

**MOBILE HEALTH DEVICES USED TO SUPPORT A COMPLIANT
LIFESTYLE IN PATIENTS WITH CHRONIC DISEASES: A
SYSTEMATIC REVIEW**

By

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DECLARATION

I hereby declare that the dissertation for the degree Magister Societatis Scientiae in Nursing at the University of the Free State is my own, independent work, and has not been previously submitted by me for a degree to any other university or faculty. I furthermore waive my copyright of the dissertation in favour of the University of the Free State.

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ABSTRACT

Increased urbanisation and the unhealthy habits individuals adopt have caused chronic diseases to approach endemic proportions; chronic diseases play the dominant role in mortality globally. Mobile devices can be used to support compliant lifestyles in patients with chronic diseases by helping patients with chronic diseases control their symptoms and manage their treatment, thereby ensuring self-efficacy. The purpose of the study was to present a critical synthesis of the best evidence, published between 2012 and 2018, that mobile health devices can support a compliant lifestyles in patients with chronic diseases. The research design was a systematic review. A focused review question was compiled based on the PICO principle (Population, Intervention, Comparison intervention and Outcome), and the PICO format directed the review process. Several search methods and databases were utilised to find relevant studies applicable to the review question. The systematic search identified 1 106 studies, though only 27 studies were selected for critical appraisal after the filtering process. Standardised critical appraisal tools were used by three researchers to critically appraise the selected studies during round-table discussions, after which eight of the 27 studies were excluded, and 19 studies were found to be methodologically sufficient for analysis. The 19 studies comprised 15 randomised controlled trials, two systematic reviews, one qualitative review and one survey. After the analysis, the following concluding statements were formulated in relation to the review question. The researcher also provided recommendations.

Concluding statement 1:

Cell phones were used to support compliant lifestyles for patients with various chronic diseases, and had positive results.

Concluding statement 2:

Messages addressing specific information, such as lifestyle changes, reminders, self-monitoring and education, were communicated to patients with chronic diseases, and had positive results in managing chronic diseases.

Concluding statement 3:

Frequency of messages varied in the synthesised studies, from 24 hours a day to 3 times monthly having positive outcomes and effectively managing patients' chronic diseases.

Concluding statement 4:

Messages originated from researchers, healthcare workers, automated messages and a centralised server and accomplished effective management of the chronic disease.

Concluding statement 5:

Positive outcomes were achieved regardless of the varied intervention periods, which lasted from 4 weeks to 3 years.

Concluding statement 6:

Compliant lifestyle was evident in all the synthesised studies, as a result of the intervention, although some results measured showed a small impact. Self-efficacy was evident in all synthesised studies, with improvement in chronic disease management.

The researcher made several recommendations. Upon concluding that compliant lifestyles were evident in patients with chronic diseases who were being supported via mobile health devices, the accessibility of this technology should be investigated and infrastructure should be developed to manage chronic diseases better. Second, messages should be adapted according to the conditions and needs of the patients concerned. Patients should be provided with the tools to self-monitor their symptoms and receive support from the staff to manage the symptoms. Third, researchers should consider the frequency of the information needed by patients, and adapt the frequency of messages according to the needs of patients. Another recommendation relates to the necessity of training the staff involved in interventions thoroughly in relation to using mobile technology for interventions. The study recommends that researchers determine the best intervention period to achieve the best results, considering patients' knowledge of the intervention and mobile devices.

More studies are needed to determine which components in the study rendered positive results, and what can be discarded or be improved. The thorough synthesis

of the studies included in the research created new information and added great value to future research. This study can form part of the theoretical underpinning of the development of mobile health applications for supporting patients with chronic diseases.

Keywords: Chronic disease, Compliant lifestyle, Mobile devices, Systematic review

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CONCEPT CLARIFICATION

Chronic diseases

Chronic diseases are defined as, “medical or health problems with associated symptoms or disabilities that require long-term management lasting three months or longer (Smeltzer, Hinkle, Bare & Cheever., 2010: 144 -145).

In this study, chronic diseases refer specifically to chronic kidney disease, cardiovascular disease, respiratory disease, metabolic disease, liver disease, haematological disease, psychiatric disorders and HIV.

Compliant lifestyle

According to Merriam-Webster (2015: online), compliance is “the act or process of doing what you have been asked or ordered to do”. In addition, lifestyle is defined as, “the particular way of living: the way a person lives or a group of people live” (Merriam-Webster, 2015: online). Compliant lifestyle will then mean that people adapt the way they live, because they were asked to change their lifestyle by a healthcare provider using a mobile health device. In this study, compliant lifestyle indicates, specifically, self-efficacy of an adult diagnosed with a chronic disease. The healthcare provider and the patient share decision-making regarding the goals to be reached, and they reach mutual consensus through dialogue.

Healthcare providers

Healthcare is “the organized provision of medical care to individuals or a community” (Soanes & Stevenson, 2009: 658). Providers are people who supply someone with a service (Soanes & Stevenson, 2009: 1156). Healthcare providers, then, refers to all persons who provide organised healthcare to persons or a community in need of healthcare. In this study, the healthcare provider will be any person who supplies a medical service to patients, nurses, health practitioners, community health workers, psychiatric care managers and adherence counsellors.

Mobile health

According to Källander, Tibenderana, Akpogheneta, Strachan, Hill, Asbroek, Conteh, Kirkwood and Meek. (2013: 1) mobile health “describes the use of portable electronic devices with software applications to provide health services and manage patient

information”. For the purpose of this study, mobile health will refer to the use of any portable electronic device used to convey health messages between adult patients diagnosed with or at risk of chronic diseases, and healthcare providers.

Patient

Soanes and Stevenson (2009: 1049) define a patient as, “a person receiving or registered to receive medical treatment”. For the purpose of this study, a patient will be all adult patients, older than 18 years of age who have access to mobile health devices and who had been diagnosed with or are at risk of developing chronic diseases.

Self-efficacy

Self-efficacy is associated with a compliant lifestyle and motivation to reach a goal (Hadgkiss, Jelinek, Taylor, Marck, Van der Meer, Pereira and Weiland, 2015: 846). Self-efficacy is associated with performance. In this study, self-efficacy is displayed when using a mobile health devices assists a person to complete a task or solve a problem.

Systematic review

According to Higgins and Green (2011: online), a systematic review “attempts to collate all empirical evidence that fits pre-specified eligibility criteria in order to answer a specific research question.” A systematic review answers a structured question in a specific manner, which will ensure an objective appraisal of evidence. If the study is repeated by a different researcher, the findings will be the same.

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LIST OF ABBREVIATIONS AND ACRONYMS

| | |
|-------|---------------------------------------|
| AIDS | Acquired immunodeficiency syndrome |
| CASP | Critical Appraisal Skills Programme |
| COPD | Chronic obstructive pulmonary disease |
| GFR | Glomerular filtration rate |
| HIV | Human immunodeficiency virus |
| NSAID | Non-steroidal anti-inflammatory drug |
| SMS | Short messaging system |
| TB | Tuberculosis |
| WHO | World Health Organization |

CHAPTER 1: INTRODUCTION

1.1 INTRODUCTION

The continued presence of chronic diseases is approaching epidemic proportions globally (Daar Singer, Persad, Pramming, Matthews, Beaglehole, Bernstein, Berysiewicz, Colagiuri, Ganguly, Glass, Finegood, Koplan, Nabel, Sarna, Sarrafzadegan, Smith, Yach & Bell, 2007: 494). More than 50% of the global population lives in urban environments, and this urbanised population generally exhibit typical signs and symptoms of chronic diseases. Co-morbidity is a common occurrence amongst patients with chronic diseases (Wu, Guo, Chatterji, Zheng, Naidoo, Jiang, Biritwum, Yawson, Minicuci, Salinas-Rodrigues, Manrique-Espinoza, Maximova, Peltzer, Phaswana-Mafuya, Snodgrass, Thiele, Ng & Kowal, 2015: 2).

Due to urbanisation and unhealthy habits that accompany it, chronic diseases are the most important cause of mortality and incapacity, and the reason for 60% of mortality globally (Desroches, Lapointe, Ratté, Gravel, Légaré & Thirsk, 2011: 1). It is estimated that, in 2020, the effect of chronic diseases will have increased to be the cause of 73% of morbidity and 60% of mortality. It is significant that 79% of fatalities attributed to these disorders occur among the aged in low/middle-income countries (Orrkog, Medin, Tsoleva & Semenza, 2013: 1).

South Africa is classified as a middle-income country. In spite of its predominantly young population, the South African government is burdened with demands made by an ageing population, and the financial demands this population place on the infrastructure that is available (Phaswana-Mafuya, Peltzer, Chirinda, Kose, Hoosain, Ramlagan, Tabane & Davids, 2013: 2). The responsibility for providing treatment is of significant medical concern, because it is necessary to establish responsibility prior to treatment taking place (Eton, Elraiyah, Yost, Ridgeway, Johnson, Egginton, Mullan, Muraid, Erwin & Monteri, 2013: 7). One of the responsibilities that persons with chronic diseases need to accept, is visiting clinics to obtain the healthcare they need. This is not always possible, due to the expense of making such trips, or because of vast distances that need to be covered. If it was possible to reach patients with chronic diseases through dialogue, without the need to incur costs involved in travelling vast

distances for health consultations, it would have a significant effect on reducing and managing chronic diseases (Mallow, Theeke, Barnes, Whetsel & Mallow, 2014: 57).

A compliant lifestyle may assist to prevent and maintain chronic diseases in patients, as well as to improve health of these individuals. Adherence to compliant lifestyles requires that patients with chronic diseases modify their behaviour. Aspects posing a risk are behavioural factors, such as failure to exercise, smoking and unhealthy eating habits (Daar et al., 2007: 494). According to Wurm, Tomasik and Tesch-Römer (2010: 25), it is important that patients take part in physical activity in order to control or even prevent chronic diseases and prevent incapacity. Methods of self-management, such as self-monitoring, setting of targets, relapse-prevention training and practical positivity, proved to be crucial mental aspects of embracing and continuing physical activity (Wurm et al., 2010: 26). In order to ensure a compliant lifestyle, patients and healthcare providers need to reach agreement on realistic goals for each patient.

Patients and healthcare providers make decisions and choose the best course of action based on treatment, existing assessment and management choices (Elwyn, Laitner, Coultner, Walker, Watson, Thompson, 2010: 971). Shared decision-making can influence patients with a chronic diseases to modify their lifestyles and to live compliant lifestyles in order to improve health and decrease mortality. Achieving these goals could be aided by using mobile health devices as a support tool for developing a compliant lifestyle.

1.2 PROBLEM STATEMENT

Mobile health devices, in supporting the development of a compliant lifestyle, may empower patients to manage their own treatment and, in the process, encourage self-supervision, promote self-sufficiency and decrease mortality (Blake, 2013: 430). Investigation has repeatedly found that chronic disease control is an area in which mobile applications could improve the condition of life of persons living with chronic disease (Chomutare, Fernandez-Luque, Arsand & Hartvigsen, 2011: 1). Mobile health devices have the potential to help patients with chronic disease control their chronic disease, and can, therefore, benefit the patient in various ways (Eng & Lee, 2013: 237). An example of this beneficial outcome is using mobile health devices to help the

patient control chronic diseases, such as Type 2 diabetes (Stuckey, Shapiro, Gill & Petrella, 2013: online).

Using mobile phones, which are the most common mobile health devices, has proven to be cost-effective (Mallow et al., 2014: 44). A systematic review conducted by Pienaar (2016:103) found that mobile devices are suitable to use for patients with chronic diseases in low/middle income countries. Mobile devices, furthermore, have the potential to improve the ability and usefulness of poorly equipped communities (Chib, Van Velthoven & Carr, 2014: 1). In low- to middle-income nations, the lower rates of and growing exposure to mobile equipment offer extensive possibilities for the use of mobile phone applications to manage chronic diseases (Aranda-Jan, Mohutsiwa-Dibe & Loukanova, 2014: 1). Mobile devices have the potential to transform healthcare, by improving accessibility to healthcare for patients, especially in short-supplied locations, in developing countries or wherever healthcare communications and facilities are frequently inadequate (Chib et al., 2014: 2).

Little evidence is available about the effectiveness of mobile devices to support compliant lifestyles in patients with chronic diseases. In a study by Free, Phillips, Watson, Galli, Felix, Edwards, Patel and Haines (2013: e1001363) the authors found that mobile applications have the potential to support patients with chronic diseases and to encourage a compliant lifestyle; however, additional studies need to be conducted to confirm the effectiveness of these applications.

1.3 PURPOSE OF THE STUDY

The purpose of the study is to provide a critical synthesis of the best existing evidence that mobile health devices can support compliant lifestyles in patients with chronic diseases.

1.4 REVIEW QUESTION

The question answered by this study is: *Do mobile health devices support a compliant lifestyle in patients with chronic diseases?* The PICO principle will apply to the study. The focused review question is depicted in Table 1.1.

Table 1.1: Review question according to PICO principle

| | |
|---------------------------------|---|
| Population | Studies of adults with chronic diseases |
| Intervention | Mobile health devices |
| Comparison interventions | Routine communication |
| Outcome of interest | To accomplish a compliant lifestyle as evidenced by self-efficacy |

1.5 PARADIGMATIC PERSPECTIVE

The researcher followed a pragmatic approach to conduct the study. The pragmatic approach, therefore, guided the researcher in selecting the research material that could answer the research question best.

Pragmatism is a way of approaching situations or solving problems that emphasises practical applications and consequences (De Vos, Strydom, Fouché & Delport, 2013: 40) It is, therefore, clear that the researcher values this approach, because reality and the significance of the end product are assessed by the practical results the product produces.

Pragmatist researchers do not choose a specific conventional method of research, instead, the research question establishes which method would work best to answer the research question and reach a reliable fact-based conclusion (Polit & Beck, 2012: 604). It is, therefore, clear to the researcher that a systematic review is the only logical and practical choice to answer the research question posed.

In this study, the researcher was committed to using methodologically high-quality studies, which were reviewed after critical appraisal of studies was identified to be possible matches for answering the research question. The researcher referred to primary studies that used any type of methodology, whether the studies had been published or were unpublished, or presented as reports or guidelines (Davies & Crombie, 2001: 4). Should secondary studies be identified, such studies should be of high quality, using a recognised assessment instrument.

The research paradigms, ontology, epistemology and methodology explain the philosophical expectations of the researcher.

1.5.1 Ontology

Ontology is described as a philosophy dealing with the nature of reality. Ontology is primarily concerned with the way the researcher understands the world (Botma, Greeff, Mulaudzi & Wright, 2010: 40). The researcher believes that the experiences of people and their ideas have an influence on the world and how they see the world. These pre-existing ideas and experiences will have a direct influence on how people perceive the possibility of mobile health assisting them to change their behaviour and achieve a compliant lifestyle.

1.5.2 Epistemology

Epistemology is described as a division of philosophy concerning the nature of information, and this describes how the researcher should collect, interpret and apply the data (Botma et al., 2010: 40). The intent of the information is finding the best evidence about supporting compliant lifestyles in patients with chronic diseases utilising mobile health devices. This was achieved by identifying all possible studies, with the assistance of a qualified librarian, critically appraising the studies according to standardised appraisal tools, such as the Critical Appraisal Skills Programme (CASP) appraisal tool, and appraising the methodological quality and validity of each study. The researcher's personal values did not hinder the research, as the process followed was as fair and as unbiased as possible.

1.5.3 Methodology

Methodology refers to the rules and actions that prescribe how the researcher must analyse or scrutinise what he/she thinks should be understood (Botma et al., 2010: 41). The researcher will follow the seven steps of a systematic review. The researcher values the rules forming part of a systematic review and adhered to these rules.

The researcher believes that primary studies of high quality could be identified by enlisting the expertise of a qualified librarian who is skilled in academic research. The librarian assisted the researcher to identify all possible studies for consideration and

prevent exclusion of studies due to inexperience, thereby guiding the researcher to conduct a thorough search. The researcher included primary studies that used any type of methodology, in order to ensure comprehensive data and prevent bias. A very detailed record should be kept of studies that were excluded, with reasons for exclusion, as well as studies that were included, and reasons for inclusion.

1.5.4 Research design

The research design used in this study is a systematic review, which is descriptive in nature. The researcher's motivation for using this design is that a comprehensive synthesis of literature could create new knowledge or perspectives that will be of value to and inform healthcare providers about the use of mobile health for patients diagnosed with chronic diseases. The data obtained forms part of the theoretical underpinning of the development of a mobile health application for patients with chronic diseases.

1.6 SYSTEMATIC REVIEW STEPS

This study was guided by an adaptation of the six steps of a systematic review (Higgins & Green, 2011: online).

Step 1: Outlining the review question and identifying the principles for inclusion of studies

In this step, a focused review question and the purpose of the review is identified clearly. A review question includes the following variables: population, intervention, comparison intervention and outcome of interest. These variables form part of the PICO format (Higgins & Green, 2011: online). The review question for the study is: *Do mobile health devices support a compliant lifestyle in patients with chronic diseases?*

Step 2: Searching for studies and gathering information

This step is characterised by the development of an effective search strategy, which is essential for the review process (Whittemore & Knafl, 2005: 548). Using a rapid appraisal, the following search words and electronic data sources were used to generate the search strategy (see Table 1.2 and Table 1.3).

Table 1.2: Search words used during rapid appraisal according to the PICO

| Variables | Search words |
|---|---|
| Population | (patient* or "at risk*") |
| Studies of adults with chronic diseases | and chronic* and (disease* or illness* or condition* or disorder*) and (tb or tuberculos* or diabet* or depres* or heart* or coronar* or cardiovascular or lung* or renal or kidney* or hepatic* or liver* or pulmonar* or lymphat* or psychiatr* or mental or haematolog* or hematolog* or "immune deficien*" or respirator* or metabol*) |
| Intervention | And |
| Mobile health devices | (telemedicine or "cellular phone*" or "cellular telephone*" or cellphone* or smartphone* or "mobile health*" or "mobile device*" or "mobile technolog*" or "mobile phone*" or "mobile telephone*") |
| Comparison interventions: Routine communication | Routine communication interventions |
| Outcome of interest: To accomplish a compliant lifestyle as evidenced by self-efficacy | and (comply* or complian* or "life style*" or lifestyle*) |

Table 1.3: Electronic platforms and data bases used in rapid appraisal

| Platform | Data bases |
|--|---|
| EBSCOhost | Academic Search Complete |
| National and international journal articles | Health Source: Nursing/Academic Edition PsycINFO Communication & Mass Media Complete CINAHL with full text SOCINDEX with full text Master FILE Premier Africa-Wide Information Business Source Complete SPORTDiscuss with full text Library, Information Science & Technology Abstracts ERIC Teacher Reference Center Humanities Source Health Source – Consumer Edition Legal Source Political Science Complete PsycARTICLES ECONLIT with full text Green File Art Source |
| ProQuest | |
| International database of dissertations and theses | |
| Scopex | |
| International database of abstracts of peer-reviewed journals, dissertations, theses and citations | |

Nexus

National database of dissertations, theses, completed and current research in South Africa

Google Scholar

International search engine of journal articles and grey literature, for example conference proceedings and unpublished theses

From the data obtained from the rapid appraisal, specific inclusion and exclusion criteria were identified.

Step 3: Choosing the studies

The actual formal search, guided by the search strategy, was implemented. The collected sample of data sources was filtered by applying inclusion and exclusion criteria to create the final list of studies for performing a critical appraisal (Higgins & Green, 2011: online)

Step 4: Appraisal and selection of studies

Critical appraisal of studies was carried out by three independent reviewers by using the CASP tools/instruments (Critical Appraisal Skills Programme, 2017: 3-111). Discrepancies between reviewers were discussed, in order to reach consensus (Higgins & Green, 2011: online). Studies included after the critical appraisal stage underwent data extraction. During data extraction, the researcher collected the data from the selected studies in order to synthesise the data.

Step 5: Information synthesis

Thematic analysis of results of the various studies, as well as the findings of these studies, formed part of the synthesis process (Critical Appraisal Skills Programme, 2017: 3-111). Data synthesis considers the strength of the data and identifies themes and sub-themes from the studies (Higgins & Green, 2011: online).

Step 6: Describing the findings and outlining the deductions

Conclusions are presented in an organised and structured manner and graded according to the strength of the evidence. The concluding statements answer the review question (Higgins & Green, 2011: online).

In a systematic review, researchers use a meticulous system, which is, for the greater part, reproducible and provable. The systematic review aspires to avoiding inappropriate or deceptive deductions that could result from a prejudiced study procedure or from a prejudiced collection of studies incorporated in the analysis (Polit & Beck, 2012: 653).

1.7 RIGOUR OF THE STUDY

Rigour in a systematic review indicates that the researcher followed the rules of a systematic review and does not have a pre-conceived opinion on the evidence (Davies & Crombie, 2001: 2). Criteria applied to enhance rigour of this study are truth value, applicability, consistency and neutrality (Botma et al., 2010: 233). Studies that used any methodology must be included and specific inclusion and exclusion criteria should be established, to ensure that all studies applicable to the research question are included in the research, and that bias is limited or excluded.

1.7.1 Truth value

Truth value implies that the researcher verified the accuracy of the data used to establish a valid conclusion (Botma et al., 2010: 233). A detailed record was maintained by the researcher about the studies selected for inclusion, with relevant reasons for inclusion, and studies excluded, with the reasons for exclusion. To enhance the truth value further, an expert researcher with experience in systematic reviews was involved in the selection and critical appraisal of the studies included in the research.

1.7.2 Consistency

Consistency means that the conclusion reached during the study should be the same if the study is replicated by another researcher, using the same data and sources as in this study (Polit & Beck, 2012: 653). The data should be traceable and the method

of gathering data, as well as the inclusion and exclusion criteria, should be clear, in order to prevent bias and to ensure all relevant data is included for the researcher to reach a comprehensive conclusion (Botma et al., 2010: 233). Systematic steps were followed to ensure consistency in the selection of studies and collection of the data. The researcher and two systematic review experts used standardised tools specific to each study design. Difference of opinion was discussed in order to reach consensus on the exclusion or inclusion of studies.

1.7.3 Neutrality

Neutrality means that the researcher is impartial and does not support either side of an argument (Soanes & Stevenson, 2009: 963). Objectivity must be maintained throughout the research process, to prevent bias. The researcher considered all applicable data, and not only data that confirmed her view. The researcher analysed the literature objectively and included all relevant studies, since data gathering was guided by a structured, stepwise process. A critical appraisal tool was used to identify high-quality studies, and it was not possible to manipulate data to reach a predetermined conclusion that the researcher had in mind before the onset of the strategic review.

1.8 ETHICAL CONSIDERATIONS

During the entire research process, ethical principles were considered. The researcher reflected on the ethical principles from the planning of the study until the conclusion of the study. The ethical considerations of this study are discussed below, namely, respect, integrity (Pozgar, Santucci & Pinella, 2014: 39-46), honesty and accuracy (Botma et al., 2010: 17–26).

1.8.1 Respect

Ethical approval was obtained from the Health Sciences Research Ethics Committee of the University of the Free State (UFS). All data sources were referenced, and citations added in text (Bak, 2012: 28). Inclusion and exclusion criteria were defined well and predetermined to ensure that all possible studies have an equal chance to be

included in the research. In a systematic review, the researcher handles the data selected with respect and conveys it with accuracy and honesty.

1.8.2 Honesty

A comprehensive reference list of all literature referenced in the compilation of the study is included, and citations were inserted to indicate where referencing is made, in order to prevent plagiarism and to extend credit to the authors of the literature used (Higgins & Green, 2011: online; Polit & Beck, 2012: 653).

