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**Experiences of the Cancer
Patients with Use of the Innovative
Healthcare Technologies**

Literature review

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<p>Abstract</p> <p>Health care systems are facing multiple challenges leading to transformation of existing care models. Information and communication technologies can play a key role in modern healthcare solutions.</p> <p>The aim of this study was to gather and analyse evidence base knowledge related to cancer patient's experiences with the use of innovative healthcare technologies based on the existing research. The purpose of this study was to provide information about healthcare experience, from the cancer patient point of view, that can be used as a resource for the nurses and nursing students.</p> <p>Research method applied in this study was literature review. Articles used in the research were obtained from CINAHL, PubMed and Elsevier Science Direct. Selection of articles was based on inclusion and exclusion criteria.</p> <p>Thematic analysis was applied in the analysis and synthesis of data of the fifteen selected articles. In results, four main themes emerged. The identified themes were: empowerment of cancer patients resulting from use of the innovative technologies in their care, experience of receiving more personalized care, improvement in treatment effectiveness and lastly reduction in the inequalities in the access to care.</p> <p>During research, it was discovered that use of technology is highly acceptable for the cancer patients and positively impacts their healthcare experience. However, technological innovation can only be meaningful if it promotes patient-centred multidisciplinary care, improves on existing standard of care, extends as well as improves life quality and reduces inequalities in care.</p>		
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1 Introduction

Health care systems are facing multiple challenges leading to transformation of existing care models. Large hospitals are reducing number of beds, focusing on acute care, instead more services are being delivered in health centers, day care facilities and at patient's home, which is also the case for cancer care. Patient's self-management of the care process is in the center of the new care model. Information and communication technologies offer constant internet connectivity and can play a key role in modern healthcare solutions. Technology can be used to reduce health care costs, manage effectiveness, increase quality of care, empower patients, improve treatment compliance and the quality of life (Nasi et al. 2015, 1-2; Silva et al. 2015, 225.)

From a public health perspective cancer care process should be a main target area for technological innovation, as it is second leading cause of mortality in Europe (WHO a, 2018). Cancer is not only a cause for an enormous healthcare costs, estimated between 83 to 86 billion euro in 2014, but also substantial indirect costs such as an early death, lost working days, disability and informal care provided by family members. Innovative healthcare technologies offer the potential to save, improve and extend the lives of millions of people diagnosed with cancer each year. (Jönsson et al., 2016; ECPC 2017, 43.)

Author of this study concluded that there is a gap in knowledge regarding oncological patient's experiences with use of the technology in their care. In existing literature researchers tend to analyze use of technology mainly in the treatment phase of care process, with significantly less focus on prevention, diagnosis, clinical decision making and follow up. Furthermore, frequently point of view of medical personnel is highlighted in the research with less attention to patient experiences with using the technology. (Nasi et al. 2015, 2-4) The aim of this study was to bridge the gap in research by conducting a literature review on cancer patient's experiences with the use of innovative

healthcare technologies and its impact on the quality of cancer prevention, treatment and care. The purpose of this research was to provide information about technology enabled healthcare experiences, from cancer patient point of view, that can be used as a resource to improve nursing care of cancer patients and as a guidance for future training of nursing students and healthcare personnel.

2 Oncological patient care

2.1 Epidemiology of cancer

European Statistical Office data shows that 1.3 million people died from cancer in 2015 (in EU-28) which accounted for 22.1% of deaths among women and 28.7 % of deaths among men. In Finland 12 161 deaths (in 2015) were caused by malignant neoplasms accounting for 23.3% of total deaths (Eurostat a, 2018). Furthermore, the global number of new cancer cases is projected to increase by 80% in low-income countries and by 40% in high-income countries by 2030 with estimated over 10 million people newly diagnosed (WHO b, 2018). International Agency for Research on Cancer estimates over 18 millions of new cancer cases (all ages, all types of cancer, both sexes) globally in 2018 as illustrated by Figure 1 (IARC, 2018).

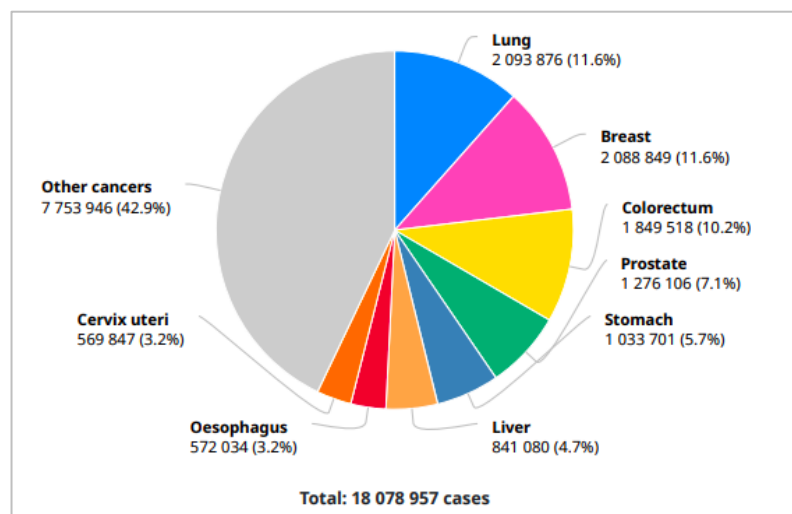


Figure 1. Estimated number of new cancer cases diagnosed in 2018 (IARC, 2018)

WHO defines cancer as growth of malignant (abnormal) cells, beyond their usual boundaries, which then can metastasize (spread) to the lymph nodes, tissues, or organs. Breast, colorectal, cervix, lung and thyroid cancer are the most common among women and lung, prostate, stomach, colorectal, and liver cancer are the most common among men. WHO recommends creating effective and affordable programs in order to reduce suffering, disability and deaths caused by cancer. (WHO c, 2018.)

According to current evidence up to 50% of cancer deaths could be prevented by implementing healthy lifestyle interventions. Prevention tools on population level include: avoiding key risk factors (such as tobacco products), reducing alcohol consumption, maintaining a healthy body weight, exercising regularly, reducing infection-related risk (vaccination) and decreasing occupation related cancer risks (radiation, asbestos exposure). (THL, 2018; WHO c, 2018.)

2.2 Current standard of care for cancer patients in Finland

In Finland nearly two-thirds of cancer patients are alive 5 years after diagnosis. The most common treatment methods include surgical treatment, radiation therapy, chemotherapy (cytotoxic drugs), biological and hormone therapy. Newer therapies are tumor type specific and include administration of cell precursors and antibodies (immunotherapy). (THL, 2018.) Due to very slow progression some types of cancers are only monitored and invasive treatments purposely delayed. Commonly therapies are combined to achieve most beneficial results. Choice of the treatment depends on cancer type, stage of disease, distribution, age and general health condition, available resources and its individually designed for each patient. Alternative therapies, such as antioxidants, vitamins, minerals, health foods, herbs are not encouraged due to lack of sufficient evidence-based research. (THL, 2018; WHO c 2018)

Rehabilitation and palliative care, which focus on improving the quality of life of patients and their families, are an integral and essential components of cancer care. (Käypä hoito, 2018; WHO c, 2018) Palliative care should focus on the patient's physical, psychological, social and existential needs. Symptoms, their severity and disability should be evaluated systematically and the response to treatment actively monitored. Primarily pain management treatment are strong opioids. Non-drug related interventions (psychosocial therapies) can be used to relieve anxiety and depression symptoms in a cancer patient when needed. (Käypä hoito, 2018)

The treatment of cancers has improved steadily over the last few decades and the outcomes of treatment in Finland are comparable with international standards (THL, 2018).

2.3 Challenges of cancer diagnosis, treatment and care

European Cancer Patient Coalition created *The European Cancer Patients' Bill of Rights* to provide every European citizen with the right to the optimum standard of care (ECPC, 2014). Among several listed key patient-centered principles of the Bill of Rights include:

“The right of every European citizen to optimal and timely access to appropriate specialized care, underpinned by research and innovation. The right to receive the most accurate information and to be proactively involved in his/her care. Cost effective care at all stages of the cancer journey, from early diagnosis through treatment and supportive care, that conforms to quality standards of care.”(ibid.)

