



THE REFERENCE FUNCTIONS OF DIGITAL HOSPICE CARE APPS FROM A SERIOUS GAME THEORY PERSPECTIVE

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Abstract

The thesis identifies a multiplicity of existing challenges and dilemmas in the hospice care field, such as the increasing demands, limited access, difficulties caused from people with life-limiting conditions living at home and other concerns. The thesis proposes a way of combining the advantages of Serious Games and mobile apps to possibly solve some challenges, namely, a digital app designed for patients from a Serious Game perspective, which could be a complement of current hospice care services and assist in remote hospice care. The analysis of existing resources exposes a lack of hospice care apps containing game elements and designed for patients. The thesis therefore formulates two criteria and conducts a review of apps in health & fitness category in the Swedish App Store. Criterion 1 is for identifying the apps and functions that meet the needs of patients with non-small-cell lung cancer (NSCLC). Criterion 2 is for making sure the functions selected containing game elements. The thesis identifies and lists 85 eligible functions and provides brief summaries and analyses. These outcomes can be considered as Reference functions for improving existing hospice care apps and inspiring future researchers and designers.

Keywords: Hospice care, Serious Games, Digital apps

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1 Introduction

Hospice care as an emerging term being created in the past few decades has been constantly redefined, according to the research from Hui, et al. (2013), who conducted a literature review summarizing definitions for hospice care, and research from Mann and Welk (1997) who defined hospice care. Based on these, hospice care can be described as a health care providing symptom management and psychological support for people with life-limiting conditions. The initiation and development of hospice care service started a few decades ago, Dame Cicely Saunders developed hospice care in England in the 1960s (Krista, 2016), the U.S. Congress created Medicare hospice benefit in 1982 (Mor and Teno, 2016). Although countries all over the world generally started working in this field and have made some achievements in this regard, there are still some problems being found from this emerging system through doing literature review, for instance, people living in rural and remote places are relatively hard to reach with this benefit (Kirby, 2016) and terminal cancer patients are reported to prefer home hospice care (Murray, 2009), however, traditional hospice care takes place at hospice care centres.

On the other hand, with the development of new technologies, the continuous upgrading of electronic products and the sustained evolution of software industry new possibilities emerge. One such area is the industry of games, as well as the emerging Serious Games industry. Serious Game has been defined variously. According to Gobel and Meimaris (2011) who elaborate the definition from Serious Game Conferences 2010 and 2011, a Serious Game refers to a game not mainly focusing on entertainment but to support learning and other purposes. Serious Games have been widely used in the health field (Voravika, et al., 2013), to enrich and facilitate people's daily life and wellbeing. Furthermore, the cases of combining Serious Game theory with health supporting related apps are well documented (Iglesias-Posadilla, Gómez-Marcos and Hernández-Tejedor, 2017; Hidalgo-Mazzei, et al., 2016; Polzer and Gewald, 2017). However, when it comes to hospice apps, there seem to be no such connection.

My aim is to explore how a Serious Game designed for patients on a mobile phone may solve some of the challenges in the hospice field, using the advantages of mobile apps such as high penetration and portability to achieve remote hospice care and characteristics of Serious Games to mobilize users' motivation and increase the frequency of usage. The analysis of existing resources exposes a lack of hospice care apps designed for patients. Thereby, the aim of this thesis is to picture a possible blueprint for such apps from Serious Game theory. Overall, the specific research question of this thesis is led to searching the Reference functions of digital hospice care apps from a Serious Game theory perspective.

The method used is to identify and analyse existing health & fitness apps to find apps and functions that meet the needs of patients and contain game elements. By analysing the existing apps, the thesis aims to determine if and how these apps and functions can be used for hospice care. The thesis is focused on finding apps and functions with relevance to the needs of people with non-small-cell lung cancer (NSCLC) in stage IV, which is the terminal stage of NSCLC while normally hospice care is considered being provided to patients (Lieberman, et al., 2006). Since there are many diseases that can cause a life-limiting condition, and people with different diseases in different stages are having different needs,

the research scope would be too wide, if the thesis concerned all categories of patients in hospice care. Two criteria are created to identify and screen apps, one is to guarantee that apps or functions can certainly meet the needs of patients, the other one is to judge if apps or functions contain game elements. The method used in the thesis can be replicated by other researchers for the study of other diseases in the hospice care field.

This thesis discusses and analyses the needs of people with NSCLC in stage IV. By analysing the existing apps to identify apps and functions that meet the needs of patients and contain game elements, the essential aim is to create a set of Reference functions which can be useful to the researchers and game designers who work on this disease. The outcomes are not necessarily adaptable to other diseases and stages, but the methods and the process being used in this thesis may be extended to do similar research for other diseases and stages in the hospice care field.

This thesis is organised as follows: The second chapter introduces the background of the hospice care field while analysing the existing challenges it faces and presents the application of serious games, especially in the medical field. The third chapter proposes a way to potentially deal with some of challenges and formulates two criteria by means of a literature review. The fourth chapter conducts a review of apps with the two criteria, lists the functions that meet the criteria, and performs a brief analysis. The fifth chapter summarizes the outcomes made by this thesis throughout the process and their potential contributions. The sixth chapter briefly summarizes the work of this thesis and envisages the future work.

2 Background

This chapter mainly introduces the background in two parts that this thesis is based on. The first part elaborates the general development of hospice care field. Through the literature review, it further analyses the existing challenges in hospice care field. The second part elaborates the extensive application of Serious Games in various industries, especially the positive impact on modern medical care field. It also talks about the application of Serious Games in mobile apps and the Gamification as a part of Serious Games.

2.1 Hospice care

Hospice care as an emerging term is being wildly used in health care field, and variably and constantly redefined in numerous literatures. Some other similar terms like “palliative care”, “supportive care” and “best supportive care” are also commonly being used (Hui, 2013), although those terms have slightly different leanings in definition. There is no authorized definition given by any relevant acknowledged organization. However, the terms “palliative care” and “hospice care” were most commonly used in the published palliative literature (Hui, 2012). This thesis chose “hospice care” to define this type of health care. Regarding the specific definition, Tehan (1980) proposed the necessity of proving a formal definition and discussed some possible standards. Mann and Welk (1997) defined hospice care and stressed the importance of psychological support in the definition. Billings (1998) argued the fundamental characteristics of hospice care patients. Jennings (2003) elaborated the necessary fundamental composition of hospice care. Overall, hospice care can be defined to describe a health care providing symptom management and psychological support for people with life-limiting condition.

We have moved from a society where hospice care was the responsibility of the family to a situation where it is more of a responsibility of the social welfare system. Hospice initiated as a social movement among a group of people, particularly in the unit of family and tribe, dates back to thousand years ago. In ancient China, hospice was even more of a deep-rooted responsibility to other family members. The first common acknowledged hospice care was conducted by Dame Cicely Saunders in England in 1967 (Dobson, 2017). According to Mor and Teno (2016), in 1982, the U.S. Congress created Medicare hospice benefit which had been extended to beneficiaries living in nursing homes in 1986. In China, the first research centre was found in Tianjin Medical University in 1988, and the first hospice and palliative facility was established in 1990 (Wu, 2015). Overall, the spontaneous traditional hospice movement is typically limited in a small scale like family, up to the time of decades ago, and then the systematic hospice care has started to be gradually established in organizations and countries.

Hospice care service as a part of health care service can not only somewhat relieve patients from suffering affliction and improve their personal well-being at the end of their life, but also benefit the whole community and country. A population-based study conducted by Chiang (2015) shows that non-hospice patients are more likely to receive high-cost care than hospice patients.

Even though the hospice care system in countries and organizations has been increasingly developed and gradually completed through the clinical practice, this field is still relatively new and problems have been exposed from various aspects. The general aging of global population has increased and will continue to grow in the upcoming decades (UNFPA, 2012).

Accordingly, the demand of hospice care has risen. This effect has been reflected differently between economically developed and developing regions of the world. According to Masa (2015), developed regions have aged, and the aging of the population has been taking place slowly. By contrast, developing regions just started experiencing population aging in a relatively fast way. Furthermore, an increasing number of patients diagnosed with incurable diseases has become the other critical factor leading to increasing demands of hospice care. Cancer is the leading cause of death in China, by 2020, approximate 5.5 million patients with incurable diseases will be diagnosed annually in China (Chen 2015).

The distribution of population all over the world is not equitable. People living in rural and remote regions are comparatively harder to be offered comprehensive hospice care than people from urban regions (Kirby, 2016). In prison, the extremely fast growth rate of aging population among inmates has been pointed by Jeremy and Christopher (2017). Even though elderly inmates are in a special situation, hospice care as one of the human rights has not fully reached them yet.

From the experience of traditional hospice clinical practice, the physical needs of patients are always being put in the first priority. Spiritual needs are occasionally ignored unintentionally. Cobb (2012) has conducted a literature review that screened and reviewed published literatures discussing spiritual needs of hospice care patients from several databases, which pointed out these needs of terminally ill patients. Marjorie (2003) conducted a case study that shows one possible way that physicians may meet some of these needs. Substantially, the unmet needs among hospice care patients are widespread, even though, there are abundantly well-documented researches showing and addressing these problems (Marjorie, 2003). Additionally, the fear of running out of time and other concerns could easily lead to various mental problems. Patients with advanced cancer typically reveal sharp deterioration in psychological status during the last months of their lives (Stukenborg, Blackhall and Harrison, 2016).

Murray, et al. (2009) discussed the place where dying people live in the research, which shows that most patients with terminal cancer prefer home hospice care. A study conducted in England by Bone, et al. (2018) indicated that between 2004 and 2014, there have been increases in the proportion of deaths taking place at home and in care homes. There is evidence showing significant changes in the increasing tendency of people with life-limiting condition who choose home as the place of residence at the end of life. The reasons could be diverse, while getting close to the date of death, some of the patients would become more careful to prevent their privacy and decline exposing their actual situation of disease, and then they tend to prefer staying more at home (Thomas, 2004). Home is not simply a physical space, but more of a place that allows patients having an emotional connection with family members and old memories (Exley, 2007).

There are other concerns regarding the challenges in hospice care. Traditionally, the modern hospice care was based on the Christian faith. With the development of globalization and the increases of multi-cultures and religions over the world, the diversity in hospice care will soon be apparent (Jina, 2012). According to Sebastiano (2016) who conducted a case study exploring the age differences in the last week of life in advanced cancer patients, which found even having the same disease, age differences can cause acutely different needs in individuals. There is a great number of people who live alone when going through life-limiting condition. Samar, Aoun and Kim (2013) studied the preferences of these people and appealed more

concerns to them. Each individual has unique interests and personality, Marjorie (2003) appeals to give patients more individual concerns and let them feel special and unique.

2.1.1 Hospice care in Sweden

Hospice care in different countries in the European Union has been continuously developing since the 1960s (Clark, 2006). Sweden is a vast but sparsely populated country. Most of its population is concentrated in the southern part of the country. According to Fürst (2000), as early as 1979, the Swedish government promoted and standardized relevant standards in the field of hospice care through an official document. The first case of hospice care was practiced as part of the national health system in 1980. In 1992, a national document in Sweden officially separated hospice care from health care system and emphasized several different types of hospice care. In 1995, after consulting with people such as industry specialists, policy makers and barristers, and taking into account various factors, the Swedish government end up ranking hospice care as one of highest priorities in its health care system. After decades of development, the hospice care system in Sweden has become more complete. Woitha, et al. (2016) integrated a variety of factors applying different weightings to compare and rank the maturity of European countries' hospice care systems, in which the United Kingdom took the lead, followed by Belgium and the Netherlands, and Sweden ranked fourth.

Ageing and incurable diseases are the two causes of an individual's life-limiting condition in hospice care field. According to Sundström (2009), Sweden was one of the first countries to experience rapid population aging. In the 18th century, the elderly people aged 65 or over accounted for 6% of the total population. In the early 20th century, the elderly people accounted for 8% of the total population (Davey, Malmberg and Sundström, 2013). Recent statistic research (IHME, 2016) has shown a list that ranks the top 10 causes of death in Sweden, which in descending order are ischemic heart disease, Alzheimer's disease, cerebrovascular disease, lung cancer, chronic obstructive pulmonary disease (COPD), colorectal cancer, lower respiratory infect, prostate cancer, atrial fibrillation and other cardiovascular. Compared to the data in 2005, the death toll from Alzheimer's disease, COPD, lower respiratory infect and atrial fibrillation has risen by more than 10%, and only the death toll from both ischemic heart disease and cerebrovascular disease has slightly declined.

Sweden enacted an ordinance in 1984, which stipulated that patients have the right to know the true situation of their conditions and to make their own decisions according to their own wishes. The act also required doctors to truthfully inform patients about their conditions.

Swedes are active in facing life when they are getting old. A survey conducted by Frändin, et al. (1991) indirectly supported this view, a total of 619 people in Gothenburg in their 70 years old were included and analysed and the results show that two-thirds of the participants walked for more than 30 minutes a day. BRIGHT SIDE (2018) pointed that walking is one of the most effective ways to prevent people from getting Alzheimer's disease. Swedes have a relatively natural attitude towards death caused by either diseases or ageing. When I talked with a hospice care expert, she mentioned that the attitude of the Swedes towards death is less restricted by religion. Most swedes think that they were born from nature and hope to return to nature after death such as being buried in the forest after death. As for the matter after death, most are even willing to contribute to society, like donating their organs. Sanner (1998) studied the attitudes of people in the country of Uppsala, Sweden, toward transplantation of organs. The results showed that 61 percent of respondents were willing to donate their own organs after death.