1.8.3 Accuracy

The researcher was directed by a skilled supervisor, who helped to ensure that studies was collected methodically and that the best research method was used to conduct the study (Polit & Beck, 2012: 656). In the critical appraisal phase, two reviewers with experience in systematic reviews formed part of the team, thereby increasing the value of the research (Higgins & Green, 2011: online). A very detailed record was kept of studies that were included or excluded, with reasons for inclusion or exclusion. A detailed list of the initial search, with the keywords used, was also be kept. There is a detailed audit trail for the complete study, which ensures the accuracy of the conclusion reached. The researcher ensured that all the literature used was traceable and accessible (Higgins & Green, 2011: online). The integrity of all studies must be maintained throughout the study.

Information retrieved from databases and other sources was treated with discretion and accountability. The appraisal and selection of studies was done by using standardised appraisal tools (Higgins & Green, 2011: online), which limited bias and ensured that only studies meeting the inclusion criteria were included.

1.9 SUMMARY

During this chapter the researcher provided a summary and short description of the way the research was conducted. A summary explained what the study entailed, which was followed by the problem statement, purpose of the study and the research question. The researcher described the paradigmatic perspectives by explaining the choice of the research method, systematic review and the methodology. Furthermore,

the steps of a systematic review were described and rigour explained. Ethical principles maintained during the study were set out. The layout of the following chapters will be as follows:

- Chapter 2: Literature review related to the mobile health devices that could support a compliant lifestyle in persons with chronic diseases
- Chapter 3: Steps 1-4 of a systematic review and the rigour of each step
- Chapter 4: Synthesis and findings, Steps 5 and 6 of a systematic review
- Chapter 5: Limitations and recommendations.

CHAPTER 2: MOBILE HEALTH DEVICES USED TO SUPPORT COMPLIANT LIFESTYLES IN PATIENTS WITH CHRONIC DISEASES

2.1 INTRODUCTION

In the previous chapter, a detailed layout of the study was provided. In this chapter, the most prevalent chronic diseases, their impact and management, are discussed, to highlight the global impact of chronic diseases. The potential of mobile health devices is reviewed, in order to clarify how this technology could promote compliant lifestyles in individuals globally, by providing accessibility to and communication with healthcare workers.

The modified health belief model will be discussed to clarify what a compliant lifestyle involves. A compliant lifestyle is discussed to indicate the impact of such a lifestyle has on the prevention and management of chronic diseases.

2.2 CHRONIC DISEASES

A chronic disease is defined as,

medical or health problems with associated symptoms or disabilities that require long-term management (3 months or longer). Chronic diseases can also be defined as a longstanding or continuous disease which cannot be cured (Smeltzer et al., 2010: 144-145).

According to Barnett, Mercer, Norbury, Watt, Wyke and Guthrie (2012: 37), 42.2% of all patients has one or more chronic diseases, and 23.2% has more than one chronic disease. Most patients 65 years and older have chronic diseases, and prevalence of chronic diseases escalates significantly with age. Overall, more patients younger than 65 years have multiple chronic diseases. Multiple chronic diseases manifest 10–15 years earlier in patients who reside in the world's most underprivileged regions than in patients in more wealthy regions (World Health Organization, 2014: 8-13).

In the majority of countries, individuals with a low socioeconomic standing, as well as individuals who are members of underprivileged or marginalised populations, have an increased chance of dying from chronic diseases. Individuals in poor countries and persons with low socioeconomic standing, furthermore, do not have easy access to healthcare, to obtain early diagnosis of chronic diseases and support regarding

management. To achieve a considerable decrease in the overall prevalence of chronic diseases, it is necessary to decrease chronic diseases in underprivileged individuals (Di Cesare, Khang, Asaria, Blakely, Cowan, Farzadfar, Guerrero, Ikeda, Kyobutungi, Msyamboza, Oum, Lynch, Marmot & Ezzati, 2013: 585).

One of the causes of chronic diseases unhealthy habits or lifestyles; it can also be caused by genetic disorders or injuries. Mostly patients with chronic diseases experience difficulty in managing the disease, because it requires continuous management by way of therapeutic regimens and lifestyle changes. Patients become emotional about the influence of the chronic disease on their life, and the effectiveness of managing the disease is influenced by several factors, among which the patient's support structure, the abruptness of onset of the disease, former experience with sickness, individual characteristics, mental stability and phases of the patient in the personal or family life cycle (Smeltzer et al., 2010: 145). Chronic diseases can be managed by adopting healthy lifestyles, preventing complications and managing symptoms (Smeltzer et al., 2010: 145).

The most prevalent chronic diseases include kidney diseases, cardiovascular diseases, respiratory diseases, metabolic diseases, liver diseases, haematological diseases, psychiatric diseases and the human immunodeficiency virus (HIV) or acquired autoimmune deficiency syndrome (AIDS). Chronic diseases will be described according to *prevalence, aetiology, signs and symptoms, complications and management* of the diseases.

2.2.1 Chronic kidney disease

According to Jha, Garcia-Garcia, Iseki, Li, Naicker, Plattner, Saran, Wang and Yang (2013:260), "chronic kidney disease is defined as a reduced glomerular filtration rate, increased urinary albumin excretion, or both." Chronic kidney disease can also be defined as kidney damage, or a glomerular filtration rate $<60 \text{ mL/min/1.73 m}^2$ for 3 months or more, irrespective of the cause (Inker, Shaffi & Levey, 2012: 303; World Health Organization, 2014: 45).

Prevalence

The *prevalence* of kidney disease is estimated to be 8-16% of people worldwide (Jha et al., 2013: 260). The *prevalence* of chronic kidney disease escalates considerably with age, from 4% at the age of 20-39, to 47% at the age of 70 years plus, which represents an increase of 43% between 20 and 70 years of age (Hallan, Matsushita, Sang, Mahmoodi, Black, Ishani, Kleefstra, Naimark, Roderick, Tonelli, Wetzels, Astor, Gansevoort, Levin, Wen & Coresh, 2012: 2350).

Aetiology

Chronic kidney diseases are mainly caused by pre-renal factors, for instance, reduced cardiac output, intravascular volume reduction, and vascular failure tributary to vasodilation or obstruction. The causes of intra-renal failure can be contributed to injury of the kidney tissues and structures, which results in tubular necrosis, nephrotoxicity and variations to renal blood flow. Post renal failure is largely triggered by obstruction of urine flow between the kidney and urethral meatus (Monahan, Sands, Neighbors, Marek & Green, 2007: 1012). The following causes are also listed for chronic kidney disease: diabetes mellitus, metabolic syndrome, chronic cardiovascular disease, heart failure, fluid overload, peripheral vascular disease, hyperparathyroidism, anaemia, autoimmune and rheumatologic disorders. Further gastrointestinal disorders, chronic lung disease and liver disease, all have a contribution to the possibility of chronic kidney disease, because they lead to inflammation, oxidation, insulin deprivation, gastro paresis, insulin resistance and pain (Carrero, Stenvinkel, Cuppari, Ikizler, Kalantar-Zadeh, Kaysen, Mitch, Price, Wanner, Wang, Ter Wee & Franch, 2013: 78). When a person's first abnormal creatinine result is not followed up by a repeat creatinine test, it may lead to a late or overlooked diagnosis of chronic kidney disease (Sim, Rutkowski, Selevan, Batech, Timmins, Slezak, Jacobsen & Kanter, 2015: 1204-1205).

Signs and symptoms

The *signs* of chronic kidney disease are increased respiratory rate, pallor, "brown line" pigmentation of nails, splinter haemorrhages of nails, yellow complexion, bruising, reduced skin turgor in volume depletion, hypertensive changes of the eyes, crepitations of the lungs in fluid overload, extra heart sounds in fluid overload, enlarged

kidneys, local tenderness of abdomen, sacral oedema, ankle oedema, peripheral neuropathy, urinalysis displaying the presence of blood and protein. Another sign is nocturia or urine frequency (Inker et al., 2014: 1.3-1.4.3; Walker, Colledge, Ralston & Penman, 2014: 462-463). The symptoms of chronic kidney disease include electrolyte imbalance and anaemia (Jha et al., 2013: 261), hypertension, dysuria, glycosuria, ketonuria and anuria (Waugh & Grant, 2010: 343-346). Other symptoms are cachexia, reduced physical activity, gut oedema, depth increase in metabolic acidosis, gastric ulcers, nutrient malabsorption, muscle wasting, fluid overload, hypoalbuminemia, infections, hyperlipidaemia, tiredness and frailty (Carrero et al., 2013:78-79; Vaziri, 2016: 80).

Complications

Complications of chronic kidney disease can manifest with one or more of the following: haematuria, glomerulonephritis, pyelonephritis, renal failure, renal calculi, urinary tract infection, urinary incontinence, cystitis, urethritis, hydronephrosis and polycystic disease (Waugh & Grant, 2010: 343-350). Complications include increased all-cause and cardiovascular mortality, kidney-disease progression, acute kidney injury, cognitive decline, anaemia, mineral and bone disorders, and fractures (Walker et al., 2014: 487-488).

Management

Chronic kidney disease *management* is initiated by the medical doctor through discontinuing potentially nephrotoxic drugs and reducing doses of therapeutic drugs according to the level of renal function (Saunders, Cifu and Vela, 2015: 615-616). Statins are prescribed, but not rosuvastatin; Acyl coenzyme A: cholesterol acyltransferase inhibitors and PCSK9 inhibitors will reduce the effect of nephrotic dyslipidaemia (Vaziri, 2016: 80). Renal replacement therapy may be necessary to prevent mortality (Walker et al., 2014: 489).

Nursing management requires matching fluid intake to urine output plus an additional 500 ml to cover insensible losses once the patient is euvoletic. The nurse should measure body weight regularly to monitor fluid requirements and ensure adequate nutritional support. The nurse should also administer proton pump antagonists, as prescribed by the medical doctor, to reduce the risk of upper gastrointestinal bleeding

(Walker et al., 2014: 482). Management of blood pressure and decrease of proteinuria is essential to prevent chronic kidney disease progress; this is done by introducing a low sodium and low protein diet (Stevens & Levin, 2014: online). Nurses can refer patients to a dietician for dietary counselling and assistance. Nurses must explain the risk posed by exposure to infection and the need for the patient to avoid exposure to persons with infection; the nurse must encourage the patient to adhere to the prescribed dietary and fluid restrictions and must inform the patient of the risks of using over-the-counter medication, and the necessity to adhere to the prescribed medication (Monahan et al., 2007: 1030).

2.2.2 Cardiovascular diseases

Ailments that might involve the heart, circulation of blood and arteries, are collectively called cardiovascular diseases, and can involve diseases, such as cerebrovascular accident, coronary heart disease, peripheral arterial disease and atherosclerosis (Raghu, Praveen, Peiris, Tarassenko & Clifford, 2015: 2).

Individuals with cardiovascular diseases or those who are at great risk of contracting cardiovascular diseases because of the manifestation of one or more risk factors, for instance, hypertension, diabetes, hyperlipidaemia or other established diseases, require timely detection and management by means of counselling and medications, where applicable (World Health Organization, 2014: 145-150).

Prevalence

Cardiovascular diseases are the foremost cause of deaths globally: more individuals die each year from cardiovascular diseases than from other causes. An expected 17.5 million individuals died from cardiovascular diseases in 2012, signifying 31% of all worldwide mortalities. More than three quarters of deaths from cardiovascular diseases occur in low- and middle-income countries, and of the 16 million mortalities below the age of 70 occur in these countries, the cause was contributed to chronic diseases (World Health Organization, 2014:145-150).

Aetiology

The main cause of chronic cardiac disease is overweight, and disability worldwide is expected to increase in the future (Mozaffarian, Benjamin, Go, Arnett, Blaha,

Cushman, de Ferranti, Després, Fullerton, Howard, Huffman, Judd, Kissela, Lackland, Lichtman, Lisabeth, Liu, Mackey, Matcher, Mcguire, Mohlep, Moy, Muntner, Mussolino, Nusr, Neumer, Nichol, Palaniappan, Pandey, Reeves, Rodrigues, Sorlie, Stein, Towfighi, Turan, Virani, Willey, Woo, Yoh, Turner, 2015: e29-e322). The primary social causes of cardiovascular diseases are unhealthy diet, physical inactivity, tobacco use and unsafe consumption of alcohol. The results of social causes could manifest in people as high blood pressure, high blood glucose, high blood lipids, overweight and obesity (World Health Organization, 2014: 145-150)

Signs and symptoms

The *signs* of cardiovascular diseases are breathlessness, sweating, cyanosis and clubbing of fingers, splintering of nails, pallor, malar flush, stigmata of hyperlipidaemia, sacral oedema, oedema of the lower legs, ascites and chest pain. The *symptoms* include thyroid disease, lung crepitations, irregular rate rhythm of radial pulse, hepatomegaly, vasculitis and arrhythmia (Thompson, Arena, Riebe & Pescatello, 2013:216; Walker et al., 2014: 526).

Complications

Possible *complications* of cardiovascular diseases are arteriosclerosis, aneurysms, hypertension, hypotension, pulmonary hypertension, thrombosis, embolism, oedema, varicose veins, cardiac failure, myocardial infarction, angina pectoris, ischaemic cardiac disease, endocarditis, rheumatic heart disease and cardiac arrhythmias (Waugh & Grant, 2010: 115-126). All the above conditions contribute to cardiac death.

Management

Management by a medical doctor's involves monitoring cholesterol levels and lipoprotein levels, reducing dietary sodium intake to less than 100 mmol/day, limiting consumption to no more than 2 alcoholic drinks per day in most men and no more than one drink per day in women, and prescribing beta blockers (Mozaffarian et al., 2015: e29-e322; Smeltzer et al., 2010: 893-894). Reducing salt intake can have a significant impact in the prevention and reduction of cardiovascular diseases (World Health Organization, 2014: 145-150). Surgical management includes permanent pacemaker placement, coronary arteriogram and, in some cases, cardiac bypass grafts (Monahan et al., 2007: 792; 794 and 841; World Health Organization, 2014: 145-150)

The *nursing management* for cardiovascular diseases is as follows: oxygen administration, administration of prescribed diuretic therapy, and anticoagulation therapy. Nurses perform an electrocardiogram and ask the medical doctor to interpret the results. Furthermore, nurses assist in diet and lifestyle adjustment training and in reducing smoking and cholesterol by executing the prescribed dietary prescriptions and administering prescribed medication. Nurses motivate an increase in physical activity and a reduction in weight by explaining the importance of exercise and healthy food choices. Nurses provide guidelines about the permitted physical activity levels for sexual activity and physical exercise (Mozaffarian et al., 2015: e22-322; Walker et al., 2014: 551-641). Management by nurses consists of instating bed rest for patients with chest pain, and when patients are haemo-dynamically stable, physical activity can be increased gradually. The family and patient are also informed about the side effects of the medication and nurses teach patients and family members what the signs and symptoms of cardiovascular diseases are, how to administer the appropriate medication and when to seek medical assistance (Walker et al., 2014: 551-641).

2.2.3 Respiratory diseases

Respiratory diseases disturb the ventilation, gas exchange and blood flow to the lungs and, in due course, this may lead to respiratory failure and mortality (Broaddus, Mason, Ernst, King, Lazarus, Murray, Nadel, Slutsky & Gotway, 2016: 44). The four primary causes of death in the world due to respiratory diseases is tuberculosis (TB), lung cancer, respiratory tract infections and chronic obstructive pulmonary disease. Asthma also causes immense worldwide mortality (Schluger & Koppaka, 2014: 407).

Prevalence

The World Health Organization estimates that there will be 1.8 million new, active cases of TB annually and that TB will contribute to 1.4 million deaths annually (World Health Organization, 2014: 145). Although TB is not considered to be a chronic disease, TB is the tenth most common cause of death in the world and therefore are discussed (Schluger & Koppaka, 2014: 407). Lung cancer and cancer of the respiratory tree causes 1.4 million deaths annually, a *prevalence* of 18.3 % of the total deaths due to cancer (Schluger & Koppaka, 2014: 407-408). Acute respiratory Infection is the cause of 4 million deaths annually, and is one of the leading causes of

death in children of five years or younger. It is also responsible for 6% of disabilities in individuals globally. Chronic obstructive pulmonary disease is the cause of 3 million deaths annually and affects 210 million people globally. Asthma affects 235-300 million people and is the cause of 200 000 deaths annually; about 80% of these deaths occur in low- or middle-income countries (World Health Organization, 2014: 160; Schluger & Koppaka, 2014: 408).

Aetiology

Four main exterior and adjustable factors are responsible for the large percentage of lung disease problems, namely, tobacco, outside air contamination, indoor air contamination and contact with lung toxins at work, which are more common in low- or middle-income countries but also contribute to these diseases in industrialised countries (Schluger & Koppaka, 2014: 408). Furthermore, Alpha1-antitrypsin is the only identified genetic abnormality that triggers chronic obstructive pulmonary disease (Monahan et al., 2007: 672).

Signs and symptoms

The *signs* of chronic respiratory disease are cachexia, fever, rash, purulent or blood-stained sputum, finger clubbing, tar-stained hands, peripheral cyanosis of the fingers, pursed lips, central cyanosis of the face, deformity of the chest, scars, intercostal indrawing, symmetry of expansion, hyperinflation, paradoxical rib movement, tachypnoea, wheezes, crackles, rales, vocal resonance and whispered voice (Walker et al., 2014: 644). The *symptoms* of chronic respiratory disease entails cervical lymphadenopathy, cor pulmonale, venous thrombosis, blood pressure increase, anaemia and cardiac apex displacement (Broaddus et al., 2016: 127).

Complications

Complications of chronic respiratory disease are the development of a pneumothorax, obstruction of the airway, impaired surfactant function, haemothorax, pleural effusion and alveolar hypoventilation (Vaughn & Grant, 2010: 255-264). Respiratory insufficiency, respiratory failure, pulmonary arterial hypertension and chronic atelectasis are other possible complications that may develop (Broaddus et al., 2016: 131; Smeltzer et al., 2010: 605). Chronic respiratory disease may lead to mortality (Broaddus et al., 2016: 44).

Management

Management by a medical doctor consists of referral for pulmonary physiotherapy, prescription of bronchodilators, IV fluid administration and chest X-rays. If indicated, treating pleural effusion by inserting a chest drain is another responsibility of the medical practitioner (Smeltzer et al., 2010: 620, 622, 631). Surgical interventions consist of lung transplantation and lung volume reduction surgery (Monahan et al., 2007: 679).

Nursing management of chronic respiratory disease consists of oxygen delivery, administration of nebulisers and inhalers, as prescribed. Nurses must teach patients the correct way to use an inhaler, nursing patients in an upright position, known as Fowler's position, maintaining the airway, administering oral steroids, antibiotics and diuretics according to prescription, and teaching the patient to identify and avoid aggravating factors. Nurses need to educate patients about the benefits of weight reduction and proper nutrition (Walker et al., 2014: 659-678). Additional nursing management includes encouraging patients to use controlled breathing techniques, such as pursed-lip breathing, the forward-leaning position and stomach breathing, in order to decrease anxiety and dyspnoea and increase expiratory tidal capacity (Monahan et al., 2007: 681).

2.2.4 Metabolic diseases

Metabolic syndrome indicates the existence of a number of identified cardiovascular disease risk aspects, such as insulin resistance, obesity, atherogenic dyslipidaemia and hypertension. These disorders are connected and share core facilitators, processes and routes (Huang, 2009: 231).

According to the National Cholesterol Education Program, Adult Treatment Panel III definition, metabolic syndrome is diagnosed when three or more of these five criteria are met: waist circumference over 101.6 cm in men or 88.9 cm in women, blood pressure higher than 130/85 mmHg, fasting triglyceride higher than 150 mg/dl, fasting high-density lipoprotein cholesterol level lower than 40 mg/dl in men or 50 mg/dl in women, and fasting blood glucose higher than 100 mg/dl. This definition is commonly used in benchmarks of metabolic syndrome. It combines the significant structures of hyperglycaemia/insulin resistance, visceral obesity, atherogenic dyslipidaemia and

high blood pressure. The increase in the prevalence of obesity can be positively correlated with diabetes and hypertension occurrence (World Health Organization, 2014: 155).

Obesity is increasing globally. The World Health Organization defines obesity and overweight as a body mass index (BMI) of $\geq 25 \text{ kg/m}^2$ and $\geq 30 \text{ kg/m}^2$ respectively. The risk of developing co-morbidities increase with a BMI of $\geq 25.0 \text{ kg/m}^2$ - $\geq 29.9 \text{ kg/m}^2$, but with a BMI $\geq 30.0 \text{ kg/m}^2$, the risk is moderate to severe for the development of co-morbidities such as those found in metabolic diseases (World Health Organization, 2014: 156). Hypertension and diabetes mellitus are the two most prominent metabolic diseases (World Health Organization, 2014:155-156).

Prevalence

The *prevalence* of metabolic diseases in adults is estimated to be 20-25% worldwide. The two most prominent metabolic diseases are diabetes and hypertension (Tanner, Brown & Muntner, 2012: 152). Diabetes, defined as a fasting plasma glucose level $\geq 7.0 \text{ mmol/L}$, was the cause of 1.5 million deaths worldwide in 2012, and the *prevalence* of diabetes was estimated to be 9% globally. Raised blood pressure is defined as systolic/diastolic $\geq 140/90 \text{ mm/Hg}$, and contributed to 9.4 million premature deaths worldwide; it had a *prevalence* of 22% globally in adults over the age of 18 (World Health Organization, 2014:160).

Aetiology

The causes of chronic metabolic disease are as follows: a family history of metabolic disorders, such as diabetes mellitus, obesity ($>20\%$ over desired body weight or BMI $>27 \text{ kg/m}^2$), race/ethnicity and hypertension (Smeltzer et al., 2010: 1197; World Health Organization, 2014: 156). Metabolic risk factors include hypertension, obesity, diabetes and raised blood lipids (World Health Organization, 2014: 155-156).

Signs and symptoms

The *signs* of chronic metabolic diseases are weight loss or obesity, dehydration, bullosis of skin, pigmentation of the skin, thyroid enlargement, cataracts, hair loss, lesions not healing or requiring extended healing time, muscle bulk, clubbing, angular stomatitis, glossitis, jaundice, lymphadenopathy, pallor, abdominal distention, ascites,

vomiting, abdominal pain and blood in faeces. The *symptoms* includes ketoacidosis, carotid pulse pressure increase, cranial nerve palsy, sensory abnormality, hepatomegaly, malabsorption and dysphagia (Walker et al., 2014: 798;838). Other *symptoms* are early morning headache, distorted vision, spontaneous nosebleed and depression (Monahan et al., 2007: 859).

Complications

Complications of chronic metabolic disease may manifest as retinopathy and cataracts. Other complications are anaemia, weight loss, dehydration, hypoglycaemia, hyperglycaemia, neuropathy and electrolyte imbalance. Digestive complications, such as gangrene of the intestine, Vitamin B12 deficiency, gingivitis, stomatitis, oesophageal varices, oesophagitis, peptic ulcers, gastritis, ulcerative colitis, Crohn's disease, intestinal obstruction and pancreatitis may also present (Waugh & Grant, 2010: 311-328). Other complications include nephropathy and foot and leg ulcers (Smeltzer et al., 2010: 1233).

Management

Management by a medical doctor consists of performing an endoscopy to identify the cause of the disease, the prescription of proton pump inhibitor drugs to protect the intestines against the development of ulcers, non-steroidal anti-inflammatory drugs to relieve symptoms of inflammation, and antibiotics to clear any infections. Surgery is performed in the case of haemorrhage (Walker et al., 2014: 821-905). Lifestyle modification and exercise should also be recommended by medical practitioners (World Health Organization, 2014: 157).

