Structure and content of the e-learning training.

Structure	Content
Module one	Ten submodules covering the problem of pain in follow-up care, the influencing biopsychosocial factors, the risk and protective factors for the prevention of chronic pain, and pain screening and evaluation methods.
Case-based exercise	HCPs participated in a two-week asynchronous discussion group and applied the learned knowledge while discussing a case of a BCS with pain problems.
Module two	Ten submodules addressing different pain treatments (including pharmacological, psychosocial, physical, lifestyle, and environmental interventions), and the importance of an interdisciplinary and integrated approach in follow-up care. A recommended integrated approach and associated tools were also presented and explained.
Case-based exercise	HCPs were again instructed to reflect on a case of a BCS in an asynchronous discussion group, using the e-learning content that was provided.

At the end of module two, an integrated approach was recommended, inspired by the American Society of Clinical Oncology guideline ‘Screening, assessment, and care of anxiety and depressive symptoms in adults with cancer’ and the Dutch version ‘Detecting the need for psychosocial care’ [86]. This integrated approach outlines certain practices regarding screening of pain and pain-related problems after breast cancer treatment and referral to other professions (Supplemental File 6).

To create an environment that makes applying such an approach in practice easier or reduces barriers to action, we also developed two guides. A first guide was designed containing advice for patients on what problems can be talked about with HCPs and what questions can be asked. The question prompt list was based on the Self-Management Navigator Tool [87, 88]. A self-report instrument for patients (i.e. the Dutch version of the Distress Thermometer and Problem List) was also added to the guide [89, 90]. Additionally, information about how to use this instrument was described. With this guide we wanted to empower BCSs and normalize talking about pain during cancer follow-up. The second guide describes hospital-based services regarding pain and summarizes databases of primary healthcare providers with experience in oncology or chronic pain. HCPs can use this guide in practice to search for possible referral options or encourage patients to search for support themselves.

3.4 Programme theory

To pursue pain prevention and treatment in breast cancer follow-up, a complex intervention was needed. Complex interventions consist of interacting components, demand behaviour change by those delivering and/or receiving the intervention, and evaluate a diverse set of outcomes at different levels [91, 92]. To achieve change, various stakeholders at multiple levels should be addressed. To outline the complexity of achieving change and implementing an intervention, a programme theory with context-related factors, mechanisms, and outcomes was presented (Figure 3). As mentioned, our intervention focuses on the level of BCSs and HCPs (shown in bold).

