Nurse's Role in Applying Telemedicine in the Management of Heart failure in Elderly

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Abstract:
With recent development in information technology, the author developed interest on how heart failure elderly patients can be cared for from a distance with the use of digital devises to reduce rehospitalization, healthcare cost, death, and improve selfcare adherence through constant monitoring. The aim of the study was to find out the role nurses play in applying telemedicine in the management of heart failure elderly patient by answering the research question what are the roles nurses play in using telemedicine in treating elderly heart failure patient? The author employed literature review method in the qualitative study where by 15 scientific articles were used as materials for the study. The scientific articles selected was analyzed using inductive content analysis. Orem's theory of self-care deficit that specifies when nursing is needed was applied to the study. The result identifies the nursing roles as technical, administrative and patient centered roles with the use of information and communication technological digital devises. The study provides Knowledge on how care can be offered from a distance for heart failure elderly patient by identifying the roles nurses play in using telemedicine in treating heart failure elderly patient. However, it is not clear which of the roles contributed more to the achieved results, therefore, more research is needed. Due to limited research about the topic, time, money and language constraint, the author used only free available full text articles for the study. The study was commissioned by DeDiWe.

Keywords:	Telemedicine, Nursing, The role of nurses, Heart Failure in Elderly
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FOREWORD

I thank the Almighty God for giving me the wisdom, Knowledge and understanding in my studies and in my thesis writing. I appreciate my supervisor Pauleen Mannevaara and all my teachers for instructing and making effort to bring the best in me. I thank the representative of DeDiWe programme Gunbritt Lejontvist for commissioning my thesis. I appreciate the love from my husband Festus and children; Chiagoziem, Ebubechukwu and Chinazaekpere during my studies. I appreciate my colleagues for their support. I appreciate my parents late Mr. Christopher and late Mrs. Paulina Okejeme for their parental care.

1 INTRODUCTION

In recent years, with the development in technology and information system, shortage of nurses, the desire to provide quality care with reduced cost, to provide frequent monitoring associated with chronic and high mortality diseases, telemedicine has been employed to support health care professionals in their work and in caring for patients. Heart failure is one of the diseases that has high mortality rate especially in elderly. In addition, frequent rehospitalization incurs cost for the patient, the family members are rubbed off their active participation in their work places, lots of difficulty is associated with movement from one place to another which are not favorable for an elderly patient. Therefore, means by which care can be offered to heart failure elderly patient is paramount. During my practical training in a cardiology ward, the number of deaths and returns to the hospital after being discharged became so often due to reoccurrence of the problem mostly with these patients. With the knowledge about telemedicine from the digital health course, the author became interested on knowing what kind of roles nurses can perform using telemedicine to care for these heart failure elderly patients. This study, therefore, intends to identify the roles the nurses can play in applying telemedicine in the management of heart failure in elderly to reduce rehospitalization and deaths due to heart failure. Orem's self-care deficit and nursing system theory will be considered in the study. The work is commissioned by DeDiWe.

2 BACKGROUND

Heart failure is a major health problem that affect over 23 million people worldwide and it is associate with significant healthcare costs, deaths and mobility especially among those ≥65 (Rodger 2013). The study shows that the significant in deaths, morbidity and healthcare cost are not related to the incidence of the disease rather due to readmission and hospitalization associated with the chronic situation in heart failure (Rodger 2013).

Heart failure has caused over 58 thousand deaths in America and over 1 million people being discharged due to heart failure in 2010 (Mozaffarian et al. 2015). It has been projected that the prevalence of heart failure will increase to 40% from 2012 to 2030 in which over 8 million adults will be affected in America and men and women with shorter life expectancy at 80 years still have 20% risk of developing new heart failure (Mozaffarian et al. 2015).

Heart failure in elderly is a chronic disease that requires frequent monitoring due to its high mortality rate and increase in rehospitalization (kashem et al 2008). According to Kashem, heart failure patients requires follow up to be able to detect the day to day changes that may lead to worst situation. This according to him is inadequate considering the labor intensive that is involved (kashem et al 2008). Study shows that elderly patient with heart failure finds telemonitoring system designed for them to be helpful in managing the chronic disease in their own homes (Evans et al 2016). Telemonitoring improve heart failure patient's selfcare treatment adherence (Unverzagt et al. 2016). According to Unverzagt, telemonitoring is one of the treatment interventions that could be used in heart failure management (Unverzagt et al. 2016). He stressed the need to develop evidenced based method that could allow heart failure patients to participate in their care (Unverzagt et al. 2016). The monitoring of blood pressure, ECG and weight measurement employed

in the telemonitoring were found to be effective in the heart failure patient reduction in mortality (Bashi et al, 2017). The feasibility study by lee shows that clinical outcomes can be improved on the short term by the voice recognition telemedicine system developed to improve self-care of the heart failure patients especially the elderly (lee et al. 2017). With low number of nurses, insufficient bed spaces (an experience from the practical training), difficult access to care facilities, telemedicine provides new ways of providing this surveillance, monitoring, care and self-care adherence and improving communication, with the elderly heart failure patient. Other studies have been done concerning the use of telemedicine to reduce rehospitalization and mortality associated with heart failure, there is need to specify and assess nurse's role and how it contributes to heart failure management in elderly. According to Ponikowski, in the European guideline, nurses form part of the multidisciplinary framework and there is an evidence that implementation of care, monitoring and exercise training which are part of non-pharmacological/non-surgical management of heart failure can improve mortality, morbidity and quality of life and it is recommended as clinical guideline (Ponikowski et al. 2016), see appendices 2. The guideline also identifies the selfcare skills that should be included in the patient education shown in appendices 3 (Ponikowski et al. 2016)

2.1.1 Definition of heart failure

Heart failure according to Dumitru loana (Medscape practice essentials) is a situation whereby the heart fails to pump blood at the rate that tissues can use it for their metabolic activities or do it with high diastolic pressure. According to McMurray, heart failure is clinically defined as a situation that presents symptoms and signs like loss of breath, swelling of the ankles, fatigue, elevated jugular venous pressure, pulmonary crackles and displaced

apex beat (McMurray el at. 2012). These symptoms are essential in monitoring how the patient is responding to treatment (McMurray el at. 2012)

2.1.2 Definition of Telemedicine

According to the world health organization in its second global surveys on e-heath (WHO global surveys 2010), telemedicine means healing from a distance with the use of modern information and communication technologies. Nursing and telemedicine imply providing care from a distance. According to Fishman, telemedicine can be defined as the use of electronic and communication technologies to provide and support health care when distance separates the participants. Distance is no more a barrier as specialist and nurses are brought together through advanced telecommunication links (Fishman 1997). Telemedicine according to her is changing nurse's role along with the computer-based patient record and was first referenced in radio news in April 1924 (Fishman 1997).

2.1.3 Difference between telehealth and telemedicine.

Telemedicine according to the evisit.com refers specifically to the clinical services and as a subset of tele heath although telehealth and telemedicine are usually used interchangeably in the health care due to their connection with the medical education, e-health patient monitoring, patient consultation through video conferencing, health wireless applications, transmission of medical reports etc.

According to evisit.com (Online source 2018) web page, telehealth was defined by the Californian telehealth resource center as:

"telehealth is a collection of means or methods for enhancing health care, public health and health education delivery and support using telecommunications technologies." (eVisit.com online source 2018)

2.1.4 Types of telemedicine

Store-and-forward in this type of telemedicine the medical data and information about the patient is shared with other health professionals at different place through a secured platform. Here the communication between those involved happens at different times which gave them the opportunity to make good decision concerning the patient (eVisit.com, online source 2018).