The nursing *management* of chronic metabolic diseases consists of administration of oral antihyperglycemic agents and subcutaneous insulin, as prescribed, fluid replacement, monitoring of potassium, high-dose oxygen administration, weight management, diet adjustment and exercise through education and referral to a dietician (World Health Organization, 2014: 156). Compiling a thorough family and personal history in order to identify high risk patients, is the responsibility of the nurse. Provision of education to the family and the patient regarding healthy lifestyle choices in order to maintain a healthy weight and exercise programme and the benefits thereof is a nursing obligation. Furthermore, nurses need to educate patients diagnosed with

diabetes regarding the storage, dosage and administration of insulin. Patients must also be educated about the signs and symptoms of hypoglycaemia and the management thereof. Nurses must emphasise the importance of proper skincare and the preventing infections and injuries, because the diabetic has a decreased healing ability. Nurses should evaluate the patient's feet with every visit (Monahan et al., 2007: 1154). All patients with high blood pressure should be educated by a nurse about the signs and symptoms of high blood pressure and maintaining a healthy lifestyle and weight in order to control high blood pressure (World Health Organization, 2014: 155-156).

2.2.5 Liver diseases

The liver is the largest organ in the human body and is responsible for removing poisons, digesting food and storing energy. There are many causes of liver diseases, among which viruses, for example, Hepatitis A, B and C. Other causes are poisons, drugs or alcohol abuse. When the liver forms scar tissue due to a disease, it is called cirrhosis (US National Library of Medicine, 2014: online).

Prevalence

Liver disease is the twelfth most prominent cause of death worldwide, and it is adults aged 45-54 who are most likely to die due to these diseases (Lazo, Hernaez, Eberhardt, Bonekamp, Kamel, Guallar, Koteish, Brancati & Clark 2013: 38-45). The *prevalence* of non-alcoholic fatty liver disease and steatosis respectively affected 31.2 million and 35 million adults globally in 2012 (Lazo et al., 2013: 38-45). Lazo et.al. (2013: 44) found that there is a definite correlation between dyslipidaemia, obesity, insulin resistance, diabetes and non-alcoholic fatty liver disease. The increase in obesity worldwide is connected to the increase of non-alcoholic fatty liver disease in adults and, therefore, as many as 55 million adults might have non-alcoholic fatty liver disease that may lead to chronic liver disease (Lazo et al., 2013: 38-39).

Aetiology

Non-alcoholic fatty liver disease contributes to 25% of cases that develop chronic liver disease. Autoimmune disease contributes to only 3% of the causes of liver disease (Armstrong, Houlihan, Bentham, Shaw, Cramb, Olliff, Gill, Neuberger, Lilford &

Newsome, 2012: 235). Obesity and overweight has a direct correlation to non-alcoholic fatty liver disease, leading to chronic liver disease, disability and death (Armstrong et al., 2012:234; World Health Organization, 2014: 155). Alcohol consumption increase the risk of developing liver disease by 25.3% to the risk of developing liver disease. Men have a higher risk of developing liver disease due to alcohol consumption, as they consume significantly more alcohol than women do (Armstrong et al., 2012: 234-235). Liver cirrhosis is caused by non-alcoholic fatty liver disease, alcoholic fatty liver disease, viral Hepatitis B, C and D, and leads to liver failure. Other causes are autoimmune hepatitis, primary biliary cirrhosis, primary sclerosing cholangitis, IgG4 cholangiopathy, recurrent bacterial cholangitis, bile duct stenosis, Budd-Chiari syndrome, right heart failure, Osler disease, hemochromatosis, Wilson's disease and alpha1-antitrypsin deficiency. Rare causes of liver disease are porphyria and certain medications (Wiegand & Berg, 2013: 96-97).

Signs and symptoms

Signs of chronic liver disease include jaundice, weight loss, scratch marks from itching, palmar erythema, flapping tremor, bruising, testicular atrophy, Dupuytren's contracture, clubbing, oedema of the legs, ascites, spider nevi, dilated abdominal wall veins, loss of body hair and abdominal distension (Walker et al., 2014: 922). The *symptoms* are leukonychia, parotid swelling, enlarged liver, fatigue and steatorrhea (Walker et al., 2014: 922). Other *symptoms* include hepatic encephalopathy, hyperdynamic circulatory state and/or hepato-renal syndrome (Laleman, Verbeke, Meersseman, Waukes, Van Pelt, Cassiman, Wilmar, Verslyne & Nevens, 2014: 523-525).

Complications

Complications of chronic liver disease are calculi of the gallbladder, oliguria and renal failure, blood coagulation defects, hepatic encephalopathy, cholangitis, cholecystitis, hepatitis, fibrosis of the liver, liver failure or cirrhosis of the liver (Waugh & Grant, 2010: 324-328). Fatal *complications* develop because of the absence of liver detoxification, the result is modified immune reaction, and modification of metabolic and regulatory functions. Fatal *complications* may include kidney failure, hepatic coma, systemic hemodynamic dysfunction, respiratory failure and increased susceptibility to infection.

The mutual influence of these *complications* account for death in up to 50-90% of cases (Laleman et al., 2014: 525).

Management

Management by a medical doctor involves draining of ascites, monitoring of liver enzymes and prescription of medication (World Health Organization, 2014: 156). Liver transplant is an option in only 20% of liver cirrhosis cases, because of low availability of donor livers (Laleman et al., 2014: 525-526). Paracentesis and peritoneo-venous shunting might be necessary as treatment for ascites. In the case of portal vein hypertension resulting in oesophageal varices, endoscopic sclerotherapy, balloon tamponade and IV pharmacological therapy might be essential to containing of bleeding (Monahan et al., 2007: 1321-1322).

The nursing *management* of chronic liver disease involves dietary adjustment by referring the patient to a dietician. Further management is administration of antibiotics and corticosteroids as prescribed, education concerning cessation of alcohol consumption, weight loss, exercise and the reduction of sodium and water intake (Walker et al., 2014: 940, 942, 944, 949). A thorough family and personal assessment history is essential for appropriate nursing management. Bed rest is essential for the patient with fatigue, and the nurse should emphasise this. The administration of anti-emetics, as prescribed, and educating patients regarding decreasing sodium intake and reducing dietary fibre to prevent bleeding, is a nursing responsibility. The nurse must encourage the patient to take six small meals a day to prevent fatigue and distention. Furthermore nurses must restrict the patient's exposure to infections and assess the family support and the patient's mood, in order to provide moral support and reassurance (Monahan et al., 2007: 1330-1331).

2.2.6 Haematological diseases

Haematological diseases affect red blood cells, white blood cells, platelets blood plasma (Smith, Nazario, Bhargava & Cassoobhoy, 2014: online). Every 10 years of a human's life, we produce the equivalent of our body weight in red blood cells and white blood cells and platelets (Dale & Mackey, 2014: e237). Blood disorders that affect red blood cells are anaemia, thalassaemia, malaria and polycythaemia vera. Blood diseases that affect white blood cells are lymphoma, leukaemia, multiple

myeloma and myelodysplastic syndrome. Blood disorders that affect platelets are thrombocytopenia and idiopathic thrombocytopenic purpura. Blood disorders that affect plasma are sepsis, haemophilia, Von Willebrand disease, hyper-coagulable state, deep venous thrombosis and disseminated intravascular coagulation (Smith et al., 2014: online).

Prevalence

According to Weatherall and Clegg (2001: 704-712), it is possible that about 7% of the world population are carriers of genetic haemoglobin disorders. Yearly, 300 000–400 000 babies are born with acute types of haematological disorders. Although most incidences of these disorders occur in tropical areas, due to population immigrations these disorders are currently encountered in the majority of countries.

It is projected that more than 300 000 babies are born yearly with either sickle cell anaemia or one of its variants, or a type of thalassaemia. Therefore, it is very challenging to provide estimations of the health burden that will be faced, mainly by underprivileged nations of the world, as haemoglobin-related conditions become more common in the future (Weatherall & Clegg, 2001: 704 - 712).

Aetiology

Chronic haematological diseases are caused by immune deficiency, genetic factors, alkylating agents, industrial exposure to benzene, radiotherapy for ankylosing spondylitis, diagnostic X-rays of the foetus in pregnancy, Vitamin B12 deficiency, iron deficiency, uncontrolled hypertension and ABO incompatibility (Smith et al., 2014: online; Walker et al., 2014: 1020, 1035). Anaemia may be caused by insufficient or defective red blood cell production, and long-term haemorrhage due to haemorrhoids, gastritis, menstruation and the use of aspirin and ibuprofen. Malaria is another haematological disease, which is caused by a parasite transmitted into the patient's blood by a mosquito, causing red blood cells to burst. Furthermore, polycythaemia vera is caused by the body producing too many red blood cells, resulting in blood clots (Smith et al., 2014: online). When white blood cells become malignant it causes lymphoma, which can be divided into non-Hodgkin and Hodgkin lymphoma. Leukaemia starts in the bone marrow, where a white blood cell becomes malignant and multiplies. Myeloma is caused by a plasma cell becoming malignant and

multiplying and then causing organ damage. Myeloblastic syndrome involves the bone marrow and usually progresses slowly, though it can develop into severe leukaemia. An enduring low platelet count is called idiopathic thrombocytopenia purpura. A scarce blood disorder that causes tiny blood clots throughout the body, depletes platelets and causes a low platelet count is referred to as thrombotic thrombocytopenic purpura. In essential thrombocytopenia the body produces too many platelets, but the platelets are defective and cause excessive blood clotting or haemorrhage. Haemophilia is a genetic disorder of the protein responsible for blood clotting; it can vary from mild to severe. Von Willebrand disease is caused by a protein in the blood that assists blood clotting. In Von Willebrand disease this protein is produced in too small quantities or it is defective, causing haemorrhage or, on the other hand, a hyper-coagulable state, where the blood clots too easily, causing excessive blood clotting. During deep venous thrombosis a blood clot forms in a deep vein; this clot can dislodge and travel through the heart to the lungs, causing a pulmonary embolism. In disseminated intravascular coagulation, small blood clots are produced simultaneously throughout the body (Smith et al., 2014: online).

Signs and symptoms

The *signs* of chronic haematological diseases are pallor, breathlessness, koilonychia in iron deficiency, telangiectasia, gum hypertrophy in acute myeloid leukaemia, glossitis and angular stomatitis in iron deficiency. Other *signs* are spontaneous haemorrhage, purpura, bruising, petechia, ascites, joint deformity, swelling of joints, and restricted movements or gangrene. The *symptoms* of haematological diseases are hepatomegaly, splenomegaly, inguinal and femoral lymph node swelling, papilloedema, fundal haemorrhage in thrombocytopenia, and urobilinogen in the urine (Rodak, Fritsma & Keohane, 2012: 219-325; Walker et al., 2014: 990).

Complications

Complications of chronic haematological diseases include anaemia, leukopenia, leucocytosis, thrombocytopenia, Vitamin K deficiency, Vitamin B12 deficiency, haemophilia, disseminated intravascular coagulation, polycythaemia, disability and, in severe cases, death (Hoffbrand, Higgs, Keeling & Mehta, 2016: 3-13; Waugh & Grant, 2010: 66-72;).

Management

Management by a medical doctor consists of monitoring blood results in all haematological diseases and prescribing medication and treatment to manage the symptoms of the disease (Monahan et al., 2007: 925).

Nursing *management* of chronic haematological diseases consists of the administration of thrombo-embolism treatment with heparin and aspirin, as prescribed. Further nursing *management* consist of blood transfusions, Vitamin B12 and folate administration, oxygen therapy, Factor VIII, platelet transfusion and iron supplement administration (Walker et al., 2014: 1011-1052). Nurses need to provide education regarding the disease, treatment, prevention and signs and symptoms. It is the nurse's responsibility to emphasise the importance of follow-up care. Education regarding the cessation of smoking is very important. In cases where increased risk of bleeding is diagnosed, education regarding the prevention of bleeding, such as the use of a soft toothbrush, avoidance of contact sport or the use of an electric shaver, must be emphasised by the nurse. The nurse must educate the patient and family regarding the management of haemorrhage when it occurs, such as applying pressure to the wound and obtaining medical treatment immediately (Monahan et al., 2007: 926; Walker et al., 2014: 926).

2.2.7 Psychiatric disorders

A psychiatric disorder is a disorder characterised by a clinically important disruption in a person's perception, mood parameters, or actions, which replicates a dysfunction in the psychosomatic, biological, or development techniques causing psychiatric behaviour. Psychiatric disorders are developing due to acute suffering or debility in public, work-related, or other essential activities (American Psychiatric Association, 2013: 29).

Psychiatric disorders can lead to mild or severe impairment, which limits major life activities. The onset of psychiatric disorders can be sudden, such as a panic attack, upsetting delusions, feelings of self-harm or hearing "voices". It might also be long-term, for instance feelings of unhappiness, uselessness, or apprehension, which persist and do not improve, subsequently affecting daily life (Parekh, 2015: online). Psychiatric and substance use disorders are significant contributors to the global

disease burden (Whiteford; Degenhardt; Rehm; Baxter; Ferrari; Erskine; Charlson; Norman; Flaxman; Johns; Burstein; Murray & Vos, 2013: 9).

Prevalence

According to Whiteford et al. (2013: 1), in 2010, psychiatric and substance abuse disorders accounted for 183.9 million disability-adjusted life years, or 7.4% of all disability-adjusted life years worldwide. These disorders accounted for 8.6 million years of life lost due to premature mortality, and approximately 6.5 million–12.1 million years lived with disability. Depressive disorders in 2010 accounted for 40.5% of disability-adjusted life years caused by mental and substance use disorders. About 25% of people suffer a mental disorder at least once in their lifetime (Gravenhorst, Mauremi, Bardram, Grünerbi, Mafora, Frost, Osmani, Arnich, Lukowicz & Tröster, 2015: 336-338).

Aetiology

It seems that stress impacts the advance of many psychiatric disorders through related processes. The consequences of stress must be seen as being a process of connected effects, starting with raised cortisol readings that influence parts of the brain, such as the hippocampus and the hypothalamo-pituitary-adrenal axis. This results in changes at intracellular levels of trophic components, such as brain-derived neurotrophic factor in neurons and, in the end, disturbing neurogenesis and plasticity of the brain. Stress also has an effect on metabolic adjustments, which involve several of the cardiovascular risk factors that add to the metabolic syndrome. These modifications were, in the past, exclusively assigned to the consequences of medications that improve symptoms of psychiatric disorders by changing the atrophic impacts of stress. Therefore, in considering psychiatric disorders and projecting its management, it is essential to separate the harmful results of stress itself from the results of medication (Goh & Agius, 2010: 201).

Signs and symptoms

The signs of chronic psychiatric disease are low self-esteem, cognitive or emotional immaturity, difficulties in communicating, medical illness and substance use. *The symptoms* are sadness, tiredness, hopelessness, helplessness, fear about the future,

social withdrawal, interpersonal problems, sleeping, eating problems, difficulty concentrating and difficulty with problem-solving (World Health Organization, 2012: 9).

Complications

Complications of chronic psychiatric disease are patients unable to perform basic tasks, suicide attempts and death. In people who committed suicide, more than 90% had an identifiable mental illness (Gravenhorst et al., 2015: 338).

Management

The *management* by a psychiatrist, who is a licensed physician with three years residency training and two years clinical psychiatric practice, consists of the prescription of medication and somatic treatment. The psychiatrist is the leader of the multidisciplinary team and specialises in the diagnosis, treatment and prevention of mental and emotional disorders (American Psychiatric Association, 2013: 20; Shives, 2012: 147).

Nursing management of psychiatric disorders consists of evaluating the patient's mental, psychological and social status. Furthermore, the nurse delivers safe surroundings, adopts the role of patient advocate, assists the patient to deal with daily difficulties and offers leadership. Nurses with a Master's degree in psychiatric nursing may perform individual, family and group therapy (Shives, 2012: 145). Furthermore, the nurse's responsibilities are as follows: administration of all drugs related to treatment, as prescribed, general and supportive psychotherapy, cognitive therapy, behaviour therapy, cognitive behaviour therapy, problem-solving therapy, psychodynamic psychotherapy, interpersonal psychotherapy, reassurance and social intervention (Walker et al., 2014: 240-242).

2.2.8 HIV and AIDS

AIDS is a chronic, possibly fatal illness caused by HIV. By destroying the immune system, HIV affects the body's capability to fight the organisms triggering infection. HIV is spread sexually and by infected blood. Furthermore, it can be transferred from mother to baby in pregnancy, childbirth or through breastfeeding (World Health Organization, 2010: 61).

Prevalence

AIDS-related deaths were reported to number 1.7 million -- a 26% reduction from the statistics for 2015 (World Health Organization, 2015: 1-200). According to the Joint United Nations Programme on HIV/AIDS (UNAIDS, 2016: 56), 36.7 million people are living with AIDS; furthermore, 46% of people use antiretroviral therapy, but only 38% have achieved viral suppression.

Aetiology

People with AIDS have an impaired immune system due to HIV. These persons are at great risk of developing infections that are uncommon in persons with a strong immune systems. These infections are referred to as opportunistic infections. The infections can be triggered by bacteria, viruses, fungi, or protozoa, and can affect any part of the body. Persons living with AIDS are at greater risk of developing some cancers, specifically lymphomas and a skin cancer called Kaposi sarcoma. Other contributors to the mortality of HIV-positive patients are hypertension, Type 2 diabetes, renal failure and bone fractures (Sandler & Douek, 2012: 655).

Signs and symptoms

Signs associated with acute HIV infection are similar to flu symptoms or viral infections, namely, mouth ulcers, thrush and swollen lymph glands. Weight loss, fever, sweats, rashes and cough are common in people with HIV infection and AIDS (San Francisco AIDS Foundation, 2016: online). *Symptoms* are pulmonary infections that cause cough, fever and shortness of breath. Gastro-intestinal infections are frequent and may cause diarrhoea, abdominal pain, vomiting and difficulties swallowing, headaches, fever, muscle pains, diarrhoea, night sweats and sore throat. Numerous people have no symptoms when they are first infected with HIV (Adamu, Petros, Zhang, Kassa, Amer, Ye, Feng & Xiao, 2014: e2831).

Complications

HIV causes neurological disorders such as cognitive disorders, vacuolar myelopathy, and sensory neuropathies (Kranick & Nath, 2012: 1243-1246). Renal function defects are found in a sizable number of patients infected with HIV (Maggi, Bartolozzi, Bonfanti, Calza, Cherubini, Di Biagio, Marcotullio, Montella, Montinaro, Mussini, Narciso, Rusconi & Vescini, 2012: 37). Haematological complications of HIV are

numerous, including high-grade lymphomas, principally Burkitt lymphoma, and thrombotic thrombocytopenic purpura, immune thrombocytopenic purpura, cytopenias and an increased incidence of thromboembolic disease ending in mortality (Machalek, Poynten, Jin, Fairley, Farnsworth, Garland, Hillman, Petoumenos, Roberts, Tabrizi, Templeton & Grulich, 2012: 487; Opie, 2012: 465). The respiratory infections of HIV include pneumocystis pneumonia, bacterial pneumonia, non-tuberculosis mycobacterial infection, pulmonary tuberculosis, acute sinusitis, acute bronchitis, lung cancer and chronic obstructive pulmonary disease, leading to mortality (Gingo, Balasubramani, Kingsley, Rinaldo, Alden, Detels, Greenblatt, Hessol, Holman, Huang, Kloorup, Phair, Sutton, Seaberg, Margolick, Wisniewski & Morris, 2013: e58812). HIV's oral complications are candidiasis, herpes zoster, herpes simplex, hairy leucoplakia and salivary gland disease (Greenspan & Greenspan, 2012: 195). HIV will lead to death in HIV positive individuals.

Management

Management by the treating doctor primarily involves acting as a mentor for the other medical staff and performing specialist consultations for complex cases, including paediatric cases (Tenthani, Cataldo, Chan, Bedell, Martiniuk & Lettow, 2012: 3). The doctor does not play a large role in HIV management, which is more concentrated in the clinic environment.

Nursing *management* consists of administering antiretroviral drugs. Nurses provide education regarding the use and possible adverse reactions of the antiretroviral medication. Patients must be monitored for opportunistic infections when they visit the clinic or hospital. Nurses provide information about signs and symptoms of secondary infection and the treatment thereof (Walker et al., 2014). Education in the prevention of transmission of the virus via unprotected sexual acts and contact with body fluids is an essential task of the nurse (Anglemyer, Rutherford, Horvath, Baggaley, Egger & Siegfried, 2013: CD009153).

2.3 COMPLIANT LIFESTYLE IN ADULTS WITH, OR AT RISK OF, CHRONIC DISEASES

Figure 2.1 depicts the modified health belief model. The health belief model was initially developed by Hochbaum, Kegeles and Rosenstock as a logical process to

describe and calculate preventive health behaviour. The researchers concentrated on the association between health behaviours, practices and use of health services. In subsequent years, the health belief model has been reviewed to include common health goals for the purpose of differentiating illness and sick-role behaviour from health behaviour. It is commonly viewed as the foundation of methodical, theory-based research in health behaviour (Hochbaum et al., 1952: online).

The modified health belief model as depicted in Figure 2.1 theorises that individual perception of threats, modifying factors, effect of action, self-efficacy and likelihood of taking recommended preventative health action are factors that influence a compliant lifestyle (Corapi, White, Phillips, Daltroy, Shadick & Liang, 2007: 21-22).