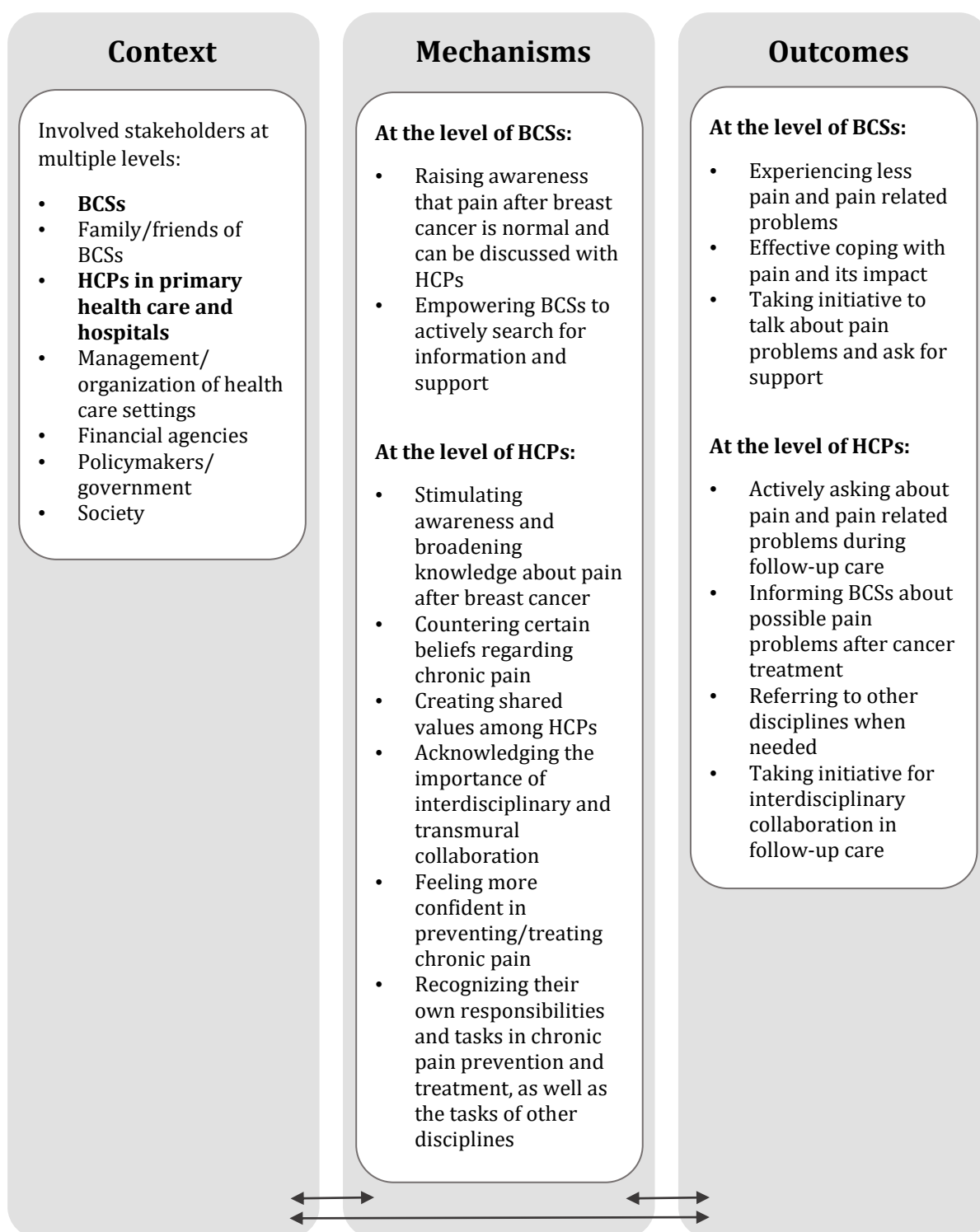


Figure 3. Programme theory with CMO hypothesis.

3.5 Testing feasibility of intervention components and materials

Within or between steps of complex intervention research, the intervention might need to be adapted. It is important to engage potential intervention users to inform these refinements [92].

Therefore, we asked eight experts to validate the content of the e-learning regarding their specific expertise in oncology and/or chronic pain, i.e. psychologists (n=2) and physiotherapists (n=2) working in primary health care and research, as well as a physician (n=1), a psychologist (n=1), and nurses (n=2) working in a pain clinic. Furthermore, the developed e-learning training was piloted in a group consisting of 17 stakeholders including researchers (n=6), HCPs with different backgrounds (n=8), representatives of professional associations (n=2), and experts in education (n=1). These stakeholders filled in an online questionnaire and/or gave feedback via e-mail. For each item, the percentage of participants who scored 'rather satisfied' or 'very satisfied' is shown in Table 3.

Table 3. Percentage of participants (n=11) who scored 'rather satisfied' or 'very satisfied' for each item regarding the e-learning training.

Item	Rather satisfied/ very satisfied (%)
Content	100%
Layout	64%
Clarity	82%
Usability	91%
Comprehensibility	82%
Meaningfulness	91%
Consistency	100%
User-friendliness	82%
Achievability	27%

Additionally, 12 of these stakeholders also participated in a focus group. In total, two focus groups (n=8 and n=5) were held to further discuss certain items. Overall, the training was deemed valid, clear, usable, comprehensible, meaningful, consistent, and user-friendly. Taking into account the COVID-19 pandemic, resulting in a high workload for many HCPs, some stakeholders shared concerns about the achievability of the training. As a response to this feedback, we made a distinction between what elements of the training are mandatory and what elements are background information. We made the learning goals explicit for each submodule so that HCPs can choose what submodules are more relevant based on their knowledge and experience.

Concerning the layout, some stakeholders stated a lack of uniformity (e.g. external links did not always open in the same manner). These navigation issues were afterward adapted. Additionally, extra icons were added to structure the training and indicate what kind of information or exercise is offered (e.g. informative text, video, reflection exercise, etc.).