2.Remote patient monitoring; with this type of telemedicine, patient's vitals and other data generation and transfer from a distance is made easier with the help of right, working and easy to use devices that is in the patient's home. Some of these devices transfers patient data automatically enabling quick response. Regular data and reports are being generated with this type of telemedicine, making it possible for health professional to follow up any abnormalities. With this type of telemedicine, patients that are recovering from a surgical operation, having chronic conditions and those at health risk are monitored for warning signs for quick intervention. This type of telemedicine is also called telemonitoring or home telehealth. With this type, close communication is maintained with the patient (eVisit.com, online source 2018).

3.Real-time telehealth: In this type of telemedicine, video and audio devices are used to maintain communication between the health professional

and the patient or among the health professionals. The nurse for instance can make assessment using real-time telehealth as an alternative to be being physically present with the patient. This can be achieved with simple compactible device, internet connection, webcam and a microphone (eVisit.com, online source 2018). This study intends to identify the roles nurses play with the different types.

2.1.5 Categories of Telemedicine

Tele-nurse: Fishman identifies tele-nurse as one of the categories of telemedicine which can be divided into two types; the tele-triage nursing that deals with collection of information from the phone and computer and using them to refer the patient to the appropriate place for treatment and home health nursing that involves the use of video to monitor patients in a central nursing station where the patient can be prompted to take measurements of the vital signs and take medications (Fishman 1997) Other categories of telemedicine as identified by Fishman include; tele-radiology: this is the ability to transport radiology images(x-rays), scans and magnetic resonance images. Tele-pathology: The ability to transmit high resolution still images of frozen slides. Tele cardiology: This involves the transmission of electrocardiogram, echocardiogram and cardiac pacemaker monitoring. Tele dermatology: This is using dermascope to transmit images of the skin. Telepresence: In this the surgeon can manipulate the instrument from the remote site with the combination of robotics and virtual reality. Video conferencing: With video conferencing, it is possible to have a two-way real interaction to provide patient education, monitoring from remote place (Fishman, 1997). Other specialties of telemedicine as identified by eVisit (eVisit.com, online source 2018) includes; Tele-psychiatry: This offers opportunity for psychiatric patients to receive treatment from specialist remotely. Tele-ophthalmology: This allow

patients to treatment about their eyes from the ophthalmologist from either live or through store and forward telemedicine. Tele-oncology: This allows cancer patients to receive care easily and conveniently through store and forward or live telemedicine. Tele-nephrology: according to eVisit (online source 2018), a family physician can consult a nephrologist about a patient with kidney disease. Tele-obestrics: This according to eVisit mean providing prenatal care remotely. For example, recording baby's heat beat at one location and forwarding it to an obsterician in another place. Tele-rehabilitation: Different professionals can deliver services remotely through this for example, physical therapy (eVisit online source 2018). This study will be focusing on the home health nursing of the tele-nurse.

2.1.6 Pros and cons of telemedicine

According to eVisit (eVisit, online source 2018), telemedicine like every other method of care has both the benefit and shortfalls. As more and more people are getting connected, people's engagements are increasing and the need to cut down on cost in the health care sector, telemedicine can transform healthcare delivery style for better. however, there can be societal and technological change in future.

Pros

- Convenience and accessible care for patient. With telemedicine, patients receive care more conveniently especially in remote places. Specialist can be connected to via telemedicine. With telemedicine, an elderly with mobility difficulty can receive care from home.
- It saves cost for health care and patient as well. According to the Online sources (eVisit, 2018 online source) over $ 2.9 trillion is spent on the healthcare in the United States and an estimated amount of $200 billion are spent unnecessarily. With telemedicine, the figure can be cut down by reducing associated cost with non-adherence to medication and unnecessary visit (eVisit, 2018 online source)

Cons

- According to eVisit (eVisit 2018 online source), telemedicine requires training in technical aspect and purchase of the equipment required for telemedicine platform.
- Patient's care continuity can be lost due to easy access to the other health care providers who may not know much about the patient (eVisit online source 2018).
- In-person interactions with the doctor which are important in making full diagnosis can be reduced through telemedicine

3 Theoretical framework

Theories are important in research studies and in nursing practice. They guide nurses in decision making concerning patient care. In research, they serve as glasses through which the studies are viewed, theories can guide the process used in the research, used to answer research questions. Research design, analysis and interpretation of data used in research study can be guided by theories. Theories allows researcher to systematically identify the relationship among variables. Theories can be used to explain findings and make it more meaningful and interpretable in research study. Theories can help researchers into understanding of the natural phenomenon and reasons for their occurrence. For this study, Orem's selfcare deficit theory will guide the author in answering the research question.

Orem's Selfcare deficit theory could be suitable for my studies because it sees nursing as an interaction between two or more people and knowledge about one's health problem is very important for promoting self-care behaviors. Through telemedicine, nurses can provide this information for the patients, Nurses can interact with their patient through phone. The theory was developed by Dorothea Orem and was first published in 1971. Her theory was rated high because it has wide range of application. The major assumption of the theory is as follows;

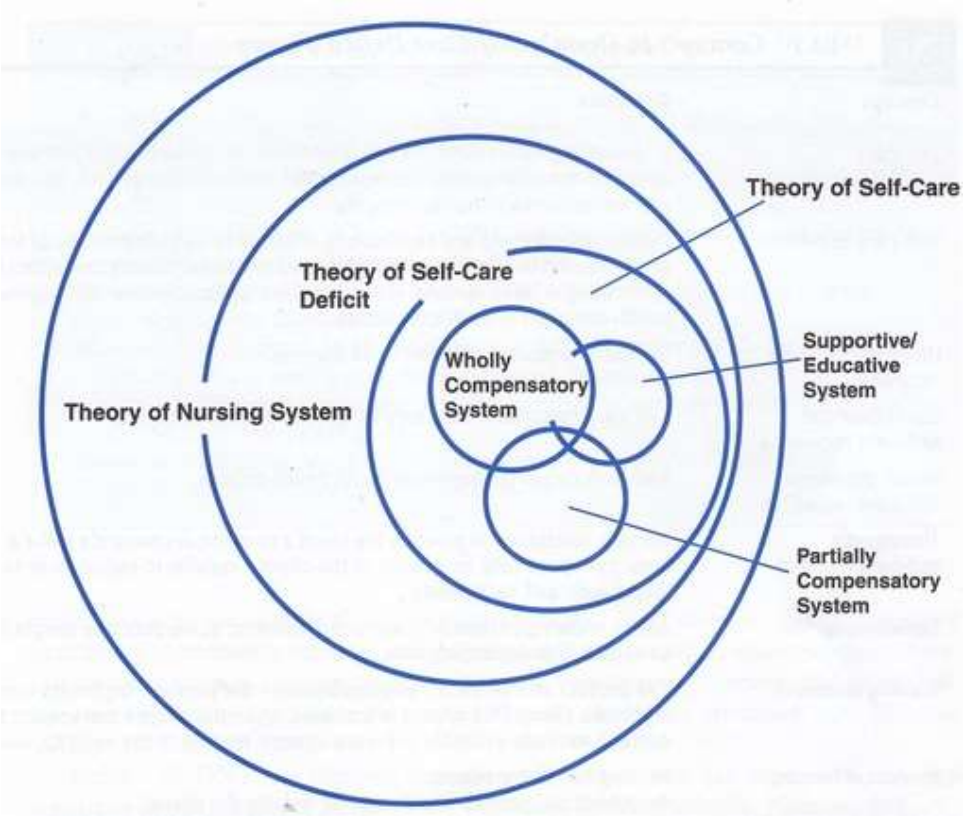

Figure 1; Orem's selfcare theory (online source 2018)

The above diagram shows the Orem's selfcare deficit nursing theory, which comprises the selfcare theory, the selfcare –deficit theory and the theory of nursing system that are interrelated.