Researchers Ashley and Lawrie (2016) described inequalities in cancer care as a global problem. It had been observed that patients with higher socioeconomic status have higher survival rates than those with lower socioeconomic status. Disparities in cancer care are caused by sociodemographic and geographical inequalities when it comes to: cancer risk factors (smoking), limited

participation in screening, timely diagnosis, awareness of the symptoms and warning signs, treatment of pain and depression in survivors, mortality outcomes, are usually associated with lower education and socioeconomic status. (Ashley 2016, 1122-1123.) Furthermore, minority ethnic and some religious groups have much lower cancer screening participation rates. Patients with other comorbidities, such as dementia, are more likely to be diagnosed at a later stage of cancer, are offered curative treatment less frequently and have poorer survival rates. (ibid., 1124.) Ashley and Lawrie (2016) recommend that interventions that aim to reduce inequalities must be targeted socio-culturally and developed in collaboration with each group experiencing disparities.

Author of this thesis opinion is that use of the innovative healthcare technology has potential to assist in reduction of the disparities in cancer care and significantly impact the quality of care, which will be further explored in the results part this study.

3 Innovative technologies in cancer care

3.1 Use of the innovative technologies in oncological care

Availability of information and communication technologies (ICTs) have increased significantly on terms both accessibility and cost. In European Union share of households with internet access increased from 55% in 2007 to 87% in 2017. (Eurostat b, 2018.)

European Commission eHealth Action Plan (2014) describes technology-enabled care as ICT tools and services that can be used to better the prevention, diagnosis, treatment, monitoring and management while improving efficiency, access and quality of care. Innovative healthcare technologies include: mHealth, eHealth, telecare, telehealth, telemedicine, digital health, wearable monitoring technology and involve use of mobile devices and digital media.

The EU eHealth Action Plan goal is to develop technology-enabled health services with patient-centric, personalized, sustainable care in mind and to empower patients to self-manage their well-being. In relation to eHealth development following patient concerns were listed in the eHealth Action Plan: poor readiness of doctors and nurses to engage with patients in the use of technology, limited patient involvement in eHealth development, reliability, security, privacy, access and ownership of their personal data. (EC, 2014)

Innovative technologies play an important role in a shift to the new cancer care health models. Outpatient care becomes more common and with use of technology it can be delivered in rural settings where access to medical personnel is limited. Understaffing of healthcare professionals is especially common in low-income countries where also access to computers is limited. In those countries use of mobile phone-based health initiatives proves efficient. (Nasi et al. 2015, 2)

Innovative technologies, such as mobile technology, can be used in automation of data collection and patient monitoring. It can support, fast-track and improve clinical decision making by nurses and doctors as presented on Figure 2.

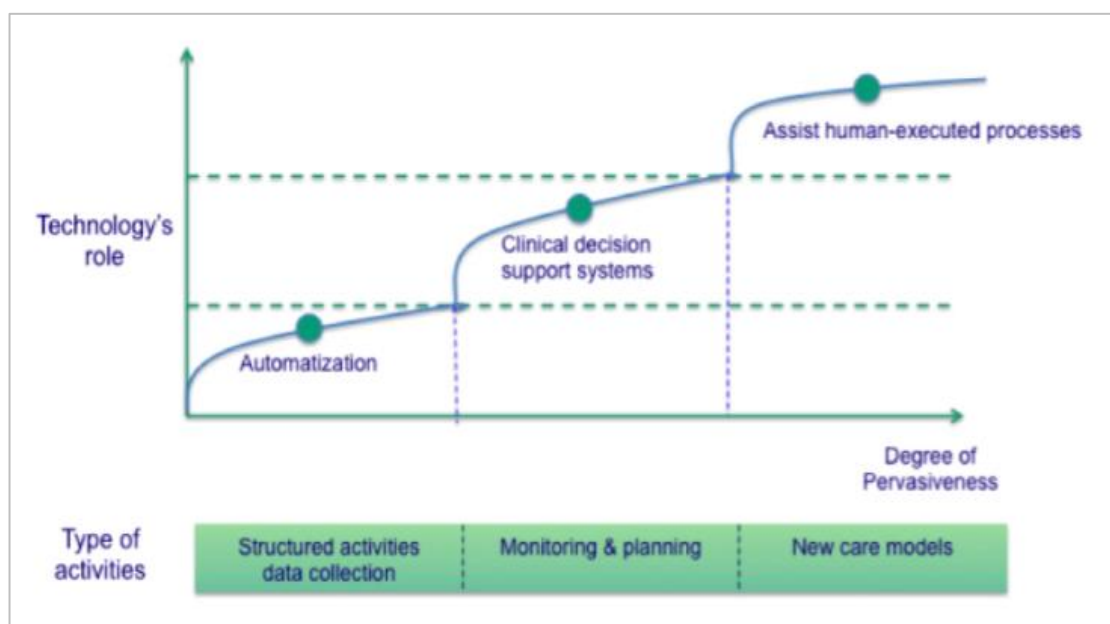


Figure 2. Role of technology in cancer care activities (Nasi et al., 2015)

mHealth technologies can play an important role in all phases of the chronic diseases (including cancer) care delivery process (see Figure 3 below), supporting prevention (scheduling reminders), diagnosis (remote access to patient information and teleradiology), clinical decision making, treatment (managing patient's symptoms and enabling self-management), and follow-up care (real time assessment of vital signs). (Nasi et al. 2015, 3-4.)



Figure 3. Use of technologies in the health care process (Nasi et al., 2015)

Health technologies are also being embraced by adults age 65 or older, even though, it is commonly thought that they might not be open to use them. In 2012 (in USA) over 69% of this population owned a cell phone and 48% a desktop computer. Older adults have an increased need for disease management interventions as multiple health problem overlap as they age, especially risk of cancer. Telemedicine is frequently used in this age group. Studies regarding use of mobile phones to report adverse chemotherapy symptoms have been conducted. When patients reported moderate to severe symptoms an alert was send to the clinical staff and subsequently patients were contacted with symptom management advice. (Joe & Demiris 2013, 947.)

European Cancer Patient Coalition, in the document on *The value of innovation in oncology* (2017), stated that technological innovation can only be meaningful if it promotes patient-centered multidisciplinary care, improves on existing standard of care, extends as well as improves life quality and reduces inequalities in care. (ECPC 2017, 8)

3.2 Types of technologies used in cancer care

European Commission lists several innovative healthcare technologies including: mHealth, eHealth, telecare, telehealth, telemedicine, digital health, wearable monitoring technology (EC, 2014). Consumer health care technologies include also videoconferencing, web-based information resources, telephone messaging (short message service/SMS and multimedia messaging service/MMS), smartphone applications and remote interpretation of medical reports. (Nasi et al. 2015, 3 & WHO, 2018.)

According to the researchers Silva, Rodrigues and Díez (2015) currently most commercialized for private consumer are: portable hemoglobin meter and self-powered pulse oximeter (distance health monitoring), mobile technology connecting patients to remote doctors, real-time access of medical services and data, body sensor networks (wireless). (Silva et al., 2015.)

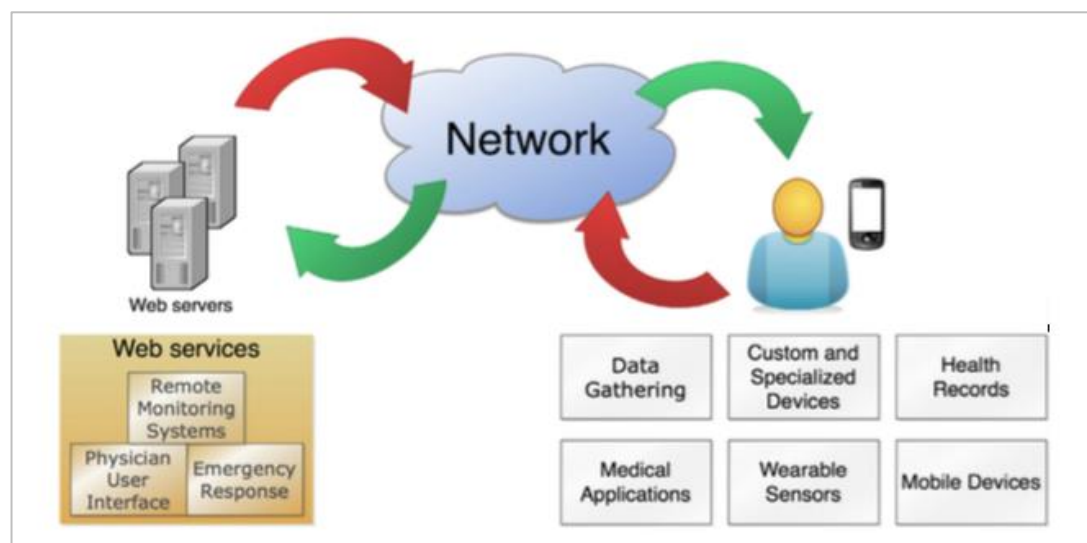


Figure 4. m-Health system set up (Silva et al., 2015)

Typical m-Health services system set up uses the Internet and Web services to provide possibility of constant interaction between doctors, nurses and patients (presented in Figure 4). Healthcare personnel and patient can easily access their medical records anytime and anywhere through smartphone, personal computer or a tablet. (Silva et al., 2015)

3.2.1 E-Health (electronic health) and m-Health (mobile health)

Mobile Health (m-Health) is an area of electronic health (e-Health). Mobile technologies such as mobile phones and wireless PDAs (personal digital assistants) are used to provide various health services and information. (WHO 2011, 6)

Electronic health and mobile health represent revolution in current delivery of care systems due to its potential to deliver effective, efficient, targeted, personalized healthcare benefiting both patients and healthcare providers (ECPC 2017, 38).

