Promoting Self-care Behavior among Heart Failure Patients

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Introduction

Preface

Heart failure (HF) is a devastating chronic condition for patients and their families[1, 2], as well as for the healthcare system[3, 4]. During the course of HF, patients are likely to experience frequent acute episodes, which can lead to admissions to the hospital. The hospital admissions are a major reason for the burden on patients, families and the healthcare system. From a population perspective, these serious issues can potentially become even worse, because the prevalence rate of HF is expected to increase in the coming years[4]. Therefore, efforts to minimize the adverse effects of HF are warranted.

One important and changeable determinant of HF hospital admissions is engagement in the recommended health behaviors, or HF self-care behaviors: "Self-care refers to specific behaviors that individuals initiate and perform on their own behalf, with the intention of improving health, preventing disease, or maintaining their well-being"[5]. Since engagement in self-care can lead to a reduction in admissions, the promotion of self-care is a potential method of improving lives of HF patients and their families and decreasing costs. Although various interventions to promote self-care behavior exist, many patients with HF still demonstrate a low level of adherence to the self-care behaviors and therefore additional effective interventions are needed.

There are many ways in which self-care behavior can be promoted. Patients can be coached, counseled and/or educated regarding self-care by nurses, health coaches or counselors, dieticians, rehabilitators or physicians, or other healthcare professionals. Patients can be provided with health information in written, audio or video format, in booklets, leaflets, mobile applications and/or websites, among other means. Health information provided to patients can range from generic (which includes providing the same content for everyone, as is the case with health information booklets) to interpersonal (which includes providing completely individualized information, as is the case in a counseling session)[6]. In between these two extreme forms of health communication, falls tailored health communication. This form of health communication consists of individualizing health information regarding a specific health behavior to individuals based on a set of characteristics which are considered relevant for the target health behavior.

It is particularly appealing to use information and communication technology (ICT) for the delivery of health behavior promotion interventions that incorporate tailored health communication, because of the potential for personalization combined with cost-effectiveness and a wide reach. Specifically, with ICT it is possible, using smart algorithms, to tailor health information based on input from assessments. This method is used in so-called computer-tailored interventions, which are particularly promising because they mimic interpersonal communication to a certain extent and allow individualization, but with a lower cost and potentially wider reach than true interpersonal health communication. When engaging in the computer-tailored intervention, patients are presented with

personal assessments of health behaviors and possible barriers and facilitators for such health behaviors, and based on their answers pre-defined health communication messages are pulled from a database.

One of the aspects for consideration in the design of health behavior promotion interventions is the setting for the delivery of the intervention, since the setting can have an impact on the content, methods strategies and length. The hospital setting holds promise for HF self-care promotion interventions, because during hospitalization, many HF patients can be easily reached, and they may be more open for change after experiencing a life threatening event that may have been instigated by their own behavior. Currently in-hospital health behavior promotion efforts mainly focus on increasing knowledge levels, by providing education as a behavior change strategy, and usually do not address patients' motivation to perform the behavior. In-hospital HF education is in general delivered by nurses, who supplement their instruction with generic written material. Previous work suggests that hospital nurses may not always provide effective education, that individualizing content to patients may be one particular area in which nurses could use support, and that nurses do not have sufficient materials (teaching aids) to support them[7]. ICT-based interventions in general, as well as computer-tailored interventions in particular, could help to fill this gap. However, individually tailored health behavior promotion in the hospital supported with ICT has to date only been marginally explored.

It is important to develop health behavior promotion interventions in a systematic manner, since this allows making selections for the intervention content, sequence and structure based on theory and scientific evidence, thereby increasing the chance that the intervention will end up affecting the intended outcome. The model of planned health promotion was used as the foundation for the work described in the current dissertation (Figure 1.1). This