According to Orem by Gonzalo 2011, (Online source 24.09.2018), nursing is required when it is not possible for someone to do all the actions that will help him to keep life going and be able to recover from sickness or live with what the sickness brings either by an adult or child's parents or guardian. Nursing is an art, which means that the nurse provides a specialized (more than ordinary) assistance to meet the needs for selfcare and participates in medical care the individual receives from the physician Gonzalo 2011(Online source).

According to Gonzalo 2011(online source) the major assumptions of the theory, is stated below;

Health: means to be structural and functionally sound, to be able to symbolize experience, communicate to others and reflect on one's self as an individual or as a group.

Humans: means men, women and children that receives care which is provided by someone.

Environment: this can either be our surroundings and where we belong to for example our family or our community.

Selfcare: these are activities an individual does to keep his life going and have good health.

Selfcare agency: This means when someone can be able to do things needed to keep his life going and it depends on some of the basic factors which can be the person's age, his sex, adequacy and availability of resources, health system, sociocultural system, family system patterns of living and environmental factors.

Therapeutic self-care demand: this means all the self-care actions that is needed to be performed to achieve selfcare requisites.

Selfcare deficit: This indicates the need for nursing; that is when there is no continuous effective selfcare.

Nursing agency: this means the attributes the nurses has that enables them to render help that is needed to improve their career's therapeutic selfcare.

Nursing system: This system is needed when the therapeutic selfcare is more than the selfcare agency.

Other subset of the theory includes; the selfcare requisites comprising three categories.

Universal selfcare requisites that deals with how to maintain functionality of the human being and his integrity. **The developmental selfcare requisites** that are required due to the new event or development from a condition. **The health deviation requisites** that comprises; seeking medical assistance, being aware of a condition and the effect it may have, effectively carrying out prescribed medical measures, understanding the effect of the prescribed medical measure, modifying the self-concept and learning to live a lifestyle that promote personal development Gonzalo 2011 (Online source). The study seeks to focus on the health deviation requisites.

The diagram below shows the major concept of the Orem's theory of self-care deficit and how they relate.

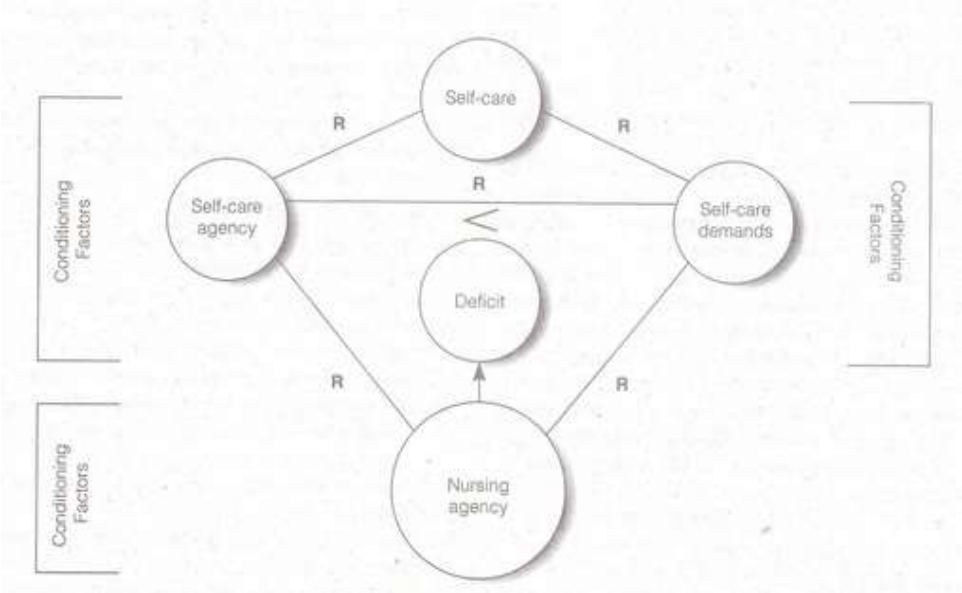

Figure 2; Orem's selfcare deficit theory (online source 2018)

R means how they relate, < means the situation at hand or the would-be deficit that requires nursing.

The basic assumption is that human beings engage in continuous communication among themselves and their environment to function well, have power to identify needs for selfcare and make necessary judgments (that is power

to act deliberately) and their agency is manifested by identifying and extending to others ways by which their needs can be seen and make inputs for themselves and for others Gonzalo 2011 (Online source).

According to the web page of the nursing theory, html (opened 4.4.2018 at 12.00pm), it was summarized that People should be self –reliant and responsible for the care and the care of other members of their family that needs the care because they are unique, and nursing involves interaction between two or more person through which primary care prevention can be provided. Knowledge about a health problem motivates selfcare behaviors that are affected by certain conditions such as socio-cultural context (Online source 2018)

This theory of self-care deficit indicates when nursing is needed which means that an adult is incapable of or cannot provide effective self -care for himself. An elderly patient suffering from heart failure is being incapacitated by the disease and therefore needs support from the nurses and a conducive environment that promotes his living. The interaction between a nurse and the patient is needed when self-care deficit occurs (Talbot 1995). Research has shown that the theory can be applied to patients with chronic illness (Kumar 2007). According to the research done with elderly patient suffering from heart failure in the United States of America, Riegel (Riegel et al. 2008) recommends that self-care should be encouraged in heart failure patients because better outcome is obtained for those who engage in it. In her study, the decision about self-care depends on the characteristics of the person, problem and environment, which is being influenced by the patient's knowledge, experience, skills and compatibility with the values. Therefore, the author finds the self-care theory as a good choice for this study because the elderly patients with heart failure are being considered in the study and through tel-

emedicine the patient with heart failure can be motivated to self-care behaviors. This study focuses on the interaction that exists between the nurse and the patient through digital devices involved in telemedicine.

4 AIMS AND RESEARCH QUESTIONS

The aims of the study

To identify the role nurse's play in using telemedicine to treat elderly patient with heart failure

Research question

What is the nurse's role in telemedicine in treating elderly patient with heart failure?

5 METHODOLOGY

This means the method that is applied by the author in collecting data used for analysis for this study.