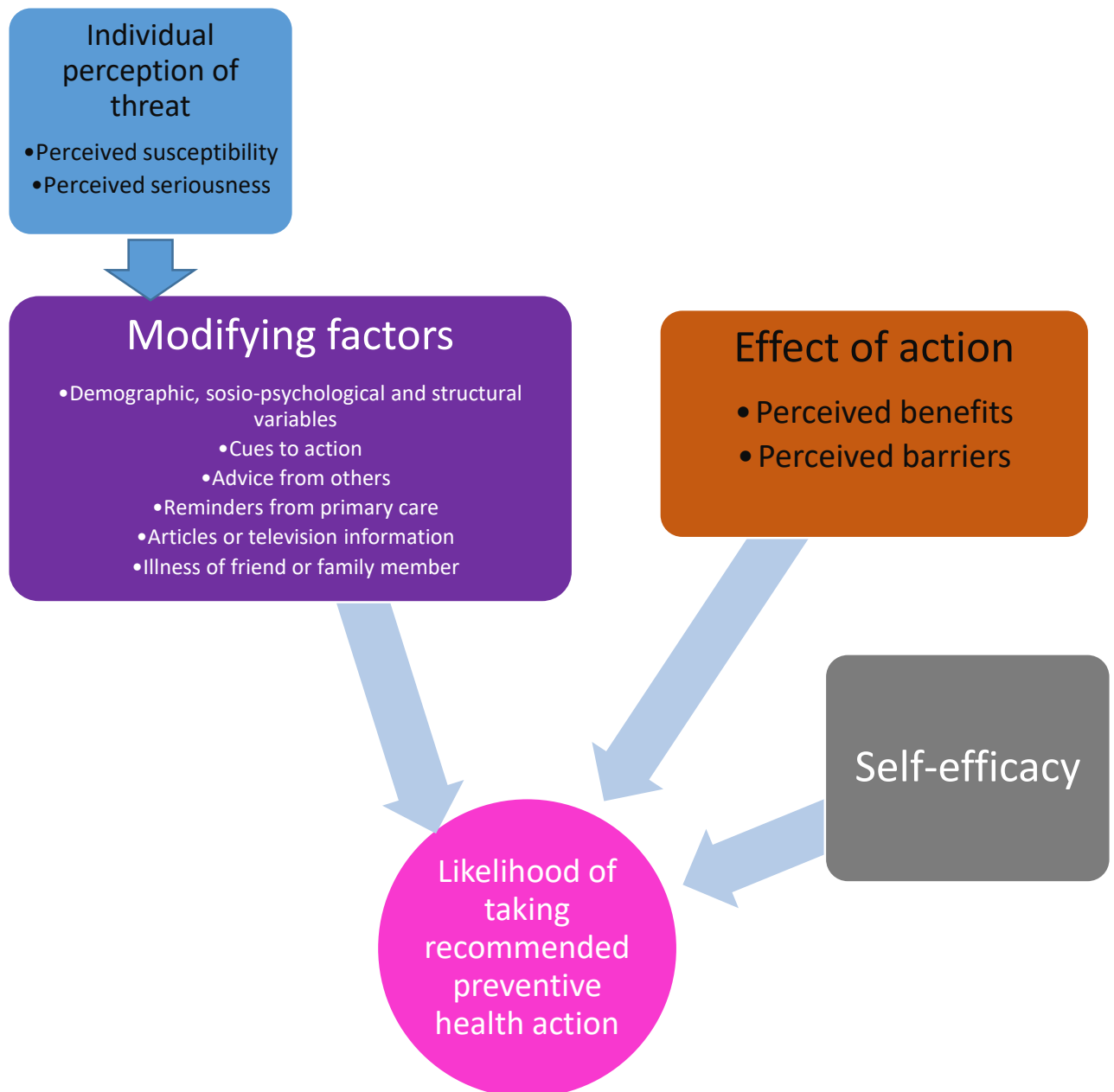


Figure 2.1: Modified health belief model (Corapi et al., 2007: 23)

2.4 APPLICATION OF THE MODIFIED HEALTH BELIEF MODEL TO A PATIENT AFFECTED BY DIABETES

When someone’s mother suffers from diabetes mellitus with renal complications, and receives renal dialysis, that individual will perceive the threat as serious and that the individual will be susceptible to the disease. This perception will be based on the fact that the patient is a close family member and the individual will have first-hand experience of the effect this disorder has on the individual and the family. Due to the

illness of the family member, the individual will be motivated to modify his/her lifestyle to prevent the onset of diabetes in themselves. The benefits of eating healthy foods (though expensive) and spending time exercising (though time consuming) will outweigh the barriers of cost and time limitations, because exercise and a healthy lifestyle will prevent the development of diabetes and need for renal dialysis. Individuals will be self-efficient because they will believe that they can prevent the onset of diabetes by living healthy lives. The possibility of preventing diabetes makes it more likely that individuals will modify their lifestyles and believe that they can reach the desired outcome, which is preventing the development of diabetes.

Compliant lifestyle actions are clearly linked with self-efficacy and patient motivation (Hadgkiss et al., 2015: 846). The accomplishment of successful precautionary and beneficial programmes is determined by a person's readiness to accept and continue the necessary activities (Riekert, Ockene & Pbert, 2013: 3).

2.5 MOBILE DEVICES IN HEALTHCARE

Mobile health is a rather new concept in medical and public health practices. Medical and public health practices can be supported by mobile health devices, such as mobile handsets, patient-monitoring devices, personal digital assistants, and other wireless devices (Goel, Bhatnagar, Sharma & Singh, 2013: e25).

Mobile devices can encourage healthy lifestyles through the short message service (SMS), text messaging, video messaging, instant messaging, the Internet, applications and voice messages. These methods can be used to improve adherence to taking medication, exercise regimes and diet, and to educate people regarding symptoms of chronic diseases (Abroms, Whittaker, Free, Mendel Van Alstyne & Schindler-Ruwisch, 2015: e107; Dale & Mackey, 2014: 2).

Mobile health will be discussed under the following headings: coverage of mobile devices worldwide, advantages of mobile devices, and mobile device application in healthcare.

2.5.1 Access to and utilisation of mobile devices worldwide

Between 2013 and 2014, worldwide utilisation of mobile devices rose by 406 million, reaching 1.82 billion devices, and Internet access via mobile devices rose by 81% in this a year. Over 1 billion consumers have access to mobile broadband Internet and a rapidly expanding mobile device app market, and all investors concerned have great expectations that this technology will improve healthcare. With over 6 billion mobile phone subscribers, it is estimated that 75% of people have access to mobile communication (Becker, Miron-Shatz, Schumacher, Krocza, Diamantidis & Albrecht, 2014: e24). Mobile device technology is crucial for increasing the success and effectiveness of reaching health objectives for persons, crowds, countries, or states (Davis, DiClemente & Prietula, 2016: e97). Widespread access to mobile devices is of specific significance in developing countries, where mobile devices are connecting people like never before.

2.5.2 Advantages of mobile devices

Due to the useful operational features of mobile devices, for instance, low start-up cost, text messaging, and adaptable payment plans, these devices can be used to communicate with patients in numerous healthcare processes. Mobile devices are utilised to distribute data to patients and, if used in combination with healthcare-related software apps, they can deliver the immediate response that is necessary to observe treatment conformity or outcome. Furthermore, mobile devices function as information-gathering devices. Mobile devices with internet access are the fastest evolving and spreading method of telecommunication-computational technology. Provided the proper infrastructure is available, devices can connect quickly with persons and equipment anywhere in the world (Davis et al., 2016: e97). Mobile devices provides a straightforward, cheap and user-friendly service and can increase the swiftness and precision of healthcare provision (Goel et al., 2013: e25).

The extensive utilisation of mobile devices, especially mobile devices capable of running several types of application software, does not end with healthcare. Apps can provide consumers with health data, calculate their physical functions, prompt them to take their medicine or assist with diagnostics (Illiger, Hupka, Von Jan, Wichelhaus & Albrecht., 2014: e42). Mobile devices can support disease management through

communication, are available 24 hours a day via internet access, and is available everywhere (Cotterez, Durant, Agne & Cherrington, 2015: 2). Mobile devices are tailored to an individual's preferences and needs, and provide individuals with easy access to health support and education, at any time or place (Nguyen, Gill, Wolpin, Steele & Benditt, 2009: 2; Stoyanov, Hides, Kavanagh, Zelenko, Tjondronegoro, & Mani, 2015: e27).

These days, a lot of work is put into utilising mobile communication to enhance different practices in healthcare, for instance, prophylactic and responsive processes. These practices help to, for example, keep doctors and patients in touch, keep residential healthcare facilities in touch with principal hospitals, and deliver prophylactic health data, to reduce the number of individuals who become patients (Nhavoto & Grönlund, 2014: e21).

Considering the growing presence of mobile devices, there is encouraging evidence that mobile devices can provide more and better healthcare services to persons and societies, whilst assisting to build up health organisations (Källander, Tibenderana, Akpogheneta, Strachan, Hill, Asbroek, Conteh, Kirkwood & Meek, 2013: 1).

2.5.3 Mobile devices and applications in healthcare

Cutbacks in health resources and competition for resources necessitate improved effectiveness and proficiency of healthcare delivery. Involving patients in assuming responsibility for controlling of their health is common way to improve healthcare. Patients who are committed and who are efficient managers of their own healthcare have more constructive clinical results than patients who are detached and inactive (Barello, Triberti, Graffigna, Libreri, Serino, Hibbard & Riva, 2016: 1).

The intensity at which the capacity and reach of mobile devices and applications has been increasing, offers a basis on which to advance the acceptance of mobile devices among older adults and younger persons, and to encourage the utilisation of mobile device technologies to increase quality of life and improve the self-sufficiency of older adults (Turner, Roubinov, Atkins & Haselkorn, 2016: 84; Wang et al., 2014: e6). The many mobile device apps that are available provide assurance of not merely improving the self-management of disorders by older adults, but supporting health activities too,

which might stop or postpone the start of a disorder. Some mobile apps can improve disease management of a number of chronic diseases (Wang et al., 2014: e6).

Mobile devices are used by individuals on the move. They collect valuable knowledge and services from mobile applications, which are downloaded onto their mobile devices and used to perform several functions (Castelnuovo, Pietrabissa, Manzoni, Corti, Ceccarini, Borrello, Giusti, Novelli, Cattivelli, Middleton, Simpson & Molinari, 2015: 3; Dinh, Lee, Niyato & Wang, 2013: 1587). Consumers appreciate qualities that save time compared to existing methods and classify a mobile device application as useful when it is easy and natural to operate, offers exact directions to manage a disorder better, and shares information with specific persons (Mendiola, Kalnicki & Lindenauer, 2015: e40).

A variety of healthcare requirements can be dealt with through mobile devices, largely in two key areas: altering user/patient actions in health-related fields, and enhancing the applications of prescribed management courses of therapy (Becker, Miron-Shatz, Schumacher, Krocza, Diamantidis & Albrecht, 2014: e24). As the global population ages, the rapid progress of mobile device technologies has the prospect of increasing the excellence of life and to improve the self-sufficiency of older adults. Mobile device technologies have this potential, because they provide uninterrupted accessibility from everywhere, at any time. Mobile devices provide interactive consumer interfaces with interactive program resources to involve consumers. Furthermore, mobile devices need minimal levels of infrastructure delivery, which means they can be used in inaccessible areas, and they deliver substantial financial value to these regions. Mobile devices offer the prospect of continuous gathering of individual health information, which can be used for positive action modification (Lu, Chi & Chen, 2013: 813; Wang et al., 2014: e6). Patient portals, as well as protected automated messaging, increase communication simplicity and proficiency, joint choices, patient self-management, patient gratification, and chronic illness control (Mirsky, Tieu, Lyles & Sarkar 2015: 1; Solomon, Wagner & Goes, 2012: e32). In an ideal setting, mobile health devices present the possibility to provide specialty care where it might not be available, decrease transport problems, transfer care from conventional health centre and hospital-based care locations, and permitting patients to be involved contributors

in controlling their disorders anywhere they might be, at times suitable to them (Miyamoto, Henderson, Young, Pande & Han, 2016: e5).

2.6 SUMMARY

In this chapter, the chronic diseases were discussed under the headings of *prevalence, aetiology, signs and symptoms, complications and management* of the diseases. The health belief model was illustrated and discussed to explain the role of a compliant lifestyle and self-sufficiency in managing chronic diseases, preventing the development thereof and preventing complications. Mobile health devices, their coverage, advantages and influence on healthcare were discussed.

In the next chapter, the systematic review as a research method will be discussed.

CHAPTER 3: RESEARCH METHOD

3.1 INTRODUCTION

In Chapter 2, the researcher discussed the role of mobile health devices in supporting a compliant lifestyle in persons with chronic diseases. Because a systematic review is a rigorous process, this research method was selected for this study. Steps 1-4 of a systematic review, and the way rigour was ensured in each step, will be discussed in this chapter.

3.2 SYSTEMATIC REVIEW AS RESEARCH METHOD

A systematic review collects the best available evidence related to the review question (Botma et al., 2010: 233; Moher, Shamsheer, Clarke, Gherzi, Liberati, Petticrew, Shekelle, Stewart & PRISMA-P Group, 2015: 3). During a systematic review, data is collected in a meticulous manner and synthesised to provide outcomes (Gough, Oliver & Thomas, 2012:88; Moher et al., 2015:3). The steps are described in detail, in order for another researcher to reproduce the methodology and for the systematic review to be updated (Higgins & Green, 2011: online; Moher et al., 2015: 3). The decision to use a systematic review to conduct research during this study was motivated by the fact that a combination of high quality studies will depict the best available evidence related to the review question.

In the following paragraphs, the researcher will discuss the features, benefits and Steps 1- 4 of a systematic review.

3.2.1 Features of a systematic review

The features of a systematic review are the following. Systematic review involves,

- Compiling a peer-reviewed protocol;
- Compiling a well-defined research question;
- Identifying detailed aims and objectives, with distinct inclusion and exclusion criteria;
- Meticulously searching and documenting the search process to identify all the suitable studies; and

- Systematically reporting and categorising the conclusions of the relevant studies (Glasziou, Irwig, Bain & Colditz, 2001: 2; Higgins & Green, 2011: online).

3.2.2 Benefits of a systematic review

A systematic review links all the studies that are relevant to the review question, thereby increasing the trustworthiness of the conclusions (Higgins & Green, 2011: online). Secondly, comparable outcomes among diverse situations and designs offer proof of rigour and possibility of transferability of findings to other locations (Glasziou et al., 2001: 1; Higgins & Green, 2011: online).

3.2.3 Steps of a systematic review

The researcher decided to adapt the six steps of Higgins and Green (2011: online) as described in their book. The steps are illustrated in Figure 3.1 with emphasis on Steps 1-4.

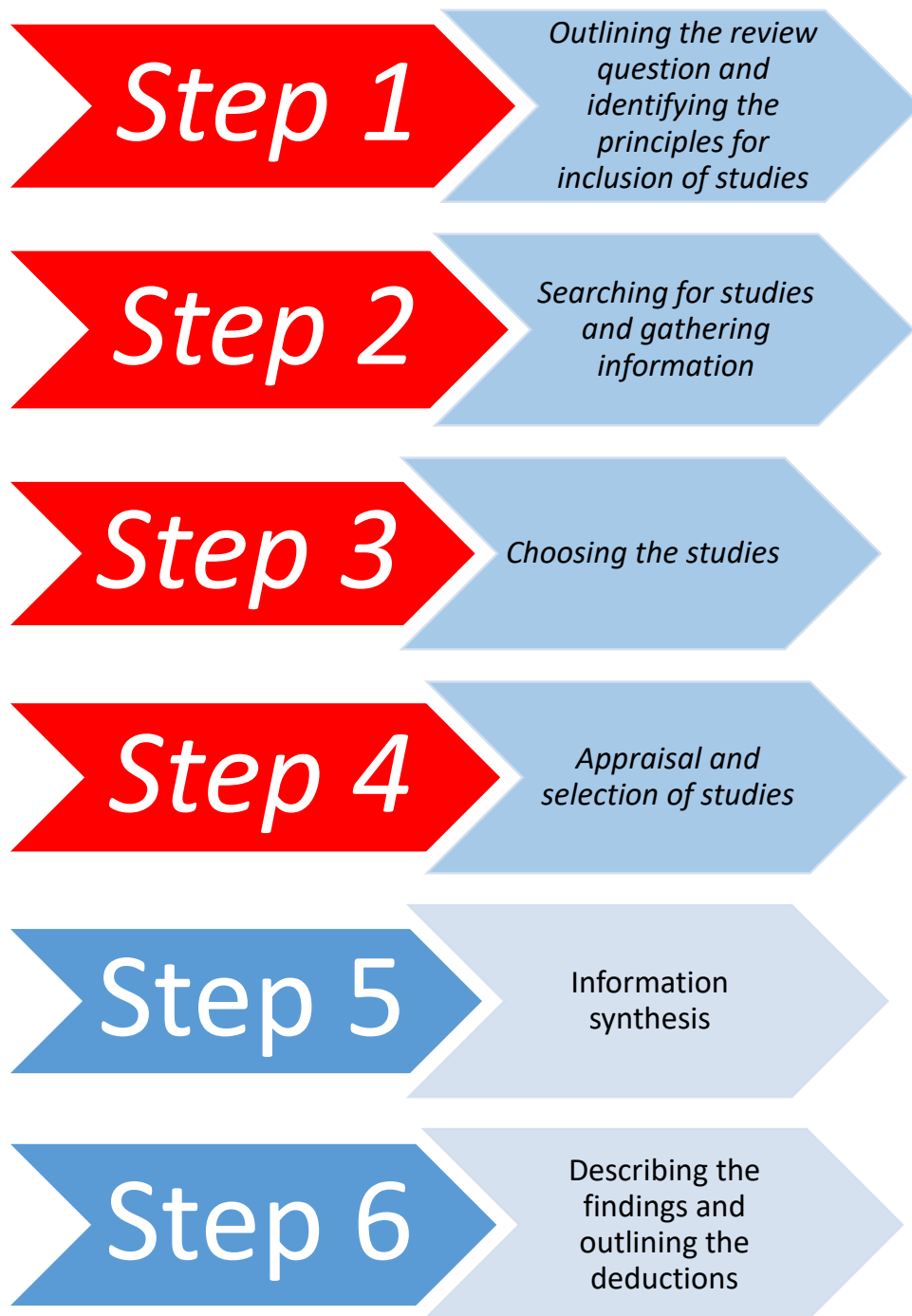
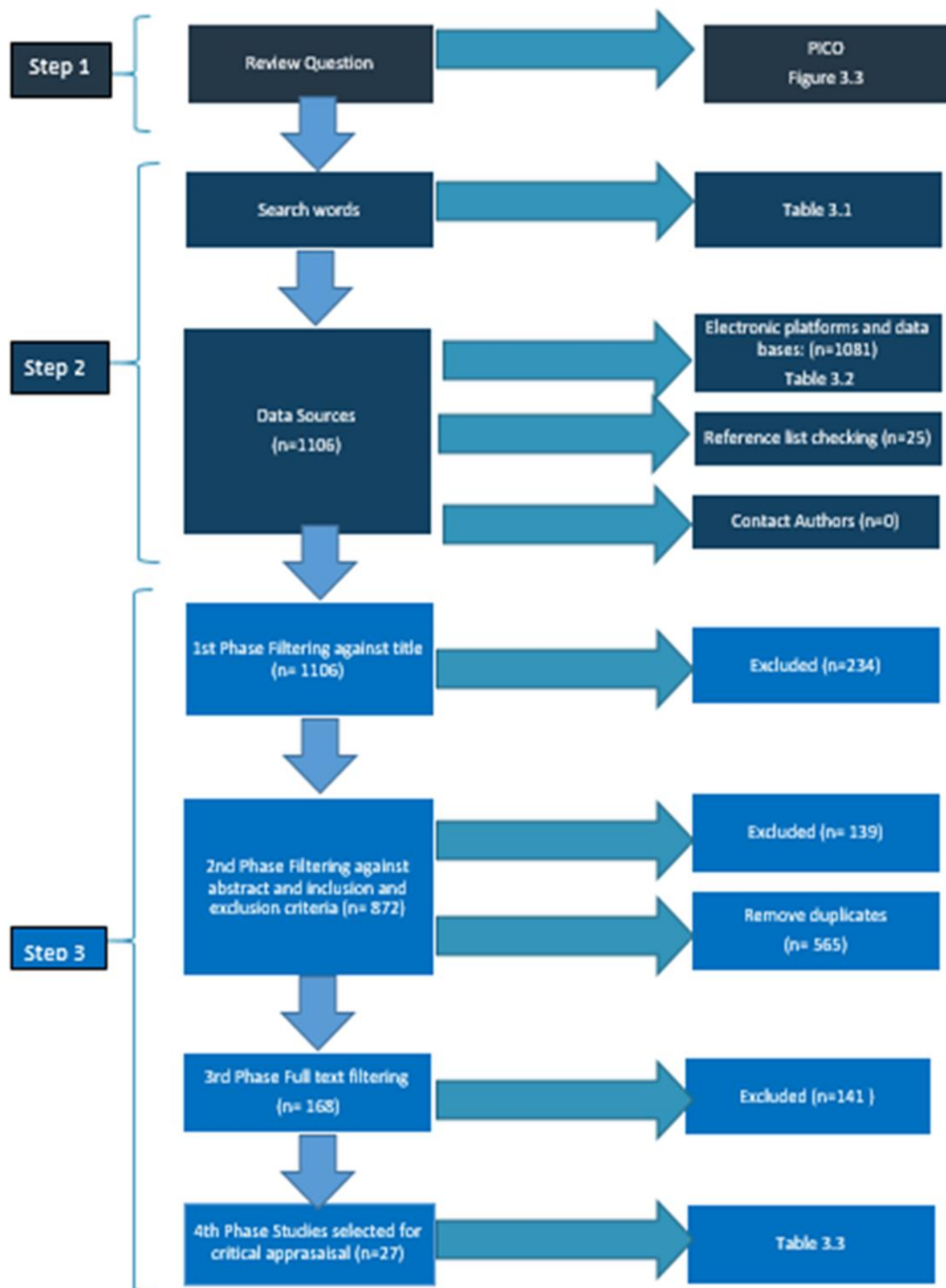


Figure 3.1: Steps of a systematic review adapted from Higgins and Green (2011: online), with emphasis on Steps 1-4

Figure 3.2 illustrates the search and sifting process that leads to studies being selected for critical appraisal.



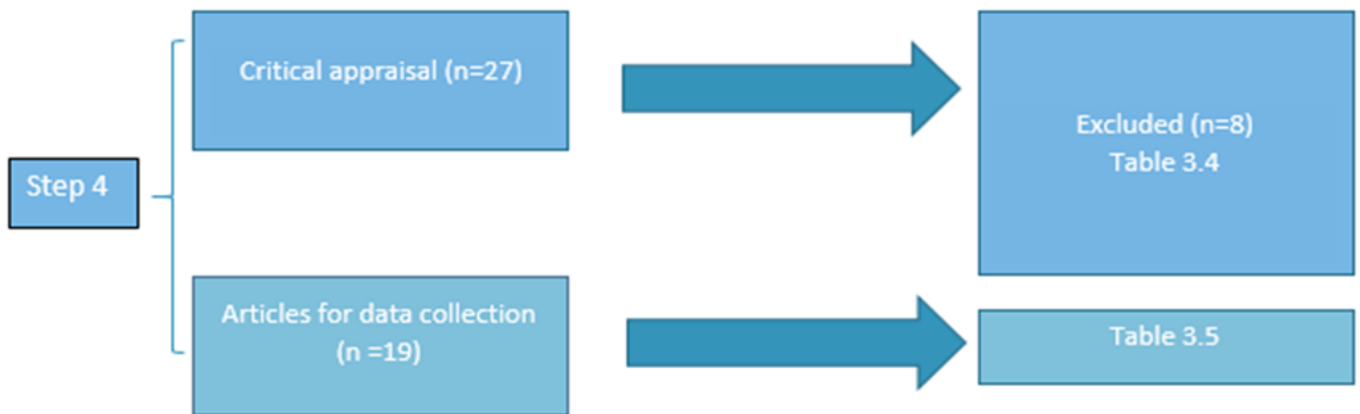


Figure 3.2: Search process followed in the study as well as studies included

3.2.3.1 Step 1: Outlining the review question and identifying principles for inclusion of studies

The review question guides several steps of the study, such as, searching for studies, gathering information from selected studies, establishing suitability of selected studies, and describing outcomes (Higgins & Green, 2011: online).

A clearly defined review question was compiled according to the population, intervention, comparison interventions and outcomes – which constitutes the PICO principle format. The PICO principle format is regarded as a gold standard in the formulation of the review question (Critical Appraisal Skills Programme, 2017: online; Higgins & Green 2011: online). The researcher consulted researchers with experience of systematic reviews to assist with the formulation of the review question. With the assistance of an experienced librarian, a rapid appraisal was performed and the review question was confirmed.

Figure 3.3. depicts the application of the PICO principle that guided the review question.