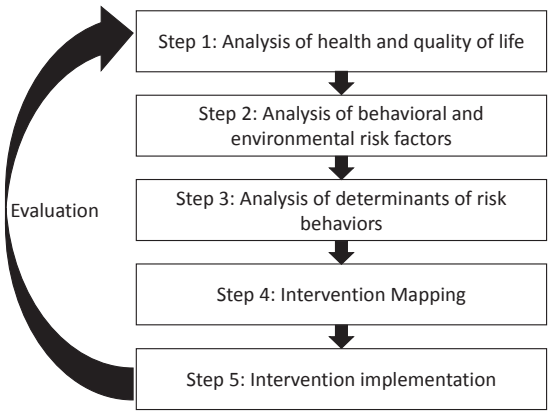

Figure 1.1: A model of planned health promotion

model postulates that health promotion interventions should address the most important and modifiable behavioral determinants[8]. The identification of behavioral determinants and the translation of these determinants into intervention strategies and techniques should be guided and informed by behavioral theories and scientific evidence. When scientific evidence is lacking, part of the intervention development process can include generation of additional evidence through empirical research.

The central element in the current dissertation was to inform and develop a new intervention aimed at promoting self-care behavior among HF patients, for delivery in the hospital using ICT (see aim 3 below). In addition to research towards this aim, we conducted research that aimed to increase the knowledge on issues of importance for the development of interventions promoting self-care behavior among HF patients. The aims of the current work were:

1. To provide further information on the merits and levels of physical activity among HF patients
2. To gain further insights into correlates and potential determinants of self-care behavior among HF patients – with the main focus on PA as an important self-care behavior
3. To develop an intervention aimed at promoting self-care behavior among HF patients and formatively evaluate it to inform its further development and (potential) implementation

The work is described in eight chapters. In this first chapter, HF is introduced as a health problem; the lack of self-care behavior among HF patients, as a risk factor for poor clinical outcomes, is described, and the relevant existing interventions to promote self-care among HF patients is outlined. This is followed by a description of the approach of the research, and finally, the research conducted within the thesis is introduced. In Chapter 2, an analysis assessing the relationship between post myocardial infarction (MI) patients' leisure time physical activity and survival, as well as moderators of this relationship (HF and psychosocial variables) is reported. In Chapters 3 and 4, systematic literature reviews are reported. These reviews included syntheses of the evidence for the various self-care behaviors associated with HF, and were conducted with the aim of assisting in the selection of the behavioral determinants that were targeted in the intervention development. An analysis of correlates of PA among HF patients in a Dutch sample from the Longitudinal Aging Study Amsterdam is described in Chapter 5. The development of an ICT-supported, tailored intervention for the hospitalized HF patients called Motivate4Change is described in Chapter 6. Motivate4Change was developed using the Intervention Mapping (IM) protocol, a stepwise method of developing interventions systematically using relevant theory and scientific evidence. Then, a formative evaluation of the intervention, in the form of a pilot study exploring needs and experiences of HF patients and nurses in the hospital setting is described in Chapter 7. Finally, Chapter 8 concludes with a general discussion.

Heart failure and associated adverse outcomes

Heart failure is defined as an abnormality to the heart's structure or function which results in insufficient pumping of blood throughout the body and a failure to supply oxygen at a rate sufficient for metabolizing tissues. Heart failure includes symptoms such as shortness of breath, fatigue, and edema (signs of fluid retention)[9]. It is characterized by periods of acute decompensation in alteration with periods of relative stability[10] and low physical activity tolerance[11]. The most common etiology of HF in Western countries is coronary artery disease[12]. Older adults are predisposed for HF because of changes in the cardiovascular system and higher prevalence of cardiovascular disease in old age[13].

Five million Americans and 15 million Europeans are living with HF[14]. It can be somewhat difficult to compare prevalence and incidence rates from different studies, due to differences in methodologies employed in the different studies, especially regarding differences in identifying HF cases. Reported prevalence rates in HF range from 2 to 30% depending on the population studied and the definition of HF used when identifying HF cases[15]. However, the reported rates provide important insight into the magnitude and importance of the problem on a population level. Reported prevalence rates in the United States (US) are 8 per 1000 at age 50 to 59 years in men, increasing to 66 per 1000 at ages 80 to 89 years (similar values (8 and 79 per 1000 respectively) were noted in women)[16]. In the Netherlands, the reported prevalence rate was 9 per 1000 in patients 55–64 years of age to 174 per 1000 in those aged over 85[17]. The prevalence of HF is projected to increase due to the aging population and improved treatment of coronary artery disease[12]. In the US, HF prevalence is estimated to increase to 6 million by 2030[4].