Health related smartphone applications have been downloaded by more than 1.7 billion people and m-Health market revenue of a total of 26 billion dollars. Mobile applications are directed mainly towards patients but increasingly also healthcare professionals. These application are used for patient self-monitoring, disease management, drug administration control and for educational purposes. (Silva et al. 2015, 268.)

An example of the mobile health application for oncological care is use of short message service (SMS), once a month, as a reminder for breast self-examination for South Korean patients who underwent breast cancer surgery. Mobile communication improved breast self-examination adherence, patient awareness and can facilitate earlier detection of interval (new or previously undetected) cancers. (Chung et al., 2015)

Wireless PDAs, such as iPads, are used in Cancer Institute (New Jersey, USA) in order to help patients endure treatment (chemotherapy infusion) and provide education to patients related to all aspects of cancer treatment (Kaplan, 2011).

3.2.2 Telemedicine and telemonitoring

Telemedicine is defined as the use of telecommunications and computer technologies (patient remote sensing, monitoring, two-way video, email) by qualified medical professionals in order to facilitate health care delivery. It enables health care practitioners to provide medical services virtually. Telehealthcare has potential to address social, cultural and geographical inequalities in healthcare delivery. (Elamin et al., 2018; Doyle-Lindrud 2016, 27; Nasi et al. 2015, 2-6).

Tele-oncology (telemedicine in oncology) is used when initial hospital visit (radiation treatment, bone marrow transplantation, palliative care) is followed by video consultation and remote supervision of further treatment. Videoconferencing is also used to connect patient local health professionals with multidisciplinary team at bigger cancer center in order to present and discuss their specific cancer case. (Doyle-Lindrud 2016, 27)

3.2.3 Patient education and cancer prevention

Internet websites maintained by National Health Service (NHS, UK) or National Institute for Health and Welfare (THL, Finland) contain evidence-based information regarding cancer prevention and treatment. Organizations such as Cancer Research UK and Macmillan Cancer Support have experience cancer nurses leading email enquiry service teams and offering other services like nurse-monitored helplines and web-based services such as message boards and forums. (Ledwick, 2009.)

Social media offer an ability to implement cancer prevention campaigns engaging large populations at low cost, connect patients and healthcare providers, develop patient supportive networks, encourage participation in cancer screenings and collecting data for advancing cancer research (Prochalska et al. 2017, 1-2.) Social media work through websites and applications that allow

users to be part of virtual community, to create and share content. Networks connect people sharing common lifestyle, interests, goals and experiences (all provided at very low or at no cost to the user). In USA 79% of the adult population uses Facebook, 32% Instagram, 31% Pinterest, 29% LinkedIn, and 24% Twitter. (ibid., 2.) Social media can provide social support, enhancement of motivation, health communication, self-regulation empowerment which can be used as a foundation of cancer prevention projects. Online communities support and empowerment has been linked to successful behavioral changes, such as (cancer risk reducing) smoking cessation or weight loss. (ibid., 5.) Ability of social media to connect people over long distances, to provide peer support and information, can be helpful to individuals living in remote rural areas. Cancer awareness and prevention campaigns are increasingly popular on social media platforms such as Facebook and Twitter. Videos and photos used on social media in cancer prevention campaigns proved to be an effective method of delivering role model narratives and impacting positive behavioral changes, such as screening attendance or symptoms awareness. (ibid., 5) International, national and local campaigns demonstrated meaningful engagement with their target audiences on social media which are now seen as cost effective and impactful cancer prevention strategy (Prochalska et al. 2017, 12.)

4 Aim, purpose and research questions

The aim of this study was to gather and analyze evidence base knowledge related to cancer patient's experiences with the use of innovative healthcare technologies based on the existing research. The purpose of this study was to provide information about cancer healthcare experience, from the patient point of view, which can be used as a resource for the nurses and nursing students. Moreover, the results of the study can be used for the possible development of nursing care of cancer patients and as a guidance for future training of nurses caring for this patient group.

This study involves two research questions:

1. What are oncological patient's experiences with the use of innovative healthcare technologies?
2. How the implementation of healthcare technologies is impacting the quality of cancer prevention, treatment and care?

5 Methodology

5.1 Literature review

The Literature review is a written document of existing knowledge on a particular topic. It is a comprehensive study and interpretation of literature that addresses chosen subject of research (Aveyard 2014, 5-6). In this research method data from various sources are gathered, appraised, synthesized and patterns analyzed (Machi & McEvoy 2009, 82; Jesson, Matheson & Laces 2011). Moreover, in the healthcare area, literature review examines existing research in order to further the science and to fill a gap in knowledge on particular topic. (Saks & Allsop 2007, 33.)

The literature reviews contribution in the field of health care is significant. Nurses and other health care professionals are expected to work in evidence-based manner and have current knowledge related to the ongoing research in their field. However, it has become impossible to be familiar with all studies on a particular topic as the research and knowledge expands on daily basis. Therefore, because literature reviews summarize a large body of knowledge, the reader does not need to read all studies separately in order to gain current knowledge (Aveyard 2010, 6-7).

In a well written literature review information about a specific topic is gathered from many different sources and analyzed in an academic manner. Literature review should not contain personal biases, it must apply principles of a scientific search and selection strategy (inclusion and exclusion criteria) and be well structured in order to enhance readability. (Cronin 2008, 1; Jesson et al. 2011, 108.)

Considering the aim, the purpose and the research questions, the author of the study concluded that the systematic literature review was a suitable research method for this thesis. Literature review allowed to establish common themes and to condense the evidence-based knowledge related to study research topic. Furthermore, the methodology of literature review must be transparent to facilitate the replication of the study. (Jesson et al. 2011, 108.)

Implementation of the study began with specifying the topic of interest and research questions, aim and purpose of the research were also considered. Subsequently, literature search was conducted based on previously defined study questions in the selected databases. Evidence-based literature was selected by evaluating its contribution to the study topic and formulated research questions. (Machi & McEvoy 2009, 2-48.)

Author of the study identified the themes, categories and associations between the topics in order to present study results in a summarized and meaningful manner. (Jesson et al. 2011, 124; Machi & McEvoy 2009; Rew 2011.) As a result, the aim of the study was achieved by summarizing patient's experiences and analyzing quality of received cancer care.

5.2 Literature search and selection process

Study data was collected from electronic databases provided through Jyväskylä University of Applied Sciences library. Following databases were used for this literature review CINAHL, Elviser Science Direct and PubMed. The search was carried out separately for each database.

A literature review was chosen for this study. Moreover, the PICOS approach, an abbreviation for participants (P), phenomena of interest/ interventions (I), comparators/ context (C), outcomes (O), and study type (S) was used in this review in order to identify key words and inclusion and exclusion criteria. (Liberati et al. 2009.)

The aim of this study was to analyze cancer patient's experiences with the use of innovative healthcare technologies and the impact it had on quality of care. The population or participants of this study were adult cancer patient (P), their experiences were the phenomena of interest (I), scientific studies investigating use of technology in cancer care (C), their outcomes (O) and the study type was based on selecting peer-reviewed studies, published in English (S). Restriction of studies selection to the last decade (2008-2018) was implemented to ensure only most recent knowledge is analyzed and fast-paced nature of innovative technologies development taken is into account. (Elamin 2018, 18-19; Liberati et al. 2009, 5)

Author of the research developed inclusion and exclusion criteria in order to assess which articles should be taken into consideration for the implementation of the study, as shown in Table 1. Scientific papers that did not meet the inclusion criteria were excluded from the study. (Aveyard 2010, 11-12.)