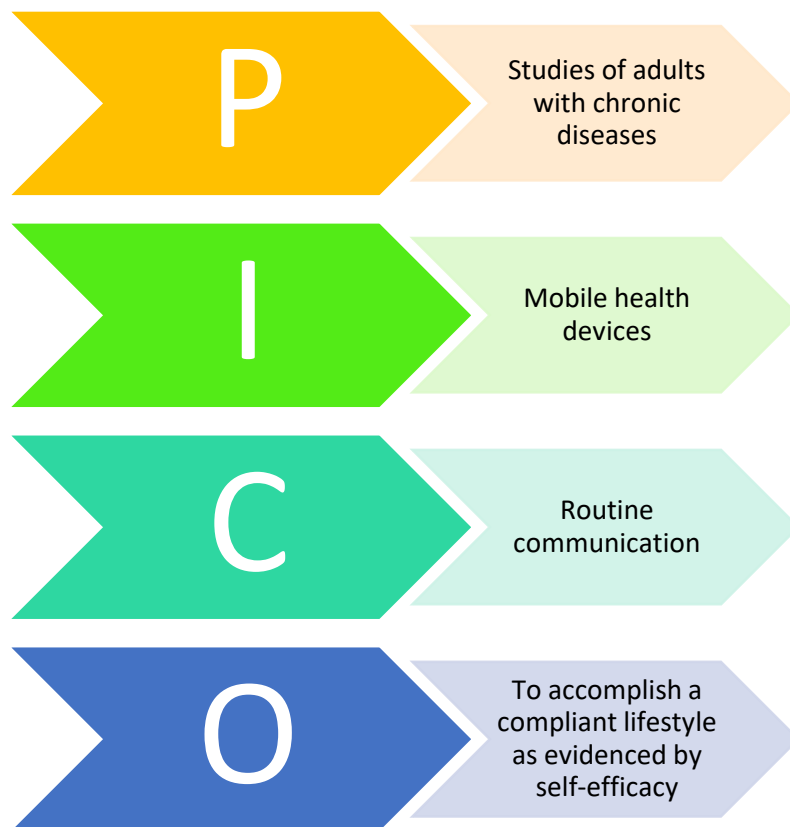


Figure 3.3: Review question according to PICO principle

The review question to be answered by this study is: *Do mobile health devices support a compliant lifestyle in patients with chronic diseases?*

Rigour in Step 1

The PICO principle is considered to be the gold standard for a systematic review. The focused review question was developed according to the PICO principle (Glasziou et al., 2001: 14). Consulting experienced researchers in systematic reviews to assist with compiling of the research question ensured rigour.

3.2.3.2 Step 2: Searching for studies and gathering of information

From the data obtained during the rapid appraisal, specific inclusion and exclusion criteria were identified. The researcher planned the search approach to identifying all possible studies related to the review question (Gough et al., 2012: 93; Higgins & Green, 2011: online).

a) Inclusion and exclusion criteria

The following criteria were identified as vital for studies to be **included** in this study. Literature had to,

- Be in English, or have an English abstract if it was in another language;
- Have been conducted on adults, 18 years and older, living with chronic diseases or at risk of developing chronic diseases;
- Refer to any mobile device supporting a healthy or compliant lifestyle;
- Refer to the period 1 January 2007 to February 2017;
- Involve primary studies;
- Be about chronic diseases discussed in this study; and
- Focus on mobile devices directly benefitting the patient, and not the healthcare professionals involved.

The following criteria **excluded** a study from the review. Literature was excluded if it,

- Involved research papers with participants younger than 18 years of age;
- Had been published before 1 January 2007;
- Was in the form of an editorial or letter to the editor;
- Related to supporting a healthy or compliant lifestyle without reference to mobile devices supporting the lifestyle;
- Related to chronic diseases not discussed in this study;
- Had been published in languages other than English, or, if in another language, it had no English abstract;
- Benefitted the healthcare professional and not the patient; and
- Tested tools or systems, instead of focussing on the patient.

b) Search words

To ensure that a thorough search was carried out, *search words* were identified and used with a truncation “*” to ensure all variations of the words were found. The *search words* were compiled for all of the PICO principles with the assistance of a subject librarian (Higgins & Green, 2011: online).

Search words are depicted in Table 3.1 and data sources will be discussed below.

Table 3.1: Search words according to the PICO principle used during the data search

| Population studies of adults with chronic diseases | Intervention Mobile health devices | Comparison interventions: Routine communication | Outcome of interest: To accomplish a compliant lifestyle as evidenced by self- efficacy |
|--|--|--|--|
| <ul style="list-style-type: none"> •(patient* or "at risk*") and chronic* •and •(disease* or illness* or condition* or disorder*) •(hypertens* or depress* or tb or tuberculos* or diabet* or heart* or coronar* or cardiovascular* or lung* or respirator* or pulmonary* or renal or kidney* or hepatic* or liver* or psychiatr* or mental or haematolog* or hematolog* or metabol* or hiv* or "acquired immunodeficiency**") | <ul style="list-style-type: none"> •(sms or "text messag**" or whatsapp* or chat* or telemedicine or telehealth or smartphone* or "cellular phone**" or "cellular telephone**" or cellphone* or smartphone* or "mobile health**") •or "mobile device**" or "mobile technolog**" or "mobile phone**" or "mobile telephone**") | <ul style="list-style-type: none"> •Routine communication | <ul style="list-style-type: none"> •(comply* or complian* or "life style**" or lifestyle* or self-effic*) |

c) Data sources

Electronic data sources were used, reference lists were checked and authors of data sources were contacted in the search.

- Electronic data sources

The researcher was assisted by a qualified librarian to identify and search electronic databases to identify studies relevant to the review question. The following platforms were searched: **EBSCOhost** is representative of all national and international journal articles; **Scopus** represents international databases of abstracts of peer-reviewed journals, dissertations, theses and citations, and **Cochrane** contains all systematic reviews of primary research in human healthcare and health policy. Various databases were identified within the platforms by the librarian who assisted the researcher (Gough et al., 2012: 111; Higgins & Green, 2011: online).

Table 3.2 depicts the electronic data bases searched.

Table 3.2: Electronic platforms and databases used to identify studies

| Platform | Database | Total abstracts | Duplicates |
|-------------------------------------|---|-----------------|------------|
| Ebscohost | Medline | 327 | 159 |
| | Academic Search Company | 201 | 119 |
| | Psyc Info | 113 | 47 |
| | CINAHL | 80 | 44 |
| | Health Source: Nursing/Academic Edition | 35 | 24 |
| | Africa-Wide Information | 12 | 7 |
| | MasterFILE Premier | 6 | 3 |
| | SPORTDiscuss with full text | 1 | 0 |
| | PsycARTICLES | 1 | 0 |
| | SocINDEX with Full Text | 1 | 0 |
| Communication & Mass Media Complete | 1 | 0 | |
| Scopus | | 301 | 160 |
| Cochrane | | 2 | 2 |
| Total | | 1 081 | 565 |

- Checking reference lists

The researcher searched the reference lists of the studies selected during the search process. Those studies were not identified when the search of the electronic data sources was done, but were identified by the researcher during the reference list checking, were included for screening. Another n=25 studies were identified through checking the reference lists.

- Contacting authors

When a particular study was not available through the library, the researcher contacted the author of the study in an attempt to obtain the study for screening. The researcher contacted n=3 authors.

Rigour in Step 2

By using more than one data source, the researcher enhanced the rigour of the study. In addition to using electronic data sources, reference lists were checked and authors were contacted. A qualified librarian assisted the researcher to compile the search words using Boolean operators, and to identify and search for relevant electronic data sources.

3.2.3.3 Step 3: Choosing the studies for critical appraisal

In Step 3 the researcher assessed the studies identified in step 2 against the review question and inclusion and exclusion criteria. Step 3 identified the studies to be included for critical appraisal. A detailed and comprehensive data sheet was compiled to ensure transparency and reproducibility. All reasons for exclusion were noted on the data sheet (Botma et al., 2010: 244; Higgins & Green, 2011: online).

Step 3 consisted of 4 phases, namely,

- Phase 1: Title was evaluated against the review question.
- Phase 2: Abstracts were evaluated against the review question and the inclusion and exclusion criteria.
- Phase 3: Full text was evaluated against inclusion and exclusion criteria.
- Phase 4: Studies were selected for the critical appraisal (Centre for Reviews and Dissemination, 2009: 23; Higgins & Green, 2011: online).

The process of searching electronic databases identified a large number of studies (n=1 081); after removing duplicates n=565 studies remained. Duplicates had to be removed manually, since duplication occurred in the various data bases and could not be removed electronically. With the assistance of a qualified librarian, the abstracts of the selected studies were obtained. The abstracts of the studies were assessed thoroughly by the researcher in relation to the review question: *Do mobile health devices support a compliant lifestyle in patients with chronic diseases?* The supervisor guided the researcher through this process. This process allowed the reviewer to analyse the abstracts immediately in relation to the review question; the total hits found in the search were (n=1 081). Reference lists were checked, and a further (n=25) studies were identified for possible inclusion, leaving the researcher with (n=1 106)

studies to analyse. These abstracts were also obtained from a qualified librarian. Furthermore, the researcher contacted three authors to obtain studies not available from the library, two studies were still ongoing, and the third author did not reply to the enquiry and that study was therefore excluded from the study. All studies that had been identified were listed in a data sheet and the reasons for exclusion of a specific article were noted on the sheet, so that the researcher could defend the decision, if required.

In **Phase 1**, n=234 studies were excluded because the title did not meet one or more of the PICO principles that defined the review question. Only the titles were scrutinised (Critical Appraisal Skills Programme, 2017: online).

Phase 2 involved n=872 studies that were left for screening. These article abstracts were analysed against the review question and inclusion and exclusion criteria, as described in Step 2 (Section 3.2.3.2). In **Phase 2**, n=139 studies were excluded. The duplicates of all the studies (n=565) were also excluded. Duplicates were defined as any studies that appeared in more than one of the electronic databases. These studies were exactly the same, so the duplicate studies were removed from the list of studies.

In **Phase 3**, n=168 studies were left for screening of the full text article. Full text articles were requested from a qualified librarian. After screening full text articles against the review question and the inclusion and exclusion criteria, a further n=141 studies were excluded (Critical Appraisal Skills Programme, 2017, 1-111). These reason for excluding studies was explicitly noted on a data sheet.

During **Phase 4**, the researcher was left with n=27 studies for critical appraisal according to Step 4. The final list of studies for critical appraisal was verified by two researchers experienced in systematic review.

Table 3.3 provides the final list of studies selected for critical appraisal.

Table 3.3: Studies selected for critical appraisal

| Title | Reference | Design |
|---|---|---|
| A cluster-randomized, controlled trial of a simplified multifaceted management program for individuals at high cardiovascular risk (SimCard Trial) in rural Tibet, China, and Haryana, India | Tian, M., Ajay, V.S., Dunzhu, D., Hameed, S.S., Li, X., Liu, Z., Li, C., Chen, H., Cho, K., Li, R., Zhao, X., Jindal, D., Rawal, I., Ali, M.K., Peterson, E.D., Ji, J., Amarchand, R., Krishnan, A., Tandon, N., Xu, L.Q., Wu, Y., Prabhakaran, D. & Yan, L.L. 2015: 815-824 | <i>Cluster - randomised control trial</i> |
| A telerehabilitation intervention for patients with chronic obstructive pulmonary disease: A randomized controlled pilot trial | Tabak, M., Vollenbroek-Hutten, M.M.R., Van der Valk, P.D.L.P.M., Van der Palen, J. & Hermens, H.J. 2014: 582-591 | <i>Randomised controlled pilot trial</i> |
| A web-delivered care management and patient self-management program for recurrent depression: A randomized trial | Hunkeler, E.M., Hargreaves, W. A., Fireman, B., Terdiman, J., Meresman, I F., Porterfield, Lee, J., Dea, R., Simon, G. E., Bauer, M. S., Unützer, J. & Taylor, C. B. 2012: 1063-1071 | <i>Randomised controlled trial</i> |
| An eHealth Diary and symptom-tracking tool combined with person-centered care for improving self-efficacy after a diagnosis of acute coronary syndrome: A substudy of a randomized controlled trial | Wolf, A., Fors, A., Ulin, K., Thorn, J., Swedberg, K. & Ekman, I. 2016: e40 | <i>Randomised controlled trial</i> |
| Effects of eight weeks sustained follow-up after a nurse consultation on hypertension: A randomised trial | Chiu, C.W. & Wong, F.K.Y. 2010: 1374-1382 | <i>Randomised controlled trial</i> |

| Title | Reference | Design |
|--|---|---|
| Efficacy of a cell phone-based exercise programme for COPD | Liu, W.T., Wang, C.H., Lin, H.C., Lin, S.M., Lee, K.Y., Lo, Y.L., Hung, S.H., Chang, Y.M., Chung, K.F. & Kuo, H.P. 2008: 651-659 | <i>Randomised controlled trial</i> |
| Expanding the efficacy of Project UPLIFT: Distance delivery of mindfulness-based depression prevention to people with epilepsy. | Thompson, N.J., Patel, A.H., Selwa, L.M., Stoll, S.C., Begley, C E., Johnson, E.K. & Fraser, R.T. 2015: 304-313 | <i>Randomised controlled cross-over design</i> |
| Health promotion through primary care: enhancing self-management with activity prescription and mHealth | Knight, E., Stuckey, M.I. & Petrella, R.J. 2014: 90-99 | <i>Randomised controlled trial</i> |
| Integrated telehealth care for chronic illness and depression in geriatric home care patients: The integrated telehealth education and activation of mood (I-TEAM) study | Gellis, Z.D., Kenaley, B.L. & Have, T.T. 2014: 889-895 | <i>Randomised controlled trial</i> |
| Long-term results after a telephone intervention in chronic heart failure: DIAL (Randomized Trial of Phone Intervention in Chronic Heart Failure) follow-up | Ferrante, D., Varini, S., Macchia, A., Soifer, S., Badra, R., Nul, D., Grancelli, H. & Doval, H. 2010: 372-378 | <i>Randomised controlled trial</i> |
| Pilot study of a cell phone-based exercise persistence intervention post-rehabilitation for COPD. | Nguyen, H.Q., Gill, D.P., Wolpin, S., Steele, B.G. & Benditt, J.O. 2009: 301-313 | <i>Randomised repeated measures exploratory study</i> |

| Title | Reference | Design |
|---|--|---|
| Randomized Controlled Trial of an Internet-Based Versus Face-to-Face Dyspnea Self-Management Program for Patients with Chronic Obstructive Pulmonary Disease: Pilot Study | Nguyen, H.Q., Donesky-Cuenco, D., Wolpin, S., Reinke, L.F., Benditt, J.O., Paul, S.M. & Carrieri-Kohlman, V. 2008: 1-19 | <i>Randomised controlled trial</i> |
| Sustained effects of a nurse coaching intervention via telehealth to improve health behavior change in diabetes. | Young, H., Miyamoto, S., Ward, D., Dharmar, M., Tang-Feldman, Y. & Berglund, L. 2014: 828-34 | <i>Randomised experimental study design</i> |
| The effect of nurse-led problem-solving therapy on coping, self-efficacy and depressive symptoms for patients with chronic obstructive pulmonary disease: a randomised controlled trial | Lee, H., Yoon, J.Y., Lim, Y., Jung, H., Kim, S., Yoo, Y., Kim, S., Ahn, J-J. & Park, H-K. 2015: 397-403 | <i>Randomised controlled trial</i> |
| Text message and internet support for coronary heart disease self-management: Results from the Text4Heart randomized controlled trial | Dale, L.P., Whittaker, R., Jiang, Y., Stewart, R., Rolleston, A. & Maddison, R. 2015: 1-11 | <i>Randomised controlled trial</i> |
| The effect of short message system (SMS) reminder on adherence to a healthy diet, medication, and cessation of smoking among adult patients with cardiovascular diseases | Akhu-Zaheya, L.M.& Shiyab, W.Y. International Journal of Medical Informatics. 2017, Vol. 98, p65-75 | <i>Randomised controlled trial</i> |

| Title | Reference | Design |
|---|---|---|
| Improving adherence to antiretroviral therapy with triggered real-time text message reminders: The China Adherence Through Technology Study | Sabin, L.L., Bachman, D.M., Gill, C.J., Zhong, L., Vian, T., Xie, W., Cheng, F., Xu, K., Lan, G., Haberer, J.E., Bangsberg, D.R., Li, Y., Lu, H. & Gifford, A.L. 2015: 551-559 | <i>Randomised controlled trial</i> |
| Therapy reminder message for Hungarian patients with type 2 diabetes | Argay, M., Meskó, A., Zekó, R. & Hankó, B. 2015: 1289-1293 | <i>Randomised controlled trial</i> |
| Internet-based dyspnea self-management support for patients with chronic obstructive pulmonary disease | Nguyen, H.Q., Donesky, D., Reinke, L.F., Paul, S.M. & Carrieri-Kohlman, V. 2013: 43-55 | <i>Randomised repeated measures study</i> |
| A ubiquitous chronic disease care system using cellular phones and the internet. | Yoo, H.J., Park, M.S., Kim, T.N., Yang, S.J., Cho, G.J., Hwang, T.G., Baik, S.H., Choi, D.S., Park, G.H. & Choi, K.M. 2009: 628-635 | <i>Randomised controlled trial</i> |
| Lifestyle-focused text messages reduced LDL-C levels, systolic BP, and BMI in coronary heart disease. | Bloomfield, H.E. 2016: 1 | <i>Randomised controlled trial</i> |
| Patients' experience of a telephone booster intervention to support weight management in Type 2 diabetes and its acceptability. | Wu, L., Forbes, A. & While, A. 2010: 221-223 | <i>Randomised controlled trial</i> |

| Title | Reference | Design |
|--|--|---|
| Telemedicine and type 1 diabetes: is technology per se sufficient to improve glycaemic control? | Franc, S., Borot, S., Ronsin, O., Quesada, J.L., Dardari, D., Fagour, C., Renard, E., Leguerrier, A.M., Vigerat, C., Moreau, F., Winiszewski, P., Vambergue, A., Mosnier-Pudar, H., Kessler, L., Reffet, S., Guerci, B., Millot, L., Halimi, S., Thivolet, C., Benhamou, P.Y., Penfornis, A., Charpentier, G. & Hanaire, H. 2014: 61-66 | <i>Randomised controlled trial</i> |
| Mobile text messaging for health: A systematic review of reviews | Hall, A.K., Cole-Lewis, H. & Bernhardt, J.M. 2015: 393-415 | <i>A systematic review of reviews</i> |
| Mobile phone text messages for improving adherence to antiretroviral therapy (ART): an individual patient data meta-analysis of randomised trials | Mbuagbaw, L., Van der Kop, M.L., Lester, R.T., Thirumurthy, H., Pop-Eleches, C., Ye, C., Smieja, M., Dolovich, L., Mills, E.J. & Thabane, L. 2013:1-5 | <i>Meta-analysis of randomised trials</i> |
| Improving treatment adherence for blood pressure lowering via mobile phone SMS-messages in South Africa: A qualitative evaluation of the SMS-text Adherence SuppoRt (StAR) trial | Leon, N., Surender, R., Bobrow, K., Muller, J. & Farmer, A. 2015: 1-10 | <i>Qualitative review</i> |
| Factors affecting frequency of patient use of Internet-based telemedicine to manage cardiovascular disease risk. | Kothapalli, P., Bove, A.A., Santamore, W.P., Homko, C. & Kashem, A. 2013: 205-208 | <i>Survey</i> |

Rigour in Step 3

A very rigorous filtering process was followed by the researcher and the review team in order to ensure that all relevant studies related to the review question were identified. A meticulous search process was conducted and thorough records were kept. The filtering process was recorded meticulously to ensure that there is an audit trail. This ensured the rigour of Step 3. The full texts of the studies were evaluated by the researcher and verified by two researchers experienced in systematic reviews.

3.2.4 Step 4: Appraisal and selection of studies

Critical appraisal is important for assessing the methodological quality of the studies selected during Step 3. The studies included were heterogeneous, meaning the studies were not similar in methodology, as described in the next paragraphs.

In Step 4, a standardised evaluation tool, specific to each study, was used by the researcher and two researchers experienced in systematic reviews, to conduct a critical appraisal of the selected studies (n=27). This procedure ensured that only high quality studies were included in the research. The Critical Appraisal Skills Program (CASP) tool (Critical Appraisal Skills Programme, 2017: 1-111) assisted the researcher and experienced researchers to appraise the methodological quality of the selected studies. When a discrepancy arose, a round-table discussion between the researcher and two researchers experienced in systematic reviews was held to reach consensus on the exclusion of studies. The level of evidence was determined by using the Johns Hopkins Nursing EBP: Levels of Evidence see (Addendum 5), (Dearholt, Dang & Sigma, 2017: 1-2).

During the critical appraisal process, seven studies were excluded, leaving n=19 studies for data extraction. The studies included for the critical appraisal that was carried out by the researcher and two researchers experienced in systematic reviews, were heterogeneous.

In total 15 randomised control trials were included for critical appraisal. The tool used to conduct the critical appraisal is the CASP randomised controlled trial study tool (see Addendum 1). Two systematic reviews were included for critical appraisal and the CASP Systematic Review Checklist was used for critical appraisal of these studies

(see Addendum 2). Also included was one qualitative study and one survey. The tool used to critical appraise the study is the CASP qualitative tool see (see Addendum 3) and CASP Survey (see Addendum 4) (Critical Appraisal Skills Programme, 2017: online). The heterogeneity of the studies did not allow for a meta-analysis to be conducted (Gough et al., 2012: 90). After the critical appraisal, data was extracted from the studies that had been included to answer the review question (Higgins & Green, 2011: online).

During this step, the researcher and two researchers experienced in systematic reviews were involved in extracting the data from the selected studies. The outcomes of interest to the review question were reached by compiling an information collection chart (Higgins & Green, 2011: online).

Table 3.4 lists the studies excluded during the critical appraisal, with the reason for exclusion, and Table 3.5 contains the data of the critical appraisal and data extraction of the selected studies.