2.2 Serious Game

The emerging term of “Serious Game” was introduced over the last few decades. As a part of game industry, its application covers a wide range of fields, including medicine, military, education, business, politics, psychology, sociology, economics, agriculture, etc. (Ma, 2011). The definition of a Serious Game is interpreted variously. Alvarez and Djaouti (2011) proposed a definition from the characteristics and objectives of the game that a Serious Game is a combination of traditional game and at least one other function, such as providing a training and imparting a knowledge, and also a Serious Game must target a market other than entertainment. Zyda (2005) defined a Serious Game as a kind of game under certain rules of the game, using entertainment for collaborative training, health and education and other fields. Overall, Serious Game is a kind of game that does not have entertainment as its main purpose. Its purpose can be to help people learn some skills, improve people's lives and even benefit the whole society.

According to the estimation from Alvarez, et al. (2010), the overall market value of Serious Games has reached 1.5 billion euros in 2010, which is all thanks to the rapid development of science and technology since modern times. The continuous upgrading of electronic components has laid a hardware foundation for the development of the game industry. The vigorous development of the game industry has given the possibility of existence and development of Serious Games as part of the game industry. With the increase in the complexity of game content, the improvement of fine arts effects, and the upgrading of engines, many games are gradually requiring higher computer hardware configurations. This demand is the driving force of hardware manufacturers to develop and produce better hardware. By contrast, only with the emergence and promotion of hardware, more sophisticated games can be produced. Therefore, it can be elaborated that games and hardware promote each other, and the emerging industry Serious Game is based on these two industries. Only by relying on the development of these two industries, Serious Games can develop better.

Serious Games have a wide range of applications in various fields. In the military field, Serious Games can be used to train and improve the technical skills of soldiers, such as shooting, flying and driving. It can also be used to simulate actual combat, in order to test soldiers' reactions to special situations and help soldiers get familiar with the terrains and other information before entering the actual battle, which will help reduce casualties (Lim, 2013). In the field of education, due to Serious Games retaining some characteristics of traditional games, which can mobilize the interests of users, games may change the learning model in the future. For example, some Serious Games have been developed to expand students' thinking abilities and improve students' numeracy skills (Clark, 2007). In the medical field, Serious Games have been used to train internship nurses, making them more familiar with surgical procedures, training them with some special skills, and teaching them how to deal with different patients (Graafland, Schraagen and Schijven, 2012). In market field, Serious Games have been used to train newly employed workers so that they can quickly adapt to the work environment. Some games can also train people special skills, such as training mayors and people's leadership with SimCity (Poplin, 2014; Alvarez, et al. 2007).

2.2.1 Serious game in medical field

The medical field is an important area of Serious Game applications. With the development of modern medicine, various advanced technologies have gradually begun to be applied in this

field, so that patients can be treated more efficiently and economically. Serious Game is one of the emerging technologies.

Serious Games for the treatment of diseases. Treatment of psychiatric disorders has long plagued medical scientists because simply relying on drug therapy is often not effective (Fernández-Aranda, et al., 2012). The rapid development of Serious Games has made medical professionals interested in using them to improve the treatment of psychiatric disorders. Serious Games have been used as an aid in the treatment of many psychiatric disorders. It is inexpensive and has been proven having a certain effect (Madeira, et al., 2011). Newman, et al. (2011) published an article describing its design of a 2D game that could help eliminate the "stigma" of patients due to depression. Chi, Agama and Prodanoff (2017) explored the possibility of using Serious Games to help the elderly people with cognitive impairments and developed a game that was played by the control group and the experimental group. The results showed that the cognitive ability of the experimental group that played the Serious Game was significantly improved.

Training for nurses and doctors. Serious Games are widely used as a teaching tool for training nurses and doctors. de Lima (2016) pointed out that Serious Games can help simulate the clinical environment before medical students formally perform clinical operations, so that they could be familiar with the clinical operating environment and processes, furthermore, reducing their psychological pressure and error rate. Ricciardi (2014) conducted a literature review and found that many literatures emphasized that serious games can help health professionals learn new knowledges and improve their professionalism.

Popularization of medical knowledge and prevention of diseases. Serious Games can allow ordinary people to learn some basic medical knowledge and can also help people prevent some diseases. Boada (2015) describes a serious game designed to assist nurses in Cardiopulmonary resuscitation (CPR) teaching. Ordinary people can also learn relevant knowledge through playing this Serious Game and be able to respond quickly in an emergency. Thompson (2010) reported that combining serious games and behavioural science can prevent type 2 diabetes and obesity in adolescents. By playing serious games, players realized the harm caused by the disease and got means to enable them to correctly reduce the occurrence of the disease.

2.2.2 Serious Games in health & fitness on apps

Mobile phone apps have grown significantly in quality and quantity in recent years. In 2013, Apple and Google Play separately announced that the number of mobile apps in their markets have reached 1 million (Ingraham, 2013; Victor 2013). After just three years, Apple's App Store has more than 2 million apps. Mobile phone apps have many advantages. Accessibility, its uploading and downloading are all achieved through the mobile apps store. Users can download them from mobile apps store without directly contacting developers. Relatively low cost of use, many apps available are free to use. Real-time, users can continuously update their apps to the latest version. The update cycle of traditional software is relatively long. Security, the software in the regular stores has been tested before being put into stores, reducing the security risks.

As a result of the development of mobile apps, Serious Games that traditionally can only be performed on computers have gradually shifted to mobile apps. There are a number of Serious Games in health & fitness on mobile stores. People with diabetes often develop complications because they cannot adhere to their care plan. Goyal (2016) designed a mobile Serious Game

app based on self-behavior management for patients with type 2 diabetes, which combines with wireless medical devices to promote self-monitoring of diabetes, provides medical guidance to patients and encourages patients to follow the guidance with some bonus system. Madeira, Mestre and Ferreirinha (2017) designed a Serious Game to intervene 3-8 years old children with phonological disorders. The results of controlled trials show that this game has very positive help for children.

2.2.3 Gamification

"Gamification" refers to adding elements of the traditional game, such as badges, points, ranks, etc., to the original content of an app or software, thereby giving the original content the characteristics of the game and mobilizing the user's enthusiasm. Gamification was first introduced in 2010 (Radoff, 2011). According to Yohannis, Prabowo, and Waworuntu (2014), the word "gamification" began to be searched by users on Google at the end of 2010, and the trend of this search is increasing. Hamari, Koivisto, and Sarsa (2014) searched the literatures in recent years and found that academia also has shown a keen interest in "gamification" and the number of papers on related topics is increasing.

Compared to Serious Games that games are used to achieve goals other than entertainment, Gamification is more like a subordinate branch of Serious Games and belongs to Serious Game theory. More precisely, in Gamification game elements are used to achieve goals other than entertainment (Landers, 2014). Gamification has generally been widely used in different fields in recent years (Kapp, 2012). Companies incorporate Gamification in the company's internal management to promote employee attendance and increase overall work efficiency. Electronic software manufacturers integrate gamified content into its products to motivate users and increase product usage. Azmi, et al. (2017) mentioned the practice and application of Gamification in student learning programming. Dias, Barbosa and Vianna (2017) explored the possibility of making use of Gamification and Serious Games in depression care.

3 Problem

Hospice care is facing a multiplicity of challenges and dilemmas, such as the increasing demands, limited access, spiritual needs unmet and other concerns. Serious Games and Gamification are broadly being practiced in various industries and serving people in different ways, which have extremely enriched and facilitated people's daily life and wellbeing. In the field of mobile phone apps that has flourished in recent years, the combination of Serious Games and mobile phone apps has supplemented and supported various industries in many aspects. The medical field is one of the areas that is widely involved.

This thesis wants to investigate an approach combining mobile apps and Serious Game theory that might contribute to the field of hospice care and solve some of the current challenges in hospice care. One potential and relatively practical way of solving some of current challenges in hospice care field such as increasing demands, limited access and problem caused from people with life-limiting condition living at home, is carrying out remote hospice care on apps that can provide and support some of services needed in hospice care, consequently, alleviating pressure from current challenges in hospice care field, especially, being designed for patients as user group to benefit patients and from Serious Game theory to make use of the advantage of Serious Games.

This thesis aims to create a lens through which a review of existing apps in health & fitness category in App Store for the possible use in hospice care can be identified and analysed. More specifically, the aim of this research is to identify and analyse Reference functions of digital hospice care apps from a Serious Game theory perspective. This aim will be achieved by:

- Create two criteria, one is to identify apps and functions that meet needs of patients, the other one is to identify functions that contain game elements.
- Analyse apps and categorize functions yielded by the two criteria.
- List a set of classified Reference functions for hospice care apps.

3.1 Search criteria and delimitation

As an early step, this thesis conducted a search in App Store. The main purposes are to investigate the current situation of related apps in hospice care and investigate the feasibility and maturity of my solution for solving some challenges in hospice care. The search is conducted in the Swedish App Store provided by Apple Inc. (2018) and several synonymous terms such as “hospice care”, “palliative care”, “supportive care” and “best supportive care” that were terms being commonly used to define this sector health care (Hui, 2013) are searched. The Swedish corresponding translations of keywords being searched in English are also being searched. The suggested translations are given by Google Translate (2018). Additionally, the search is repeated on another account in the same Sweden App Store showed the same results. The brief searching results has been shown up below (Table 1). The complete search results with full details can be found in Appendix B.

Table 1 Searching results of synonymous terms and corresponding translations

Several keywords below regarding hospice care being searched in Swedish App Store

Searched keywords	Hospice care	palliative	Others (including 2 synonymous terms and 4 corresponding translations)
Number of results	47	60 (16 overlapped within the search results for “hospice care”)	4 (all overlapped within the search results for “hospice care”)

As can be seen from Table 1, the search results for “hospice care” and “palliative care” are the most common ones, and the search results for other keywords are covered by the search results for “hospice care” and “palliative care”. The total of 91 non-repeating results are divided into several categories below (Table 2).

Table 2 Searching results from Swedish App Store

A summary of the search results of keywords regarding hospice care from Swedish App Store has been showed below (only 91 non-repeating results being analysed and categorized, 20 overlapped apps are not included in the analysis section below), of which 91 descriptions were screened and 23 downloaded totally.

Category	Simply homepage of hospice care centre	Assisting nurses or professionals (Training or supporting nurses or caregivers 10, giving relevant knowledge 4)	Supporting patients (Sharing wishes 2, symptom control 3, decision making 2, religious needs 1)	Non-related (Entertainment 3, auction conferences 7, organization 5, medicine tool 6, unclassifiable 5)	Non-English (Chinese 2, German 3, unknown 3)
Number of results	34	14	8	27	8

From the Table 2, most apps being found available online were related to the homepage of a specific hospice centre, simply guiding users to register their family members. The non-related apps are sharing a big portion of the results, in contrast, the apps designed for supporting hospice care patients were only a few (8 of 91). In order to further analyse these apps that support patients, I downloaded them and conducted a detailed comparison.

Table 3 The comparison of apps for supporting hospice care patients

Features Name of apps	Clear statement that app was designed for patient	Practical measures that carry out symptom control	Involving any animation s and pictures	Involving any audio input and output	Keeping or sharing of wishes	Including game elements or based on games
Royal Trinity Hospice	×	×			×	
My Own Voice					×	
Palliative Care Symptom Guide		×				
Hear me	×			×		
SPICT app						
Religious Needs App						
Palliate Guide		×				
NHS Palliative Care		×				

From the above Table 3, it can be seen that only a small part of the apps supporting the patients declare themselves being designed for patients. Some of them declare that they can carry out symptoms control, in fact, they only explain the meanings of symptoms and do not provide practical and feasible measures. Most of these apps are relatively simple and they are more like a textbook. Some are structurally confusing because part of the app is functionally supporting patients and the other part is simply a portal of a hospice care centre. These apps rarely use animations and audio, but simple texts. No game elements or game-based apps are found.

3.2 Method

The essential attribute of the selected apps should be that they can meet the needs of hospice care patients. Regarding the fact that in the hospice care field, there are a great many reasons causing a life-limiting condition the needs are miscellaneous and uncontrollable. Therefore, this thesis mainly focuses on analyzing the specific needs of people with one specific disease.

There are plenty of apps related to the health field and some of them have functions that could possibly meet the requirement of hospice care apps. Instead of making up Reference functions, a screening and generalization of existing health apps constitutes a structured and effective way to identify them.

The whole structure of the method is summarized in Figure 1. The apps reviewed in this thesis are all available in Swedish App Store from 1st of April to 30th of April 2018, and the category of apps has been limited to health & fitness. Two criteria are being created through a literature review before reviewing apps. The process of creating two criteria are shown in Figure 1 on both sides.

- The first part of Criterion 1 is to identify the apps that possibly meet needs.
- The second part of Criterion 1 is to select the functions that could meet needs.
- The second Criterion is for ensuring that the functions selected contain game elements.

Once the two criteria being created, the process of reviewing apps starts from the middle top of Figure 1. Apps available in April in health & fitness category of the Swedish App Store (2018) would go through the first filter (part 1 of Criterion 1), then apps that possibly meet needs of patients would be collected and ready to go through next filter. The second filter formed by part 2 of Criterion 1 and Criterion 2 would mainly identify the functions that meet the needs of patients and contain game elements. At last, the functions would be categorized into different groups in which each group meets one of needs of patients.

I, the author of this thesis, claim that I have read the corresponding rules and guidelines from CODEX (2018) while doing this research, and all the methods designed in this thesis and related content written are subject to these rules and guidelines.