Table 1. Inclusion and exclusion criteria

Inclusion Criteria	Exclusion criteria
Articles published in English	Literature review articles
Articles published between years 2008 and 2018	Articles describing experiences of non-oncological patients
Peer-reviewed academic journal articles	Duplicate studies
Full text access for JAMK students	Pediatric patient population
Articles related to research topic	
Article respond to research question	
Articles found with defined key words	

Database searches were conducted in November 2018. Boolean logic and use of keywords connected by AND, OR were used in the search for the articles. (Aveyard 2010, 40-41; Machi & McEvoy 2009, 41.) The following list of keywords and their synonyms (shown in Table 2) were used in the searches: cancer patients, experiences, technology, telemedicine, e-Health, web-based.

Table 2. Article search keywords and their synonyms

Keywords	CINAHL	Elsevier Science Direct	PubMed
“cancer patients” OR “oncological patients”	1849	152	225
AND			
“experiences” OR “view” OR “perspective”			
AND			
“technology” OR “telemedicine” OR “e-health” OR “web-based”			

Articles have been chosen by title and filtered based on their abstracts. Duplicates of the articles were removed. The searches were completed with consideration of the research questions of this study regarding patient's experiences with use of technology and its impact on the quality of care. Full text articles which answered the research question were chosen for the literature review. A total of 15 articles were selected for this literature review and thematic analysis. Subsequently, findings from chosen articles were collected, analyzed and incorporated into the study using a systematic approach (Aveyard 2010, 11; Heynsbergh et al. 2018, 3-4) Selected articles are presented in Appendix 1 including the publication information, aim, research method, sample and main results.

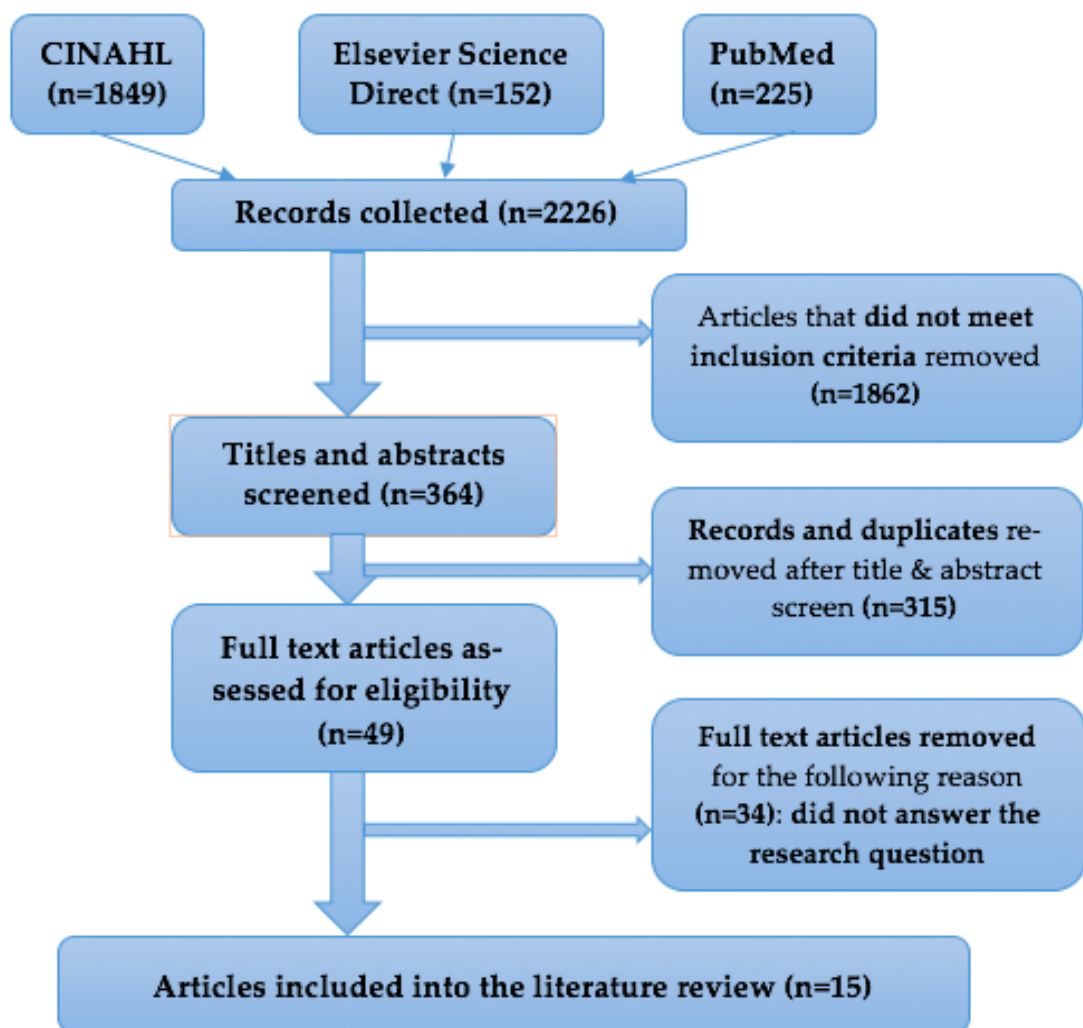


Figure 5. Article selection process

5.3 Data analysis

Thematic analysis of the selected articles was undertaken to synthesise the data in this study (Braun & Clarke 2006, 79). The goal of thematic analysis is to identify and examine reoccurring themes. Furthermore, the similarities and differences that occur between and within these themes are observed. Thematic analysis allows flexible exploration of the data and reporting of participants experiences, therefore author considers it suitable for this study. (Braun & Clarke 2006, 79; Saks & Allsop 2006, 124.) According to researchers Braun and Clarke (2006, 15-23) thematic analysis process can be divided into six phases. Figure 6 illustrates the process.

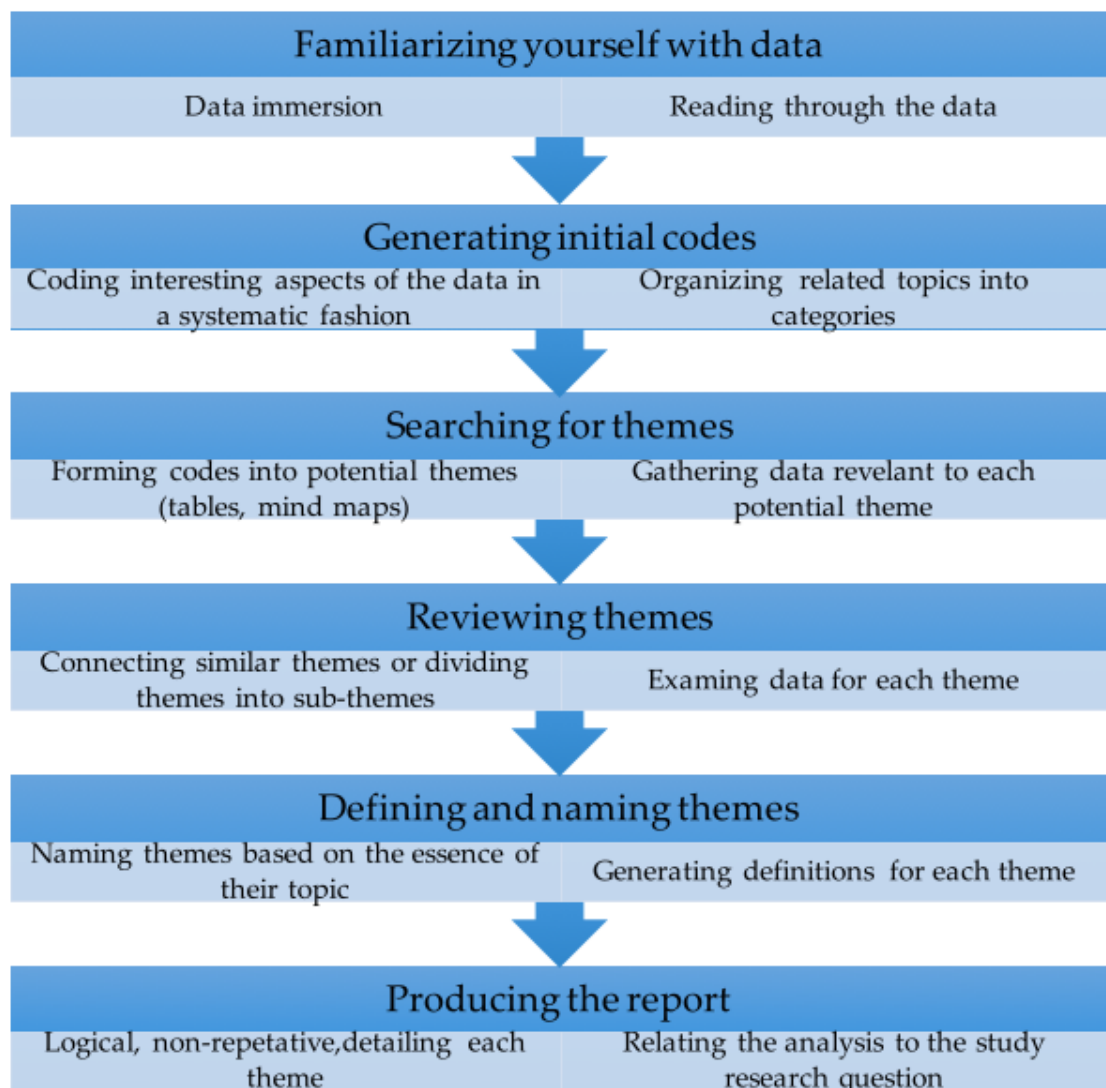


Figure 6. Process of using thematic data analysis (Braun & Clarke 2006, 16-23)

6 Results

Four main themes emerged from thematic analysis and synthesis of data from the selected articles (presented in Table 3). The first was the empowerment of cancer patients resulting from use of the innovative technologies in their care, the second was the experience of receiving more personalized care, the third was improvement in treatment effectiveness and lastly inequalities in access to care were reduced. These themes are further discussed below.