5.1 Data collection

This study is a literature review, scientific articles were collected through a comprehensive search in scientific data bases such as academic search elite (EBSCO) that yielded 26 hints by the key words; nursing and telemedicine and heart failure and elderly and 3 articles were selected. With the same key words, the author search PubMed and 77 hints were obtained, and 4 articles were selected. Science direct was search, 296 results were obtained, and 1 article was selected. Three (4) other articles were obtained from the references made by other researchers in the selected article which the author searches the journals for the article. With the key words telemedicine in elderly patients with heart failure and the role of nurses, academic elite (EBSCO) yielded 6 hints, an article was chosen, PubMed yielded 2, all were chosen. The 15 articles were chosen based on the inclusion and exclusion criteria. Articles that author founds relevant in relation to the study that are in English language, free, those the author could have access to and recent, were included. Articles that involves telemonitoring in heart failure in elderly between 2005 and 2017 were included. Articles that considered telemonitoring outside heart failure was excluded. The 15 articles are listed below;

1.Black JT, Romano PS, Sadeghi B, Auerbach AD, Ganiats TG, Greenfield S, Kaplan SH Ong MK & BEAT-HF Research Group. 2014 A remote monitoring and telephone nurse coaching intervention to reduce readmis-

sions among patients with heart failure: study protocol for the better effectiveness after transition- Heart failure (BEAT-HF) randomized controlled trial. Trials vol15 issue124, pp. 45-62
2. Long G. 2017 Impact of home telemonitoring on 30 –day hospital Readmission rates for patients with heart failure: a systematic review. MEDSURG Nursing, vol. 26 issue 5, pp. 337-348.
3. Unverzagt S, Meryer G, Mittmann S, Samos FA, Unverzagt M & Prondzinsky R, 2016. Improving Treatment Adherence in Heart Failure. Dtsch Arztebl Int. Vol 113 issue 25 pp. 423-430
4. Evans J, Papadopoulos A, Silvers CT, Charness N, Boot WR, Schlachta-Fairchild L, Crump C, Martinez M, Ent CB. 2016. Remote Health Monitoring for Older Adults and those with Heart Failure: Adherence and System Usability. Telemed J E Health vol 22 issue 6, pp. 480-488. doi: 10.1089/tmj.2015.0140
5. Hobbs, Joanne Kathleen, 2016 NE SERIES Reducing Hospital Readmission Rates in Patients with Heart failure. MEDSURG Nursing, Vol 25 issue 3, PP. 145-152
6. Vuorinen A-L, Leppänen J, Kaijaranta H, Kulju M, Heliö T, Gils M v & Lähteenmäki J. 2014. Use of Home Telemonitoring to Support Multidisciplinary Care of Heart Failure Patients in Finland: Randomized Controlled Trial. Journal of medical internet research. Vol 16 issue 12.
7. Cleland J G. F, 2006.The trans-European Network- home-care management system (TEN- HMS) study: an investigation of the effect of telemedicine on outcomes in Europe. Supplement 1, Vol. 14, p23-28. 6p.
8. Seto E, Leonard K J, Cafazzo J A, Barnsley J, Masino C & Ross H J.2012 Mobile Phone-Based Telemonitoring for heart failure Management: A Randomized controlled Trial. Journal of medical internet research. Vol 14, issue 1, pp. 1-14.

9. Kashem A, Droogan M T, Santamore W P, Wald J W & Bove A A. 2008. Managing Heart Failure Care Using an Internet-Based Telemedicine System. Journal of cardiac failure, Vol 14, issue 2, pp. 121-126.
10. Kato N P, Johansson P, Okada I, Vries A E d, Kinugawa K, Strömberg A, & Jaarsma T 2015. Heart failure telemonitoring in Japan and Sweden: A Cross-Sectional Survey. Journal of medical internet research, Vol 17, issue 11, e258 P.1-11
11. Lee H, Park J-B, Choi S W, Yoon Y E, Park H E, Lee S E, Lee S-P, Kim H-K, Cho H-j, Choi S-y, Lee H-y, Choi J, Lee Y-j, Kim Y-J, Cho G-Y, Choi J, & Sohn D- W. 2017. Impact of a Telehealth Program with Voice Recognition Technology in Patients with Chronic Heart Failure: Feasibility Study. JMIR MHEALTH AND UHEALTH Vol 5, issue 10, pp. 1-15.
12.Bashi N, Karunanithi M, Fatehi F, Ding H, & Walters D. 2017. Remote Monitoring of patients with Heart Failure: An Overview of the Systematic Reviews. Journal of Medical internetresearch, Vol. 19, issue 1. PP 1–14.
13.Balk A H, Davidse W, Dommelen P v, Klaassen E, Caliskan K, Burgh P v d, & Leenders C M, 2008. Tele-guidance of chronic heart failure patients enhances Knowledge about the disease. A multi-centre, randomized controlled study. European journal of heart failure, volume 10, issue11, PP 1132-1142.

14.Cleland J G F, Louis AA, Rigby A S, Janssens U, Balk A H.M.M, & TEN-HMS Investigators.2005. Noninvasive Home Telemonitoring for Patients with Heart Failure at High Risk of Recurrent Admission and Death: The Trans-European Network-Home-Care Management system (Ten-HMS) study. Journal of American Cardiology, volume 45, issue 10. PP 1654-1664.

15.Barrett D. 2017. Rethinking presence: a grounded theory of nurses and teleconsultation. Journal of Clinical Nursing, Volume 26, issue 19/20. PP3088-3098. 11p. DOI: 10.1111/jocn.13656

5.2 Data analysis

This is an iterative activity that involves the forward and backward movement to and from the collection into the analysis and trying to get the answer to the research question (Holloway & Galvin 2017). Here the author intends to interpret, describe, reduce, summarize, categorize the articles selected to bring an understanding of the data(articles) that is collected. Describing, interpreting, reducing data are common to qualitative data analysis which can take different approach that is flexible and creative (Holloway & Galvin 2017). Qualitative data analysis is done to gain insight on a phenomenon for example how is a thing is occurring, work or look like (Talbot 1995). The author intends to apply the approach that is coherent to the research method that is being used for this study. This is because the result will be based on the data (articles) generated. There is no rigid prescription on which approach to use (Holloway & Galvin 2017). The content analysis based on grounded theory will be used for analyzing the data for this study. The grounded theory was developed by Glaser and Strauss in 1986 and is a qualitative research method that identifies the relationship between concepts in an inductive manner, which means that the researcher goes to the data frequently to find data that has not been included (Talbot, 1995). The method in grounded theory, involves, coding which is marking important places in the text and writing them in margins. This is followed by forming memos

that help in the thinking process. The memos are then form into primary categories which are often presented in diagrams to show how they are linked. The central meaning is reached through inductive or deductive. This is followed by evaluating the relevance of the relationship and how they interact. This leads to the comparing and analyzing for similarities or differences (Talbot 1995).

The author read through the selected articles to identify the year, the objective of the study, the type of study (that indicate the level of evidence), the type of telemedicine used, the roles nurses perform with the different telemedicine method/system applied to monitor elderly patient with heart failure and the findings of the selected articles. The analysis is shown in the table appendix 1 and the nursing roles are represented in the figure 3 and telemedicine system in figure 4.