The reported incidence rates were 1.3 cases per 1000 population per year for those aged 25 years or over in the United Kingdom (UK). The incidence rate increased from 0.02 cases per 1000 population per year in those aged 25–34 years to 11.6 in those aged 85 years and over, and was higher in men than women[18]. In the US, a much higher incidence rate was found among older adults, aged 80-89: 27 per 1000 population per year among men, and 22 per 1000 population per year among women[16]. In the Netherlands, in a sample of 55 years of age and over, an incidence rate of 2 cases per 1000 population per year was found.

Heart failure is associated with a number of adverse outcomes, including high mortality rates[1]. In the previously mentioned UK study[19], a 15% mortality rate was demonstrated one month after HF diagnosis and a 28% mortality rate was demonstrated after one year of diagnosis[19]. The previously–mentioned Dutch study demonstrated a 14% mortality rate one month and 37% one year after HF diagnosis[17]. Hospitalization among HF patients may be related to increased risk of mortality[20]. Heart failure is also associated with severe symptom burden and functional limitations[21], high patient and caregiver burden[1,2] and a low quality of life for patients[22].

Finally, HF is associated with frequent readmissions[23]; in the US more than one million hospital discharges for HF occurred in 2005[14]. A US-based study found that 65% of HF patients >65 years from a sample of Medicare patients were hospitalized at least once[24]. It has also been found that in the US, within three months, 20-30% of the HF patients that have been hospitalized are readmitted to the hospital[4]. A main reason for unplanned hospital admission is worsening of HF[19, 24], which are known to be somewhat preventable. Specifically, it is estimated that 50% of the readmissions can potentially be prevented[24]. The frequent readmissions cause a burden on patients, their caretakers and the medical system[23]. In fact, HF accounts for approximately 1-2% of the total healthcare budget in developed countries[3], and the costs are highest in the US; a review including economic data covering 98.7% of the world's population demonstrated that the US accounted for 28.4% of the global HF costs[25]. The HF-related costs are primarily due to the readmissions[3]. In the US, in-hospital HF care accounts for approximately 60% of the HF-related costs, while costs for disease management, including outpatient follow-up visits with general practitioners, cardiologists, and/or HF nurses, as well as the costs for chronic medication, are far lower. European countries demonstrate a similar pattern[26].

Insufficient engagement in self-care behavior as a risk factor for adverse clinical outcomes in heart failure

Usually, HF cannot be reversed, but can be managed with pharmacological treatment, as well as non-pharmacological treatment, namely engaging in self-care behaviors. As previously argued, one of the main reasons for readmissions is worsening of HF. Insufficient and/or inadequate engagement in self-care behavior can lead to a worsening of the condition, and thereby also to hospital readmissions and other adverse outcomes. Specifically, it has been reported that 42% of cardiac decompensation (which likely leads to emergency department (ED) visits and hospitalization) was due to lack of adherence to the regimen[27]. Moreover, it has been found that among patients with symptomatic (i.e. more severe) HF, practicing above average self-care management (including symptom recognition and taking appropriate action) can lead to event free survival (events include ED visits and hospitalizations) similar to non-symptomatic HF patients[28].

Pharmacological treatment is common practice for the treatment of HF patients, including diuretics, angiotensin-converting enzyme inhibitors, beta blockers and Angiotensin II receptor blockers (ACC/AHA guidelines). For the medications to be effective, patients must take their medications as prescribed to them by their doctor. However, although research on medication adherence using self-report measures demonstrates that adherence to HF medication is sufficient[29], studies that use more objective measurement techniques such as claims data that provide an indication of prescription fillings[30], or medication event monitoring

(MEMS) data[31], demonstrate low adherence rates. The distinction between self-reported and objectively measured medication adherence is particularly important as it reveals that medication adherence can affect survival rate; one study found that objectively measured medication adherence (using MEMS data) was related to event free survival, while self-reported medication adherence was not[32].