Table 3. Thematic analysis of selected articles

<u>Research questions</u>	<u>Themes</u>	<u>Sub-themes</u>
What are oncological patient's experiences with the use of innovative healthcare technologies?	Innovative technologies and cancer patient empowerment	<ul style="list-style-type: none"> > Self-monitoring > Peer-support > Education, increased knowledge > Decision support > Taking responsibility for own health outcomes > Gaining evidence-based knowledge > Making informed treatment decisions > Motivation & adherence to treatment > Access to data and medical records
	Enabling more personalized cancer care	<ul style="list-style-type: none"> > Targeting specific patient reported symptoms not what is assumed in the standard of care > Patient centered approach to innovation design > Patient involvement in treatment decisions > Improved quality of life > Support for patients families > Individually design outpatient care > Individual advice on symptom management & direct communication with medical team (alert generating apps) based on patient input of data (chemotherapy side effects)

How the implementation of healthcare technologies is impacting the quality of cancer prevention, treatment and care?	Improved treatment effectiveness	<ul style="list-style-type: none"> > Fewer hospital visits > Reduced under-treatment & under-reporting of symptoms > Increased knowledge about diagnosis & improved interaction with HCPs > Improved standard of care due to patient self-reporting (data collection) > Real-time response to cancer treatment toxicity symptoms > Fast advice on symptoms management > Increased patient safety > Reduction in post-surgical anxiety & stress
	Reduced inequalities in access to care	<ul style="list-style-type: none"> > Improved access to specialist oncological care for rural area patients (multi-professional care teams) > Lower cost of access to services > Reduced travel time/ frequency to main cancer centers
		<ul style="list-style-type: none"> > Reduced waiting time for consultation > Increased exposure of minority groups to screening/prevention campaigns > User friendly (easy to use for all socioeconomic groups)

6.1 Innovative technologies and patient empowerment

Cancer diagnosis and treatment have significant impact on patient quality of life. Unfortunately, in standard cancer care several patient needs are unrecognized and unmet, due to limited time with healthcare staff and centralization of the care. Cancer patients are expected to be more pro-active in managing their health. Self-management, self-monitoring and incorporation of eHealth are essential part of modern supportive cancer care services as it empowers the patients and improves their health outcomes. (Duman-Lubberding et al., 2016.)

Researchers Duman-Lubberding, Uden-Kraan, Jansen et al. (2016) concluded that cancer patients using self-management OncoKompas application reported

high satisfaction rate and improved quality of life. Similarly, Trautmann, Hentschel et al. (2016) pointed out that cancer patients suffer from numerous mental and physical complaints but many experienced symptoms were left untreated by physicians. Patients reported that use of smartphone and PC technology helped them to submit symptoms efficiently and receive real-time assessment and assistance from their medical team. (Trautmann et al., 2016)

Patients experienced earlier detection of the adverse events, reported improved medical monitoring and increased frequency of referrals for psychological support. It was noted that elderly patients and those in poor physical condition needed support with using the technology. Electronic assessment of participant reported outcomes added patient perspective to the routine cancer care (ibid.)

Increasing number of cancer patients takes on the responsibility of managing their personal health, including being actively involved in medical treatment decisions (Sickin, 2009.) Internet technology proved to be helpful source of knowledge for such patients. Searching for health information was reported third (after use of an email and general browsing) online activity. Proactive patients gain knowledge on: when to seek medical help, when to request additional information from their medical team or when they needed to ask for second opinion. (ibid.)

Sickin (2009) reported that half of breast and prostate cancer patients used internet to find support and information. Subsequently, cancer patients confronted information found online with the expertise provided by their medical team. Patients reported feeling empowered by peer-support (in cancer support groups), medical information found on-line motivated them to play more proactive role in their cancer care treatment. Study reported that common concern among patients was the risk of obtaining wrong or harmful medical advice. Regardless, internet based knowledge was seen playing

complementary role to evidence-based information provided by healthcare professionals. (Sickin, 2009)

Davison, Szafron et al. (2014) study found that prostate cancer patients did not feel empowered to participate in treatment decisions. Treatment discussions were often not patient-centered and clients were unsatisfied with received information and, at the same time, unable to communicate their values and preferences. (ibid.)

Patients reported that web-based Decision Support Intervention (Prostate Cancer) allowed them access to detailed information they required. Patients who used Decision Support Intervention experienced lower levels of decision conflict and higher satisfaction with patient-physician communication and guidance received. (Davison et al., 2014)

Patient empowerment can also be gained through increased education about the disease and cancer treatments. Unmet information needs can lead to poor treatment decisions and increased anxiety. Haase et al. (2016) reported that VN (virtual navigation) tool called the Oncology Interactive Navigator (OIN) was an effective tool for patients. Clients reported that VN enabled an access to information which enhanced their patient-oncologist relationship. Patients living in remote areas were provided with websites network and patient support. Patients reported satisfaction with access to high quality evidence-based information containing graphics, animations, patient experience videos, knowledge about treatment centers and overall comprehensive source of cancer information. The tool assisted patients to feel in control of their treatment and navigate the health care system better. (Haase et al. 2016.)

Finally, motivation, empowerment and increased adherence to treatment was achieved through interactive video program loaded onto a touch-screen computer (breast cancer survivor stories) studied by Pérez, Sefko, Ksiazek et al. (2014). Patients reported that program was a positive, interesting and

informative experience. Self-identification with stories presented in storytelling format (on touch-screens) convinced patients to receive recommended surveillance mammograms and improved adherence to follow-up care. (Pérez et al., 2014)

6.2 Enabling more personalized cancer care

Innovative technologies allow to target specific patient reported symptoms and not just what is commonly assumed as a standard check-list of complaints. Previously patients noted that their symptoms were frequently under-identified and under-treated due to limited assessment. Researcher Mark, Fortner, Johnson et al. (2008) found that patients using an electronic patient symptom screening and reporting tool (PACE) reported receiving more effective and personalized care. Patients highlighted the educational value of PACE system providing them with materials in text, video, audio, and graphic format. System helped to identify, track, and document patients' symptoms and was viewed as helpful by the users. Patients experienced significant increase in assessment rates for pain, depression and fatigue. (Mark et al. 2008.)

Cancer care can also be personalized by providing patients with telehealth support. After post-surgery hospital discharge monitoring of self-reported symptoms of lung cancer patients is usually limited to a few consultations. (Timmerman et al., 2016). Users of tele-healthcare, provided via smartphones and body sensors, rated the technology as crucial in achieving good quality care while transferring from an inpatient to outpatient care. Patients reported that they were willing to input required data and wear monitoring devices as it reduced their insecurities during post-surgical recovery and provided an improved quality personalized care. (ibid.)

Patient centered approach and personalized care were also researched by Fu, Axelrod, Guth et al. (2016). Patients reported that The Optimal Lymph-Flow

(TOLF) provided them with a valuable health education focused on safe and innovative self-care strategies for lymphedema symptoms. Patients rated positively quality of the received personalized evaluation and recommendations of self-care strategies after submitting every symptom report. Moreover, breast cancer patients found avatar technology useful in acquiring skills in lymph fluid drainage through specially design exercises. Patients reported that the TOLF system provided them with pragmatic, personalized self-care strategies while improving their overall well-being. (Fu, et al. 2016.)

Personalized care can also be achieved through increased patient involvement in their treatment decisions. Patients stated that tools such as Decision Support Intervention (for prostate cancer patients) and previously mentioned virtual Oncology Interactive Navigator allowed them to identify and communicate their values and preferences, take initiative and are resulted in higher levels of satisfaction with treatment decisions. (Davison et al. 2014, Haase et al. 2016.)