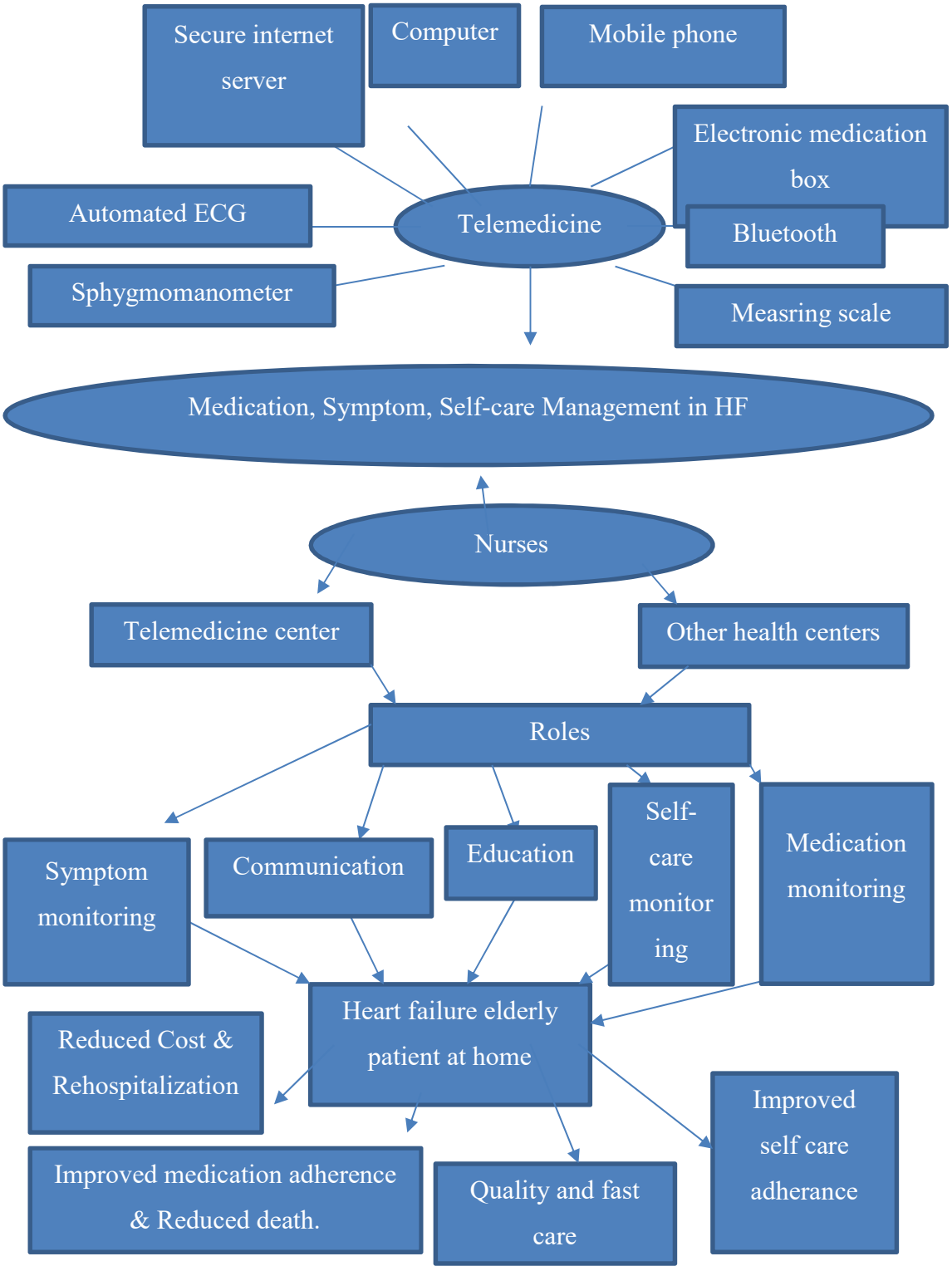

Figure 3; Nurses role in using telemedicine in treating heart failure elderly patient.

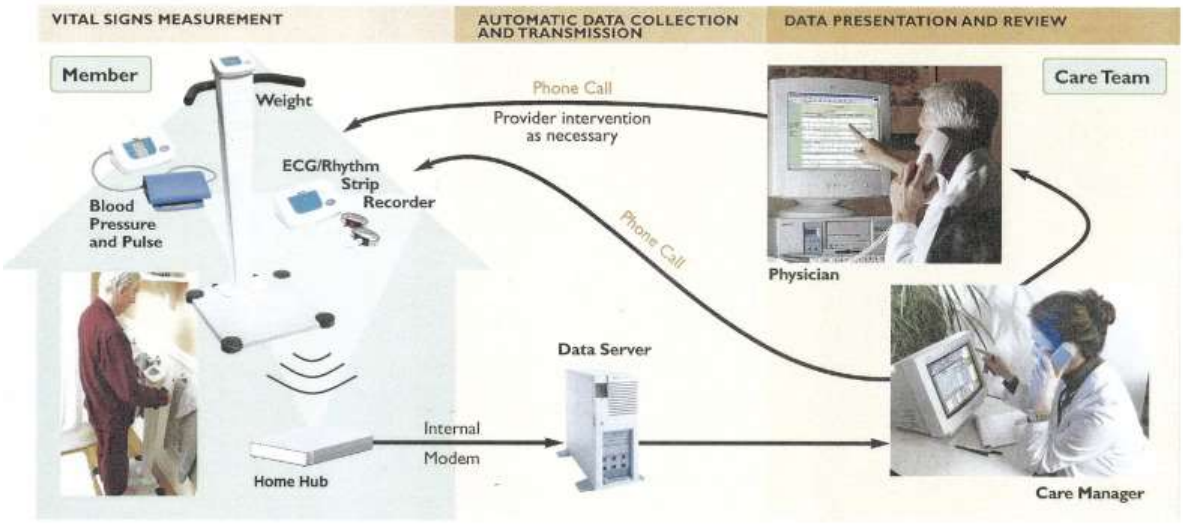

Figure 4; telemedicine system

The diagrams above shows the different digital devices applied to care for the elderly patient with heart failure. It also shows the nurses at different places with different roles such as symptom monitoring, communication, education, selfcare monitoring, and medication monitoring in caring for heart failure elderly patient at home that leads to reduced healthcare cost and rehospitalization, death, improved medication adherence, quality and fast care and improved selfcare adherence.

5.3 Ethical consideration

The ethical consideration in this study is that the author follows the ethical guidelines for writing degree thesis as provided by the school authority. The author tries not to copy the work of others but rather applied works by other researchers and referenced them accordingly. The issue of plagiarism; that is using someone's own work as one's own was avoided. The author has observed the good scientific practice as required by the institution by avoiding cheating, fabrication, negligence, ethical carelessness, falsification, misappropriation and use of unauthorized helping aids. (Online source, guideline for good scientific practice in studies at Arcada)

6 FINDINGS/ RESULTS

Based on the articles analyze, the following modern information and communication technological devices such as mobile phone, Electrocardiogram(ECG), automated measuring scale, sphygmomanometer, computer, electronic medication boxes, secured internet server, Virtual devices, ideal life pod, Television Channels, voice recognition system, Health buddy were used as **telemedicine systems/methods** to communicate, educate, motivate the selfcare activities, monitor and manage medications and symptoms for the elderly heart failure patient (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12,13,14, 15).

From the articles, nurses in telemonitoring centers performs **nursing role** which can be sub divided into administrative role, technical role and patient centered role that are inter-related due to the interaction that is involved in them.

6.1 Administrative role

This role includes making consultation with the physician to review patient's medications and relating with other health care disciplines, imputing data in the electronic heath records, referring patients to visit clinic or emergency department, and browsing the internet to gain more knowledge, (2, 3, 4,5, 6,12,13, 14,15)

6.2 Technical role

The nurses receive training on the telemedicine systems/methods and then can assist the patient with the technical difficulties arising from the equipment in the form of operational role (13) telling them what button to press to get clearer image or to switch on. Teaching the patient how the telemonitoring equipment works.