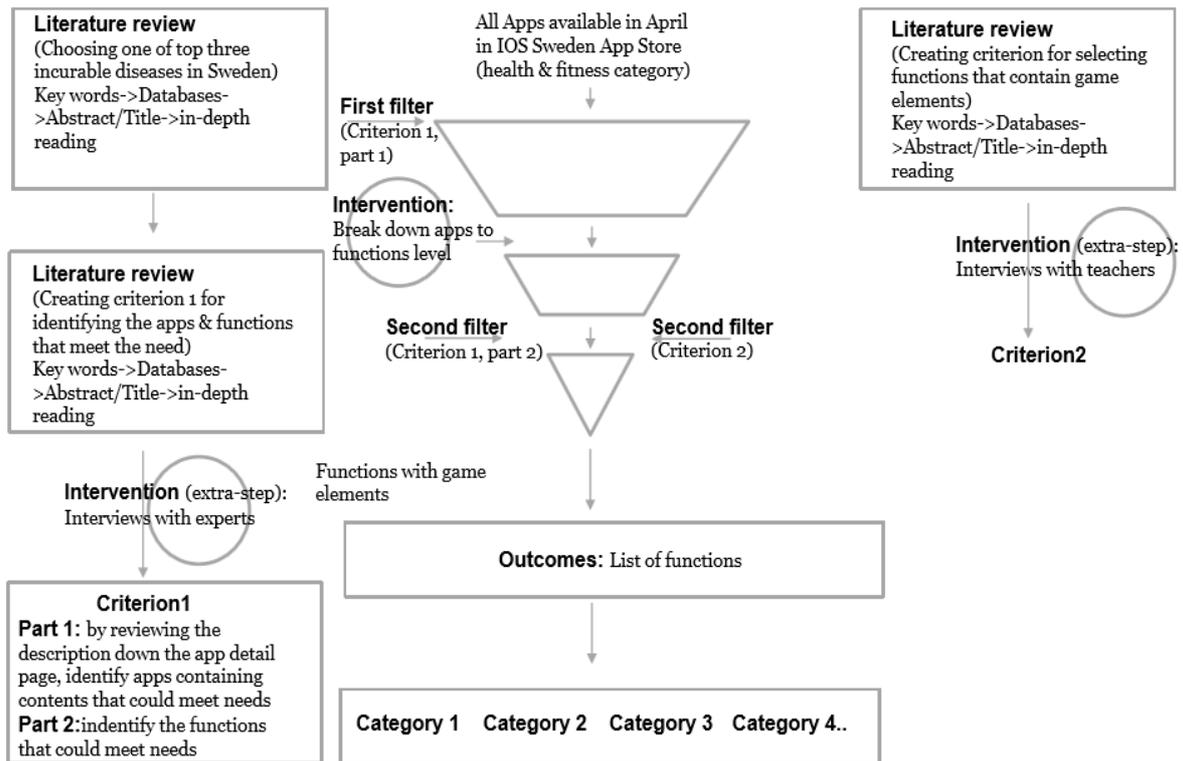


Figure 1 Structure of method

3.3 The process of selecting disease lung cancer

The suitable disease being selected as a cause of people with life-limiting condition to demonstrate and analyse the needs required in hospice care in this thesis must be representative, practicable and acceptable. Thereby, it would be chosen from one of the top incurable diseases in Sweden. The website of IHME (2016), shows the top 5 causes of years of life lost (YLLs) in 2016 which in descending order are ischemic heart disease, cerebrovascular disease, Alzheimer's disease, lung cancer, self-harm. In order to choose the most representative one, this thesis analysed the characteristics of each of them through literature review from CINAHL (2018) (see the brief summary of search results in Table 4 and the complete summary with all searching terms and limitations in Appendix B), Table 5 shows the analysis of characteristics of these diseases.

Table 4 Searching process of diseases from CINAHL

Disease name	Yield	Abstract screened
Ischemic heart disease	206	112
Cerebrovascular disease	221	80
Alzheimer's disease	104	100
lung cancer	257	180
Self-harm	111	95

Table 5 The analysis of characteristics of diseases

Ischemic heart disease	
Types of this disease	Ischemic heart disease can be divided into three types: normal coronary artery (NCA), nonobstructive coronary atherosclerosis (NOCA), stable angina (SA), unstable angina (UA), and acute myocardial infarction (AMI) (Fan, et al., 2017)
Stages of disease	Lusignan, et al. (2004) conducted a study with 19,470 patients with ischaemic heart disease in phase 1 and 19,784 patients in phase 2
Average age of disease	Ohlsson and Merlo (2011) investigated the mortality and morbidity of ischemic heart disease from 2000-2003 among 684,673 people age 30-84 living in Scania, Sweden, and found 8,068 cases of this disease from age group 50-64 and 23,297 cases of this disease from age group 65-84
Common symptoms	Cassar, et al. (2009) presented several symptoms in this disease that are typical angina, atypical angina, or noncardiac chest pain
Average time left after being diagnosed	Sedlis, et al. (2015) assigned 2287 patients with ischemic heart disease, and found the median duration of survival for all patients was 6.2 years

Continue Table 5 above:

Cerebrovascular disease	
Types of this disease	Cerebrovascular disease can be divided into three types: ischemic stroke or mini-stroke and hemorrhagic stroke.
Average age of disease	Kuwabara, et al. (2008) analysed 13856 patients with CVD, and found there were 5172 (37%) patients under 65 years of age, 4096 (30%) 65-74 years and 4588 (33%) 75 years or older
Common symptoms	Vermeer, et al. (2007) analysed 202 patients (men 53% and women 47%, mean age 65.2) with stroke in 2014 in Ontario and results showed 36% of patients having varying grades of depressive symptoms
Mortality and morbidity of disease	Huerta, et al. (2013) recruited totally 13576 men and 19416 women aged from 29 to 69 and carried out a 12.3 year of mean follow-up, found that 210 transient ischemic attacks and 442 stroke cases (80% ischemic, 10% hemorrhagic stroke, 7% subarachnoid hemorrhage, and 3% others)
	Sozio, et al. (2009) enrolled 1041 incident dialysis patients in 81 clinics from 1995 to 1998 and followed up until 2004, 165 patients experienced a cerebrovascular attack with the morbidity of 4.5 times per 100 persons per year and only 56% of patients survived from attack
Average time left after being diagnosed	Bravata, et al. (2003) conducted a research among 5123 patients with Cerebrovascular, 670 (14.0%) died within 6 months, and 2517 (52.6%) died within 5 years
Alzheimer's disease	
Stages of disease	Fujisawa, et al. (2017) investigated the differences of physical function among the people with Alzheimer's disease and people with normal cognition, totally 882 individuals (aged ≥ 65) were included, of which 210 were diagnosed with normal cognition, 273 with mild cognitive impairment, 181 with mild Alzheimer's disease (AD) and 197 with moderate AD
Average age of disease	Rosenwax, McNamara and Zilkens (2009) investigated the health care service in Australia from 2000-2002 and found that 992 people died of Alzheimer's disease, of which 90.4% were aged 75 or more years
Common symptoms	Kavé and Dassa (2018) studied the association between language ability and disease severity, compared the performance of describing pictures between 35 individuals with Alzheimer's disease and 35 participants and found that people with AD were with decreasing vocabulary diversity
	Hendriks, et al. (2014) studied the symptoms of people with dementia in their last week through questioners completed by physicians and the

results showed that most common symptom among patients was pain (52%), and then agitation (35%) and shortness of breath (35%)

Average time left after being diagnosed The recent research (Henry, Querfurth and LaFerla, 2010) shows generally patients after being diagnosed can be expected having 3-9 years left

lung cancer

Types of this disease The two main types are small-cell lung carcinoma (SCLC) and non-small-cell lung carcinoma (NSCLC)

Stages of disease Liberman, et al. (2006) studied the time intervals before patients with NSCLC got surgery in Canada from 1993 to 2002, in which 114 patients were in stage I, 47 patients were in stage II, 41 patients were in stage III, 24 patients were in stage IV

Average age of disease Ohlsson and Merlo (2011) investigated the mortality of Respiratory disease from 2000-2003 among 684,673 people age 30-84 living in Scania, Sweden, and found 6,820 cases from age group 50-64 and 20,565 cases from age group 65-84

Common symptoms Skaug, Eide and Gulsvik (2007) studied the physiological condition of 271 patients in the last 8 weeks of life, pain was recorded in 85% of the patients, psychological symptoms (anxiety, insomnia, and/or depression) in 71%, dyspnea in 54%, neurologic symptoms in 28%, cough in 24%, nausea in 21%, and hemoptysis in 9%

Mortality and morbidity of disease Bugge, et al. (2017) studied the mortality of 692 (53.2% males and 46.8% females) patients with stage I and II NSCLC after being operated, found that the mortality of young females was 35.2%, of young males was 34.9%, of old males was 51.2%, and of old females was 42.8%

Eguchi, et al. (2017) studied the the lung cancer mortality and noncancer mortality among 2186 patients who had undergone the operation for I NSCLC, and the results show that in patients < 65, 65 to 74, and ≥ 75 years of age, the lung cancer mortality was 7.5%, 10.7%, and 13.2% and the noncancer mortality was 1.8%, 4.9%, and 9.0%

Average time left after being diagnosed Oskarsdottir, et al. (2017) studied the morality of patients who had undergone the surgery for NSCLC in Iceland, with totally 489 patients analysed (the average age was 67 years old, 53.8% females and 46.2% males), and found that the percentage of patients who died in 30 days was 0.6%, died in 1 year was 15% and died in 5 years was 50.8%

Continue Table 5 above:

Self-harm	
Average age of Self-harm	Wand, et al. (2018) pointed in the article that the rates of suicide in older people are comparably higher than other age groups
Common method	Filippatos and Karasi (2017) conducted study aiming to determine the clinical characteristics of patients who attempted suicide, 203 suicide attempts (the mean age was 40.5 years old) in Greece were collected and analysed, the most common method used was self-poisoning (80.8%), 63.9% of attempts involved self-cutting or self-stabbing, and 13.9% was due to self-handing
Motivation of Self-ham	Filippatos and Karasi also pointed out in the same article that 59.6% of suicide attempts was related to interpersonal relationships

This thesis chooses and analyses the top five incurable diseases in Sweden instead of top ten since the disease chosen has to be a top-ranking and relatively representative incurable disease. The other reason is that I am making the analysis of their characteristics in descending order according their rank list and when the analysis of top five diseases being completed, I have got a satisfactory choice, and hence there is no need to continue. This thesis only searched one database, CINAHL (2018), to fill up the whole Table 5 (The analysis of their characteristics) because the information used to determine which disease should be chosen is exhaustive in CINAHL.

Although ischemic heart disease is the leading cause of mortality in Sweden, it has a wide variety of types that make it difficult to differentiate between diverse types. The development stage of ischemic heart disease was not clearly found in the literature review. According to Lusignan, et al. (2004), it can only be seen that this disease may have two stages. Symptoms are more likely to be physical symptoms and the best treatment may be medication. This disease is a conventional chronic disease with a comparatively long survival period.

The prominent feature of cerebrovascular disease is that its onset time is relatively uncertain. People who have experienced this disease are often not prepared and well aware when death come close. In a recent study (Sozio, et al., 2009), only 56% of patients who experienced cerebrovascular attack survived from it. A comparably clear stage division has not been found from literature review.

Alzheimer's disease is a typical disease caused by aging. Therefore, the patients with Alzheimer's disease are generally older. Patients with this disease usually have three to nine years from being diagnosed to death. One of the most common symptoms is the loss of cognitive ability that makes patients not preferable to use mobile apps. The patients can be divided into different stages, according to the degree of loss of cognitive ability. However, the only concern that made this disease not being picked was that patients may not be able to use the apps designed for patients properly.

Although self-harm is the fifth most common cause of death in Sweden, the people who can be involved in hospice care can only be those who failed to commit suicide for the first time and were fatally injured. At the time of reviewing the literature, the literature that focused on this group of people was rarely found. It would be difficult to analyse the needs of this group

of people later on. Consequently, self-harm has not been selected as the research target of this thesis. However, this finding can be regarded as a reminder that there is a lack of research on this group people and might provide some sort of inspiration for potential follow-up researchers.

Lung cancer can be divided into two main types that are small-cell lung carcinoma (SCLC) and non-small-cell lung cancer (NSCLC). NSCLC is relatively more common. NSCLC can be divided into four distinguishable stages, of which stage I is considered the early stage of disease, and stage IV is considered the terminal stage that normally hospice care is considered being provided to patients. While doing the literature review, I have found many studies around this disease which could allow me further analyse the needs of patients with this disease in hospice care and then find apps and functions that meet their needs through apps reviewing. Overall, by comparing the top five incurable diseases in Sweden, NSCLC is the most representative and suitable one to choose. The patients with NSCLC disease in stage IV thus would be chosen to research their needs.

3.4 The process of creating Criterion 1

In order to search the needs of patients with NSCLC in stage IV and furthermore create the Criterion 1 for identifying the apps & functions that meet the needs, this thesis manages searching several databases. The selecting process has been recorded below (see the brief summary of searching results in Table 6 and the complete summary with all searching terms and limitations in Appendix B).