Self-care behaviors in HF, in addition to taking medications as prescribed, include engaging in physical activity, restricting salt, fluid and alcohol intake, and monitoring signs and symptoms[9]. Clinical guidelines for the diagnosis and treatment of HF recommend self-care behavior to HF patients, and state that patients should receive education on this topic[9, 33]. Previous findings suggest that physical activity has an impact on clinical outcomes, and more specifically that performance of PA among HF patients can lead to a reduction in readmission and mortality rates[34]. However, most research conducted to date regarding effects on clinical outcomes has focused on structured exercise training programs[35] rather than PA that is structured or conducted at one's leisure time. Despite the promising effects, adherence to PA recommendations is inadequate among HF patients[9]. Only 53% reported being physically active in one study[36]; another study showed that although 80% of the patients indicated that PA is important, only 39% reported engaging in sufficient PA[29]. Likewise, a third study showed that although 95% of the patients indicated that daily PA was important, only 11% reported engaging in daily PA[37]. There is therefore a clear indication that PA needs to be promoted among HF patients. Despite the potential for positive effects of PA for HF patients, healthcare providers do not always invest efforts into promoting PA among this patient population. Reasons include lack of knowledge about the efficacy of the behavior and financial reasons[38].

As previously mentioned, salt intake restriction is another self-care behavior recommended for HF patients[39]. However, dietary restrictions in HF have less evidence for their efficacy on clinical outcomes[34], although at least one study shows a relationship between objectively measured restriction of sodium intake and event free survival[40]. A state-of-the-science paper concludes that a number of reported studies demonstrate relationships between excess sodium intake and hospital admissions, but the evidence is insufficient to make specific recommendations that are grounded in scientific evidence[41]. Reported rates of adherence to the sodium restriction recommendation are 20-71%[42]. For example, one study that used urine sodium excretion assessment to assess sodium intake, found that only 25% of the HF patients in the sample were adherent to the sodium intake recommendation[43].

In addition, it is recommended that HF patients restrict their fluid intake (1.5-2 liters a day for patients with severe HF, while for patients with moderate HF it has been suggested that fluid restriction is less likely to lead to a benefit). However, there is limited evidence regarding the effectiveness of this recommendation in improving clinical outcomes, and the evidence that does exist is mixed[9, 39]. In any case, adherence to the fluid intake restriction recommendation seems to be suboptimal; one study reports 73% adherence to the fluid

restriction recommendation[29] and another reports a 48% adherence rate[37]. In addition, specifically alcohol restriction is recommended for HF patients, but one study reports that although 86.3% of the patients in the sample agreed that avoiding alcohol consumption is important, only 33.3% reported restricting their intake[37].

Despite the somewhat limited evidence for salt and for fluid intake restrictions' effects on clinical outcomes, there is some evidence suggesting that a combination of fluid and salt intake may be beneficial for HF patients. Specifically, in a study that included an intervention with individualized dietary recommendations, restricting salt and fluid intake according to the guidelines-based recommendations, the intervention group had a better composite end-point score than the control group, (the composite end point consisted of HF severity (New York Heart Association class), hospitalization, weight, peripheral edema, quality of life, thirst, and diuretic prescriptions)[44].

Monitoring signs and symptoms, with the goal of anticipating or recognizing deterioration, includes assessing symptoms such as shortness of breath and edema and taking appropriate action if encountered[39, 45]. There has not been much research published on the rates of adherence to this recommendation, but an observational study in which patients were asked twice regarding their self-care at a one-month interval, demonstrated that approximately 50% of patients monitored their symptoms at baseline and 62% at follow up[46]. A study that measured compliance to the self-care behaviors with self-report methods, found that from baseline (at index hospitalization) until an 18-month follow-up, compliance with daily weighing ranged from 34% to 85%[47]. Specifically, it increased from 34% at baseline to 85% at 1 month, but decreased over time to 67% at 18 months.

In conclusion, there are a number of recommended self-care behaviors for HF management. There is at least some evidence that adherence to most of these recommended self-care behaviors can lead to an improvement in clinical outcomes, but for the evidence for some of these behaviors is more convincing than for others. Self-reported adherence rates to the recommendations are often low, and when measured objectively the evidence regarding low adherence levels is even more convincing.