6.3 Patient centered role

Under this role, the nurse provides the patient with knowledge about the disease and its management through **education** (1, 6, 10, 11, 12). This they do by providing information about the disease, the kind of food to eat, the importance of medication, the importance of restricting fluid and salt intake, the best way to take measurements. The nurse provides answers to the patient in areas of confusion with their treatment plan and other questions related to the disease the patient might have. The study done by Hobbs indicates that provision of education leads to reduction in readmission (1). The nurse provides clinical care by making **assessment** (13) of the patient to identify for example, through the virtual devices, swollen ankles and the jugular in the neck which are part of the signs and symptoms of heart failure that can be seen. The nurse provides therapeutic care by providing support and encouragement, motivation through **communication** (2,3, 4,7,9,10, 11, 12) that constantly exist between them by phone calls when they answer patient calls or make calls to patient when there are alerts in the measurements. This encouragement and support nurses provide often builds confidence in patients to perform activities that boots their selfcare agency and adherence. The nurse provides **effective monitoring**

(2,3,7,9,10,11,12,15) of the measurement values, medications and symptoms. Through this, problems are identified earlier and are treated. To achieve better result, more than one system/method of telemedicine can be employed as argued by Black that mobile phone alone will not be effective but must be combined with other methods such as home telemonitoring of weight, heartrate and blood pressure and pre-discharge education to achieve reduced hospitalization for heart failure elderly patients (6). Nurses performs all the above nursing roles to achieve improved knowledge about the disease, more adherence to medication, reduced hospitalization, death, patient's satisfaction and improved selfcare adherence. According to Hale, maintaining medication adherence reduced hospitalization up to 80% in elderly patients with heart failure (2). Kashem in his research identified that combining telemedicine surveillance with the usual care improves reduction in hospitalization (5). Black identifies that combination of centralized phone call, patient engagement during hospitalization with telemonitoring reduces hospitalization (6)

7 DISCUSSION

This study identifies the various roles nurses play in applying telemedicine in the management of heart failure. It is in line with the work of Atkin (Atkin P et al. 2012), where nurses provide technical support with telemonitoring equipment, observing patient's measurements, assessments, and making consultations to matrons. It can also be seen from the results that nurses perform roles through telemedicine in accordance with the recommendations made by the European guideline concerning nurses being part of the multidisciplinary frame work in managing heart failure (Ponikowski et al. 2016). Some of the problems with telemedicine as identified by the evisit (eVisit 2018 online source) such as technical problems with the equipment, reduced in-person interaction are taken care of by the nurses who monitors the patient and refers them to doctors when needed (2, 3, 4, 5, 6,12,13,14,15). The nurses provide advice to the patient on how to handle technical problems with the equipment and how to get help with the cost (13). Modern telecommunication technological devises allow for quick, efficient way to maintain constant communication and interaction between the patient and nurses and other health professionals. Communication is essential role played by nurses, therefore should be done effectively. This method involves communication between the nurse and the patient in the language the patient understands (Black et al, 2014). The nurse plays an important role in telemonitoring by being the most closed person to the patient. According to Boyne, telemonitoring could improve cost associated with heart failure care as an as addition to usual care through provision of education and support for patients with heart failure (Boyne et al. 2014). With telemedicine, the nurse can access and monitor measurement values for large number of patients without making physical visit to each patient thereby reducing cost for patient and having time to do other things (Cleland 2006). The Orem's theory of nursing system

specifies the general and specific roles of nurses and patients, with telemedicine, the patient and the nurses have separate roles. This mean that, nurses perform all the nursing roles identified from the data and because human beings are unique, through assessment the nurse identifies the unique need in each patient thereby supporting, encouraging, motivating that patient to develop the confidence to perform disease management plans made or prescribed activities by the doctor to achieve health and overcome selfcare deficit. It is recommended that an elderly patient with heart failure requires individualized care (Ponikowski et al. 2016). With the telemedicine methods, the patient can participate in the care through refilling of the electronic medication box and communicating medication changes to the monitoring center through phone (Hale et al, 2016). Orem's theory identifies three classifications of nursing system which can be wholly, partly and supportive system that can provide the patient with the self-care needs that is required. Hourly, daily, weekly monitoring can be achieved through telemedicine and patients that have higher risk will be identified on time. Selfcare behaviors can be improved by creating ways through which patients can participate in their care (see Hale et al 2016). The theorist recognizes that members of the health care system can develop special technologies which can be a system information about how a process can be done to achieve certain result with or without instrument. Modern information and communication technologies involved in telemedicine enhances and helps to create interpersonal relationship in providing nursing roles (Online source, 2018). There is a great evidence which reflect the contributions of nurses in a study where telehealth is part of the care strategies for fragile patients (Hobson et al, 2017). Use of telemonitoring devices such as medication adherence technologies can be good method to reduce healthcare cost and provide quality care for the patient (Hale et al 2016)

8 CONCLUSION

This study shows that the heart failure elderly patient can have quality care from a distance using electronic devices which is made possible through telecommunication and information system. Nurses play nursing roles of administrative, technical and patient centered role through telemedicine that led to improved medication adherence, reduced hospitalization, improved self-care abilities, reduces death, improved Knowledge about the disease, reduced cost, and increased access to fast and quality care. The study provides knowledge for the nurses on ways they can care for heart failure elderly patient through telemedicine. However, it is not clear which role contributed most to the improved results because patients also played some roles in telemedicine system. More research is therefore needed.

8.1 Strengths, limitations and recommendation

The articles used in this study were collected from data bases approved by the school authority and were recent. However due to financial requirement involved in most recent articles that would have been more relevant to the study, they were not accessed by the author. Therefore, most recent information might be missing, and few studies are done on the topic. The author recommends more studies on the roles of nurses in the care of heart failure elderly patient through telemedicine.

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APPENDICES

9 APPENDIX 1

Table1: 15 articles Table analysis

No	Author and year	Aim	Telemedicine method	Nurses role	Findings
1	Hobbs et al. 2016	To determine whether post- discharge telephone call will reduce readmission for adult patients with heart failure with those that do not receive post-discharge telephone call	Mobile phone	To advocate for phone call communication as part of the post discharge care based on the screening of risk of readmission. Nurses provides education, reviewed medication and diet, making screening	Telephone call and multidisciplinary intervention was suggested as what will prepare patients for possible complication coordination of care, patient involvement and better education leads to

				for risk, and advice patient on the need or constant measuring of weight and vital signs.	treatment adherence in heart failure which prevents readmission
2	Hale et al. 2016	Mean age 77. To compare the MedSentry medication monitoring system with the usual care in adult patients that have heart failure.	Medication monitoring device system that consist of an electronic device with camera and the monitoring center with those that makes contact to patient when	The nurse contacted the patient when there is alert of missing medication and patient did not take their medication. That means monitoring	The use of MedSentry medication reduced the risk of unplanned hospitalization and unplanned days hospitalized.

			medications are not taken		
3	Vuorien et al. 2014	To know whether the multidisciplinary care of the heart failure patient will be improved with telemonitoring at cardiology outpatient clinic at Helsinki University central hospital.	Telemonitoring assisted selfcare that consisted of personal telephone contacts and visits	To follow –up the patient status, make contacts when the reported measurements were beyond the target values, to make invitations for visits, to encourage the patient in the use of telemonitoring system.	Increase in the use of health care resources especially for nurses. Increase in patient's interest in their health. No death rate during the study period. Increased individualized care with pharmacological therapy of heart failure patient.