Table 6 Selecting process for non-small-cell lung cancer

Database	Yield	Title screened	Abstract screen
CINAHL EBSCOhost	via 76	76	36
ClinicalTrials.gov	41	38	13
Medline via Ovid	92	87	29
Mary Ann Liebert	16	16	16
Scopus	137	96	31

The 4 selected articles have been full-text reviewed and analysed, in which 4 articles elaborate the needs of patients from different perspectives and some even provide actual suggestion that can meet these needs. This thesis sorts out the key points that 4 articles represent and organizes them in the following sections.

3.4.1 Feasibility of Yoga for lung cancer survivors

Through reviewing the article from Fouladbakhsh, Davis and Yarandi (2014), this article discovered some common symptoms that affect the physical functioning and mental health of patients with non-small cell lung cancer, such as sleep problems, anxiety, depression, cough, chest pain and so on, which all contribute to the patient's failure to have a good and healthy quality of life. On the other hand, this article found some potential advantages of

Complementary and Alternative Medicine (CAM, such as yoga and Tai Chi, which is a traditional Chinese exercise, including slow movement and meditation) in symptom management and mind regulation, and CAM has been widely practiced in cancer patients in the United States. However, there are not many studies in lung cancer patients, so this article attempts to explore the feasibility of practicing yoga in patients with lung cancer, as well as to explore the impact of practicing yoga on lung cancer patients.

In a community in the U.S., a total of seven patients with NSCLC in I-III stages participated. The study lasted a total of 14 weeks and was divided into three parts including three weeks of preintervention, eight weeks of yoga practice and three weeks of postintervention. By assessing and comparing the changes in sleep quality, mood, salivary cortisol levels, and Quality of Life (QoL) during the first three weeks and the last three weeks, the results show that there was no significant change in sleep quality, but the use of sleep medicines was reduced by 65%, indicating a potential improvement, there was significant improvements in mood and in QoL. Although the patients involved in the study were only in the stage I-III, it still shows that yoga is a feasible option for NSCLC survivors.

3.4.2 Dyspnea among patients with NSCLC

The article (Shin, et al., 2014) points out that dyspnea is one of the most common symptoms in patients with non-small cell lung cancer (NSCLC). About half of the patients have a clinical record of dyspnea. This difficulty in breathing can lead to decreased quality of life, decreased physical activity, sleep disturbances, and the increases of panic disorder symptoms.

In order to further investigate the independence and association of dyspnea and panic disorder symptoms, in a period of nearly four years, 624 patients with NSCLC were studied, with an average age of 63.7 years, of which approximately half were female (52.6%). The patient's disease stage is distributed in I-IV, about half of which are in stage IV (52.7%). The results of the study showed that about half of the participants (48.7%) had symptoms of dyspnea in the past week, which is consistent with the results of previous studies. 11.2% of patients had panic disorder symptoms in the past four weeks, and those who reported dyspnea were twice as likely to have panic disorder symptoms. This article reveals the prevalence of dyspnea in patients with NSCLC, as well as the other symptoms it brings. Respiratory regulation can therefore be regarded as a need for the patient with NSCLC.

3.4.3 Symptom distresses in patients with NSCLC

The article (Kuo and Ma, 2002) points out that chemotherapy and radiotherapy are the main treatments for non-small cell lung cancer (NSCLC). Its purpose is to control and relieve symptoms, but the treatment process often brings some undesired physical and psychological symptoms to the patient, such as insomnia, fatigue, anxiety and depression, panic, anger, etc. Few studies have focused on this symptom distress and corresponding coping methods, so this article was conducted in two hospitals in Taipei in 2000. A total of 73 patients with NSCLC were studied. Most of the patients were older than 71 years and nearly half of them were in stage IV (50.7%). The results of the study showed that fatigue and sleep problems are the main physical symptoms, and depression, anxiety and depression are the main psychological symptoms. These results are generally consistent with the results of previous studies. The article gives family members and nurses some advice centred on emotional control to mitigate the negative effects of these symptoms. Therefore, emotional control can be considered a need for NSCLC patients.

3.4.4 Sleep problem among patients with NSCLC

According to (Dickerson, et al., 2012), sleep is essential to health and directly affects physical function, memory and quality of life. Patients with lung cancer have worse sleep quality than those with other diseases. However, there is relatively little research on sleep in patients with lung cancer. Therefore, the researchers from this article conducted interviews with patients and used the approach of Heideggerian Hermeneutics to analyse the content of the interviews in order to study the sleep status of lung cancer patients.

At a cancer centre in the United States, 26 newly diagnosed patients with NSCLC were selected as samples. Among them, 16 were males and 10 were females, the average age was 66 years old, 12 were in stage IV, and the rest were in stages II- III. The results showed that although few people were worried about their sleep, many people from interviews being found had problems with sleep, such as trouble falling and staying asleep (insomnia), frequent awakenings (fragmented sleep), racing minds, poor sleep, etc. Only two people interviewed showed that they had a healthy sleep and sleep hygiene practices, such as regular sleep time, not watching TV before bedtime and not sleeping too much during the daytime.

Overall, the article reveals the significant sleep-wake disturbances in patients with NSCLC and calls on families, friends, and health care teams of patients to encourage them to maintain a normal life, with a particular focus on improving sleep. The need of patients of improving sleep quality is therefore summed up from this article.

3.4.5 Criterion 1

The purpose of Criterion 1a is to be used to search in the App Store, and to determine the apps from the search results that will be downloaded and further analyzed. The Criterion 1a has two functions. The first function is to be searched as keywords in the App Store, requiring the search results to cover all the potentially required apps. Therefore, Criterion 1a is considered a high-level summary of patients' needs. The second function of Criterion 1a is to judge whether the app can meet the needs of the patients by reviewing the app description on app details page. The condition of the judgment is whether the app states that it can meet these needs. The Criterion 1a does not serve as a valid basis for judging whether this statement is true or not.

Apps usually have multiple functions and may have complex structures. Criterion 1b can separate and extract the required functions from other functions. The method used is to use some simple judgment sentences to divide the different functions and choose the required functions that can meet the certain needs of the patients. This Criterion 1b is used for further analysis after downloading the apps (see in Table 7).

Table 7 Criteria 1

Criterion 1a (for selecting apps)	Criterion 1b (for selecting functions)
Yoga	The function has a basic yoga practice method
Respiratory regulation (Breathe, Breath)	The function has a method to adjust breathing

Emotion regulation (Release stress, Emotion control, Keep calm)	The function has a way to regulate and relieve emotions
Sleep (Sleep improvement)	This function has a way to regulate sleep

3.5 The process of creating Criterion 2

The initial purpose of creating Criterion 2 is for making sure the functions selected containing game elements. From the perspective of serious game theory, the accurate interpretation of having game elements on some functions may also be referred to as Gamification. In order to determine the existence of game elements in functions, this thesis has searched several databases (see the brief summary of searching results in Table 8 and the complete summary with all searching terms and limitations in Appendix B), analyzed the full texts of several articles (see in the following subsections), and worked out Criterion 2 (see in Table 9). This thesis sorts out the categorized game elements from the full-text review of 2 articles in the following sections.

Table 8 Selecting process of creating criterion 2

Database	Yield	Title screen	Abstract screen
IEEE Xplore	55	55	32
Scopus	82	50	30
SpringerLink	172	130	41
Web of Science	107	87	21
ACM Digital Library	642	120	57

3.5.1 The factors affecting gamification and game elements

According to Denden, et al. (2017), Gamification is a concept that was proposed around 2010. The impact of various limiting factors on Gamification has not yet been explored. This article designs experiments to investigate the effects of differences in age, gender, and gaming frequency on perception of game elements and gamification.

At a university in Tunisia, a total of 83 volunteers participated, among which women accounted for the majority (67.47%). By answering the questionnaire, the participants were divided into two groups, often playing games and those not often playing games. A gamified learning tool, Moodle, was used to conduct the experiment. The learning tool was implemented with eight game elements, points, levels, progress bar, leader-boards, avatar, badges, feedback, and chatting system. Participants used this learning tool for a one-month experiment. After the experiment, they were assessed the level of Gamification perception. As a result, it was found that overall Gamification played an active role. There is no difference in the perception of gamification between those who often play games and those who do not often

play games. Women have a higher awareness of the badge game elements, and there are no gender differences in other game elements.

The results above can be adapted into the patients with NSCLC involved in my thesis, whose gender and gaming experience therefore will not interfere with the effects of Gamification. Finding the functions with game elements in my thesis is indirectly proved to be a positive and feasible way.

3.5.2 The empirical studies on gamification

According to the article from (Hamari, Koivisto, and Sarsa, 2014), Gamification has gradually become a trending topic in recent years. The purpose of this article is to examine the academic study status of this topic. Through searching several major databases and conducting a literature review, the article lists the most discussed game elements among studies which are points, leader-boards, badges, levels, stories, clear goals, feedback, progress, rewards, and challenges. This article also found that a majority of the reviewed studies evaluating Gamification can indeed produce positive effects and benefits, although some claim that the effects and benefits are not long-term.

The main contribution of this article to my thesis is that it integrates a number of academic studies on Gamification and summarizes the categories of the game elements being included among studies, thus contributing to the formulation of the Criterion 2

3.5.3 Criterion 2

Through the full-text analysis of the two articles above, the following table (Table 9) summarizes the different categories of game elements and provides some common examples inside the curved brackets extracted from the full-text review. When the Criterion 2 is used to judge the function and determine if there is a game element contained, the function can be stated that contains a game element once at least one category of Criterion 2 is satisfied.

Table 9 Criterion 2

Criterion 2 is for identifying the function that contain game elements
Progression (Levels; Challenges; Progress bar)
Points (Virtual goods; Status)
Achievement (Badges)
Rewards (Altruism)
Stories (Background)
Social system (Chatting room; Communication)
Leader-boards (Competition)
Feedback (Self-expression; Sharing; Inviting)

4 Apps review

4.1 Identifying process

According to the different needs of patients, this thesis makes the review from four aspects regarding the functions expected: practicing yoga, regulating breathing, regulating emotions and improving sleep quality. The identifying process is conducted in the Swedish App Store. All the details of apps downloaded are shown in the Appendix A. The steps to review are:

- Searching with keywords of Criterion 1a.
- Screening description of apps with Criterion 1a and downloading the apps that declare themselves containing required information.
- Using Criterion 1b and Criterion 2 simultaneously to identify the apps and functions.

Apps screening process is recorded in the following table (Table 10).

Table 10 Reviewing process

Category and searching terms	Yoga	Respiratory regulation (Breathe, Breath)	Emotion regulation (Release stress, Emotion control, Keep calm)	Sleep (Sleep improvement)
Number of apps being reviewed and examined the description with Criterion 1a	60	61	39	92
Number of apps being downloaded	14	21	10	11
Number of functions after being screened by two criteria (1b and 2) simultaneously	31	18	23	13

4.2 Reviewing process

This section provides further analysis of the apps and functions identified in the previous section.

4.2.1 Yoga

This thesis investigates (see in Table 11) the first 60 results after searching the keyword “Yoga”, downloads and further analyses 14 apps that declare they could help practice Yoga below.

Table 11 The summary of functions and apps that meet Criteria

Game elements	Manifestation
Progression	Levels system (Daily Yoga)
	Workout calendar (Yoga Girl; Asana Rebel)
	Statistics of Yoga time and Calories consuming (Asana Rebel)
	My Yoga Tree (Gotta Joga)
Points	Coins (Daily Yoga)
Achievement	Badges (Daily Yoga)
Rewards	Daily check-in reward (Daily Yoga)
	Daily tasks reward (Daily Yoga)
	Lucky Draw (Daily Yoga)
Stories	
Social system	Personal profile (Daily Yoga; Yoga Studio; Asana Rebel; Yogaia; Yoga for Weight Loss; Gotta Joga; YogaGlo; Prenatal Yoga)
	Followings and Followers (Daily Yoga; Prenatal Yoga)
	Chatting system (Daily Yoga)
	Build-in forum (Daily Yoga; Prenatal Yoga)
	Build-in blog (Gotta Joga)
Leader-boards	Weekly leader-board (Daily Yoga)
	Monthly leader-board (Daily Yoga)
	Overall leader-board (Daily Yoga)
Feedback	Inviting friends (Daily Yoga)
	Sharing (Daily Yoga; Yogaia; xFit Yoga)

This thesis summarizes all the functions found meeting Criterion 1b and containing game elements in the Table 11 above. Some of functions uniquely used in individual app have been specifically sorted out in the following paragraphs.

“Lucky Draw” is a function in “Daily Yoga” (see in Figure 2). After clicking on a shaking colourful gift package shown up on the top right of screen, the user can choose one of the six upside-down cards. After the selection, all the cards will be flipped back to face up, and the user will get the number of gold coins indicated on the selected card. At the same time, the number of gold coins on other cards can also be seen. Gold coins can be consumed to buy virtual items such as membership cards, new yoga lessons, and to unlock new features in the build-in Coin Centre.