The developed guides were also piloted in a group consisting of 14 stakeholders including BCSs (n=10) and HCPs with different backgrounds (n=4). These stakeholders filled in an online questionnaire and/or gave feedback via e-mail. In general, the guides were deemed valid, clear, usable, comprehensible, meaningful, user-friendly, and achievable (Table 4). No major changes were necessary.

Table 4. Percentage of participants (n=10) who scored ‘rather satisfied’ or ‘very satisfied’ for each item regarding the guides.

Item	Rather satisfied/ very satisfied (%)
Content	90%
Layout	80%
Usability	100%
Comprehensibility	100%
Meaningfulness	90%
User-friendliness	80%
Achievability	100%

3.6 Planning for intervention implementation

To implement the e-learning training, we invited HCPs who work in the domain of oncology and/or chronic pain management within primary health care or hospital-based care in Flanders, Belgium. Before we developed the training, we asked HCPs about possible difficulties in organising an interdisciplinary training. Some participants stated that hospital-based HCPs often organize training sessions during the day. In contrast with primary healthcare providers, who train after their working hours in the evening. Therefore, we opted for asynchronous e-learning with the possibility of choosing where and when you participate. Additionally, accreditation was

requested for following the e-learning, as it was appointed during the focus groups as a facilitator for participation. In Belgium, it is mandatory for certain disciplines to follow a few accredited trainings each year.

To implement the guides, we engaged HCPs from hospitals in Ghent, Belgium. These HCPs distributed a flyer among BCSs during follow-up consultations. When a BCS met the necessary requirements and showed interest in the study, we contacted them with more information about the study and offered the developed guide with the Distress Thermometer [89, 90]. Patients would fill in the Distress Thermometer and brought their guide to their next appointment in the hospital. During the consultation, their medical specialist discussed the filled out questionnaire and referred for further evaluation and/or treatment when necessary, using the guide with referral options. Depending on the digital literacy and assertiveness of the BCS, the HCP could also give the guide home and empower them to search for support themselves. In this way, we took into account possible pitfalls in implementing the intervention, discussed during our focus groups and in collaboration with our steering group. A barrier that was often mentioned, were the lack of time and resources of HCPs. Therefore, it was of importance to stimulate a shared responsibility between patient and HCP, by means of the guides. Furthermore, administrative tasks such as the inclusion of patients and providing the first guide, were executed by the research team to reduce the workload of the participating HCPs as much as possible. Finally, to facilitate the use of the guides during consultations, the research team contacted each involved HCP to discuss the expectations and how to organize this new way of working. An information form of three pages was also provided to the HCPs, emphasizing the importance of screening and referral in the context of pain complaints after breast cancer treatment.

4. Discussion and conclusion

4.1 Discussion

We utilized the intervention mapping approach to plan an intervention useful for the prevention and treatment of chronic pain after breast cancer treatment. The final intervention was a package

including an e-learning training for HCPs as well as two guides for use in clinical practice. When addressing the prevention and treatment of chronic pain, change is essential at various levels such as the level of patients, HCPs, and at the context level. An intervention can respond to one level, which provides targeted but also limited outcomes. Ideally, interventions should aim to change multiple levels [80, 93]. Often, studies aim only at changing the level of individual patients [94]. In this study, we addressed the level of patients and of HCPs. Furthermore, we tried to stimulate interdisciplinary collaboration between HCPs.

We used IM to guide our planning process. Since an integrated approach in the field of breast cancer follow-up care is not well-established, we had to build on theories and evidence on what might work in this context and how to best establish such an approach. Our study has shown IM to be suitable for intervention development within the oncology field and the translation of theories into practice [37]. Grounding an intervention in theories can improve the effectiveness of the intervention by identifying theoretical domains on which the intervention should focus. In this study, we opted to focus on five domains of TDF, i.e. awareness/knowledge, beliefs, professional confidence, outcome expectancies, and professional role/identity. We also specified effective behaviour change methods to address these domains such as consciousness raising, modelling, discussion, feedback, and enablement [36]. Additionally, transparency of all intervention components and quality of the intervention development are ensured [36, 37]. Furthermore, IM stimulates to incorporate the needs of stakeholders during the development and planning process. Thus, the intervention was developed in co-design with relevant stakeholders such as BCSs, HCPs, and experts in oncology or chronic pain. Instead of approaching stakeholder participation as a practical one-time step, we tried to address it as a basic attitude during the whole planning process [49, 51, 58, 95-100]. However, while applying an IM approach, we had to take into account the time-consuming process and the need for diverse skills within the research team.