4	Lee et, al. 2017	To evaluate the voice recognition with new information communication technology concerning improvement in the clinical or laboratory outcomes in patients with chronic heart failure.	The ICT voice recognition system that works via the patient's hand-held mobile phone or land line. The system provides the opportunity to make automatic phone calls to the patients and nurses when there are abnormalities in the figures and symptoms provided by	To provide timely selfcare feedback and to adjust schedules for clinic visits. The nurse together with other health care professionals make decision about the patients care while looking at the patient individually in terms of risk and benefit.	Improvement in the uNa value and in symptoms when measured with an established questionnaire that measures the subjective influence of the heart failure and the treatments of heart failure quality of life, in terms of physical and emotional aspect due to adherence to the ICT

			the patient.		program. Improvement in the intake of sodium.
5	Kashem et al.2008	To apply the internet-based system that will overcome the pitfalls associated with phone call follow up.	The use of secure internet server to transmit data obtained from digital scale and response concerning the symptoms that both patient and nurses can have access through a secured password and identification.	Coaching of the patient on the use of telemedicine, updating patient information and answering questions about heart failure on the web site. Communicate with patient to clarify difficult issues.	There was reduction in hospitalization when compare with control group.

6	Black et al. 2014	To evaluate how effective the care patient receives during transition, post-discharge phone call couching combined with home telemonitoring of weight, blood pressure heart rate and symptoms for older adults.	The ideal life pod, the ideal life body-Manager and BP-manager which is a wireless devise that transmit patient weight, blood pressure, heart rate and responses to the symptoms.	The nurse uses the teach back techniques to educate the patients to increase their understanding about heart failure, use of the home monitoring equipment and how to live with heart failure. Maintaining a Post-discharge couching telephone call. Access the data that was transmitted by the ideal	The telemonitoring system allows the nurse to have direct contact to the information from the patient which provides room for assessment and verification, and confirmation of the severity of the symptoms generated by the equipment, reinforce patient provider-

				life pod. Offers motivation for patient that stops transmitting data. Contacts the patient and give advice to visit emergency room when the figures are beyond the predetermined parameters.	relationship with regular patient's provider through telephone communication and providing information on the patient's needs. Large number of patients were able to be contacted through coughing phone calls. Patients from multiple hospitals received services from specialized

					nurses. The incorporation of scale in the telemonitoring system provides comfort for the heart failure patent as the disease management requires programs associated with specialized clinic or home visits. Some patients are too frail to make regular visits. Patient use of equip-

					ment issues was addressed by combining telemonitoring and nurse couching strategy. The study is yet to be completed
7	Boyne et al. 2014	To analyze how telemonitoring can affect knowledge, self-care, self-efficacy and adherence about heart failure.	A health buddy telemonitoring device that through which patients received daily preset questions and dialogues concerning their symptoms, knowledg	The nurse contacted the patient for discussion when there is high risk alert which is positive response to lack of knowledge, symptoms and an issue	When compared with usual care group, there was increased knowledge about the disease, self-care, self-efficacy and adherence to health behaviors such as

			e and behavior concerning the disease by pressing on a button and responses (transferred in profiles of low, medium, and high) are sent through secure internet server to the nurse's desktop.	related to behavior.	fluid restriction, importance of medication, weighing and to using telemonitoring system.
8	Bashi et al. 2017	To evaluate the most evidence based remote patient monitoring that is effective	Information and communication technologies that is used for monitor-	The role of the nurse was not directly mentioned due to the type of study. However,	Most systematic reviews used an approach that is not measurable with

			ing of vital signs and supporting patient's physical health.	nurses must have played roles in the individual studies upon which the study was made.	the standardize tool. Telemonitoring has benefited in reducing clinical outcomes and mortality in heart failure. Recommended that physiological monitoring of the patient, weight measurement, blood pressure and ECG must be part of routine treatments for

					heart failure patient. Reduction in health care utilization through home telehealth. Mobile phone monitoring effectiveness remains the same despite combination with videoconferencing but was highly accepted by patient.
9	Cleland 2006	To compare the effect that occurs when patient are	Daily Mini clinic in the morning and evening	Providing the patient with management plan of the care.	Efficient use of the staff was achieved by saving cost and

		managed by receiving specialist advice delivered by primary care physician without a special knowledge or provide the care through a specialist nurses or through home telemonitoring.	with simple wireless which transfer data to a standard telephone system of the patient and the nurse's computer.	Monitoring the data generated by the device.	time for both patient and the nurse, and there was no adverse effect when the patient are monitored by telemonitoring. Improved Communication and data processing were achieved. Nurses were learning the technology involved in the system during the study.

10	Long et al. 2017	Systematic review to determine how home telemonitoring affect the 30-day hospital readmission rates in patient with heart failure.	Studies that were included used home telemonitoring where by devices to gather data concerning weight, blood pressure and symptoms were in the patient home. Telephone contact and provision of educational materials.	Monitoring of incoming data. Maintaining telephone contacts. Providing educational materials.	Some studies showed a reduction in readmission.
11	Kato et al. 2015	A cross sectional survey to describe the use of	Non-invasive telemonitoring devices that	To receive data generated and com-	Few and no hospitals in japan and Sweden

		non-invasive method in monitoring heart failure patients, to improve understanding/confirm expectations of nurses and cardiologist concerning telemonitoring. and to describe the barriers associated with telemonitoring in Sweden and Japan.	requires active interaction of the user	municated through internet in the telemonitoring center and provide feedback to the patient. participated in the survey.	have introduced telemonitoring for heart failure patients respectively. Telemonitoring was seen by nurses as beneficial and could reduce hospitalization and increase patient's self-care. Nurses duties in differs with organizational set up of different countries. example,

					titration of drugs. The benefits of telemedicine were not seen by all the nurses in their practice and could affect the way technology is perceived as a better alternative to the current method. Certain group of patient may not benefit from telemonitoring due the barriers presented by their condition,

					Example, giving older patients with physical and psychosocial impairments telemonitoring equipment or those without internet access which can be overcome with increased knowledge of telemedicine.
12	Seto et al. 2012	A randomized controlled trial to investigate the effect highly automated	A telemonitoring system that is designed to suit the patients that will	The alerts are sent directly to the cardiologist, who identifies the patient	There was improvement with providing effective medication(al-

		phone and user centered will have on self-care and clinical outcomes of heart failure patients telemonitoring.	be using it. the system functions were not disclosed. However, the weight, blood pressure monitor ECG (self-check) were automatically transmitted through a wireless Bluetooth to mobile phone with high patient data security which also sends feedback or alert to the phone.	from which the alert came. depending on the type of alert, the patient is instructed what to do either to repeat the measurement or go to emergency department or call emergency line. The nurses occasionally call the patient to educate and to change medication.	dosterone) that could reduce mortality. self-care adherence was improved as patient received immediate automated instructions to modify the lifestyle example reducing the amount of salt intake in their meals and fluid restriction.

			It also has a reminder phone call when the patient did not take their medication after 10 am every morning.		
13	Barrett et. Al 2017	To develop a theory that shows evidenced based knowledge concerning the use of teleconsultation by nurses.	Teleconsultation by nurses through virtual devices; that is through video. In which data was collected through Interview.	That nurses perform their roles by maintaining nursing presence in form of operational, therapeutic, clinical and social presence with the patient.	The video enabled them to see the patient and provided nursing presence more than using mobile phone but can be hindered by technical faults that may arise during the video call.