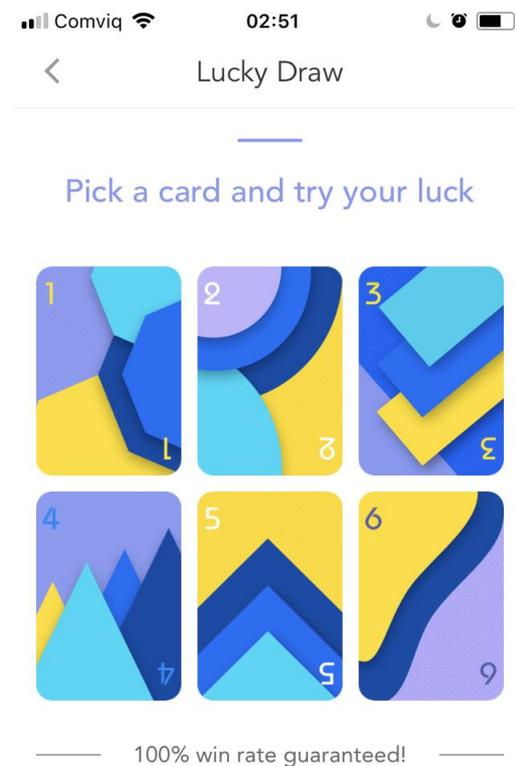


Figure 2 Lucky Draw (Daily Yoga, 2018)

“My Yoga Tree” is a function provided by “Gotta Joga” (See in Figure 3). After the completion of a section of yoga training, the calories burned and the exercise time can be converted into nutrition to help the Yoga Tree grow a bit. With constant training, Yoga Tree will continue to thrive. The app also allows the user to compare the appearances of the sapling before and after the changes to see how the sapling have grown.

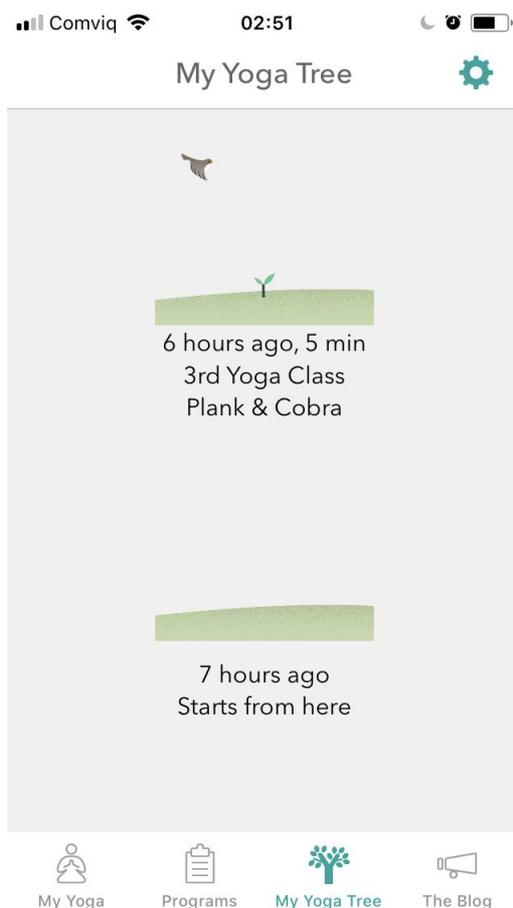


Figure 3 My Yoga Tree (Gotta Joga, 2018)

Overall, almost all kinds of game elements have been found in this review for helping users to practice yoga. Many examples found are worthy as Reference functions for future hospice app designers. Creating forums and blogs is a way for yoga practitioners to exchange their experiences. Rewarding users with virtual items when they reach a certain level of achievement might be a way to mobilize their enthusiasm. Designing leader-boards so as to add competition elements could possibly be a way to extend the user's practice time and improve efficiency. Adding statistical recorders or work calendars allows users to track their training volumes. Allowing them to share their own achievements on social medias might encourage more people around them to join, which might trigger mutual incentive effects.

4.2.2 Respiratory regulation

This thesis searches several synonymous keywords, such as “Breathe”, “Breath” and “Respiratory regulation” respectively. A total of 61 apps (see in Table 12) from top search results are reviewed, and the ones whose descriptions meet the criterion 1a are downloaded and further analysed below.

Table 12 The summary of functions and apps that meet Criteria

Game elements	Manifestation
Progression	Statistics of Check-in days and Practice time (Stop, Breathe & Think; Breethe; Breathe -4-7-8; BreatheSync; ZenMixer)
Points	
Achievement	My Stickers (Stop, Breathe & Think) Trophy (ZenMixer)
Rewards	
Stories	Conversational User Guide (Stop, Breathe & Think) Monster needs help (Breathe, Think, Do with Sesame)
Social system	Personal profile (Breethe; Breathe Pro; BreatheSync)
Leader-boards	
Feedback	Sharing (Stop, Breathe & Think; Breathe Pro) Self-expression (ZenMixer)

This thesis summarizes all the 18 functions found according with both Criterion 1b and 2 in the Table 12 above. Some of functions have been specifically sorted out in the following paragraphs.

“My stickers” is a function from “Stop, Breathe & Think” (see in Figure 4). Unlike the common achievement system that provides trophies and badges, Stop, Breathe & Think offers different cartoon stickers as a reward for achieving certain achievements. Sticker pages can be accessed directly from the top right corner of the screen.

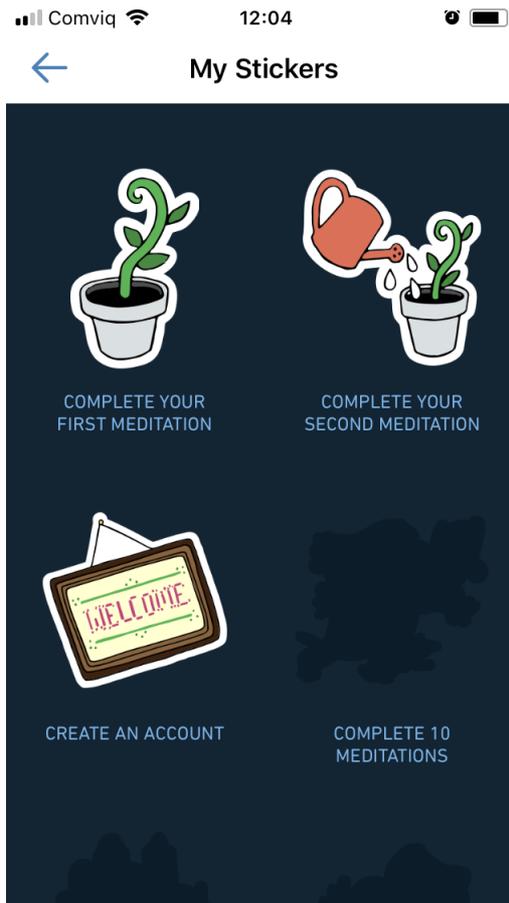


Figure 4 My stickers (Stop, Breathe & Think, 2018)

A “Monster needs help” story (see in Figure 5) from “Breathe, Think, Do with Sesame” essentially runs through the entire app. After entering the app, a cartoon monster appears and the user is asked to complete five challenges to help this monster adjust his breathing. In the process of helping the monster to adjust his breathing, the app will ask the user to do some breathing adjustment to help the monster, so as to indirectly achieve the purpose of adjusting the user's breathing.



Figure 5 Monster needs help (Breathe, Think, Do with Sesame, 2018)

The reviewed apps all have the function of regulating the breathing. Some require the cooperation of users' other body parts, such as pressing and holding screen with finger, which increases the interestingness of users and is also considered a game element. Apps found generally provide data statistics services, which allow users view their total practice time and practice progress at any time.

4.2.3 Emotion regulation

This thesis reviews 39 apps from top search results (see in Table 13) after searching some synonymous keywords, such as "Calm", "Emotion" and "Stress". 10 apps that state they could help regulate emotion are downloaded and further analysed below.

Table 13 The summary of functions and apps that meet Criteria

Game elements	Manifestation
Progression	Statistics of Practice time, Mindful minutes, Session completed (Calm; Headspace; Mindfulness; CalmMind; Calm Harm; Humm.ly) The Oak Tree (Oak)
Points	
Achievement	Badges (Headspace)
Rewards	
Stories	Introduction Animation (Oak)
Social system	Personal profile (Calm; Oak; Headspace; Mindfulness; Humm.ly) Daily Community Activity Log (Oak) Real-time online user's number (Oak; Headspace) Add a Buddy (Headspace) Blog (Relax Meditation)
Leader-boards	
Feedback	Sharing (Calm; Mindfulness; CalmMind) Inviting (Headspace)

All the functions found meeting Criterion 1b and containing game elements are summarized in the Table 13. Some of functions have been sorted out in the following paragraphs.

"Add a Buddy" is a function from "Headspace" (see in Figure 6). In the user's profile page, the user can add another user as a buddy through the invitation. Most of emotion regulation

exercises require a few days of continuous effort. “Add a buddy” allows two people to practice together and oversee each other, which may urge two people to stick with practice longer.

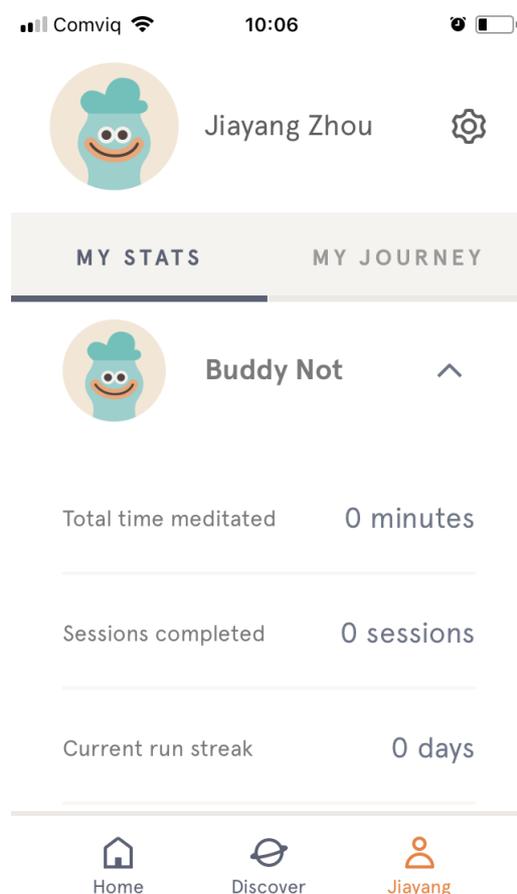


Figure 6 Add a Buddy (Headspace, 2018)

Meditation has been found to be a primary means of releasing stress, calming emotion and relaxing body and mind. “Oak” provides a platform showing the daily community activity log where users can check others’ records that can somehow urge themselves sticking longer on the practice. The sharing and inviting system are also effective ways to promote app itself and increase user stickiness.

4.2.4 Sleep

“Sleep” and “Sleep improvement” are searched as keywords for reviewing apps that could improve sleep quality. A total of 92 apps are reviewed from top search results with Criterion 1a, of which 11 are downloaded and further analysed in the following Table 14.

Table 14 The summary of functions and apps that meet Criteria

Game elements	Manifestation
Progression	Statistics of Nap time, Sleep time and Sleep nights (Sleep Better; Tide; Shleep)
Points	Your Shleep Score (Shleep)

Achievement

Rewards

Stories

Conversational User Guide (Shleep)

Social system

Personal profile (Sleep Better; Sleep TimeFree; Shleep)

Leader-boards

Feedback

Sharing (Sleep Better; Rain Rain; Relax & Sleep Well)

Inviting (Shleep)

Direct contact with experts (Shleep)

This thesis summarizes all the functions in the Table 14 above. Some of functions have been pointedly sorted out in the following paragraphs.

“Conversational User Guide” is a function from “Shleep” (See in Figure 7). This app personifies a cartoon lamb and sets up a conversation between the current user and the lamb. Through the conversation, the app builds up the user's current sleep status so as to provide a personalized solution to improve the quality of the user's sleep.

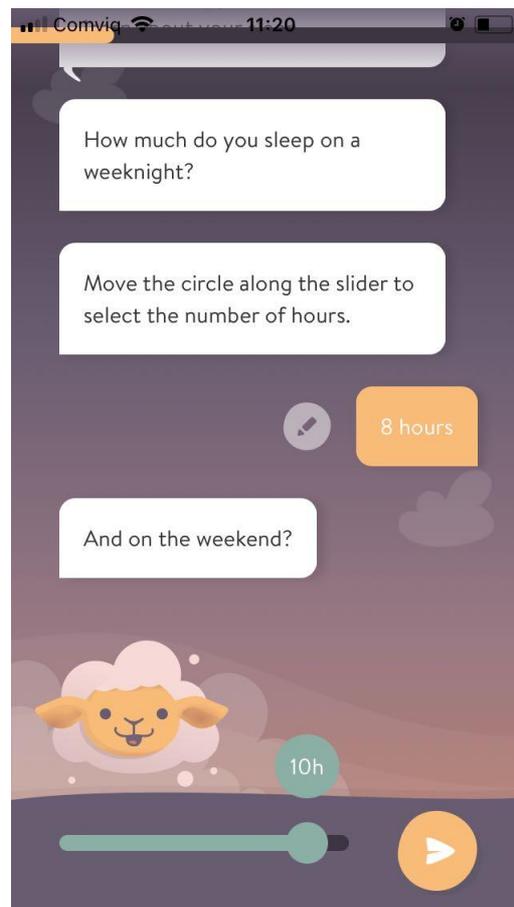


Figure 7 Conversational User Guide (Shleep, 2018)

“Direct contact with experts” (See in Figure 8) allows users to directly contact the relevant sleep specialists to resolve their personal concerns. This kind of function is firstly discovered here in the entire apps review.