Similarly, in study by Kearney, McCann, Norrie et al. (2009) chemotherapy patients using mobile phone-based, remote monitoring called Advanced Symptom Management System (ASyMS) reported improved assessment of side effects due to more effective patient-doctor communication. Patients rated positively the self-care advice sent via mobile phone including instructions on medication, relaxation techniques or dietary advice. Significantly lower levels of fatigue were reported by patients in the intervention group. Patients viewed the symptom assessment system as an innovative tool which allowed them to receive better monitoring and management of chemotherapy-related toxicity symptoms. (Kearney et al., 2009.)

Innovative technologies have potential to significantly impact cancer patient quality of life. Under treatment of pain is associated with higher levels of anxiety, depression, and reduced quality of life. OncoKompas tool (Duman-

Lubberding et al., 2016) and telemonitoring intervention (Kim et al., 2013) proved useful in outpatient management of cancer pain, as patients reported significant reduction in pain levels and improvement in quality of life.

Patients are not the only ones who benefit from technology related improvements and more personalized cancer care, so do their families. Studies by Haase et al. (2016) on Oncology Interactive Navigator and Timmerman et al. (2016) on use of telehealth in cancer rehabilitation, concluded that support of patient families was optimized, helped them adjust, manage, and cope with their relative diagnosis which subsequently improved the cancer patient's health outcomes.

6.3 Improved treatment effectiveness

Effective use of technology in outpatient setting has potential to reduce frequency of hospital visits. Use of an innovative home telemonitoring with point of care (POC) hematology analyzer connected to telecommunication hub was researched by Nimako, Lu, Ayite et al. (2013). Patients were satisfied with direct monitoring, improved communication with the medical team and reduced need for hospital visits was reported. (Nimako et al., 2013.)

Treatment effectiveness was also improved by reduced under-treatment of the negative cancer therapy symptoms. In previously described PACE study 44% of cancer patients stated that the innovatory approach helped them to remember symptoms and that they felt encouraged to discuss their symptoms with their medical team. (Mark et al., 2008.)

An increase in treatment quality was reported in several other studies as a result of an improvement in patient's education. In research on Virtual Oncology Interactive Navigator (Haase et al., 2016) and web-based Decision Support (Davidson et al., 2014) patients experienced feeling more in control of their treatment and reported improved patient-physician communication. Patients

were satisfied with their care outcomes and found provided access to comprehensive and reliable source of cancer information to be an efficient intervention. (ibid.)

Collection of data through use of technology for patient self-reporting had significant impact on perceived treatment effectiveness. Innovations such as chemotherapy toxicity Advanced Symptom Management System or home telemonitoring and POC analyzer system, facilitated more accurate picture of morbidities and improved care as reported by chemotherapy patients. (Kearney et al. 2009; Nimako et al. 2013)

Improvement in quality of care can also be achieved through innovative technologies used for patient safety development. In the study by Rodriguez and Rowe (2010) SpringBoard speech-generating device for patients recovering from head and neck cancer surgery was analyzed. Those patients usually experience anxiety due to inability to communicate their basic requests, such as pain relief, but also critical needs requiring immediate attention (difficulty breathing, accidental disconnection of oxygen or ventilator). Patients found programmed communication needs, such as breathing problems, suction request, pain management or nurse assistance and use of gender-specific voice very effective. (Rodriguez et al., 2010.) Patients preferred using device over nonverbal communication strategies and reported that safety and quality of care during postoperative period was improved as they were able to communicate urgent needs more effectively. (ibid.)

6.4 Reduced inequalities in access to care

Cancer patients living in a remote areas have limited access to specialist oncological care due to extended travel time required and costs involved. Healthcare professionals in rural areas may have narrow experience and feel inadequately prepared to manage physical and psychological needs of cancer

patients and access to multi-professional team of specialist is restricted. (Sabesan et al. 2014; Watanabe et al. 2013.) In Canada and Australia telemedicine, tele-oncology and video-consultations are increasingly used in order to provide more equal access to cancer care. Real-time visual and audio assessment of the patients, in their local health center, with support of nurses and doctors was provided. (ibid.)

In the studies conducted by Sabesan (2014) and Watanabe (2013) patients experienced improved identification of their care needs provided via video-conference based assessment. Patient reported more frequent review of their medications provided by the multidisciplinary team of specialist from the main cancer center. Both clients and local physician rated positively ability to receive the management plan and recommendation immediately after video-conference call. (ibid.) In the Canadian study patient's savings were on average 190 dollars per each visit, when their face-to-face consultation was replaced with tele-oncology. Patients feedback included satisfaction with the convenience of technology use, enhanced access to care, reduced costs and travel time and shorter wait time for consultation. (Watanabe et al, 2013).

Innovative health technologies can be used to reach minority groups, with higher prevalence of cancer, in order to increase cancer screening attendance and to conduct prevention campaigns. In USA interactive video program with breast cancer survivor stories loaded onto a touch-screen computer increased motivation to participate in recommended mammograms as reported by patients with African American background (Pérez et al., 2014.)

Majority of the health technologies presented in this thesis were developed with patient contribution. Researchers goal was to provide a user friendly experience for all socioeconomic groups. OncoKompas tool for example was evaluated as clear and understandable by 84 % of users (Duman-Lubberding et al., 2016). In TOLF intervention (to enhance self-care for lymphedema symptom

management) potential technical barriers were refined to ensure even patients with minimal technical skills could successfully complete the download to their smartphone, laptop or iPad and were able to use this health technology. (Fu, et al. 2016)

Moreover, patients noted that for cancer care clients with limited technology skills more time should be allocated for teaching (by nurses or through interactive tutorials) on how to use the innovative tools. Finally, presence of health professional during tele-oncology visits was highly valued by the patients, as they were able to manage technical problems and, more importantly, fill the gaps in communication between the specialists and patients. (Haase et al. 2016; Sabesan et al. 2014; Trautmann et al. 2016.)

7 Discussion

7.1 Discussion of main results and implications to nursing practice

The aim of this study was to present main aspects of the experiences of cancer patients with use of the innovative health technologies and its impact on quality of care. Study identified four themes: patient empowerment through access to health technologies, innovation enabling more personalized care, improved effectiveness and reduced inequalities in access to cancer treatments.

Studies included in this literature review (n=15) presented patient experiences with various types of health technology. Previous studies commonly focused on the treatment phase of cancer care process with limited analysis of prevention, diagnosis, clinical decision making and follow up. Furthermore, existing literature on use of technology in cancer care largely focused on health care providers (HCPs) perspectives and included limited analysis of patient experiences. Health care providers, in the previous research studies, have

pointed out the negative side to use of technology, such social networking, as a cause of misinformation and increased exposure to harmful advice. Quality of care was analyzed mostly from HCPs point of view and consisted of investment/cost balance. Lastly, impact of the use of technology on patient safety, right to equal and timely access to care was not widely researched. Patients opinions on their family experiences with access to technology were not widely discussed.

This study focused exclusively on presenting and analyzing patient point of view in order to assess the effectiveness of technological innovations. Moreover, author of this study presented how various health technologies can be used at all stages of care process, optimize patient cancer care experience and improve quality of life. It was concluded that innovative technologies have potential to accommodate the needs of new healthcare models which are increasingly focused on outpatient care and patient self-management, provided that, appropriate training is available and patients views are included.

Contributions of the study to the existing literature include necessity to focus on the patients and their experiences as essential in creating effective patient-centered technologies. Firstly, the current study have found that ability to effectively use the technology can be affected by dementia and various disabilities, lack of proper training, and therefore presence of trained professional was occasionally required. Secondly, patient empowerment was identified as a key outcome of using self-management technologies. Furthermore, growing need among patients for access to evidence-based, comprehensive cancer information and education was identified. This study highlighted that patient experience of the quality of care was improved by greater participation in decision making and technology enabled patient-doctor communication. Technology have enabled patients to recognize and reduce the under-treatment of experienced side effects significantly. Similarly, patients quality of life was improved when family was included in the use of

technological innovations. Lastly, patient safety was increased and their anxieties reduced in both post-surgical recovery and out-patient settings when an appropriate technology was used.

Results of this study indicated that more focus should be placed on evaluating the end-user experiences. Implementation of the innovative cancer care technologies can be successful only if it is patient-centered. Patients were willing to use self-management technologies only if safety was increased and appropriate training and HCPs assistance was provided, regardless how cost effective innovation was. Cancer patients expected increase in use of technology in prevention, decision making and follow up phases of cancer care process. Study determined that expanding use of technology to phases of care, other than treatment, empowered and motivated patients.