Table 3.4: Studies excluded during the critical appraisal

| Title | Authors, date and pages | Design | Reason for exclusion |
|--|--|------------------------------------|--|
| A ubiquitous chronic disease care system using cellular phones and the internet | Yoo, H.J., Park, M.S., Kim, T.N., Yang, S.J., Cho, G.J., Hwang, T.G., Baik, S.H., Choi, D.S., Park, G.H. & Choi, K.M. 2009: 628-635 | <i>Randomised controlled trial</i> | Poorly described randomisation, not clear how randomisation was carried out or if the allocation sequence was concealed. |
| Lifestyle-focused text messages reduced LDL-C levels, systolic BP, and BMI in coronary heart disease | Bloomfield, H.E. 2016: 1 | <i>Randomised controlled trail</i> | Not clear how randomisation was carried out and control group not described. |
| Patients' experience of a telephone booster intervention to support weight management in Type 2 diabetes and its acceptability | Wu, L., Forbes, A. & While, A. 2010:221-223 | <i>Randomised controlled trial</i> | How randomisation was carried out was not clearly explained and blinding not described. |
| Telemedicine and Type 1 diabetes: is technology per se sufficient to improve glycaemic control? | Franc, S., Borot, S., Ronsin, O., Quesada, J.L., Dardari, D., Fagour, C., Renard, E., Leguerrier, A.M., Vigerat, C., Moreau, F., Winiszewski, P., Vambergue, A., Mosnier-Pudar, H., Kessler, L., Reffet, S., Guerci, B., Millot, L., Halimi, S., Thivolet, C., Benhamou, P.Y., Penfornis, A., Charpentier, G. & Hanaire, H. 2014: 61-66 | <i>Randomised controlled trial</i> | Poorly described randomisation, not clear how randomisation was carried out or if the allocation sequence was concealed. |

| Title | Authors, date and pages | Design | Reason for exclusion |
|--|--|---|--|
| An e-Health diary and symptom-tracking tool combined with person centered care for improving self-efficacy after a diagnosis of acute coronary syndrome: A substudy of a randomized controlled trial | Wolf, A, Fors, A., Ulin, K., Thorn, J., Swedberg, K. & Ekman, I. 2016: e40 | <i>Sub-study of a randomised controlled trial</i> | Not clear how patients were allocated to the control group. Blinding not clear. |
| Internet based dyspnea self-management support for patients with chronic obstructive pulmonary disease | Nguyen, H.Q., Donesky, D., Reinke, L.F., Wolpin, S., Chyall, L., Benditt, J.O., Paul, S.M. & Carrieri-Kohlman, V. 2013: 43-55 | <i>Randomised controlled trial</i> | Poorly described randomisation, not clear how randomisation was carried out or if the allocation sequence was concealed. |
| Randomized controlled trial of an internet-based versus face-to-face dyspnea self-management program for patients with chronic obstructive pulmonary disease: Pilot study | Nguyen, H.Q., Donesky-Cuenca, D., Wolpin, S., Reinke, L.F., Benditt, J.O., Paul, S.M. & Carrieri-Kohlman, V. 2008: 1-19 | <i>Randomised controlled trial</i> | Randomisation not clearly described, no clear blinding of healthcare workers or patients described. |
| Health promotion through primary care: enhancing self-management with activity prescription and mHealth. | Knight, E., Stuckey, M.I., & Petrella, R.J. 2014: 90-9. | <i>Randomised controlled trial</i> | Not a chronic disease researched, only a disease risk. |

Table 3.5: Critical appraisal and data collection

| Randomised Controlled Trials (n=15) | | | | |
|---|--|--|---|---|
| Bibliographic detail | Methodology | Outcomes and intervention | Critical appraisal/ Level of evidence | Study findings |
| <p>Tian, M., Ajay, V.S., Dunzhu, D., Hameed, S.S., Li, X., Liu, Z., Li, C., Chen, H., Cho, K., Li, R., Zhao, X., Jindal, D., Rawal, I., Ali, M.K., Peterson, E.D., Ji, J., Amarchand, R., Krishnan, A., Tandon, N., Xu, L.Q., Wu, Y., Prabhakaran, D. & Yan, L.L.</p> <p>2015</p> <p>A cluster-randomized, controlled trial of a simplified multifaceted management program for individuals at high cardiovascular risk (SimCard Trial) in rural Tibet, China, and Haryana, India</p> | <p><i>Aim:</i></p> <p>Develop and evaluate a simplified cardiovascular management programme delivered by community health workers with the aid of a smartphone-based electronic decision support system.</p> <p><i>Design:</i></p> <p>Single-blinded cluster-randomised control trial.</p> <p><i>Setting:</i></p> <p>27 villages in China and 20 in India's Haryana State.</p> | <p><i>Primary outcomes</i></p> <p>Patients-reported anti-hypertensive medication use pre- and post intervention.</p> <p><i>Secondary outcomes:</i></p> <ol style="list-style-type: none"> 1) Aspirin use 2) Systolic blood pressure 3) Proportion of current smokers 4) Aware of the harms of high-salt diet 5) Receiving monthly follow-ups from community health workers 6) Individuals hospitalised. <p><i>Data collection:</i></p> <p>Community health workers collected data at baseline and one year follow-up. Measured blood pressure, height, weight,</p> | <p><i>Critical appraisal tool used:</i></p> <p>Critical Appraisal Skills Programme randomised controlled trial study tool.</p> <p>A suitable design was applied to a clearly focussed problem.</p> <p>Randomised by stratification by country in China and India generated by central computerised process</p> <p>All patients who entered the trial were accounted for at the end of the study.</p> <p>The patients and community health workers were blinded to the allocation of the intervention group.</p> <p>The intervention and control groups were similar at base line.</p> | <p><i>Primary outcomes:</i></p> <p>Post intervention the medication adherence increased by 25.5% (P<0.001). This was statistically significant between intervention and control groups in both countries.</p> <p><i>Secondary outcomes:</i></p> <ol style="list-style-type: none"> 1) Significant increase in aspirin use. 2) Significant reduction in systolic blood pressure (P=0.04) in China, but not in India. 3) No change in tobacco use. 4) No change in knowledge on harmful effects of high salt intake. 5) Monthly feedback had a statistically significance difference for China (P<0.001) and India (P=0.20). |

| Randomised Controlled Trials (n=15) | | | | |
|---|--|--|--|--|
| Bibliographic detail | Methodology | Outcomes and intervention | Critical appraisal/ Level of evidence | Study findings |
| <p><i>Circulation</i> 139(9): 815-824</p> | <p><i>Sample:</i> 2 086 individuals: China: intervention 557/control 479, India: intervention 538/control 512.</p> <p><i>Inclusion criteria:</i></p> <ol style="list-style-type: none"> 1) Coronary heart disease 2) Stroke 3) Diabetes Mellitus 4) Systolic blood pressure ≥ 160 mmHg <p><i>Exclusion criteria:</i></p> <ol style="list-style-type: none"> 1) Cardiovascular disease-related complications that cannot be managed in a primary care setting 2) Malignancy or life-threatening disease | <p>waist circumference, did lifestyle counselling. The community health worker prescribed one or both of the medications, in India the doctor would prescribe the medication and do further screening for new symptoms, diseases or side effects. Survey questionnaires measuring demographics, lifestyle behaviours, medical care, medication use and other relevant information.</p> <p><i>Intervention group:</i> Followed-up by community health workers on monthly basis assisted by Electronic decision support system in the form of an Android-based app.</p> <p><i>The control group:</i> Received usual cardiovascular management without additional intervention; in India, the medication used in trial were</p> | <p>Data collection was done and the results were clearly and accurately presented.</p> <p>Application to the context is possible.</p> <p><i>Score on appraisal tool:</i> 10/11</p> <p>Included</p> <p>Level of evidence: I</p> | <p>6) Hospital admissions (P=0.53) net difference -1.9.</p> <p><i>Limitations:</i></p> <ol style="list-style-type: none"> 1) The results may not be the same if community health workers are not available, because their active engagement is directly related to the outcomes. 2) The availability of the same medication in India to the control group might have influenced the significance of systolic blood pressure reduction. 3) Lifestyle factors did not decrease, possibly because the trial period was too short and the lifestyle intervention was not intensive. 4) The study was not able to evaluate the effectiveness of different components or specific measures of the simplified |

| Randomised Controlled Trials (n=15) | | | | |
|---|---|---|--|---|
| Bibliographic detail | Methodology | Outcomes and intervention | Critical appraisal/ Level of evidence | Study findings |
| | <p>3) Bedridden individuals</p> <p>4) Currently participating in other clinical trials</p> <p>5) Unable to stay in the village longer than eight months of the year</p> | <p>available to patients in the primary-care facilities serving the control villages.</p> <p><i>Data analysis:</i></p> <p>For the primary outcome, proportion of high-risk individuals treated with anti-hypertensive medication, mixed logistic model with two sets of random intercepts, for village an unstructured covariance matrix structure was specified. All models included fixed effects for groups, time and group-by-time interaction. Model-based-p value to test net difference. Same model used for other dichotomous outcomes.</p> | | <p>cardiovascular management programme.</p> <p>5) Results on the lack of impact on lifestyle factors and the significant results on clinical care indicators suggested that the pharmaceutical components in the “2+2” model may have played a bigger role.</p> <p><i>Recommendations:</i></p> <p>Larger, context-specific trials are needed to enhance and refine the management programme and to pinpoint cost-effective components of the model.</p> |
| <p>Tabak, M., Vollenbroek-Hutten, M.M.R., Van der Valk, P.D.L.P.M., Van der Palen, J., & Hermes, H.J.</p> | <p><i>Aim:</i></p> <p>1) To investigate the effects of a telerehabilitation intervention on health status and activity</p> | <p><i>Primary outcome:</i></p> <p>Activity level measured by a pedometer (in steps/day).</p> | <p><i>Critical appraisal tool used:</i></p> <p>Critical Appraisal Skills Programme randomised controlled trial study tool.</p> | <p><i>Primary outcomes:</i></p> <p>The intervention group showed a non-significant increase in the number of steps/day in week 1 (+340 steps) and week 2 (+505</p> |

| Randomised Controlled Trials (n=15) | | | | |
|---|---|---|---|--|
| Bibliographic detail | Methodology | Outcomes and intervention | Critical appraisal/ Level of evidence | Study findings |
| <p>2014</p> <p>A telerehabilitation intervention for patients with chronic obstructive pulmonary disease: A randomized controlled pilot trial</p> <p><i>Clinical Rehabilitation</i></p> <p>28(6): 582-591</p> | <p>level of patients with chronic obstructive pulmonary disease</p> <p>2) To investigate how patients comply with the intervention and whether compliance is related to treatment outcomes.</p> <p><i>Design:</i></p> <p>A randomised controlled pilot trial.</p> <p><i>Setting:</i></p> <p>Not stipulated where in the Netherlands</p> <p><i>Sample:</i></p> <p>34 participants. 14 intervention group and 16 control group.</p> <p><i>Inclusion criteria:</i></p> | <p><i>Secondary outcome:</i></p> <p>Compliance expressed as the time the activity coach was worn. Compliance was calculated by dividing the number of days the activity sensor was worn by the minimum number of days that was prescribed (\geq four days/week).</p> <p><i>Data collection:</i></p> <p>Data were collected at baseline and weeks 1, 2 and 4 from the website. Patients completed online diaries daily.</p> <p><i>Intervention group:</i></p> <p>Used the telerehabilitation application, consisting of an activity coach (3D-accelometer with smartphone) for ambulant activity registration and real-time feedback, complemented by a web portal with a symptom diary</p> | <p>The design was suitable and addressed a clearly described problem.</p> <p><i>Randomisation:</i></p> <p>Computer-generated randomisation list. Recruitment, randomisation, and allocation were performed by different persons.</p> <p>All patients in the trial were accounted at the end of the study.</p> <p>The data collection was not blinded to the data collector.</p> <p>The intervention and control groups were comparable at baseline.</p> <p>The data collection and results were precisely and clearly conveyed.</p> | <p>steps), and a decrease in the last feedback week (-162 steps).</p> <p>After 2 weeks the steps increased from 3 500-5 500 to 6 300.</p> <p>Decrease in fatigue levels ($p=0.078$).</p> <p><i>Secondary outcomes:</i></p> <p>86% of patients complied with activity coach.</p> <p>The diary was filled 17.3 ± 7.8 times on average more than prescribed.</p> <p><i>Limitations:</i></p> <p>1) The effect of exacerbations was not evaluated in this trial.</p> <p>2) Small sample size.</p> <p>2) Small sample size, due to limited availability of the activity coach, and insufficient power represents considerable limitations.</p> |

| Randomised Controlled Trials (n=15) | | | | |
|-------------------------------------|---|---|---|---|
| Bibliographic detail | Methodology | Outcomes and intervention | Critical appraisal/ Level of evidence | Study findings |
| | <p>1) No infection or exacerbation in four weeks prior to measurement</p> <p>2) Current or former smoker</p> <p>3) Able to read and speak Dutch</p> <p>4) Access to Internet at home</p> <p><i>Exclusion criteria:</i></p> <p>1) Impaired hand function causing inability to use the application</p> <p>2) Disorders or progressive disease seriously influencing daily activities</p> <p>3) Other diseases influencing bronchial</p> | <p>for self-treatment of exacerbations, for four weeks.</p> <p>The intervention group's compliance was measured by the number of visits to the web and the time the activity sensor was worn.</p> <p><i>Control group:</i></p> <p>Usual care.</p> <p><i>Data analyses:</i></p> <p>Activity level measured by number of steps per day with pedometer. Results described in terms of mean ± standard deviation, counts or percentage. Level of significance set at $p < 0.05$ and trend $p < 0.10$. Effect of feedback on activity levels, a mixed model analysis for repeated measures, was performed. Time of measurement was used within-subjects factor and group as a between-subjects factor. Sidak</p> | <p><i>Score on appraisal tool:</i></p> <p>10/11</p> <p>Included</p> <p>Level of evidence: I</p> | <p>3) Physical activity can significantly improve in the short term, but long-term effects were not determined.</p> <p>4) Compliance with the activity coach was high and was directly related to activity improvement.</p> <p><i>Recommendations:</i></p> <p>Future studies are recommended with a larger sample size investigating treatment effects and compliance on both the short and long term.</p> <p>1) The effect of exacerbations was not evaluated in this trial.</p> |

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| | <p>symptoms and/or lung function</p> <p>4) Need for regular oxygen therapy (>16 hours per day or pO₂ <7.2 kPa)</p> <p>5) History of asthma</p> <p>6) Started training with a physiotherapist less than 6 weeks before the trial</p> | <p>was used to correct for multiple comparisons. Differences between groups used paired t-test. Pearson product-moment correlation coefficient was calculated to evaluate the relationships between continuous variables. Pearson-Chi-square was used to compare variables. The COPD Questionnaire was used to measure health status for each patient, a change difference of 0.4 represents the minimal importance difference for an individual patient. Medical Research Council Dyspnoea Scale was used to grade the effect of dyspnoea on daily activity. Multidimensional Fatigue Inventory assessed fatigue. Only the days where 50% of day was measured were included.</p> | | |
| <p>Hunkeler, E.M., Hargreaves, W.A., Fireman, B., Terdiman, J., Meresman, J.F.,</p> | <p><i>Aim:</i></p> <p>Assessing the impact of an Internet-delivered care</p> | <p><i>Primary outcomes:</i></p> | <p><i>Critical appraisal tool used:</i></p> | <p><i>Primary outcomes:</i></p> <p>On the 6-point psychiatric status rating scale, severity among eCare participants decreased by nearly</p> |

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| <p>Porterfield, Y., Lee, J., Dea, R., Simon, G.E., Bauer, M.S., Unützer, J. & Taylor, C.B.</p> <p>2012</p> <p>A web-delivered care management and patient self-management program for recurrent depression: A randomized trial</p> <p><i>Psychiatric Services</i></p> <p>63(11): 1063-1071</p> | <p>management and patient self-management programme, eCare for Moods, on patients treated for recurrent or chronic depression.</p> <p><i>Design:</i></p> <p>Randomised control trial.</p> <p><i>Setting:</i></p> <p>Two Kaiser Permanente specialty mental health clinics in northern California.</p> <p><i>Sample:</i></p> <p>51 individuals in the intervention group and 52 individuals in the control group.</p> | <p>Estimate depression severity on a 6-point scale for each of the 105 study weeks.</p> <p><i>Secondary outcomes:</i></p> <ol style="list-style-type: none"> 1) Current depression severity 2) Depression presence 3) Sheehan Disability Scale 4) Short Form-36 item scales <p><i>Data collection:</i></p> <p>Telephone interviewers conducted follow-up interviews at baseline, 6, 12, 18 and 24 months. At each follow-up a current psychiatric status rating was obtained, using the longitudinal Interval Follow-up Evaluation, Sheehan Disability Scale, 36-item Short-Form Health Survey, Alcohol Use Disorders Identification Test and questions about use of psychotropic medications, social support</p> | <p>Critical Appraisal Skills Programme randomised controlled trial study tool.</p> <p>The design was appropriate and directed to a clearly aimed health challenge.</p> <p><i>Randomisation:</i></p> <p>Done by a statistician blinded to candidates' identities, who prepared random treatment assignments in blocked sets of four.</p> <p>All patients were assessed in the groups they were randomised to and all participants were reported on at the conclusion of the study</p> <p>The interviewers were blinded to the treatment condition. The intervention and control groups were similar at baseline except for marital status.</p> | <p>three quarters of a point more, on average (estimate -.74 on the 6 point scale over 2 years, 95% confidence interval (CI) = -1.38 to -.09, p=.025)</p> <p><i>Secondary outcomes:</i></p> <ol style="list-style-type: none"> 1) eCare participants were less depressed (-.24 over two years, CI=-.46 to -.03, p=.026). 2) Improved mental health (p=.003). 3) Greater satisfaction with specialty care (p=.003). 4) New coping skills (p<.001) and more confidence in managing depression (p=.006). <p><i>Limitations:</i></p> <p>The small sample size limited the precision of findings. Some eCare patients might have under- or overreported symptoms to emphasise improvement. Generalisation is limited due to the</p> |

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| | <p><i>Inclusion criteria:</i></p> <p>1) 18 years or older not currently hospitalised</p> <p>2) Diagnosis of recurrent or chronic depression</p> <p>4) Use Internet at home</p> <p>5) Will receive psychiatric care at the same clinic during the coming year</p> <p><i>Exclusion criteria:</i></p> <p>1) History of manic or hypomanic episodes</p> <p>2) Diagnosis of bipolar disorder</p> | <p>employment and use of sick leave.</p> <p><i>Intervention group:</i></p> <p>24 hour access to eCare, seven days a week, for 12 months. Twice daily, psychiatric care manager, monitored the site. Participants could enlist a care partner. eCare offered participants personalised self-monitoring, secure messaging with their eCare manager, depression education and social support, a monitored discussion group, problem-specific advice, a personal database, task lists and an appointment calendar.</p> <p><i>Control group:</i></p> <p>Usual care.</p> <p><i>Data analysis:</i></p> <p>Primary test of hypothesis focused on the time-by-treatment interaction effect, included in a repeated-measures model of depression severity. The repeated-measures model was fitted to the series of 105 weekly depression-severity</p> | <p>Information collection was completed and the outcomes were clearly and truthfully presented.</p> <p>Use in this study context is possible.</p> <p><i>Score on appraisal tool:</i></p> <p>10/11</p> <p>Included</p> <p>Level of evidence: I</p> | <p>way the sample was compiled and p values are from multiple tests of secondary outcomes. The control group probably received less intensive treatment due to the primary care setting.</p> <p><i>Recommendations:</i></p> <p>Replicating this study with larger and more varied samples in other practice settings would clarify the clinical effects and costs of the intervention and the generalisability of the findings. Similar programmes could be beneficial for other conditions.</p> |
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| | | measurements. Secondary outcomes were measured at baseline, 6, 12, 18 and 24 months by repeated-measures analyses focussing on time-by-treatment interaction effect. Cohen's d was calculated to compare findings with those of other studies. Standardised mean difference in depression severity attributable to the eCare intervention. Values of .2 suggest a small effect, .5 medium effect and .8 large effect. t-Test used to compare care utilisation and cost. | | |
| Chiu, C.W. & Wong, F.K.Y. 2010 Effects of 8 weeks sustained follow-up after a nurse consultation on | <i>Aim:</i> Examined whether there was an incremental effect on blood pressure control when using a nurse clinic combined with telephone follow-up. | <i>Primary outcomes</i> Differences in reduction of blood pressure reading. <i>Secondary outcomes:</i> 1) Blood pressure monitoring 2) Exercise | <i>Critical appraisal tool used:</i> Critical Appraisal Skills Programme randomised controlled trial study tool. A relevant design was used to investigate a clearly directed problem. | <i>Primary outcomes:</i> The intervention group achieved a significant reduction in systolic and diastolic blood pressure. The differences between systolic and diastolic blood pressure were, |

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| <p>hypertension: A randomised trial.</p> <p><i>International Journal of Nursing Studies</i></p> <p>47(11): 1374-1382</p> | <p><i>Design:</i></p> <p>Randomised control trial.</p> <p><i>Setting:</i></p> <p>A family medicine clinic in the public hospital system of Hong Kong.</p> <p><i>Sample:</i></p> <p>63 Subjects, (n=31) intervention and (n=32) control group.</p> <p><i>Inclusion criteria:</i></p> <p>1) Referred by physicians at the family physician clinic with poor blood pressure control or newly diagnosed</p> <p>2) Confirmed to have a reading of systolic blood pressure over</p> | <p>3) Diet compliance</p> <p>4) Medication</p> <p>5) Satisfaction with care</p> <p><i>Data collection:</i></p> <p>Was done by two nurses at the baseline visit and at eight weeks. The satisfaction questionnaire was delivered by a clinic assistant who was blind to the grouping prior to the second nurse clinic visit. The nurse who ran the clinic assigned a score to each aspect of adherence, complete adherence 2 and non-adherence 0. Exercise should be performed 30 min/day, diet adherence included salt restriction, control of fat intake and fruit and vegetable consumption. Medication was measured on dose, frequency and timing of taking. Home blood pressure was measured on frequency and time.</p> | <p>Patients were randomised using sets of computer-generated random numbers. The numbers were placed in sealed envelopes and the allocation of treatment was only known after the patient entered to the study.</p> <p>All the patients who were recruited to the trial were reported on at the end of the study.</p> <p>There was no significant difference in the baseline characteristics between the intervention and control groups.</p> <p>Data collection was finished and the results are clearly and accurately presented in table form.</p> <p>The application to context is possible with certain adaptations.</p> | <p>-19.03 mmHg ($p < 0.0001$) and -11.68 mmHg ($p < 0.0001$) respectively.</p> <p><i>Secondary outcomes:</i></p> <p>1) Home blood pressure measurement improved ($Z = -5.29, p < 0.0001$)</p> <p>2) Exercise increased ($Z = -4.60, p < 0.0001$)</p> <p>3) Diet compliance improved ($Z = -2.71, p < 0.0007$)</p> <p>4) Medication adherence improved ($Z = -2.00, p = 0.046$)</p> <p>5) Satisfaction with care improved (m 39.32, SD 5.30)</p> <p><i>Limitations:</i></p> <p>1) Subjects were in early stage of being diagnosed with hypertension and intervention should be tested in patients with longer history of hypertension.</p> |

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| | <p>90 mmHg at the nurse clinic</p> <p>3) Able to communicate</p> <p>4) Alert and orientated</p> <p>5) Able to be contacted by telephone at home</p> <p><i>Exclusion criteria:</i></p> <p>1) Not able to communicate</p> <p>2) Old-age-home residents</p> | <p><i>Intervention group:</i></p> <p>Routine Blood pressure nurse clinic consultation and two phone calls to the patients every 2-3 weeks during the 8 weeks:</p> <p>1) addressing the patient's health condition</p> <p>2) Assessing the blood pressure readings, healthy lifestyle and goals</p> <p>3) Reinforcing health self-management, health advice and assessing the need for referrals</p> <p>4) Reviewing and revising goals</p> <p>5) Encouraging and arranging time for next telephone call</p> <p><i>Control group:</i></p> <p>Usual care</p> <p><i>Data analysis:</i></p> <p>Baseline data between groups was compared by Chi-square</p> | <p><i>Score on appraisal tool:</i></p> <p>10/11</p> <p>Included</p> <p>Level of evidence: I</p> | <p>2) Small sample size, selected from only one family clinic, weak power of 0.5.</p> <p>3) Generalisation should be done with caution.</p> <p>4) Two different nurses were used to provide care for the control and intervention groups, individual differences might play a role in the outcomes.</p> <p><i>Recommendations:</i></p> <p>The sustained effect of the intervention needs to be established in further studies.</p> |

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| | | test and independent <i>t</i> -tests. The differences between means and relative ranking of values were measured by the <i>t</i> -tests and Wilcoxon signed test. Difference in means and ranked scores measured by independent <i>t</i> -tests and Mann-Whitney <i>U</i> -test. Multivariate linear regression analysis was used to detect factors contributing to improved systolic blood pressure. All the data was analysed using SPSS 11.1 for Windows. | | |
| Liu, W.T., Wang, C.H., Lin, H.C., Lin, S.M., Lee, K.Y., Lo, Y.L., Hung, S.H., Chang, Y.M., Chung, K.F. & Kuo, H.P. 2008 Efficacy of a cell phone-based exercise programme for COPD | <i>Aim:</i> Efficacy of a cell-phone-based exercise programme for COPD. <i>Design:</i> Pilot study randomised control trial. | <i>Primary outcomes:</i> 1) Exercise training change in distance in incremental shuttle walking test from baseline value. 2) Walking distance. 3) Breathlessness. 4) Short form 12 physical component summary at one year. | <i>Critical appraisal tool used:</i> Critical Appraisal Skills Programme randomised controlled trial study tool. A suitable design was applied to a clearly focussed problem. <i>Randomisation:</i> Patients assigned to the cell phone group according to a | <i>Primary outcome:</i> 1) Significant difference in incremental shuttle walking test ($p < 0.001$). 2) Significant increase in the walking distance and improvement lasted for 9 months until end of the self-management period (306.7±21.2 m, $p < 0.001$). |