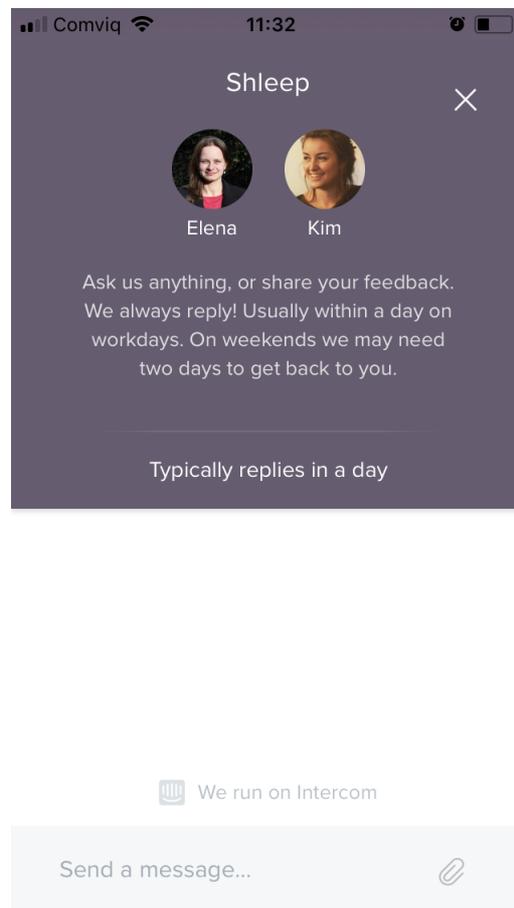


Figure 8 Direct contact with experts (Shleep, 2018)

Relaxing sounds are generally found to be used for improving sleep quality. The user's usage statistics and personal profile are still the most frequently used game elements. The points system is only found in one place. Other game elements such as the rewarding system and achievement system are not detected.

It is important to mention that all the functions that have been screened out and listed in this chapter are simply because they meet the two criteria that this thesis creates. Future researchers and designers must consider the potential ethical issues of these functions when reading and making use of this thesis.

5 Analysis

This thesis has basically achieved the initial goal, namely, through apps review, to list the functions as Reference functions that can meet the needs of patients in hospice care field and contain game elements from a Serious Games perspective. The listed functions as the practical references can guide and inspire future researchers and app designers who work in the hospice care field and want to use apps trying to solve some of the existing challenges in hospice care field. From identifying issues that arise in the hospice care field at the beginning to listing Reference functions as a main result, this thesis has obtained a great number of outcomes in this process:

- Analysed and compared the top 5 incurable diseases in Sweden.
- Analysed the needs of patents with NSCLC (Criterion 1a and 1b being created from this process).
- Investigated and analysed the existing hospice care apps in Swedish App Store.
- Summarized and categorized the common game elements in Gamification (Criterion 2 being created from this process).
- Identified and reviewed apps and functions in Swedish App Store which might contribute to hospice care field as Reference functions for future researchers and designers.

These outcomes above are presented separately in different chapters. In the fourth chapter, apps review chapter, the thesis sorts out the apps and functions from four parts: Yoga, Respiratory regulation, Emotion regulation and Sleep improvement. The thesis analyzes some unique functions and concludes with an overall summary at the end of each subsection. Additionally, this thesis has used different mobile phones doing the apps review once again to avoid system error.

The thesis performs a statistical analysis here of all analyzed apps. Of the 56 apps in total are downloaded for further analysis in the chapter four. All apps can meet criterion 1b, namely, can meet one of needs of patients with NSCLC. 85 functions containing game elements have been found from the further analysis of these downloaded apps. 23 apps require users to log in before users could access most of functions. 42 apps provide in-game purchase to unlock extra functions. The thesis finds that the number of game elements contained in an app is positively correlated with its ranking in search results (See in Figure 9).

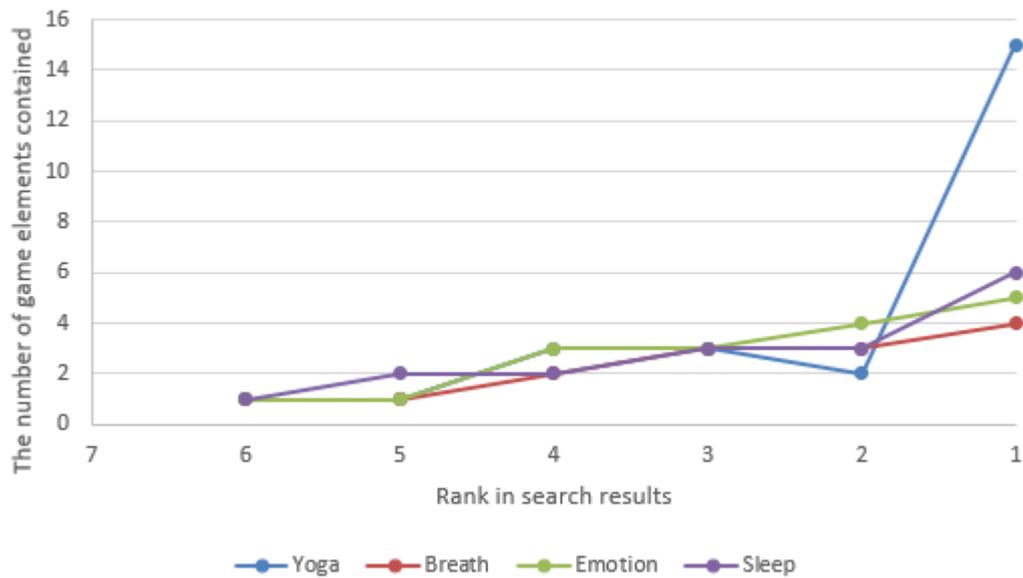


Figure 9 Relation between Rank in search results and the number of game elements contained in an app

According to Kissmetrics (2018), the higher an app ranks (the value of ranking should be lower; 1 is the best) in an app store's search results, the more popular it is. The above line chart (Figure 9) may indirectly indicate that the more game elements contained is one of the factors that makes an app rank higher. This conclusion may serve as a guide for future related app designers.

This thesis through literature review finds that hospice care is facing a multiplicity of challenges and dilemmas, such as the increasing demands, limited access, spiritual needs unmet and other concerns, and that the combination of Serious Games and mobile apps plays an important role in many areas, especially in the medical field. The thesis therefore proposes a way that a digital app designed for patients from a Serious Game perspective, which could possibly solve some of the challenges such as increasing demands and limited access by being a complement of current hospice care service and assisting remote hospice care achieved.

The main outcome of this thesis in terms of Reference functions, on the basis of satisfying the needs of the patients, containing game elements to mobilize the enthusiasm of the patients and the advantages of the mobile apps, could be considered a guide for improving existing hospice care apps and inspiring future researchers and designers. It is also possible to facilitate the practice of the combination of Serious Games and mobile apps in the field of hospice care.

6 Conclusions

6.1 Summary

This thesis wants to investigate an approach combining mobile apps and Serious Game theory that might contribute to the field of hospice care by providing a way that could potentially solve some of the current challenges in hospice care, such as increasing demands, limited access and problem caused from people with life-limiting condition living at home. The potential and relatively practical way is carrying out remote hospice care on apps that can not only provide and support some of services needed in hospice care, consequently, alleviating pressure from current challenges in hospice care field, but also are designed for patients as user group to benefit patients and from Serious Game theory to make use of the advantage of Serious Games.

The analysis of existing hospice care apps exposes a lack of apps designed for patients and containing game elements. This thesis then aims to create a lens through which a review of existing apps in health & fitness category in the Swedish App Store for the possible use in hospice care can be identified and analysed. More specifically, the research question is to identify and analyse Reference functions of potential digital hospice care apps from a Serious Game theory perspective. This aim has been achieved by:

- Create two criteria, one is to identify apps and functions that meet needs of patients, the other one is to identify functions that contain game elements.
- Analyse apps and categorize functions yielded by the two criteria.
- List a set of classified Reference functions for hospice care apps.

During the process of answering research question, the thesis has found some existing problems in the field of hospice care, analysed and compared the characteristics of the top five incurable diseases in Sweden, summarized the needs of patients with NSCLC and summarized the basic classification of game elements. The main outcome of this thesis in terms of Reference functions that satisfy the needs of the patients, contain game elements to mobilize the enthusiasm of the patients and make use of the advantages of the mobile apps. It could be considered a guide for improving existing hospice care apps and inspiring future researchers and game designers who work in the hospice care field and want to use apps trying to solve some of the existing challenges in hospice care field. It is also possible to facilitate the practice and application of Serious Games and mobile apps in the field of hospice care.

6.2 Discussion

Serious Games have a great number of applications in the medical field. However, in the process of writing this thesis, it's been found that Serious Games have not been applied in a way that can possibly solve some of challenges in the field of hospice care. The approach of this thesis can be seen as an attempt to combine Serious Games and hospice care to further solve some challenges.

The thesis proposes an approach of combining Serious Games with mobile apps to meet the needs of patients, thereby providing some of services needed and relieving some of the existing challenges in the field of hospice care. This approach in the thesis has been firstly put forward

by the author of this thesis and has not been found similar with other research works in the fields of Serious Games and hospice care.

As the result, the thesis has listed a bunch of Reference functions found through an apps review in App Store. Although various apps reviews regarding Serious Games and the field of health care have been conducted in different ways in other researches (Graafland, et al., 2014; Lister, et al., 2014), the reviewing method in this thesis has been independently come up by the author of this thesis.

It can be considered that this thesis explores the application of Serious Games in the field of hospice care and in a certain sense connects the research work in Serious Games and hospice care.

6.3 Future Work

The thesis conducts the apps review only in Swedish App Store, which does not include apps from Android Apps Store and other countries' App Stores. Additionally, because of the limited funding of this thesis, thesis doesn't download payment required apps and doesn't purchase in-game purchase that can unlock full functions in some apps. This results in the lack of the identification and analysis of other potentially valuable apps and functions. Further future work can consider approaching the apps in other App Stores and purchasing payment required apps.

The Criterion 1 is identifying the functions that meet the needs of patients, but to determine whether a certain app meets the needs is to look at whether the app claims that it can meet this need from its description. Therefore, the actual efficacy of a set of Reference functions proposed and generalized by the thesis has not been verified. The future work might be to test and determine whether the selected functions work effectively.

The Criterion 2 is screening the functions that contain game elements. The thesis merely includes functions that contain game elements but doesn't further explore which game elements would serve better in Reference functions to solve the challenges in the field of hospice care. Future work can further subdivide game elements and explore the different practical effects of different game elements to patients in the field of hospice care.

There are many diseases causing a person with life-limiting condition. The thesis only analyses the needs of patients with NSCLC. Future work may consider adapting the same research methods in this thesis to search other Reference functions for other diseases.

6.4 Conflicts of Interest

None declared.

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Appendix A - The apps being used in this thesis

Table 15 The apps being used in this thesis

“A” stands for title screen, “B” stands for description screen, “C” stands for being downloaded screen, and marks mean this app in this thesis was being practised the corresponding screen methods.

Name of apps	Author, accessible link and date	A	B	C
2018 CAHSAH•CHA PCA Conference	DoubleDutch, 2018. <i>2018 CAHSAH•CHAPCA Conference</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/2018-cahsah-chapca-conference/id969702326?l=en&mt=8 > [Accessed 26 April 2018].	×		
3 Minute Mindfulness	Zenco Limited, 2018. <i>3 Minute Mindfulness</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/3-minute-mindfulness/id982502810?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
5 Minute Yoga Workouts	Olson Applications Limited, 2018. <i>5 Minute Yoga Workouts</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/5-minute-yoga-workouts/id362093404?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Acclivity Health	Acclivity Health Solutions, Inc., 2018. <i>Acclivity Health</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/acclivity-health/id1261464971?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
AfterShock: Facing a Serious Diagnosis	Center for Advancing Health, 2018. <i>AfterShock: Facing a Serious Diagnosis</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/denver-hospice/id892948595?l=en&mt=8 > [Accessed 26 April 2018].	×	×	×
AirScripts	AirScripts, 2018. <i>AirScripts</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/airscripsts/id968436945?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
Altus Hospice	iReferDR, LLC., 2018. <i>Altus Hospice</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/altus-hospice/id716778097?l=en&mt=8 > [Accessed 26 April 2018].	×		
Animal Crackers: by children for children	MN Digital Media Ltd., 2018. <i>Animal Crackers: by children for children</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/animal-crackers-by-children >	×	×	

	children-for-children/id1175426779?l=en&mt=8> [Accessed 26 April 2018].			
Anxiety Relief Hypnosis	Surf City Apps, LLC., 2018. <i>Anxiety Relief Hypnosis</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/anxiety-relief-hypnosis/id720652195?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Asana Rebel: Yoga and Fitness	Asana Rebel GmbH, 2018. <i>Asana Rebel: Yoga and Fitness</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/asana-rebel-yoga-and-fitness/id1067860796?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Avow Hospice	iReferDR, LLC., 2018. <i>Avow Hospice</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/avow-hospice/id1128248642?l=en&mt=8 > [Accessed 26 April 2018].	×		
Bone Mets Calculator	Jon Giambattista, 2018. <i>Bone Mets Calculator</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/bone-mets-calculator/id1220291287?l=en&mt=8 > [Accessed 26 April 2018].	×		
Breathe - 4-7-8 Method - Keep Calm & Get to Sleep In 1 Minute	Slay, 2018. <i>Breathe - 4-7-8 Method - Keep Calm & Get to Sleep In 1 Minute</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/breathe-4-7-8-method-keep-calm-get-to-sleep-in-1-minute/id1008766169?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Breathe Calming Reminders for Mindful Breathing	KSI Technology, LLC., 2018. <i>Breathe Calming Reminders for Mindful Breathing</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/breathe-calming-reminders-for-mindful-breathing/id976954751?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Breathe 4 7 8	Oscar Morrison, 2018. <i>Breathe 4 7 8</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/breathe-4-7-8/id1056974914?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Breathe Deep - Personal Assistant for Breathing Meditation, Pranayama	Igor Mineev, 2018. <i>Breathe Deep - Personal Assistant for Breathing Meditation, Pranayama Breath and Ujjayi</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/breathe-deep-personal-assistant-for-breathing-meditation/id1141679494?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×