Furthermore, while HCPs focus was on poor quality of knowledge which patients access through web-based technologies, patients themselves, reported awareness of the misinformation and increase need for access to evidence-based knowledge recourses provided by their care team. Moreover, an issue of an equal access to cancer care was previously researched. Patients experienced that access did not equal with an actual effective use of technology. In the study results concern about limited and inefficient access to care technologies was expressed in relation to patients with disabilities, poor technology literacy and lack of presence of the trained health care personnel in an outpatient/home setting.

The results of the current review highlighted high levels of patients satisfaction with the use of technology as it enabled them to better monitor and report side-effects of the chemotherapy treatment. Timely and personalized advice on symptom management significantly improved their quality of life. Previous research found that side effects were frequently under treated. Furthermore, study found that the quality of life was increased when patient family was

included in use of cancer technology for the affected relative, which was not highlighted in previous studies. As the disease progresses and as cancer patient's morbidities increase, so does the burden on family. Innovative technologies have potential to reduce this burden and through education, improved access to care team, real-time symptom management advice, they could empower the patients and their families.

This study also resulted in the following implications to the nursing practice from the patient point of view. Firstly, cancer patients feedback should be increasingly included in the development of innovative health technologies. Holistic care, which includes patient family, should be promoted when implementing outpatient self-care technologies. Secondly, high levels of satisfaction, improved quality of life and acceptance of technology, as reported by the patients, will increase use of the innovations in future cancer care. Furthermore, technology increased timely access to quality cancer care and should be used in outpatient care settings and for patients living in the remote areas. Patient safety was greatly improved with increased use of sensor and self-reporting technologies.

Current study also highlighted potential implications to the nursing care for health care professionals interacting with cancer patients using innovative technologies. Firstly, adequate guidance should be given on effective use of technology and technology cannot replace direct interaction with nurse, especially for disabled clients and patients with dementia. Secondly, reduction in hospital visits frequency (attributed to use of technology) can improve distribution, allocation and efficiency of hospital personnel resources. Lastly, nurses and doctors should acknowledge patients need for evidence-based knowledge and provide appropriate resources through innovative technology.

7.2 Ethical consideration, validity and reliability

Ethical considerations

Ethical principles are essential part of scientific research. Study fulfills ethical criteria when both accuracy and honesty are applied while carrying out the scientific research, which is subsequently presented without biases. Awareness of the bias (in selection, cost, language, availability) enabled the author to implement strategies to minimalize the risk. (Malone, Nicholl, and Tracy 2014, 279-280.) In this study the most impactful could potentially be availability and selection bias. Articles chosen for this research were selected only from data bases available for JAMK students inevitably causing limited availability and selection bias. Similarly, only articles available with full text were included. Never less, author strived to present credible results using articles from available databases.

Research misconduct, such as plagiarism, falsification or fabrication of data must be avoided when conducting scientific study. Appropriate credits have been given when referencing another person's research, both as an in text citations and as a list of references. To the best of the language abilities author strived to avoid any unintentional plagiarism which could be caused by insufficient paraphrasing of the original work. (Walker, 2008). Appropriate credits have been given to the authors of original information whose research contributed greatly to this study.

This study was conducted as a literature review and existing publish research articles were analyzed (without collection of data from respondents), therefore issues like confidentiality and informed consent where not an issue in conducting this review. However, necessary ethical considerations, such as transparency of findings, were applied in this study. Lastly, standards of ethical

research were met in all reviewed articles. (Furseth & Everett 2013, 15; Horner and Minifie 2011, 348).

Validity and reliability

Research data is considered valid when it enables finding the answers to the proposed research questions (Furseth & Everett 2013, 109). Reliability of this study is based on factual representation of information obtained from research articles. Evidence-based knowledge was applied in the research by analyzing peer-reviewed articles from 2008 to 2018 and their selection was based on inclusion and exclusion criteria in order to strengthen the study. Therefore, it is author's conclusion that information contained in this study is valid and can be used by nursing students and healthcare professionals.

Limitations of the study include focus on patient experiences of health technologies while excluding point of view of health care providers. Author of this study have found, that health care provider's perceptions of innovative technologies were already frequently included in an existing literature, while analysis of patient experiences might add to the available body of knowledge. Moreover, newer research (from 2018) reporting patient experiences with use of healthcare technologies was not available for the author due to limitations of analyzing only open access research studies.

7.3 Conclusions and recommendations

Health care systems are facing multiple challenges leading to transformation of existing care models. Innovative information and communication technologies can play a key role in modern healthcare solutions. (Nasi et al. 2015, 1-2; Silva et al. 2015.) The purpose of this study was to provide information about healthcare experience, from the patient point of view, that can be used as a resource for the nurses and nursing students caring for this patient group.

Findings of this study indicate that use of technology is highly accepted by the cancer patients and it positively impacts their healthcare experience. However, appropriate training must be provided and safety standards established. Technology can reduce inequalities in access to treatments and consultations for patients living in remote areas with limited access to specialized care. Empowerment of patients through use of technology and increased self-management can improve quality of care and reduce costs for both health care providers and their clients.

In conclusion, as stated by European Cancer Patient Coalition (2017) it is important to note that any technological innovation can only be meaningful if it promotes patient-centered multidisciplinary care, improves on existing standard of care, extends as well as improves life quality and reduces inequalities in care.

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Appendices

Appendix 1. Summary of the Selected Articles

Acronym used: HCPs – Health Care Providers.

Author(s), year, country	Aim(s)	Sample	Research method	Main results
Davison et al. 2014, Canada	To measure the preferences and values of men newly diagnosed with prostate cancer using a web-based decision support technology .	n=49 male prostate cancer patients	Quantitative data analysis & patient questionnaires.	<p>Decision Support Intervention-Prostate Cancer is a useful tool to help patients <i>identify and communicate their values and preferences</i> to physicians at the time of treatment discussions.</p> <p>Patients reported high levels of <i>satisfaction with their treatment decision, and involvement in treatment decision making</i>.</p> <p>Levels of <i>decision conflict</i> were significantly lower after a treatment decision was made, and men reported assuming a significantly more <i>active role in treatment decision making</i> than originally preferred.</p>
Duman-Lubberding et al. 2016, Netherlands	To investigate the feasibility of an online self-management application (OncoKompas) among cancer survivors.	n=56 head and neck cancer patients	Quantitative data analysis of patient questionnaires. Semi-structured interviews of cancer survivors & health care providers.	<p>OncoKompas had high <i>patient satisfaction</i> score. Their <i>quality of life improved</i> and was monitored via participant reported outcomes, followed by automatically generated <i>individually tailored feedback and personalized advice</i> on supportive care services.</p> <p>In order to enhance feasibility and increase satisfaction, time it takes to use OncoKompas should be reduced, measurement precision improved, and it should be tailored towards even more <i>personalized advice</i> for patients.</p>
Fu et al. 2016, USA	To evaluate usability, feasibility, and acceptability of	n=30 breast cancer patients	Qualitative data analysis &	Breast cancer survivors were very <i>satisfied</i> with the system: 90% rated the system having <i>no usability problems</i> . The majority

	TOLF (The Optimal Lymph Flow) patient-centered, web-and-mobile-based educational and behavioral health IT system among breast cancer survivors.		end-user testing.	of participants 96.6% strongly agreed that the system was <i>easy to use</i> and <i>effective in helping to learn</i> about lymphedema, symptoms and self-care strategies. System users reported <i>empowerment</i> , appreciated <i>high quality information</i> , useful <i>avatar simulation</i> videos, easy <i>accessibility</i> , and <i>user-friendliness</i> . Study provided evidence on breast cancer survivor's <i>acceptance of TOLF's usability</i> as well as feasibility of using technologically-driven delivery model to <i>enhance self-care</i> strategies for lymphedema symptom management.
Haase et al. 2016, Canada	To explore perspectives of patients with cancer and Health Care Providers (HCPs), about a cancer-related VN (Virtual navigation) tool called the Oncology Interactive Navigator.	n=20 cancer patients (study 1) n=13 HCPs (study 2)	Qualitative secondary analysis combining data sets (from 2 qualitative studies) and an inductive approach used.	Patients reported satisfaction with <i>access to a reliable, comprehensive</i> and readily <i>accessible source of cancer information</i> . The tool assisted patients to <i>feel in control</i> of their treatment and navigate the health care system better. Patient-focused technology <i>optimized the patient and family experience</i> in cancer care. However, HCPs noted that more time should be allocated for <i>teaching the patient how to use</i> the virtual navigation tool.
Kearney et al. 2009, UK	To evaluate the impact of a mobile phone-based, remote monitoring, advanced symptom management system (ASyMS) on the incidence, severity and distress of six chemotherapy-related symptoms in patients with	n=112 breast, lung or colorectal cancer patients n=56 intervention group	Randomized controlled trial & quantitative data analysis, patient questionnaires.	Study demonstrates that ASyMS can <i>support the remote management</i> of six <i>chemotherapy-related symptoms</i> : nausea, vomiting, fatigue, mucositis, hand-foot syndrome and diarrhoea. It has demonstrated that the ASyMS system could provide a more <i>accurate reflection</i> of chemotherapy-related <i>toxicity</i> and could provide a <i>better means of monitoring</i> toxicity in clinical practice with the potential <i>to decrease</i>