Determinants of engagement in self-care behaviors

According to the model of planned health promotion, information on behavioral determinants is crucial for the development of new interventions[48]. In order to modify targeted health behaviors, interventions should address behavioral determinants. Various theories and theoretical models of health behavior which seek to explain and predict health behavior, suggest a range of behavioral determinants. These include Social Cognitive Theory (which specifies determinants such as self-efficacy and outcome expectations)[49], Theory of Planned Behavior (which specifies determinants such as behavioral beliefs, subjective

norms, perceived behavioral control and intentions to perform the behavior)[50], and the Health Belief Model (which specifies determinants such as perceived severity and susceptibility, perceived benefits and barriers and cues to action)[51], among others. Information on determinants can be extracted from such theories. Health behavior theories are often based on research which explored and tested behavioral determinants and tests the relationships between determinants and behavioral outcomes. Observational studies that measure the relationships between relevant variables and the behavioral outcomes provide important information on observed relationships but can rarely indicate the direction of causality. Intervention studies which assess the effects of interventions on outcomes can also include an analysis of effect mediators, and thereby reveal information on behavioral determinants while also providing insight into the direction(s) of causality.

Information on determinants of self-care behavior among HF patients was crucial in the scope of the current work, which had a central aim of developing a health promotion intervention for HF patients. To have an overview of the existing information regarding determinants of self-care, we opted to synthesize the existing evidence in two literature reviews (Chapters 3 and 4), one on correlates and determinants of non-pharmacological self-care behaviors and one on correlates and determinants of medication adherence. In addition, we performed a study on correlates (as presumed determinants) of PA among HF patients (Chapter 5).

Existing interventions aimed at promoting heart failure self-care behavior

Various interventions promoting self-care behavior among HF patients, spanning community and inpatient settings, have been developed and tested, showing various levels of efficacy. Disease management programs are often multidisciplinary, aim to improve quality and cost effectiveness of care[52, 53], and often include an educational component which addresses self-care[54-56]. Disease management programs may include telehealth components (including digital transfer of physiological data from the patient at home to a healthcare provider) and/or telephone support (including phone calls from a healthcare provider) and often include educational components[57]. Although there is some promising evidence, the evidence is mixed regarding the effects of such programs, and which program aspects are effective[58].

In the hospital, typically HF nurses provides education (in the US in-hospital education may be referred to as discharge instructions) to patients before their discharge from the hospital[59]. Quality measures which have been developed by the American Joint Commission, include a measure of the provision of discharge instructions which states that all HF patients should receive written instructions or educational material on six topics before hospital discharge (diet, activity, discharge medications, weight monitoring, treatment

plan for worsening signs or symptoms, and keeping follow-up appointments)[60]. Therefore, structured efforts to promote the provision of education to hospitalized HF patients have been, and are still being, implemented.

However, results demonstrate poor adherence to the discharge instruction quality measure, and this is regarded a main reason for the high readmission rates of HF patients within one month of discharge[59]. In fact, it has been reported that the majority of HF nurses spend less than 15 minutes on pre-discharge HF education[61]. A study that measured the frequency with which recommendations were provided on behavioral topics at a US hospital, found that recommendations were infrequently provided regarding many self-care behaviors. It was found that, within a US patient sample, 20% received education on only one or none of five non-pharmacologic behaviors, and only 5% received education on all topics. The most frequent recommendation was related to salt intake reduction (84.1%), followed by physical activity (32.9%), restriction of fluid intake (22.7%), weight monitoring (21.5%) and <1% of patients were counseled about alcohol consumption[62]. It has been suggested that the instructions are often not delivered due to the fact that they are labor-intensive, and require a dedicated nurse to spend a substantial amount of time for their delivery[59]. In addition, nurses may be more comfortable providing education on some topics than others[61]. A questionnaire measuring understanding of discharge instructions demonstrated that immediately after the nurse has provided the discharge instructions to patients, only 7% of patients understood all 6 topics of education[63]. These findings suggest that HF inpatient education demonstrates room for improvement, both in terms of the proportion of patients that receive instructions, as well as in the level of understanding of the patients that do receive them.