Breath and Ujjayi				
Breathe Pro	Kenkou GmbH, 2018. <i>Breathe Pro</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/breathe-pro/id1105390591?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Breathe Well	Complitech, 2018. <i>Breathe Well</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/breathe-well/id599253059?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Breathe, Think, Do with Sesame	Sesame Street, 2018. <i>Breathe, Think, Do with Sesame</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/breathe-think-do-with-sesame/id721853597?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Breathe: Meditation, Mindfulness, and Stress Relief Button	Stefan Djordjevic, 2018. <i>Breathe: Meditation, Mindfulness, and Stress Relief Button</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/breathe-meditation-mindfulness-and-stress-relief-button/id1072037598?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Breathe+ Simple Breath Trainer	Dynamic App Design LLC., 2018. <i>Breathe+ Simple Breath Trainer</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/breathe-simple-breath-trainer/id1106998959?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Breathe2Relax	National Center for Telehealth & Technology, 2018. <i>Breathe2Relax</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/breathe2relax/id425720246?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
BreatheSync	Breathe Sync Ltd., 2018. <i>BreatheSync</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/breathesync/id722304193?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Breethe - Meditation & Music	OMG. I Can Meditate! Inc., 2018. <i>Breethe - Meditation & Music</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/breethe-meditation-music/id920161006?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Calm	Calm.com, 2018. <i>Calm</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/calm/id571800810?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Calm Harm	Stem4, 2018. <i>Calm Harm</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/calm-harm/id961611581?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×

CAPC National Seminar	CrowdCompass, Inc., 2018. <i>CAPC National Seminar</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/capc-national-seminar/id1259440202?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
Capital Caring	iReferDR, LLC., 2018. <i>Capital Caring</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/capital-caring/id704591779?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
CareGiver Prayer	Ken Joy, 2018. <i>CareGiver Prayer</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/caregiver-prayer/id1078497295?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
CellTrak	CellTrak Technologies Inc., 2018. <i>CellTrak</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/celltrak/id666382612?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
CHPN Exam Prep 2017 Version	Bua Nguyen, 2018. <i>CHPN Exam Prep 2017 Version</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/chpn-exam-prep-2017-version/id1252618361?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
CHPN Exam Prep 2018	Learn & Train, 2018. <i>CHPN Exam Prep 2018</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/chpn-exam-prep-2018/id1313915198?l=en&mt=8 > [Accessed 26 April 2018].	×		
Clinical Explorer	McKesson Corporation, 2018. <i>Clinical Explorer</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/clinical-explorer/id1242788382?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
ComfortHospiceCare	carol cable, 2018. <i>ComfortHospiceCare</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/comforthospicecare/id796907464?l=en&mt=8 > [Accessed 26 April 2018].	×		
Compassionate Care Hospice	iReferDR, LLC., 2017. <i>Compassionate Care Hospice</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/compassionate-care-hospice/id1316897125?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
Compton Hospice App	Warbler Digital Limited, 2018. <i>Compton Hospice App</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/compton-hospice-app/id889871546?l=en&mt=8 > [Accessed 26 April 2018].	×		

Daily Yoga - Yoga Fitness Plan	Daily Yoga Software Technology Co. Ltd., 2018. <i>Daily Yoga - Yoga Fitness Plan</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/daily-yoga-yoga-fitness-plan/id545849922?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Denver Hospice	iReferDR, LLC., 2018. <i>Denver Hospice</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/denver-hospice/id892948595?l=en&mt=8 > [Accessed 26 April 2018].	×		
Échelle PPS	Palli-Science, 2018. <i>Échelle PPS</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/%C3%A9chelle-pps/id426132147?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
eOpioid: Opioids & Opiates Calculator	SentientWare, 2018. <i>eOpioid: Opioids & Opiates Calculator</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/eopioid-opioids-opiates-calculator/id329470252?l=en&mt=8 > [Accessed 26 April 2018].	×		
Family Home Care	Lona Lewis, 2018. <i>Family Home Care</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/family-home-care/id934627404?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
Friends of HCA Hospice Care	MEQO, 2017. <i>Friends of HCA Hospice Care</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/friends-of-hca-hospice-care/id1271626628?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
Geriatric Nursing	Elsevier Inc., 2018. <i>Geriatric Nursing</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/geriatric-nursing/id1069091686?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
Geriatrics At Your Fingertips	American Geriatrics Society, 2018. <i>Geriatrics At Your Fingertips</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/geriatrics-at-your-fingertips/id541103737?l=en&mt=8 > [Accessed 26 April 2018].	×		
Haven Health	iReferDR, LLC., 2018. <i>Haven Health</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/haven-health/id980950125?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
Headspace: Guided Meditation	Headspace meditation limited, 2018. <i>Headspace: Guided Meditation</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/headspace-guided-meditation/id493145008?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×

Hear Me	Una MacConville, 2018. <i>Hear Me</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/hear-me/id1079101819?l=en&mt=8 > [Accessed 26 April 2018].	×	×	×
HomeCare100	iReferDR, LLC., 2018. <i>HomeCare100</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/denver-hospice/id892948595?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
Hospice Austin	iReferDR, LLC., 2018. <i>Hospice Austin</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/hospice-austin/id740940062?l=en&mt=8 > [Accessed 26 April 2018].	×		
Hospice Care 101-Nursing Best Practices and Tips	David Eric Bloomquist, 2017. <i>Hospice Care 101-Nursing Best Practices and Tips</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/hospice-care-101-nursing-best-practices-and-tips/id1192814445?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
Hospice of Southwest Ohio	Hospice of Southwest Ohio, 2018. <i>Hospice of Southwest Ohio</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/hospice-of-southwest-ohio/id572065763?l=en&mt=8 > [Accessed 26 April 2018].	×		
Hospice of The Valley	iReferDR, LLC., 2017. <i>Hospice of The Valley</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/hospice-of-the-valley/id599024043?l=en&mt=8 > [Accessed 26 April 2018].	×		
Hospice Research Governance Toolkit	Spindogs Ltd., 2018. <i>Hospice Research Governance Toolkit</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/hospice-research-governance-toolkit/id1095360755?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
Hospicehome	ESD Services Limited, 2018. <i>Hospicehome</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/hospicehome/id887380362?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
HPBC&HOBC	iReferDR, LLC., 2018. <i>HPBC&HOBC</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/hpbc-hobc/id638962418?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
HPNA HPCC HPNF	HPNA, 2018. <i>HPNA HPCC HPNF</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/hpna-hpcc-hpnf/id1039460214?l=en&mt=8 > [Accessed 26 April 2018].	×		

Humm.ly- Self Love with Music	Humm.ly, 2018. <i>Humm.ly- Self Love with Music</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/humm-ly-self-love-with-music/id1286398926?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
ICS-ATLANTES	Itbook Editorial, 2018. <i>ICS-ATLANTES</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/ics-atlantes/id649822084?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
IM Your Doc	IM Your Doc, 2018. <i>IM Your Doc</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/im-your-doc/id586517737?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
JPSM	Elsevier Inc., 2018. <i>JPSM</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/jpsm/id686310482?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
Labor Day Auction by Hospice & Community Care	Labor Day Auction by Hospice & Community Care, 2017. <i>Labor Day Auction by Hospice & Community Care</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/labor-day-auction-by-hospice-community-care/id1135047075?l=en&mt=8 > [Accessed 26 April 2018].	×		
LeadingAge Ohio	Results Direct, 2018. <i>LeadingAge Ohio</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/leadingage-ohio/id1207126192?l=en&mt=8 > [Accessed 26 April 2018].	×		
Learning Senior Care Quiz	Information Technology And Resource Development LLC., 2018. <i>Learning Senior Care Quiz</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/learning-senior-care-quiz/id1046211206?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
MASCC 2015	Mobile Event Guide GmbH, 2018. <i>MASCC 2015</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/mascc-2015/id1002343281?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
Max und Urli vom Erlingerhof	CS Caritas Socialis, 2018. <i>Max und Urli vom Erlingerhof</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/max-und-urli-vom-erlengerhof/id1105627169?l=en&mt=8 > [Accessed 26 April 2018].	×		
MedHand Mobile Libraries	Indextra AB, 2018. <i>MedHand Mobile Libraries</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/medhand-mobile-libraries/id557073873?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
Medicine Journal	Elsevier Inc., 2018. <i>Medicine Journal</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/medicine-	×	×	

	journal/id589555796?l=en&mt=8> [Accessed 26 April 2018].			
Mediprocity	Mediprocity Inc., 2018. <i>Mediprocity</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/mediprocity/id532674856?l=en&mt=8 > [Accessed 26 April 2018].	×	×	×
Meditate,Relax, Sleep: Calm Mind	Igor Mineev, 2018. <i>Meditate,Relax,Sleep: Calm Mind</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/meditate-relax-sleep-calm-mind/id1147582937?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Mindfulness & Calm - Zen Mixer	BrainCake Inc., 2018. <i>Mindfulness & Calm - Zen Mixer</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/mindfulness-calm-zen-mixer/id1130926006?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
MLC 2018	X-CD Technologies Inc., 2018. <i>MLC 2018</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/mlc-2018/id1350591392?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
mvi Patient Referral Application	Halcyon Consulting, LLC., 2018. <i>mvi Patient Referral Application</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/mvi-patient-referral-application/id828242105?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
My Own Voice	My Own Voice, 2018. <i>My Own Voice</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/my-own-voice/id1059482072?l=en&mt=8 > [Accessed 26 April 2018].	×		
Neonatal Palliative Care	Imagineear, 2018. <i>Neonatal Palliative Care</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/neonatal-palliative-care/id974657725?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
NHSScotland Palliative Care Guidelines	SCET, 2018. <i>NHSScotland Palliative Care Guidelines</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/nhsscotland-palliative-care-guidelines/id964222025?l=en&mt=8 > [Accessed 26 April 2018].	×	×	×
Nurse Sticker Pack	Howtobewebsmart, 2018. <i>Nurse Sticker Pack</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/nurse-sticker-pack/id1167825560?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
Oak - Meditation & Breathing	Courtney Circle, 2018. <i>Oak - Meditation & Breathing</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/oak-meditation-breathing/id1210209691?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×

Oriental Relaxing Sounds	UniqueApps, 2018. <i>Oriental Relaxing Sounds</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/oriental-relaxing-sounds/id771293303?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Orthodose	Dr V. Vandenhoute, 2018. <i>Orthodose</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/orthodose/id645827778?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
PalCare	IT Resourcing, 2018. <i>PalCare</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/palcare/id1122847037?l=en&mt=8 > [Accessed 26 April 2018].	×	×	×
Palliate Guide	Emad Al-Rikabi, 2018. <i>Palliate Guide</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/palliate-guide/id1076219888?l=en&mt=8 > [Accessed 26 April 2018].	×	×	×
Palliate SD	Emad Al-Rikabi, 2018. <i>Palliate SD</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/palliate-sd/id1134758206?l=en&mt=8 > [Accessed 26 April 2018].	×		
Palliativ-Archiv	Palliativ Portal, 2018. <i>Palliativ-Archiv</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/palliativ-archiv/id922866263?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
Palliative Care	Barbara Tausch, 2018. <i>Palliative Care</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/palliative-care/id1295710352?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
Palliative Care Fast Facts	HAIPEG ZHANG, 2017. <i>Palliative Care Fast Facts</i> . [IOS] Version 1.2.2. Available at: < https://itunes.apple.com/se/app/palliative-care-fast-facts/id868472172?l=en&mt=8 > [Accessed 26 April 2018].	×	×	×
Palliative Care Symptom Guide	Smashed Crab Studio Ltd., 2018. <i>Palliative Care Symptom Guide</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/palliative-care-symptom-guide/id1168941132?l=en&mt=8 > [Accessed 26 April 2018].	×	×	×
Palliative Medicine Pocketbook	Graham Grove, 2018. <i>Palliative Medicine Pocketbook</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/palliative-medicine-pocketbook/id1204749954?l=en&mt=8 > [Accessed 26 April 2018].	×	×	×
Palliativ-Portal	Palliativ Portal, 2018. <i>Palliativ-Portal</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/palliativ-portal/id561086415?l=en&mt=8 > [Accessed 26 April 2018].	×	×	

Pallium App	Pallium Canada, 2018. <i>Pallium App</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/pallium-app/id1125059344?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
Pillow: Smart sleep tracking	Neybox Digital Ltd., 2018. <i>Pillow: Smart sleep tracking</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/pillow-smart-sleep-tracking/id878691772?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Prenatal Yoga Pregnancy Pilate	Dawnsun Technologies, LLC., 2018. <i>Prenatal Yoga Pregnancy Pilate</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/prenatal-yoga-pregnancy-pilate/id1021876360?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Progetto Salute	Netkom Group srl, 2018. <i>Progetto Salute</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/progetto-salute/id961970628?l=en&mt=8 > [Accessed 26 April 2018].	×		
Rain Rain Sleep Sounds	Tim Gostony, 2018. <i>Rain Rain Sleep Sounds</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/rain-rain-sleep-sounds/id478687481?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Rain Sounds HQ: sleep aid	Phase4 Mobile, 2018. <i>Rain Sounds HQ: sleep aid</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/rain-sounds-hq-sleep-aid/id888786749?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
ReachOut Breathe	ReachOut Australia, 2018. <i>ReachOut Breathe</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/reachout-breathe/id985891649?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Relax & Sleep Well	Diviniti Publishing Ltd., 2018. <i>Relax & Sleep Well</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/relax-sleep-well/id412690467?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Relax Meditation: Mindfulness, Sleep Sounds, Noise	Ipnos Software Inc., 2018. <i>Relax Meditation: Mindfulness, Sleep Sounds, Noise</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/relax-meditation-mindfulness-sleep-sounds-noise/id367506176?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Relax Melodies: Sleep Sounds	Ipnos Software Inc., 2018. <i>Relax Melodies: Sleep Sounds</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/relax-melodies-sleep-sounds/id314498713?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×