	lung, breast or colorectal cancer.			chemotherapy-related morbidities. It offers a <i>systematic approach to symptom assessment</i> which can facilitate a more accurate picture of the real-time morbidity experience of patients receiving chemotherapy.
Kim et al. 2013, South Korea	To test the effectiveness of standardized education and telemonitoring for improving pain, distress, anxiety, depression, quality of life (QoL), and performance in outpatients with advanced cancers.	n=108 cancer patients with advanced solid tumor	Randomized controlled trial & quantitative data analysis, patient questionnaires.	The <i>telemonitoring plus standardized education</i> group showed more significant <i>improvement in reported pain</i> (VAS scale). Standardized pain education using nursing specialists is an <i>efficient</i> way to improve not only pain but also <i>anxiety, depression, performance, and QoL</i> .
Mark et al. 2008, USA	To evaluate The Patient Assessment, Care and Education (PACE) System—an electronic patient symptom screening and reporting system for oncology.	n=100 patients of oncology clinic n=92 Health Care Providers (HCPs)	Quantitative data analysis & satisfaction questionnaires completed by both patients and HCPs.	Screening and reporting system helps to <i>identify, track, and document</i> patients' most important <i>symptoms</i> . Patients found the system easy to use and helpful. The chart revealed that <i>assessment rates</i> for depression, fatigue, and pain increased after The PACE System was implemented. The PACE System is an effective solution to the problem of <i>under-identification</i> and <i>under-treatment of symptoms</i> in patients receiving cancer treatment.
Nimako et al. 2013, UK	To examine the accuracy and acceptability of a home telemonitoring system for patients receiving chemotherapy.	n=10 patients receiving chemotherapy in outpatient setting	Patient questionnaires & quantitative data analysis.	Patients used the <i>telemonitoring</i> system to <i>analyze</i> their own blood (capillary) and to enter <i>symptoms and temperature</i> data. The level of clinical agreement between the system and the laboratory standard was good. The telemonitoring system correctly <i>generated alerts</i> when

				<p>set limits of lab values were crossed.</p> <p>Patients felt that the system <i>easy to use</i> and give them a <i>greater feeling of control</i>, resulted in <i>fewer hospital visits</i> and <i>improve their quality of life</i>. Patients liked <i>the direct communication and monitoring by their medical team</i> and the <i>automated feedback</i>.</p>
Pérez et al. 2014, USA	<p>To address persistent health disparities between African American and Caucasian breast cancer patients by implementing interactive video program (breast cancer survivor stories) loaded onto a touch-screen computer.</p>	n=10 African American breast cancer survivors	<p>Patient questionnaires & quantitative data analysis.</p>	<p><i>Interactive</i> video program (breast cancer survivor stories) loaded onto a touch-screen computer was favorably evaluated by breast cancer survivors.</p> <p>Survivor stories were found to be <i>“interesting and informative,”</i> and usable. Participants identified with storytellers, the stories <i>convinced</i> them to <i>receive recommended surveillance mammograms</i>.</p> <p>Delivery of information through use of narratives has been associated with <i>increased engagement and healthcare participation</i> among African American breast cancer patients.</p> <p>Intervention improved <i>adherence to follow-up care</i>.</p>
Rodriguez et al. 2010, USA	<p>To test the feasibility of using a programmable speech-generating device (PSGD) in hospitalized adults with head and neck cancer experiencing speechlessness.</p>	n=21 postoperative head and neck cancer patients	<p>Quantitative data analysis & patient questionnaires.</p>	<p>Participants were <i>satisfied with using the device</i> and considered the technology to be important during the <i>postoperative period</i>.</p> <p>The integration of technologic interventions like <i>programmable speech-generating device</i> may offer a more <i>reliable strategy to communicate urgent and emergent postoperative needs</i> compared to time-consuming nonverbal communication strategies.</p>

Sabesan et al. 2014, Australia	To test feasibility of tele-oncology model replacing face-to-face specialist cancer care.	n=32 cancer patients	Exploratory, descriptive, qualitative study & semi-structured interviews.	<p><i>Effective communication and doctor-patient relationship</i> were maintained this model of care.</p> <p>Patients noted the benefits of <i>local health professionals being present during tele-oncology visit. Nurses filled any gaps in communication</i> between specialists and patients, troubled technical problems.</p> <p>High patient satisfaction rates regarding ability to <i>receive specialist services closer to home, reduced travel time</i> and its economic consequences and positive technical aspects of telehealth, such as the clarity of audio and video.</p>
Sickin. 2009, USA	To examine the role and perceived importance of participation in online health discussion groups in increasing patients medical knowledge and enhancing their interaction with HCPs.	n=350 participants of discussion groups for cancer patients	Quantitative and qualitative data analysis.	<p>The respondents who interacted with fellow patients in Internet cancer discussion groups had <i>increased knowledge about their diagnosis</i> when interacting with their HCPs.</p> <p>Patient reported <i>feeling empowered and cope better</i> with the stress of the illness. Improvements were reported in <i>patient-provider health-care-related communication</i>.</p> <p>Health websites, message boards and chat rooms provide virtual network of <i>information and support</i> for cancer patients.</p> <p>Reported risks: participants in Internet cancer discussion groups may obtain <i>wrong and even harmful information</i> from one another.</p>
Timmerman et al. 2016,	To report on use of the multimodal ICT-supported	n = 10 lung cancer patients	User-centered design approach	ICT supported rehabilitation program facilitated <i>symptom monitoring and physical fitness training</i> . <i>Accessibility</i> and

Netherlands	(telehealth) cancer rehabilitation program with and for lung cancer patients treated with lung resection and their healthcare professionals.	n = 5 focus groups (HCPs), n = 5 scenarios (HCPs)	of: semi-structured interviews (audio-recorded and transcribed), focus groups and scenarios.	<p><i>quality of current care were improved</i>, patients reported <i>reduced insecurities</i> related to experienced symptoms and recovery.</p> <p>Patients have seen added value to their recovery in: <i>monitoring of health status, web-based tailored exercise program, psychological education, information</i> related to treatment of pain and <i>support for family</i>.</p> <p>Patients were willing to <i>wear monitoring devices</i> and complete questionnaires, as long as was of <i>clinical value</i>.</p>
Trautmann et al. 2016, Germany	To analyze implementation of a systematic electronic, real-time assessment of patient-reported outcomes (PRO) in routine cancer care.	n=126 cancer patients	Quantitative statistical analysis. Patient questionnaires & interviews with HCPs.	<p>Self-administered, <i>electronic assessment tool</i> improved cancer patients care satisfaction. Based on data (inputted by patients) PRO-tool can be used as basis for <i>patient-centered cancer treatment</i>.</p> <p>Patients' acceptance of the technology was increased when <i>interactive tutorial</i> (on electronic questionnaires and tablet PCs) were available.</p> <p>An electronic real-time assessment of PRO adds the <i>patients' perspective to clinician's skills</i> and knowledge as well as <i>guideline-based therapy</i> in routine cancer care.</p>
Watanabe et al. 2013, Canada	To assess the feasibility of using videoconferencing to provide specialist multidisciplinary PC and palliative RT consultation to cancer patients in rural areas	n=44 palliative care and palliative radiotherapy patients	Quantitative analysis & patient and doctor surveys.	<p>Patients and physicians indicated <i>a high degree of satisfaction</i> with the clinic and delivery of <i>specialist multidisciplinary PC consultation by videoconferencing</i>.</p> <p>Patients reported: <i>convenience, reduced travel time and costs, reduced wait time</i> for</p>

	and to explore symptom, cost, and satisfaction outcomes.			consultation, <i>enhanced access</i> to care, perceived ability to communicate effectively with the provider and overall ease of use. <i>Technical difficulties were occasionally</i> encountered and arranging telehealth appointments was <i>more time-consuming</i> compared to in-person appointments.
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