Although the vast majority of patient education and health behavior promotion efforts for the hospital setting are nurse-led, at least some effort has been aimed at ICT-based interventions. A CD rom-based educational program has been developed for HF patients for the hospital setting[64], focusing on providing information to patients by displaying animations, photos and voice-overs. This program was focused only on transferring information to patients (i.e., education) rather than motivating patients for behavior change. However, it demonstrated similar (although not superior) results as standard education[65], as well as patients' acceptance of the technology[66].

An additional study tested an ICT-based self-care behavior education intervention, but delivered in the home rather than the hospital setting. In this study, a group of patients that received an in-hospital standard education, including face-to-face and written components, were compared to a group that received a video educational intervention for viewing in the home setting in addition to the standard in-hospital education. Results showed that three-month healthcare utilization was similar between groups but patients that received video education needed less medication, received more HF literature, and needed less telephone support from healthcare providers. Patients that received video education also had greater

symptom reduction and greater self-care adherence[67]. Therefore, although there has not been much research on ICT-based self-care behavior interventions for HF patients, there is some evidence suggesting that such interventions can be at least as effective as standard education. As previously argued, ICT-based interventions may be more cost-effective and have a wider reach, and may therefore be preferable over standard education even when they do not demonstrate a superior effect.

It may be worthwhile to focus on technological efforts on the hospital setting and design more effective in-patient education and self-care promotion programs for use specifically in the hospital. Hospitalization may constitute a teachable moment[68], activating patients to change their behavior after discharge, and may provide an opportunity to reach more patients. Finally, technological solutions for the promotion of self-care behavior may take over some of the HF nurses' educational tasks, thereby freeing up some of their time and allowing them to provide more intensive instruction to the patients that need it. However, the hospital setting may have an impact on the experiences of patients with a health promotion program. For instance, the patient's physical and emotional state when in the hospital[69] may influence their experiences with the program, which may influence its efficacy level.

Paper-based instruction materials and teaching aids are typically used by HF nurses to supplement their instruction about self-care behavior in the hospital. Paper-based instruction materials on HF self-care are readily available through various organizations, including the British Heart Foundation, the Heart Failure Association of America and the European Society of Cardiology. However, it may be worthwhile to develop ICT-based programs, because such programs allow patients to interact with the technology, facilitating learning beyond paper-based materials. ICT-based programs can include assessments for patients to complete, and in this manner collect information on characteristics such as knowledge level or motivational factors, among others. With the information that is collected from the patients, it is possible to tailor health information, personalizing the programs to each individual patient. This is more difficult to achieve with paper-based programs, which therefore usually provide only generic information. Furthermore, with ICT-based programs, tailoring of health information can be achieved at a relatively low cost[70] and it is convenient[71] to deliver and access programs.

Tailored health communication

Within programs that provide tailored communication, the source, message and/or channel of communication to the individual can be customized[72]. It has been suggested that tailored health information is superior to generic health information in leading to a change in health behavior; some of the reported mechanisms include more intensive cognitive processing, greater relevance of the information provided to the individual receiving it

and self-evaluation properties of the feedback received[73]. Studies that tested tailored health communication interventions have shown promising results in promoting nutrition-related behaviors[74,75] smoking cessation[76] and physical activity[77], among other health behaviors, but most of these studies were conducted for primary prevention purposes, among apparently healthy people.

Fewer studies on computer-tailored health education have targeted patient populations, and only one study tested a tailored health communication intervention among HF patients. In this study, health beliefs regarding taking HF medications, following a sodium-restricted diet, and self-monitoring for signs of fluid overload, were assessed in the intervention group, which received messages from a nurse, which were tailored to each patient based on the results of their assessments. Patients in the control group received usual care, including discharge teaching by a staff nurse and written educational materials[78]. This study found no effect of the intervention group, in comparison to the control group, on readmission rate or quality of life. However, beliefs, which are the presumed determinants of the health behaviors affecting clinical and quality of life outcomes, did change in the expected direction over time within the intervention group. In sum, tailoring seems to be a promising behavior change strategy. There is only one known (not ICT-based) tailored self-care behavior intervention for HF patients, and it demonstrates room for improvement.