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| <p><i>The European Respiratory Journal</i> 32(3): 651-659</p> | <p><i>Setting:</i> Not provided.</p> <p><i>Sample:</i> 48 patients, (n=24) in the intervention group and (n=24) in the control group</p> <p><i>Inclusion criteria:</i> 1) Moderate to severe COPD. 2) >40 years old</p> <p><i>Exclusion criteria:</i> 1) Acute exacerbation or treatment with corticosteroids for ≥3 months prior to study 2) <40 years and >80 years 3) Requiring for oxygen therapy</p> | <p><i>Data collection:</i> The intervention group completed questionnaires via cell phone regarding respiratory symptoms, including breathlessness, cough and sputum before starting exercise. Pulmonary function testing was performed at start of the study, every 4 weeks first 3 months and at the end of the self-management period, during clinical visits. The forced vital capacity, forced expiratory volume in one second inspiratory capacity and breathlessness were measured before and after the incremental shuttle walking test. Walking distance, body mass index and Short Form -12 was also recorded.</p> <p><i>Intervention group:</i> Patients were asked to undertake daily endurance exercise training with cell phone</p> | <p>table of random numbers at the start of the study.</p> <p>All patients who entered the trial were accounted for at the end of the study.</p> <p>The intervention and control groups were similar at baseline.</p> <p>Data collection was done and the results were clearly and accurately presented.</p> <p>Application to the context is possible.</p> <p><i>Score on appraisal tool:</i> 10/11 Included Level of evidence: I</p> | <p>3) Breathlessness measured by the Borg scale significantly decreased at the self-management period (3.2±0.2 versus 3.9±0.2, $p<0.05$).</p> <p>4) Significant decrease of SF-12 physical component summary at 1 year (30.9±2.2, $p<0.05$).</p> <p>The distance walked in the incremental shuttle walking test by the intervention group was significantly greater than that of the control group after 12 and 52 weeks of home exercise training.</p> <p><i>Limitations:</i> 1) Small sample size makes generalisation difficult. 2) Intervention is not suitable for patients with visual or hearing impairment and patients not able to operate a cell phone. 3) It cannot be guaranteed that the patient was actually walking during</p> |

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| | <p>4) Symptomatic cardiovascular disease</p> <p>5) Systemic diseases limited exercise capacity</p> <p>6) Use of medication limited exercise performance</p> <p>7) Impaired hearing or vision</p> | <p>assistance. The level of endurance walking was reassessed and readjusted at return clinical visits every 4 weeks during the first 3 months for the following 9 months. No telephone reinforcement was made during this period, monitoring done on the website.</p> <p><i>Control group:</i></p> <p>Received same protocol but was asked verbally to undertake daily exercise.</p> <p><i>Data analysis:</i></p> <p>The repeated measures test of ANOVA was used to compare data within groups. The two-tailed unpaired t-test or non-parametric Mann-Whitney U-test was applied to compare results between groups. Statistical significance was defined as $p < 0.05$. all data was presented as the mean \pmSEM.</p> | | <p>the whole duration of music played.</p> <p><i>Recommendations:</i></p> <p>The significant clinical benefits need to be confirmed in a larger study. Good compliance may encourage establishment of a more comprehensive telemedicine model for long-term home-based rehabilitation programmes and monitoring systems.</p> |

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| Bibliographic detail | Methodology | Outcomes and intervention | Critical appraisal/ Level of evidence | Study findings |
| <p>Thompson, N.J., Patel, A.H., Selwa, L.M., Stoll, S.C., Begley, C.E., Johnson, E.K., & Fraser, R.T.</p> <p>2015</p> <p>Expanding the efficacy of Project UPLIFT: Distance delivery of mindfulness-based depression prevention to people with epilepsy</p> <p><i>American Psychological Association, Journal of Consulting and Clinical Psychology</i></p> <p>83(2): 304-313</p> | <p><i>Aim:</i></p> <p>Evaluating the efficacy of a mindfulness-based cognitive therapy intervention for preventing major depressive disorder episodes in people with epilepsy.</p> <p><i>Design:</i></p> <p>Randomised, controlled, cross-over design.</p> <p><i>Setting:</i></p> <p>Georgia, Michigan, Texas and Washington.</p> | <p><i>Primary outcome:</i></p> <p>Assess the effectiveness of Project UPLIFT for:</p> <ol style="list-style-type: none"> 1) Depressive symptoms decrease and preventing the incidence of depressive episodes in adults with epilepsy. 2) Neurological disorders depression inventory for epilepsy. 3) Incidence of major depressive disease episodes. <p><i>Secondary outcome:</i></p> <p>Expand the use of Project UPLIFT to three additional states.</p> <p><i>Data collection:</i></p> <p>All patients were assessed at baseline, 9-10 weeks and 18-20 weeks by the facilitators.</p> | <p><i>Critical appraisal tool used:</i></p> <p>Critical Appraisal Skills Programme randomised controlled trial study tool.</p> <p>An appropriate model was used to study a clearly focussed problem.</p> <p>Randomisation of patients were stratified by whether they were on antidepressants or in psychotherapy.</p> <p>All the patients were reported on at the completion of the study.</p> <p>The intervention and control groups were similar at baseline.</p> <p>Data gathering was done and the outcomes portrayed recognisably and truthfully.</p> | <p><i>Primary outcome:</i></p> <ol style="list-style-type: none"> 1) Decrease in depressive symptoms was significant in the modified Beck Depression Inventory, Beck Depression Inventory and Patient Health Questionnaire-9 (F1,104= 3.895, $p=0.050$). 2) Neurological Disorders Depression Inventory for Epilepsy improved (F1, 50=0.02, $p=0.88$). 3) Incidence of major depressive disease episodes decreased 0/52 (0%, 95%c.i.:0.0%-6.9%). <p><i>Secondary outcomes:</i></p> <p>The project UPLIFT was expanded to 3 other states and the outcomes did not differ between the states.</p> <p><i>Limitations:</i></p> <ol style="list-style-type: none"> 1) Due to the crossover design, only the analyses before crossover could employ a control condition |

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| | <p><i>Sample:</i></p> <p>118 patients (n=62) intervention group and (n=56) control group.</p> <p><i>Inclusion criteria:</i></p> <p>1) Diagnosed with epilepsy</p> <p>2) At least 3 months post initial diagnosis of epilepsy and either on medication or physician-approved to participate</p> <p>3) Symptoms of depressions, but absence of moderate-to-severe depression on the Center for Epidemiologic Studies-Depression scale or Major Depressive Disorder according to the Patient Health Questionnaire-9</p> <p>4) 21 years and older</p> <p>5) English speaking</p> | <p>Main outcome measure was the modified Beck Depression Inventory.</p> <p>The 6-item Neurological Disorders Depression Inventory for Epilepsy, eliminating items that might overlap with cognitive deficits or side effects of seizure medications.</p> <p>Patient Health Questionnaire-9. 18 true and false items assessing depression knowledge.</p> <p>13 Likert-scaled skills items.</p> <p>24-item Depression Coping Self-Efficacy Scale. Self-Compassion scale. Satisfaction with Life Scale.</p> <p>14 items from the Behavioral Risk Factor Surveillance System.</p> <p><i>Intervention group:</i></p> <p>Weekly telephone sessions at a scheduled time. Reminder calls before each session.</p> <p>The web-based intervention: The patients could only access the course they were enrolled in. If a</p> | <p>The implementation is possible to the context.</p> <p><i>Score on appraisal tool:</i></p> <p>10/11</p> <p>Included</p> <p>Level of evidence I</p> | <p>and the follow-up period was only 10 weeks.</p> <p>2) Intervention was compared to TAU condition rather than another active intervention, resulting in several limitations</p> <p>3) Only four states participated, with one or two referral clinics.</p> <p>4) Distance delivery allows treatment for patients across state lines, mental health professionals are licensed at state level, thus locations must be restricted.</p> <p><i>Recommendations:</i></p> <p>No recommendations made by the researchers.</p> |
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| | <p>6) Access to a telephone</p> <p>7) Mentally stable, as determined by a score of >23 on the telephone version of the Mini-Mental Status Examination</p> <p><i>Exclusion criteria:</i></p> <p>1) Too depressed</p> <p>2) Expressed suicidal ideation</p> | <p>patient did not log in 3 days after session was posted they received a reminder.</p> <p><i>Control Group:</i></p> <p>Usual care.</p> <p><i>Data analysis:</i></p> <p>Data input and management was performed using SPSS version 19.0. All statistical tests were 2-sided and a P value ≤ 0.05 was considered statistically significant. The difference in incidence was assessed using a Fisher's Exact test. Repeated-measures analysis of each outcome used a means model with SAS Proc Mixed. Mediation was assessed using the student version of LISREL 8.8. Model fit was determined by examining the Satorra- Bentler X^2.</p> | | |

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| Bibliographic detail | Methodology | Outcomes and intervention | Critical appraisal/ Level of evidence | Study findings |
| <p>Gellis, Z.D., Kenaley, B.L. & Have, T. T.</p> <p>2014</p> <p>Integrated telehealth care for chronic illness and depression in geriatric home care patients: The integrated telehealth education and activation of mood (I-TEAM) study</p> <p><i>Journal of the American Geriatrics Society</i></p> <p>62(5): 889-895</p> | <p><i>Aim:</i></p> <p>To evaluate an integrated telehealth intervention (Integrated Telehealth Education and Activation of Mood (I-Team)) to improve chronic illness and comorbid depression in the home healthcare setting.</p> <p><i>Design:</i></p> <p>Randomised control trail.</p> <p><i>Setting:</i></p> <p>Hospital-affiliated home healthcare setting. Place not specified.</p> | <p><i>Outcomes:</i></p> <ol style="list-style-type: none"> 1) Depression status 2) Health and functional status 3) Problem-solving coping skills 4) Health utilisation 5) Healthcare outcomes after 12 months. <p><i>Data collection:</i></p> <p>Was done by two trained, blinded graduate research assistants pre-and post intervention.</p> <p>Depression status assessed by Hamilton Depression Rating Scale and Patient Health Questionnaire.</p> <p>Patient Satisfaction Questionnaire.</p> <p>Health and functional status was assessed using the medical outcomes study 12-item Short-</p> | <p><i>Critical appraisal tool used:</i></p> <p>Critical Appraisal Skills Programme randomised controlled trial study tool.</p> <p>A suitable design was applied to a clearly focussed problem.</p> <p>Randomisation done by computerised random number generator, ensuring comparability across conditions.</p> <p>All patients who entered the trial were accounted for at the end of the study.</p> <p>Baseline demographic data between participant groups was examined, and no differences were found.</p> <p>After data collection, the outcomes were precisely depicted.</p> | <p><i>Outcomes:</i></p> <ol style="list-style-type: none"> 1) Depression scores were 50% lower in I-TEAM group at 3 and 6 months ($P=.02$ and $.05$). 2) Health status of I-TEAM improved at 3 and 6 months ($P=.01$ and $.05$). 3) I-TEAM participants significantly improved their problem-solving skills and efficacy in managing their medical condition ($P=.001$) at 3 months. 4) I-TEAM participants had significantly fewer emergency department visits ($P=.01$) but not significantly fewer hospital admissions 12 months after baseline. 5) Healthcare outcomes after 12 months improved ($P=.03$). |

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| | <p><i>Sample:</i></p> <p>Medically frail older homebound individuals (n=57), I-TEAM and (n=58) Usual Care+P</p> <p><i>Inclusion criteria:</i></p> <ol style="list-style-type: none"> 1) 65 and older who were above-average users 2) Primary diagnosis of heart failure or chronic obstructive pulmonary disease 3) Screened positive for depression indicated by Patient Health Questionnaire-2 with score greater than 3 <p><i>Exclusion criteria:</i></p> <ol style="list-style-type: none"> 1) Cognitive impairment 2) Diagnosis of dementia based on chart review | <p>Form Survey - 12 Physical Component and Mental Component subscales.</p> <p>For 75 and older national mean scores are 40.8 and 52.6 respectively.</p> <p>Problem-solving Inventory - Revised.</p> <p><i>Intervention group:</i></p> <p>A 3-month intervention consisted of integrated telehealth chronic illness and depression care, with a telehealth nurse conducting daily telemonitoring of symptoms, body weight and medication use, providing 8-weekly sessions of problem-solving treatment for depression and providing communication with participant's primary care physicians, who also prescribed antidepressants.</p> <p><i>Control group:</i></p> <p>Usual care.</p> <p><i>Data analysis:</i></p> <p>Baseline demographic characteristics were compared</p> | <p>Two trained and blinded research assistants collected pre-and post intervention data. A blinded, trained research interviewer assessed the participants at baseline and 6 months, and a health utilisation was done at 12 months.</p> <p>Application to the context is possible.</p> <p><i>Score on appraisal tool:</i></p> <p>11/11</p> <p>Included</p> <p>Level of evidence I</p> | <p>6) Emergency department visits reduced ($P=.06$), hospital days did not reduce ($P=.10$).</p> <p><i>Limitations:</i></p> <ol style="list-style-type: none"> 1) It was a small sample size and is not generalisable to all home care agencies. 2) The influence of antidepressants, dosage and adherence on the outcomes was not analysed. 3) The amount of interaction with the nurse was not evaluated. <p><i>Recommendations:</i></p> <p>Future investigation of the influence of antidepressants on the outcomes may better clarify its effect.</p> <p>Telehealth service should expand to include populations with a variety of diagnoses.</p> <p>Effect of telehealth monitoring on the outcomes.</p> |
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| | <p>3) Inability to use a telemonitoring device because of physical inability</p> <p>4) Behavioural problems that would interfere with use of the device</p> | <p>using independent-sample <i>t</i>-tests and Chi-square tests.</p> <p>Intention-to-treat analysis was conducted with all randomised participants to assess intervention effectiveness.</p> <p>Random effects regression was the main analytical method used for assessing outcomes and the change between baseline and follow-up measurements to test for the effects of condition, time and interaction the between condition and time. This method controls for baseline score and covariates and includes missing case data.</p> | | |
| <p>Ferrante, D., Varini, S., Macchia, A., Soifer, S., Badra, R., Nul, D., Grancelli, H. & Doval, H.</p> <p>2010</p> | <p><i>Aim:</i></p> <p>To assess the rate of death and hospitalisation for heart failure 1 and 3 years after randomised trial of</p> | <p><i>Outcomes:</i></p> <p>1) To improve diet and treatment compliance.</p> <p>2) Promote exercise.</p> | <p><i>Critical appraisal tool used:</i></p> <p>Critical Appraisal Skills Programme randomised controlled trial study tool.</p> | <p><i>Outcomes:</i></p> <p>1) Significantly more patients in the intervention group were taking Beta-blockers ($p=0.003$), spironolactone ($p=0.03$), digoxin ($p= 0.04$) and furosemide ($p=0.007$).</p> |

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| <p>Long-term results after a telephone intervention in chronic heart failure: DIAL (Randomized Trial of Phone Intervention in Chronic Heart Failure) follow-up</p> <p><i>Journal of the American College of Cardiology</i></p> <p>56(5): 372-378</p> | <p>telephone intervention aimed to improve education and compliance in stable patients with heart failure ended.</p> <p><i>Design:</i></p> <p>Randomised, controlled, open-label, multicentre trial.</p> <p><i>Setting:</i></p> <p>51 participating centres in Argentina.</p> <p><i>Sample:</i></p> <p>1 518 patients, (n=760) in the intervention group and (n=758) in the control group.</p> <p><i>Inclusion criteria:</i></p> <p>Not clearly stated.</p> | <p>3) Regularly monitor symptoms, weight and oedema.</p> <p>4) Promote early visits if signs of clinical deterioration are detected.</p> <p>5) Hospitalisation, and death at 1 year and 3 years.</p> <p><i>Data collection:</i></p> <p>Nurses collected data by completing adherence indicators derived from questionnaire applied at every telephone call.</p> <p>Minnesota Living with Heart Failure Questionnaire. The 3 areas adherence improvement were measured, diet, weight control and medication was rated as having improved 0 indicators, 1, 2, or 3 indicators.</p> <p>All analysis was performed by intention to treat. The effect of the intervention is reported using</p> | <p>The design chosen was applicable and focussed and addressed the problem.</p> <p><i>Randomization:</i></p> <p>All events were assigned by a committee blinded to randomisation status. All the patients were accounted for at the finish of the study. Base-line clinical characteristics and treatment was the same for both groups. Data collection was done and the results were clearly and accurately presented.</p> <p>All events were assigned by a committee blinded to randomisation status. Application to the context is possible.</p> <p><i>Score on appraisal tool:</i></p> <p>11/11</p> <p>Included</p> | <p>82.8% improved regarding medication compliance and 40.7 % improved their diets.</p> <p>2) Improvement is physical domain ($p = 0.007$).</p> <p>3) 34.9% improved in daily weight control.</p> <p>4) Ambulatory visits.</p> <p>5) At one year after trail 19% reduction of incidence ($p=0.013$) and at 3 years 12% significant reduction ($p=0.05$). All-cause mortality was the same for the 2 groups. The clinical benefit of the intervention remained 1 and 3 years after the trial period.</p> <p><i>Limitations:</i></p> <p>1) Optimal compliance in patients was low (15%).</p> <p>2) One limitation could be a biased classification due to the open trail design and head.</p> |

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| | <p><i>Exclusion criteria:</i> Not clearly stated</p> | <p>relative risk and relative risk reduction. <i>Intervention group:</i></p> <p>Patients received an exploratory booklet at randomisation and were followed up with a telephone intervention by specialised nurses. Nurses could adjust diuretic dose and suggest unscheduled visits to the attending cardiologist. Initially, patients were called every 14 days, after fourth call the frequency was adjusted according to severity of each case and patient compliance. Objectives were to improve diet and medication compliance, promote regular exercise, monitor symptoms, weight and oedema, promote early visits if signs of clinical deterioration were detected.</p> <p><i>Control group:</i></p> <p>Continued treatment with their cardiologist in the same manner</p> | <p>Level of evidence I</p> | <p>3) Physicians could have intensified care for these patients, although unlikely, as prescriptions was similar for both groups.</p> <p><i>Recommendations:</i></p> <p>Patients who change their behaviour early during the intervention are at lower risk of events. In light of the available evidence, the implementation of these programmes could become a standard of care for patients with heart failure.</p> |

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| | | <p>as the intervention group, except for the phone calls and the explanatory booklet.</p> <p><i>Data analysis:</i></p> <p>Characteristics of patients are reported as percentages and mean \pm standard deviation and compared to Pearson Chi-square test and t test for categorical and continuous variables, respectively.</p> <p>All analysis were performed by intention to treat.</p> <p>Primary end point was assessed using the log-rank test and depicted using Kaplan-Meier curves.</p> <p>The effect of the intervention is reported using relative risk and relative risk reduction, and tested using log-rank tests, considering person-time incidence rates.</p> | | |

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| | | <p>Variables were included in a Cox regression model to assess the impact of adherence in the primary end point and HF admissions 3 years after follow-up.</p> <p>All analyses with a p value <0.05 were considered statistically significant.</p> | | |
| <p>Nguyen, H.Q., Gill, D.P., Wolpin, S., Steele, B.G. & Benditt, J.O. 2009</p> <p>Pilot study of a cell phone-based exercise persistence intervention post-rehabilitation for COPD</p> <p><i>International Journal of Chronic Obstructive Pulmonary Disease</i></p> | <p><i>Aim:</i></p> <p>To determine the feasibility and efficacy of a six-month, cell-phone-based exercise persistence intervention for patients with COPD following pulmonary rehabilitation.</p> <p><i>Design:</i></p> <p>Randomised repeated measures exploratory study</p> | <p><i>Outcomes:</i></p> <ol style="list-style-type: none"> 1) Incremental cycle test 2) Six-minute walk 3) Total steps/day 4) % Active time at moderate to high 5) Peak performance 6) St George's respiratory total score 7) SF-36 Composite physical functioning. | <p><i>Critical appraisal tool used:</i></p> <p>Critical Appraisal Skills Programme randomised controlled trial study tool.</p> <p>The trial addressed a clearly focussed issue.</p> <p>Randomisation performed by a biostatistician who was not involved in the day-to-day study operations, who generated the randomisation sequence and placed the randomisation in separate, sealed, opaque envelopes.</p> | <p><i>Outcomes:</i></p> <ol style="list-style-type: none"> 1) Incremental cycle test improved: Baseline: 54.4±7.9, 6 months: 48.9±7.9, ($p=0.29$). 2) Six-minute walk improved: Baseline: 1 240±125, 6 months: 1 194±125, ($p=0.12$). 3) Total steps per day improved: Baseline: 6 692±1 007, 6 months: 5 675±1 007 ($p=0.04$). 4) % Active time increased: Baseline: 27.1±2.6, 6 months: 23.6±2.6, ($p=0.003$). |

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| 4: 301-313 | <p><i>Setting:</i> Not clearly stipulated</p> <p><i>Sample:</i> 17 participants MOBILE-coached (n=9) and MOBILE-Self-Monitored (n=8)</p> <p><i>Inclusion criteria:</i></p> <ol style="list-style-type: none"> 1) Stable COPD 2) Pulmonary function results show moderate to severe disease according to GOLD criteria 3) No plans to participate in a maintenance programme 4) Patients receiving supplemental oxygen were acceptable if their O₂ saturation | <p>8) SF-36 Composite mental functioning.</p> <p><i>Data collection:</i> The participants completed one-item questions assessing their satisfaction with rehabilitation's effects on their overall health, expectations that persisting with exercise would help maintain their health, perceived importance, motivation and confidence to continue their exercise.</p> <p>Support for exercise was measured by a 13-item Social Support and Exercise Survey.</p> <p>Exercise performance was assessed using the six-minute walk and incremental cycle ergometer tests.</p> <p>Free- living ambulatory physical activity was measured using a</p> | <p>The randomisation scheme was stratified by gender.</p> <p>All patients who entered the trial were properly accounted for at the end.</p> <p>The intervention and control groups were not similar by age and disease severity, at baseline.</p> <p>Data collection was done and the results are clearly and accurately presented.</p> <p>The research assistant performing the outcome assessments was blinded to the group assignment. The interventionist was, however, not blinded.</p> <p>The results can be applied to the local population.</p> <p><i>Score on appraisal tool:</i> 8/11</p> | <p>5) Peak performance improved: Baseline: 68.4±5.0, 6 months: 56.6±5.0, ($p=0.002$).</p> <p>6) St George's respiratory total score showed improvement: Baseline: 38.3±4.7, 6 months: 41.7±4.7, ($p=0.15$).</p> <p>7) ST-36 Composite physical functioning improved Baseline: 32.8±2.3. 6 months: 33.8±2.3, ($p=0.51$).</p> <p>8) SF-36 Composite mental functioning improved: Baseline: 50.6±3.8, 6 months: 46.9±3.8 ($p=0.38$).</p> <p><i>Limitations:</i></p> <ol style="list-style-type: none"> 1) Small sample size and self-selected nature of sample are important limitations of this exploratory study; small sample size may have created a situation where outliers adversely influenced the mean estimates. |