The next step of IM includes evaluating the implementation process and the intervention's impact to investigate how changes occur as a result of the intervention [36]. We do not yet know if the

intervention will affect clinical outcomes related to chronic pain in BCSs. When proven effective, a future challenge will be ensuring the long-term sustainability of the intervention in practice. We can use the Sustainability Model as a tool to identify the strengths and weaknesses of our implementation plan. This model includes ten factors related to process, staff, and organization [79]. For example, it is of importance that HCPs experience benefits of the intervention that surpass beyond helping patients. Therefore, we developed guides to facilitate screening for pain and referral to other disciplines and settings with the aim of making follow-up consultations run more smoothly. A possible barrier to maintenance is the involvement of researchers in certain administrative aspects. Extra mechanisms will have to be put in place to continue beyond the research project. Another barrier might be the lack of involvement of policymakers or financial agencies in our research project. These are important stakeholders in setting procedures or providing the required facilities to support the new way of working in an ecologic manner [38, 79, 91].

4.2 Conclusion

Systematic and coordinated follow-up care is lacking for BCSs with pain complaints. Existing interventions are often not implemented as recommended, because the need for follow-up is not noticed and/or the necessary materials for follow-up are not available [11, 12]. Furthermore, the development and implementation processes of existing pain interventions are not always reported in a clear manner. This study outlines a step-wise description of how an intervention - aimed at the prevention and treatment of chronic pain in BCSs - was developed, embedding the planning process within theories of behaviour change and qualitative data.

4.3 Practice implications

The developed intervention can be adapted according to the target population and context, and used for other cancer populations. We also aim to inform other researchers, HCPs, and policymakers about how to prepare for the implementation of an intervention, taking into account its complexity. For example, it is of great importance to assess the needs of various target groups

and involve multiple levels. Our needs assessment emphasizes the necessity for countering current beliefs regarding pain among HCPs such as biomedical beliefs. By educating HCPs about possible pain problems and influencing biopsychosocial factors we hope to raise awareness about current prejudices and the importance of their behaviour in interaction with patients (e.g. listening to pain complaints, showing respect towards the patient, and providing clear information).

5. Authorship contribution statement

Yaël Slagmuylder: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Writing - original draft. **Peter Pype:** Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Supervision, Validation, Writing - review & editing. **Ann Van Hecke:** Conceptualization, Funding acquisition, Validation, Writing - review & editing. **Emelien Lauwerier:** Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Validation, Writing - review & editing.

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7. Declaration of competing interests

No competing interests to declare.

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10. Figure caption list

Figure 1. Target behaviour and steps in preventing pain. *The prevention of (chronic) pain during breast cancer follow-up requires an adequate response from healthcare providers. The target behaviour of healthcare providers in preventing pain is described in Fig. 1. The described behaviour and steps in preventing pain follow a step-wise care model.*

Figure 2. Target behaviour and steps in treating pain. *Treatment of (chronic) pain in breast cancer survivors requires an adequate response from healthcare providers. The target behaviour of healthcare providers in treating pain is described in Fig. 1. The described behaviour and steps in treating pain follow a step-wise care model.*

Figure 3. Programme theory with CMO hypothesis. *To outline the complexity of achieving behaviour change and implementing an intervention, a programme theory with context related factors, mechanisms, and outcomes is presented in Fig. 3. The developed intervention in this study focuses on the level of breast cancer survivors and on the level of healthcare providers, both shown in bold.*

11. Supplemental Files

Supplemental File 1 Topic guide for focus groups.pdf

Supplemental File 2 Online questionnaires.pdf

Supplemental File 3 Matrix of domains, target behaviour, and change objectives.pdf

Supplemental File 4 Matrix of behaviour change methods and intervention components.pdf

Supplemental File 5 Screenshots of the e-learning training.pdf

Supplemental File 6 An integrated approach.pdf