Religious Needs	Justin Malewezi, 2018. <i>Religious Needs</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/religious-needs/id1368616951?l=en&mt=8 > [Accessed 26 April 2018].	×	×	×
Royal Trinity Hospice	Royal Trinity Hospice, 2017. <i>Royal Trinity Hospice</i> . [IOS] Version 1.0.2. Available at: < https://itunes.apple.com/se/app/royal-trinity-hospice/id1211739543?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
Roze Room Hospice	Roze Room Hospice, 2018. <i>Roze Room Hospice</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/roze-room-hospice/id1294318483?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
Sarahospice	Sara Rahmanian Koushkaki, 2018. <i>Sarahospice</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/sarahospice/id1304706724?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
Saxtant	The Mayorga Firm, Inc., 2018. <i>Saxtant</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/saxtant/id1181451925?l=en&mt=8 > [Accessed 26 April 2018].	×		
Shleep: sleep & energy boost	Shleep B.V., 2018. <i>Shleep: sleep & energy boost</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/shleep-sleep-energy-boost/id1282558793?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
SICP	Tecnoconference, 2018. <i>SICP</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/sicp/id1010646993?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
Signature Services	Avamere Health Services, LLC., 2018. <i>Signature Services</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/signature-services/id909990683?l=en&mt=8 > [Accessed 26 April 2018].	×		
Silverado Hospice	iReferDR, LLC., 2018. <i>Silverado Hospice</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/silverado-hospice/id1053248398?l=en&mt=8 > [Accessed 26 April 2018].	×		
Simply Yoga - Fitness Trainer	Daily Workout Apps, LLC., 2018. <i>Simply Yoga - Fitness Trainer</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/simply-yoga-fitness-trainer/id413817051?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×

Sleep Better - Sleep Tracker	runtastic, 2018. <i>Sleep Better - Sleep Tracker</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/sleep-better-sleep-tracker/id922541792?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Sleep Cycle alarm clock	Northcube AB, 2018. <i>Sleep Cycle alarm clock</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/sleep-cycle-alarm-clock/id320606217?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Sleep Time: Sleep Cycle Alarm	Azumio Inc., 2018. <i>Sleep Time: Sleep Cycle Alarm</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/sleep-time-sleep-cycle-alarm/id555564825?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Sleep Timer & Nature Sounds	AppsYouLove, 2018. <i>Sleep Timer & Nature Sounds</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/sleep-timer-nature-sounds/id1235012424?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Sleep Well Hypnosis	Surf City Apps, LLC., 2018. <i>Sleep Well Hypnosis</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/sleep-well-hypnosis/id720652207?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Sooner Hospice	bfac, LLC., 2018. <i>Sooner Hospice</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/sooner-hospice/id1194245743?l=en&mt=8 > [Accessed 26 April 2018].	×		
SPICTapp	Noel Chidwick, 2018. <i>SPICTapp</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/spictapp/id1019520197?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
Spotlight Senior Services Phx	Lona Lewis, 2018. <i>Spotlight Senior Services Phx</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/spotlight-senior-services-phx/id847844111?l=en&mt=8 > [Accessed 26 April 2018].	×		
SpotlightTuc	Lona Lewis, 2018. <i>SpotlightTuc</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/spotlighttuc/id834452315?l=en&mt=8 > [Accessed 26 April 2018].	×		
St Gemma's Hospice	AppsbyMe, 2018. <i>St Gemma's Hospice</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/st-gemmas-hospice/id912358420?l=en&mt=8 > [Accessed 26 April 2018].	×		
Sta-Home	bfac, LLC., 2018. <i>Sta-Home</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/sta-home/id920102628?l=en&mt=8 > [Accessed 26 April 2018].	×	×	

Stop, Breathe & Think	Stop, Breathe & Think, 2018. <i>Stop, Breathe & Think</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/stop-breathe-think/id778848692?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Stop, Breathe & Think Kids	Stop, Breathe & Think, 2018. <i>Stop, Breathe & Think Kids</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/stop-breathe-think-kids/id1215758068?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Successful Aging Resources	John Owings, 2018. <i>Successful Aging Resources</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/successful-aging-resources/id1266961267?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
Symposia iPlanner	ASCO, 2018. <i>Symposia iPlanner</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/symposia-iplanner/id1061671061?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
Terapia dei sintomi	Eventi Telematici, 2018. <i>Terapia dei sintomi</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/terapia-dei-sintomi/id1052259078?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
Texas Total Care Hospice	Appsme Ltd., 2017. <i>Texas Total Care Hospice</i> . [IOS]. Available Version 1.1 at: < https://itunes.apple.com/se/app/texas-total-care-hospice/id1131202522?l=en&mt=8 > [Accessed 26 April 2018].	×		
The Annual Assembly	American Academy of Hospice and Palliative Medicine, 2018. <i>The Annual Assembly</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/the-annual-assembly/id1200552717?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
The Breathing App	Edwin Stern, 2018. <i>The Breathing App</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/the-breathing-app/id1285982210?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
The Mindfulness App	MindApps, 2018. <i>The Mindfulness App</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/the-mindfulness-app/id417071430?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
The Mindmate - Relax & Sleep	Spring Tech Co., Ltd., 2018. <i>The Mindmate - Relax & Sleep</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/the-mindmate-relax-sleep/id1370264566?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×

Tide: Sleep, Focus, Meditation	Moreless, Inc., 2018. <i>Oriental Relaxing Sounds</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/tide-sleep-focus-meditation/id1077776989?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Understand Me	Una MacConville, 2018. <i>Understand Me</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/understand-me/id1079936612?l=en&mt=8 > [Accessed 26 April 2018].	×	×	×
Universal Breathing - Pranayama Lite	Saagara, 2018. <i>Universal Breathing - Pranayama Lite</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/universal-breathing-pranayama-lite/id435871685?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
VideoWill	Zapalony Pty. Ltd., 2018. <i>VideoWill</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/videowill/id828817313?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
VitalTalk Tips	Vital Talk, 2018. <i>VitalTalk Tips</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/vitaltalk-tips/id1109433922?l=en&mt=8 > [Accessed 26 April 2018].	×	×	×
VITAS Healthcare	Vitas Healthcare Corporation, 2018. <i>VITAS Healthcare</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/vitas-healthcare/id587426132?l=en&mt=8 > [Accessed 26 April 2018].	×	×	
WA - What comes After happens now	WA, LLC., 2018. <i>WA - What comes After happens now</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/wa-what-comes-after-happens-now/id1222306908?l=en&mt=8 > [Accessed 26 April 2018].	×	×	×
We Breathe	Headfirst Publishing Pty Ltd., 2018. <i>We Breathe</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/we-breathe/id383542615?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
xFit Yoga – Daily Oriental Yoga for Relaxation, Strength and Flexibility	Turnt Apps, LLC., 2018. <i>xFit Yoga – Daily Oriental Yoga for Relaxation, Strength and Flexibility</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/xfit-yoga-daily-oriental-yoga-for-relaxation-strength/id796855961?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Yoga for Beginners Daily Poses	Health and Fitness Plus AB, 2018. <i>Yoga for Beginners Daily Poses</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/yoga-for-beginners-daily-poses/id1148951074?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×

Yoga for Beginners Weight Loss	Himel Shaha, 2018. <i>Yoga for Beginners Weight Loss</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/yoga-for-beginners-weight-loss/id1145392544?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Yoga Girl - Home Yoga Lessons	Mimoza Xhaxho, 2018. <i>Yoga Girl - Home Yoga Lessons</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/yoga-girl-home-yoga-lessons/id1102672758?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Yoga Studio: Mind & Body	Fit for Life, LLC., 2018. <i>Yoga Studio: Mind & Body</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/yoga-studio-mind-body/id567767430?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Yoga with Gotta Joga	Gotta Apps, 2018. <i>Yoga with Gotta Joga</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/yoga-with-gotta-joga/id880583924?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
YogaGlo - Yoga and Meditation	YogaGlo, Inc., 2018. <i>YogaGlo - Yoga and Meditation</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/yogaglo-yoga-and-meditation/id1023475268?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Yogaia Live Yoga Video Classes	Yoogaia Oy, 2018. <i>Yogaia Live Yoga Video Classes</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/yogaia-live-yoga-video-classes/id980526384?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×
Yogobe	Yogobe, 2018. <i>Yogobe</i> . [IOS]. Available at: < https://itunes.apple.com/se/app/yogobe/id1183831182?l=en&mt=8 > [Accessed 10 May 2018].	×	×	×

Appendix B - Complete Tables

Table 16 Searching results of synonymous terms and corresponding translations

Several keywords below regarding hospice care being searched in Swedish App Store							
Searched keywords	Hospice care	palliative		supportive care	best care	supportive	
Number of results	47	60 (16 overlapped within the search results for “hospice care”)		3 (all overlapped within the search results for “hospice care”)	0		
Corresponding translations of keywords regarding hospice care being searched in Swedish App Store							
Searched keywords	Hospice vård (translated from “hospice care”)	palliativ vård (translated from “palliative care”)		stödjande vård (translated from “supportive care”)	bästa vård (translated from “best supportive care”)	stödjande	(translated “best supportive care”)
Number of results	0	1 (all overlapped within the search for “hospice care”)		0	0		

Table 17 Searching process of diseases from CINAHL

Disease name	Search terms	Limits	Yield	Abstract screened
Ischemic heart disease	ischemic heart disease AND (information OR stage)	Limiters – Peer Reviewed; Abstract Language; References Search Boolean/Phrase	206	112

Cerebrovascular disease	(cerebrovascular disease OR cva) AND (categories OR common symptoms OR information)	Limiters – Peer Reviewed; Abstract Available; English Language; Research Article; References Available; Human; Search modes – Boolean/Phrase	221	80
Alzheimer disease	Alzheimer disease AND (terminal OR TI stages)	Limiters – Peer Reviewed; Abstract Available; English Language; Research Article; References Available; Human; Search modes – Boolean/Phrase	104	100
lung cancer	TI lung cancer AND (TI stage OR TI information)	Limiters – Peer Reviewed; Abstract Available; English Language; Published Date: 20080101-20180431; Research Article; Search modes – Boolean/Phrase	257	180
Self-harm	Self-harm AND (motivation OR information OR average age)	Limiters – Peer Reviewed; Abstract Available; English Language; Published Date: 20000101-20180431; Research Article; Search modes – Boolean/Phrase	111	95

Table 18 Selecting process for non-small-cell lung cancer

Database	Search terms	Limits	Yield	Title screened	Abstract screened
CINAHL via EBSCOhost	(NSCLC OR non-small cell lung cancer) AND (terminal care OR hospice care OR needs OR symptom	Limiters – Peer Reviewed; Full Text – limits hitlist to this vendor (EBSCO); Abstract Available; English Language; Research Article; Search modes – Boolean/Phrase	76	76	36

		managemen t OR symptom)				
ClinicalTrials .gov		Symptoms NSCLC Stage IV	United States; Sweden	41	38	13
Medline Ovid	via	(NSCLC OR non-small cell lung cancer) AND (symptom managemen t OR symptom)	limit 10 to (abstracts and English language and full text and humans)	92	87	29
Mary Liebert	Ann	(NSCLC OR non-small cell lung cancer) AND (symptoms OR needs of patients)	Filters applied: Research Article; January 2000- April 2018	16	16	16
Scopus		TITLE-ABS- KEY (NSCLC OR non- small AND cell AND lung AND cancer) AND (symptoms OR needs)	(DOCTYPE (ar) AND PUBYEAR > 2009) AND LIMIT-TO (ACCESSTYPE(OA))) AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (EXACTKEYWORD, "Article")) AND (LIMIT-TO (LANGUAGE, "English")) AND (LIMIT-TO (SRCTYPE, "j")) AND (LIMIT-TO (AFFILCOUNTRY, "United States"))	137	96	31
Total screen	title					313
Abstract screen						125
Full-text screen						4

Table 19 Selecting process of creating Criterion 2

Database	Search terms	Limits	Yield	Title screen	Abstract screen
IEEE Xplore	("Document Title": Gamification) AND Serious game)	Advanced Keyword/Phrases; Metadata Only; Specify Year Rang: from 2008 to Present	55	55	32
Scopus	"Gamification" AND Serious Games	("Gamification" AND serious AND games) AND DOCTYPE (ar) AND PUBYEAR > 2009	82	50	30
SpringerLink	Serious games AND Gamification	within 2010 – 2018; Gamification in title; English	172	130	41
Web of Science	TITLE: (Gamification) AND TOPIC: (Serious games)	Timespan: 2010-2018; Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI	107	87	21
ACM Digital Library	(+Serious +games Gamification)	Published since 2010	642	120	57
Total title screen					442
Abstract screen					181
Full-text screen					2