				The assessment of the patient is done through video. The nurse gives support, reassurance, and develop nurse/patient relationship. They serve as channel of communication by providing information for the practioners. They serve as translators of medical terminologies for	Education of the nurse, patient, third party carers and frequent interaction with the patient were compensators. Too old and mentally affected patient were identified as not able to engage in teleconsultation.

				the patient. They act as third party when patient needs more explanation about their care.	
14	Balk et al. 2008	To evaluate the effect of the MOTIVA system on heart failure patient.	The use of tv channels to provide educational material and reminds the patient about their medication, performed health related surveys, encourage the patient	The nurses performed the teleguidance of the patients by providing advice on salt restriction, prescribed medication, fluid intake, and agreed life style.	There were increase in Knowledge about heart failure. There was better access to nurses and doctors and large number of patients were cared for. The study shows

			to maintain a good lifestyle. It also includes automated devices that will be used to measure daily blood pressure and weight which are connected to a secured internet	Consultation of the cardiologist were done by the nurses. Phone calls were answered, and ideal values were set for the measurements and they were analyzed by the nurses.	low hospitalization, mortality and decrease in emergency department visits as problems were identified on time and patients were directed to heart failure nurses who provides treatment.
15	Cleland et al. 2005.	To identify whether outcomes is improved with home telemonitoring and	Electronic devices such as sphygmomanometer, weighing scale, single lead ECG with	The nurses monitored the values and received alerts for values outside	There were better organization of care that was achieved by the increase

		nurse telephone support and usual care	wrist-band electrodes worn by the patient. With short range radio transmitter in each, they are connected to the patient's phone with the hub that transmit measurements through secure internet to the workstation	preset values, they give advices and consulted physicians. They scan patient data and implemented management plan.	monitoring of the patient and support they get from the nurses. Earlier detection of cardiovascular problems led to better health management and patients were satisfied with the care they received

9.1 Appendix 2

European Guideline Recommendation about Heart failure

Recommendations	Class [a]	Level [b]	Ref [c]
It is recommended that regular aerobic exercise is encouraged in patients with HF to improve functional capacity and symptoms.	I	A	321, 618–621
It is recommended that regular aerobic exercise is encouraged in stable patients with HFrEF to reduce the risk of HF hospitalization.	I	A	618, 619
It is recommended that patients with HF are enrolled in a multidisciplinary care management programme to reduce the risk of HF hospitalization and mortality.	I	A	622–625
Referral to primary care for long-term follow-up may be considered for stable HF patients who are on optimal therapy to monitor for effectiveness of treatment, disease progression and patient adherence.	IIb	B	626, 627
Monitoring of pulmonary artery pressures using a wireless implantable haemodynamic monitoring system (CardioMems) may be considered in symptomatic patients with HF with previous HF hospitalization in order to reduce the risk of recurrent HF hospitalization.	IIb	B	628, 629
Multiparameter monitoring based on ICD (IN-TIME approach) may be considered in symptomatic patients with HFrEF (LVEF ≤35%) in order to improve clinical outcomes.	IIb	B	630

9.2 Appendix 3

Nurse's role in heart failure patient care as recommended European guideline

Education topic	Patient skills	Professional behaviours
Definition, aetiology and trajectory of HF (including prognosis).	• Understand the cause of HF, symptoms and disease trajectory. • Make realistic decisions including decisions about treatment at end-of-life.	• Provide oral and written information that takes account of educational grade and health literacy. • Recognize HF disease barriers to communication and provide information at regular time intervals. • Sensitively communicate information on prognosis at time of diagnosis, during decision making about treatment options, when there is a change in the clinical condition and whenever the patient requests.
Symptom monitoring and self-care.	• Monitor and recognize change in signs and symptoms. • Know how and when to contact a healthcare professional. • In line with professional advice, know when to self-manage diuretic therapy and fluid intake.	• Provide individualized information to support self-management such as: ⇨ In the case of increasing dyspnoea or oedema or a sudden unexpected weight gain of >2 kg in 3 days, patients may increase their diuretic dose and/or alert their healthcare team. ⇨ Use of flexible diuretic regime. ⇨ Self-care support aids such as dosette box when appropriate.
Pharmacological treatment.	• Understand the indications, dosing and side effects of drugs. • Recognize the common side effects and know when to notify a healthcare professional. • Recognize the benefits of taking medication as prescribed.	• Provide written and oral information on dosing, effects and side effects (see web tables 7.4–7.8 – practical guidance on use of pharmacological agents).
Implanted devices and percutaneous/ surgical interventions.	• Understand the indications and aims of procedures/ implanted devices. • Recognize the common complications and know when to notify a healthcare professional. • Recognize the importance and benefits of procedures/ implanted devices.	• Provide written and oral information on benefits and side effects. • Provide written and oral information on regular control of device functioning, along with documentation of regular check-up.
Immunization	• Receive immunization against influenza and pneumococcal disease	• Advise on local guidance and immunization practice.
Diet and alcohol	• Avoid excessive fluid intake. • Recognize need for altered fluid intake such as: ⇨ Increase intake during periods of high heat and humidity, nausea/vomiting ⇨ Fluid restriction of 1.5–2 L/day may be considered in patients with severe HF to relieve symptoms and congestion. • Monitor body weight and prevent malnutrition. • Eat healthily, avoid excessive salt intake (>6 g/day) and maintain a healthy body weight. • Abstain from or avoid excessive alcohol intake, especially for alcohol induced cardiomyopathy.	• Individualize information on fluid intake to take into account body weight and periods of high heat and humidity. Adjust advice during periods of acute decompensation and consider altering these restrictions towards end-of-life. • Tailor alcohol advice to aetiology of HF; e.g. abstinence in alcoholic cardiomyopathy. • Normal alcohol guidelines apply (2 units per day in men or 1 unit per day in women). 1 unit is 10 mL of pure alcohol (e.g. 1 glass of wine, 1/2 pint of beer, 1 measure of spirit). • For management of obesity (see Section 11.15).
Smoking and recreational substance use.	• Stop smoking and taking recreational substances.	• Refer for specialist advice for smoking cessation and drug withdrawal and replacement therapy. • Consider referral for cognitive behavioural theory and psychological support if patient wishes support to stop smoking.
Exercise	• Undertake regular exercise sufficient to provoke mild or moderate breathlessness.	• Advice on exercise that recognizes physical and functional limitations, such as frailty, comorbidities. • Referral to exercise programme when appropriate.
Travel and leisure	• Prepare travel and leisure activities according to physical capacity. • Monitor and adapt fluid intake according to humidity (flights and humid climates). • Be aware of adverse reactions to sun exposure with certain medication (such as amiodarone). • Consider effect of high altitude on oxygenation. • take medicine in cabin luggage in the plane, have a list with you of treatments and the dosage with the generic name.	• Refer to local country specific driving regulations regarding ICD. • Provide advice regarding flight security devices in presence of ICD.
Sleep and breathing (see co-morbidities Section 11.16).	• Recognize problems with sleeping, their relationship with HF and how to optimize sleep.	• Provide advice such as timing of diuretics, environment for sleep, device support. • In presence of sleep-disordered breathing provide advice on weight reduction/control.
Sexual activity (see co-morbidities Section 11.7).	• Be reassured about engaging in sex, provided sexual activity does not provoke undue symptoms. • Recognize problems with sexual activity, their relationship with HF and applied treatment and how to treat erectile dysfunction.	• Provide advice on eliminating factors predisposing to erectile dysfunction and available pharmacological treatment of erectile dysfunction. • Refer to specialist for sexual counselling when necessary.