Approach of the current work

As previously discussed, the current work addresses three aims. The first aim, relating to the merits and levels of PA among HF patients, is addressed with a study on the mortality-reduction effects of PA among MI survivors (with and without HF). This study focused on post-MI patients for two reasons. Post-MI patients' life expectancy has substantially increased in the past 40 years, although it is still lower compared to the healthy population[79]. However, post-MI patients' life expectancy is likely to be substantially reduced if they develop HF[80]. This suggests that it is still important to understand what can curb mortality rates among post-MI patients, despite the fact that they are apparently lower than in the past, and it is particularly important to understand this for the post-MI patients that also developed HF. Importantly, the decrease in mortality rates of post-MI patients has been found to parallel an increase in subsequent HF[79]. Specifically, the 30-day incidence of HF after an MI rose from 10% in 1970-1979 to 23% in 1990-1999[79], making HF a major possible outcome of having an MI, and decreasing life expectancy for those that develop it. Therefore, although the study did not focus specifically on HF patients, due to MI being a likely predecessor of HF, it was deemed suitable to address the effects of PA among sub-groups of post-MI patients (including HF patients) in the current work.

Further understanding about the levels of PA among HF patients (aim 1), can be gained by understanding differences between sub-groups of patients in terms of the influences of the health behaviors on outcomes (i.e. the moderators of the relationship between the behaviors and the clinical outcome). Information on how different sub-groups of patients are influenced by engaging in self-care behavior is important because it can be used to target interventions to specific groups. For example, this information can support decisions regarding the specific elements that should be included or excluded in the intervention, when delivered to certain sub-groups of patients, as well as regarding the intensity of delivery of the intervention components to sub-groups of patients. We investigated two important psychosocial moderators of the relationship between leisure time physical activity (LTPA) and survival among post-MI patients, specifically depression and low social support, which are both mortality risk factors.

As previously mentioned, we worked according to the model of planned health promotion[8] (Figure 1.1)). This model postulates that in the process of the development of a health promotion intervention addressing a risk behavior, such as non-adherence to self-care, the determinants of the risk behavior should be known so they can be addressed. We therefore conducted systematic literature reviews synthesizing the evidence on presumed determinants of HF self-care, as well as additional research on this topic. This work addresses the second aim of the current work, relating to the correlates and presumed determinants of self-care behavior among HF patients.

Finally, although one tailored intervention for HF patients exists[78], no information is available on whether this intervention followed a systematic planning and intervention development approach. In the development of Motivate4Change, a computer-tailored intervention designed specifically for hospitalized HF patients, we worked according to a stepwise approach that has been advocated to develop effective intervention programs[8]. Specifically, the IM protocol[48] was used to guide the development of the intervention. The IM protocol is a stepwise method that is used to develop interventions systematically using relevant theory and evidence. By going through the steps and creating matrices, decisions are made regarding the specific behavioral change objectives. These change objectives are then achieved by identifying theory and evidence-based strategies and behavior change techniques. When this approach is used, determinants and change strategies that are most likely to affect the desired outcomes are selected for inclusion in the intervention, increasing the confidence in its efficacy. Finally, studying the experiences and needs of the users of Motivate4Change in the intended setting for implementation was considered a final step in its design, providing information on important issues to be incorporated in the resulting program and in the potential future implementation of the program.

This thesis consists of eight chapters describing the rationale for promoting self-care behaviors in HF patients, existing and newly-generated knowledge regarding determinants of self-care behaviors, and the development and formative pilot evaluation of an ICT-based

intervention to promote self-care behavior intervention. After this general introductory chapter, in Chapter 2 an analysis assessing the relationship between leisure time physical activity and survival among post-MI patients, as well as moderators of this relationship (HF and psychosocial variables), is reported. In Chapters 3 and 4 we report on systematic literature reviews that assessed the evidence for the various HF self-care behaviors, which assisted in the selection of the behavioral determinants that were targeted in the self-care behavior promotion intervention. Since the reviews demonstrated little evidence about the determinants of PA among HF patients, we conducted an analysis of correlates of PA among HF patients, which is described in Chapter 5. Chapter 6 includes a description of the development the Motivate4Change intervention using the IM protocol, and the formative pilot evaluation of Motivate4Change is described in Chapter 7. Finally, the thesis ends with a general discussion in Chapter 8.