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| | <p>was maintained at >88% on >6 L/min of nasal oxygen during the 6 minute walk test</p> <p>5) Age ≥40 years</p> <p>6) Ability to speak, read and write English</p> <p>6) Permission given by health provider</p> <p><i>Exclusion criteria:</i></p> <p>1) Active symptomatic illness</p> <p>2) Unable or unwilling to use the study issued cell phone</p> <p>3) Resided outside the wireless coverage area</p> | <p>pager-sized, lightweight, Stepwatch 3 Activity Monitor.</p> <p><i>Intervention and control group:</i></p> <p>MOBILE – C group consisted of collaborative monitoring of symptoms and exercise and ongoing feedback with reinforcement text messages weekly.</p> <p>MOBILE – SM group participants continued to use the cell phone to enter data about their symptoms and exercise.</p> <p>A standard text message was sent to participants each week for six months.</p> <p><i>Data analysis:</i></p> <p>Independent Student's t-tests or Chi-squared tests were used to compare baseline characteristics between groups.</p> <p>General linear mixed models, as well-established class of linear</p> | <p>Included</p> <p>Level of evidence I</p> | <p>2) Participants did not always carry the test phone with them and, thus, reminders was missed and participants forgot to log their daily information, not maximising the full potential of the cell phone.</p> <p>3) Patients referred by pulmonary rehabilitation coordinators are highly motivated individuals, and selecting participants from the pulmonary rehabilitation programme might have introduced heterogeneity in baseline characteristics.</p> <p><i>Recommendations:</i></p> <p>Primary methodological challenge for future research on any technology-mediated clinical or behavioural intervention is rapid changes in the technologies themselves, which could undermine both internal and external study validity.</p> |

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| | | <p>models particularly suited for longitudinal repeated measures data, which does not exclude individuals with missing data, were used to estimate the effect of treatment, adjusting for individual variation in the outcomes of exercise, performance, physical activity and Health related quality of life.</p> <p>Significance was determined using Wald tests ($p < 0.05$). No alpha levels were adjusted.</p> | | |
| <p>Young, H., Miyamoto, S., Ward, D., Dharmar, M., Tang-Feldman, Y & Berglund, L.</p> <p>2014</p> <p>Sustained effects of a nurse coaching intervention via telehealth to improve</p> | <p><i>Aim:</i></p> <p>To evaluate the benefits of nurse telehealth coaching for persons with diabetes living in rural communities through a person-centred approach using motivational</p> | <p><i>Outcomes:</i></p> <ol style="list-style-type: none"> 1) Self-efficacy 2) Physical health 3) Mental health 4) Satisfaction with diabetes care <p><i>Data collection:</i></p> <p>Done by mailing surveys to patients, using a self-addressed</p> | <p><i>Critical appraisal tool used:</i></p> <p>Critical Appraisal Skills Programme randomised controlled trial study tool.</p> <p>The applicable design was relevant to the clearly focussed problem.</p> <p>Randomisation conducted by mailing consent forms to interested participants and on</p> | <p><i>Outcomes:</i></p> <ol style="list-style-type: none"> 1) Intervention group higher self-efficacy score relative to the control group ($p < 0.05$). 2) A trend towards a higher score for physical health ($p < 0.08$). 3) Not a significant difference in mental health in the intervention group ($p = 0.44$). |

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| <p>health behavior change in diabetes</p> <p><i>Telemedicine Journal And E-Health: The Official Journal of The American Telemedicine Association</i></p> <p>20(9): 828-34</p> | <p>interviewing techniques.</p> <p><i>Design:</i></p> <p>A randomised experimental study design</p> <p><i>Setting:</i></p> <p>Six rural federally qualified health center community clinics in northern and central California</p> <p><i>Sample:</i></p> <p>101 participants, (n=51) intervention group and (n=50) control group</p> <p><i>Inclusion criteria:</i></p> <p>1) Registered at one of the sites for care</p> | <p>return envelope, baseline, 16 weeks and 9 months.</p> <p>Outcomes were measured in both groups using the Diabetes Empowerment Scale, Short Form-12 and satisfaction surveys.</p> <p>Mean scores for each outcome were measured at baseline, 16 weeks and 9 month follow-up for both groups.</p> <p><i>Intervention group:</i></p> <p>Nurse telehealth coaching for 5 sessions. Two modes of meeting with their nurse coach were offered, by telephone or face-to-face videoconference. Calls were scheduled every 2 weeks for five sessions average 30 minutes.</p> <p>Participants were encouraged to choose one behaviour change area and realistic goals were set for the duration of the study and guidance was provided to</p> | <p>return the forms were randomised to the intervention or control group.</p> <p>The patients at the start and end of the study were reported on accurately.</p> <p>The intervention and control groups were similar at baseline.</p> <p>The outcomes were clearly and accurately depicted after data collection had been completed.</p> <p>The study can be applied to the current context.</p> <p><i>Score on appraisal tool:</i></p> <p>10/11</p> <p>Included</p> <p>Level of evidence I</p> | <p>4) Regarding satisfaction with diabetes care, the intervention group trend toward higher satisfaction ($p=0.71$).</p> <p><i>Limitations:</i></p> <p>1) Low response rate at 16 weeks follow-up.</p> <p>2) Self-reporting bias, where participants might report results to match goals set.</p> <p>3) Lack of measurement of clinical outcomes. In partnering with different clinics the researchers were unable to mandate regular visits or biometric testing at specified intervals to elicit information about the impact of the study to determine the feasibility of offering specialised care in rural communities remotely.</p> <p><i>Recommendation:</i></p> <p>An important next step is integrating the efforts of the</p> |

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| | <p>2) Over 18 years of age</p> <p>3) Diagnosis of either Type 1 or 2 diabetes</p> <p>4) Able to speak English or Spanish</p> <p>5) Has a telephone</p> <p><i>Exclusion criteria:</i></p> <p>1) Self-identified vision or literacy challenges</p> <p>2) Hearing problems</p> | <p>generate reasonable solution to overcome barriers. Most participants chose nutrition or physical activity as a target.</p> <p><i>Control group:</i></p> <p>Usual care</p> <p><i>Data analysis:</i></p> <p>Baseline characteristics were compared between the individuals in the telehealth, health behaviour coaching and usual care.</p> <p>Comorbidity score was calculated for each participant to assess the burden of coexisting disease, each coexisting condition was assigned a score of 1.</p> <p>Continuous variables were compared using a Student's <i>t</i> test or the Wilcoxon Signed-Rank <i>t</i> test and categorical variables were compared using</p> | | <p>telehealth coach and participant with primary care through communication with the healthcare provider and data sharing within the electronic health record.</p> |

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| | | <p>the Chi-squared test and Fisher's exact test.</p> <p>Self-efficacy scores, physical and mental health composite scores, and satisfaction with diabetes care scores were analysed using the Student's <i>t</i> test.</p> | | |
| <p>Lee, H., Yoon, J.Y., Lim, Y., Jung, H. Kim, S., Yoo, Y., Kim, A. J-J. & Park, H-K.</p> <p>2015</p> <p>The effect of nurse-led problem-solving therapy on coping, self-efficacy and depressive symptoms for patients with chronic obstructive pulmonary disease: a randomised controlled trial</p> <p><i>Age and Ageing</i></p> | <p><i>Aim:</i></p> <p>To examine the effects of nurse-led, problem-solving therapy on coping, self-efficacy and depressive symptoms for patients with COPD.</p> <p><i>Design:</i></p> <p>Randomised controlled trial.</p> <p><i>Setting:</i></p> <p>Three outpatient clinics at a university-</p> | <p><i>Outcomes:</i></p> <p>Problem-orientated coping, self-efficacy and depressive symptoms.</p> <p><i>Data collection:</i></p> <p>Was done by a trained nurse. Interviews were recorded and the research team and principal investigator reviewed the interviews every 10th case.</p> <p>Coping was measured using Jalowiec Coping Scale. The 15 Items of the problem-orientated coping was used in this study.</p> | <p><i>Critical appraisal tool used:</i></p> <p>Critical Appraisal Skills Programme randomised controlled trial study tool.</p> <p>A suitable design was applied to a clearly focussed problem.</p> <p><i>Randomisation:</i></p> <p>Screening yielded 254 participants, who were randomly assigned to the intervention or control groups.</p> <p>A previous meta-analysis study indicated that the mean effect size of problem-solving therapy for depression was</p> | <p><i>Outcomes:</i></p> <p>There were no group differences between the pre- and post tests on problem-orientated coping ($P=0.212$), self-efficacy ($P=0.230$) and depressive symptoms ($P=0.283$).</p> <p>However, the participants in the intervention group reported increased self-efficacy ($P=0.041$) and decreased depressive symptoms ($P=0.009$), despite no group difference.</p> <p><i>Limitations:</i></p> <p>1) The majority of patients were male and from tertiary hospitals</p> |

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| 44(33): 397-403 | <p>affiliated medical centre and two respiratory clinics in South Korea</p> <p><i>Sample:</i></p> <p>(n=254) participants, (n=129) intervention group and (n=125) control group participants</p> <p>151 participants completed the study (n= 78) intervention and (n=73) control</p> <p><i>Inclusion criteria:</i></p> <p>1) 40-80 years</p> <p>2) Diagnosed with COPD based on a pulmonary function test</p> <p>3) Stable condition and expected to live ≥6 months as</p> | <p>The Cronbach's <i>a</i> of the Jalowiec Coping Scale was 0.08.</p> <p>Self-efficacy was measured using the COPD Self-Efficacy Scale, 34 items with scores ranging from 0 low self-efficacy and 5 good self-efficacy. Cronbach's <i>a</i> was 0.96.</p> <p>Depressive symptoms were measured with CES-D, 20 items with 4 point rating scale 0-3. Reliability of CES-D was 0.86.</p> <p><i>Intervention group:</i></p> <p>A registered nurse with ≥3 years clinical experience in internal medicine was chosen as the primary interventionist. The nurse provided individualised intervention through 12 telephone sessions per patient with an interval of 2 weeks over 6 months. The initial sessions lasted 60 minutes and the</p> | <p>0.40[11], (1-β=0.80) at a two tail α= 0.05. This study over-recruited by 25%.</p> <p>All patients who entered the trial were accounted for at the end of the study.</p> <p>The intervention and control groups were similar at baseline.</p> <p>Data collection was done and the results are presented clearly and accurately.</p> <p>Application to the context is possible.</p> <p><i>Score on appraisal tool:</i></p> <p>11/11</p> <p>Included</p> <p>Level of evidence I</p> | <p>where they received optimal care in managing COPD.</p> <p>2) The study had a high dropout rate (41%), the longer period of intervention in this study might have resulted in the higher percentage of dropouts.</p> <p>3) Generalisation must be done with caution.</p> <p><i>Recommendations:</i></p> <p>Further randomised controlled studies with diverse study participants in terms of gender and region and an extended follow-up period are recommended to obtain clear evidence of the effects of nurse-led problem solving therapy for patients with COPD.</p> |

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| | <p>determined by physician specialising in respiratory medicine</p> <p><i>Exclusion criteria:</i></p> <p>1) Severe co-morbid conditions that interfered with walking</p> <p>2) Communication difficulties due to hearing loss or illiteracy</p> | <p>following sessions were 30 minutes.</p> <p>All sessions were recorded and evaluated by the research team, principal investigator and another research nurse. The nurse also kept a case management diary log to maintain consistency of the intervention.</p> <p><i>Control group:</i></p> <p>Usual care from primary care providers</p> <p><i>Data analyses:</i></p> <p>PASW 18.0 was used for data analysis.</p> <p>Levene's test was used to assess the homogeneity of three outcome variables at baseline between the groups.</p> <p>A paired t-test was conducted to examine the difference of the</p> | | |

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| | | means between pre-and post test scores in each group. To examine the intervention effect by group, regression analysis was utilised using post-test scores, dependent and independent variable. | | |
| Dale, L. P., Whittaker, R., Jiang, Y., Stewart, R., Rolleston, A. & Maddison, R. 2015 Text message and internet support for coronary heart disease self-management: Results from the Text4Heart randomized controlled trial. <i>Journal of Medical Internet Research</i> | <i>Aim:</i> To investigate the effectiveness of a mHealth-delivered comprehensive cardiac rehabilitation (CR) program (Text4Heart) to improve adherence to recommended lifestyle behaviours (smoking cessation, increasing physical activity, healthy diet and nonharmful alcohol use) in addition to usual care | <i>Primary outcomes:</i> Lifestyle behaviour changes <i>Secondary outcomes:</i> 1) Clinical and psychological outcomes 2) Cholesterol 3) Cardiovascular risk probability 4) Medication adherence and psychological outcomes <i>Data collection:</i> Smoking history questionnaire, scored 0 not currently smoking, 1 had a cigarette past 7 days. | <i>Critical appraisal tool used:</i> Critical Appraisal Skills Programme randomised controlled trial study tool. A suitable design was applied to a clearly focussed problem. <i>Randomisation:</i> Following informed consent and the baseline assessment, participants were randomised in a one-to-one ratio and stratified according to smoking status. The randomisation sequence was computer generated by a statistician independent to the project | <i>Primary outcomes:</i> The intervention group increased adherence to recommended lifestyle behaviour changes from 33% to 53% at 6 months. <i>Secondary outcomes:</i> 1) No differences in clinical or other psychological outcomes. Intervention group reported significantly greater hospital anxiety ($p=.01$). 2) Intervention group had lower low-density lipoprotein cholesterol ($p=.05$), |

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| 17(10): 1-11. | <p>(traditional cardiac rehabilitation).</p> <p><i>Design:</i></p> <p>A 2-arm, parallel, randomised controlled trial</p> <p><i>Setting:</i></p> <p>Two large metropolitan hospitals in Auckland, New Zealand</p> <p><i>Sample:</i></p> <p>Eligible patients (n=123), intervention (n=61) and control (n=62)</p> <p><i>Inclusion criteria:</i></p> <p>1) English-speaking adults with a diagnosis of chronic heart disease</p> | <p>Fruit and vegetable intake 1 \geq5 servings daily 0 \leq4 servings.</p> <p>Alcohol intake 1 \leq 13 units per week, 0 \geq 14.</p> <p>Physical activity 1 \geq14 units of moderate-to vigorous activity/week, 0 \leq13 units measured by the Godin Leisure Time Physical Activity Questionnaire.</p> <p>Secondary outcome, Morisky 8-item Medication Adherence Questionnaire and Brief Illness Perception Questionnaire.</p> <p><i>Intervention group:</i></p> <p>Usual care plus a 24-week mHealth programme sent by automated daily text messages and access to a supporting website commencing within a week of the baseline assessment.</p> | <p>using a block size of 6. Allocation was concealed in sequentially numbered, opaque, sealed envelopes.</p> <p>All patients who entered the trial were accounted for at the end of the study.</p> <p>The intervention and control groups were similar at baseline.</p> <p>Data collection was done and the results are presented clearly and accurately.</p> <p>Participants and outcome assessors were not blinded to the treatment allocation. Investigators, project statisticians and usual care cardiac rehabilitation programme leaders were blinded to group allocation.</p> <p>Application to the context is possible.</p> | <p>3) There were 13 (n=8 intervention and n=5 control) serious adverse events reported during the trial, although none were study-related.</p> <p>4) The intervention group reported a significantly greater medication adherence score ($p=0.04$).</p> <p><i>Limitations:</i></p> <p>1) The outcome assessors were not blinded.</p> <p>2) The primary outcome measure was self-reported so recall bias is possible.</p> <p>3) The composite score did not capture all aspects of behaviour</p> <p>4) The findings might not be transferable to other populations because the sample was predominantly New Zealand European, earned higher than the average yearly income and were generally text message and computer literate.</p> |

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| | <p>2) Access to the Internet</p> <p><i>Exclusion criteria:</i></p> <p>1) Untreated ventricular tachycardia</p> <p>2) Severe heart failure</p> <p>3) Life-threatening coexisting disease with life expectancy less than 1 year</p> <p>4) Significant exercise limitations for reasons other than chronic heart disease</p> | <p>Patients were educated about their cardiovascular risk and they were supported to make lifestyle changes.</p> <p>Participants had to measure their physical activity using a pedometer. All participants were phoned at 3 months post randomisation to collect primary outcome data, no telephone coaching was done. At 6 months participants were seen at a clinic or in a home setting for final follow-up assessment.</p> <p>Participants received a pedometer for self-monitoring activity. Seven text messages were send per week and reduced to 5 for weeks 13-24. Text messages were bi-directional. The messages regarding steps were automated but the questions were responded to personally.</p> | <p><i>Score on appraisal tool:</i></p> <p>10/11</p> <p>Included</p> <p>Level of evidence I</p> | <p><i>Recommendations:</i></p> <p>A larger study with longer follow-up is needed to determine whether these behaviour changes can result in clinically significant outcomes.</p> |

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| Bibliographic detail | Methodology | Outcomes and intervention | Critical appraisal/ Level of evidence | Study findings |
| | | <p><i>Control group:</i></p> <p>Usual care alone</p> <p><i>Data analysis:</i></p> <p>Treatment evaluations were analysed by intention to treat, using the observed data collected from all randomised participants. Missing data was not imputed if less than 10%. All statistical analyses used SAS version 9.3. All statistical tests were 2-sided at a 5% significance level. Logistic regression was used to measure the main treatment effect.</p> | | |
| <p>Akhu-Zaheya, L. M. & Shiyab, W.Y.</p> <p>2017</p> <p>The effect of short message system (SMS) reminder on adherence to a healthy diet, medication, and</p> | <p><i>Aim:</i></p> <p>To assess the effects of SMS reminders on adherence to a healthy diet, medication, and cessation of smoking among adult patients</p> | <p><i>Outcomes:</i></p> <ol style="list-style-type: none"> 1) Medication, adherence 2) Adherence to the Mediterranean diet 3) Smoking cessation | <p><i>Critical appraisal tool used:</i></p> <p>Critical Appraisal Skills Programme randomised controlled trial study tool.</p> <p>An appropriate design was applied to a clearly focussed research problem.</p> | <p><i>Outcomes:</i></p> <ol style="list-style-type: none"> 1) The intervention group had a significant effect on medication adherence ($p=.001$). 2) The same result was reported for the healthy diet ($p<.05$). |

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| Bibliographic detail | Methodology | Outcomes and intervention | Critical appraisal/ Level of evidence | Study findings |
| <p>cessation of smoking among adult patients with cardiovascular diseases</p> <p><i>International Journal of Medical Informatics</i></p> <p>98: 65-75.</p> | <p>with cardiovascular diseases.</p> <p><i>Design:</i></p> <p>Randomised control trial.</p> <p><i>Setting:</i></p> <p>University teaching affiliated hospital in the north of Jordan.</p> <p><i>Sample:</i></p> <p>160 Patients (n=52) in the experimental group, (n= 52) in the placebo group and (n=56) in the control group.</p> <p><i>Inclusion criteria:</i></p> <p>1) Outpatient with cardio vascular disease</p> | <p><i>Data collection:</i></p> <p>The researcher and research assistant collected data at baseline and 3 months. Tools used were the following:</p> <ol style="list-style-type: none"> 1) Morisky 8-Item Medication Adherence Scale 2. A self-report questionnaire. 3. Mediterranean Diet Adherence Screener. 4. Readiness to Quit Smoking Ladder. <p>Inferential statistics using the ANOVA and <i>t</i>-test was used to assess research hypothesis.</p> <p><i>Intervention group:</i></p> <p>The participants in the intervention group received 3 reminder messages via cell phone daily. The first message was about medication (according to its frequency), the second</p> | <p><i>Randomisation:</i></p> <p>Patients were given numbers from 1-180; by shuffling, numbers were randomly selected and assigned to participants. Patients were allocated to the three groups randomly.</p> <p>All the study participants were reported on at start and end of the study.</p> <p>The intervention, placebo and control groups were similar at baseline except for the placebo group having a larger income than the other groups.</p> <p>The results of the trial are valid.</p> <p>The results will help locally.</p> | <p>3) There were no significant differences between groups regarding the intent to quit smoking ($p>.05$).</p> <p>No significant differences were found between the groups regarding the number of cigarettes smoked.</p> <p><i>Limitations:</i></p> <ol style="list-style-type: none"> 1) Although text messaging is able to reach many participants individually and at a scheduled time, it rarely allows for active communication. 2) Some participants felt that the frequent messages interrupted their private time and, to some extent, was repetitive and boring. 3) The current study had difficulty detecting changes in participants' health status. Failing to update the participants' health-related events |

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| Bibliographic detail | Methodology | Outcomes and intervention | Critical appraisal/ Level of evidence | Study findings |
| | <p>2) Male and female 18 years and older</p> <p>3) Active phone number and mobile phone</p> <p>4) Can receive text messages via cell phone</p> <p>5) Able to read and write</p> <p>6) Diagnosed with cardio vascular disease at least 3 months ago</p> <p>7) Willing to sign consent form</p> <p><i>Exclusion criteria:</i></p> <p>1) Other co-morbidities</p> <p>2) Neurological and mental disorders</p> | <p>message was about diet, importance of benefit of maintaining a healthy diet and the third message was about smoking cessation (harm caused by of smoking and second-hand smoking and encouragement to quit). Messages were programmed and sent to the patients automatically. Content of the message provided by researchers. The placebo group received general health messages and the control group received usual care.</p> <p><i>Control group:</i></p> <p>Usual care</p> <p><i>Data analysis:</i></p> <p>Data was analysed using the Statistical Package for Social Science version 21 for Windows. The level of significance for the study was set at the.05. Inferential statistics using the</p> | <p><i>Score on appraisal tool:</i></p> <p>11/11</p> <p>Included</p> <p>Level of evidence I</p> | <p>might prevent text messages from approach its goals.</p> <p>4) The last limitation is self-reporting bias in completing the self-report questionnaire. Participants might answer positively to some questions to appear to be good patients.</p> <p><i>Recommendations:</i></p> <p>Further study is needed to replicate the current study.</p> |

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| Bibliographic detail | Methodology | Outcomes and intervention | Critical appraisal/ Level of evidence | Study findings |
| | | ANOVA and t-test was used to assess the research hypothesis. | | |
| <p>Sabin, L.L., Bachman D.M., Gill, C.J., Zhong, L., Vian, T., Xie, W., Cheng, F., Xu, K., Lan, G., Haberer, J.E., Bangsberg, D.R., Li, Y., Lu, H. & Gifford, A.L.</p> <p>2015</p> <p>Improving adherence to antiretroviral therapy with triggered real-time text message reminders: The China Adherence Through Technology Study</p> <p><i>Journal of Acquired Immune Deficiency Syndromes</i></p> <p>69(5): 551-559</p> | <p><i>Aim:</i></p> <p>To assess the effect of triggered cell-phone reminders and counselling utilising objective adherence on antiretroviral adherence among Chinese HIV-infected patients.</p> <p><i>Design</i></p> <p>Randomised controlled trial.</p> <p><i>Setting:</i></p> <p>Guangxi Centre for Disease Control and Prevention anti-retroviral therapy clinic in Nanning, China.</p> | <p><i>Primary outcome</i></p> <p>The difference in the proportion of intervention and control subjects achieving optimal on-time adherence post-intervention >95%</p> <p><i>Secondary outcome:</i></p> <p>Post intervention differences in CD4-cell count and UDVL, and change in CD4-cell count from baseline to month 9 between arms.</p> <p><i>Data collection:</i></p> <p>Adherence counsellors collected data monthly when patients visited the clinic, for 6 months. Electronic adherence monitoring through the trial.</p> <p>The primary analysis was by intention to treat, a secondary</p> | <p><i>Critical appraisal tool used:</i></p> <p>Critical Appraisal Skills Programme randomised controlled trial study tool.</p> <p>The design was suitable and was directed towards a specific problem.</p> <p><i>Randomisation</i></p> <p>Performed on site, through a block randomisation procedure in which the site coordinator pulled an unmarked allocation envelope, the inside of which had a single paper stamped with either “intervention” or “control”, from a larger envelope that originally held 10 such allocation envelopes, five for each arm. When each envelope was empty, it was</p> | <p><i>Primary outcomes:</i></p> <p>1) In the last intervention month 87.3% achieved optimal adherence ($p=0.003$), mean adherence was 93.3% ($p=0.039$).</p> <p>2. Post-intervention differences in clinical outcomes were not significant.</p> <p><i>Secondary outcomes:</i></p> <p>The mean change in CD4-cell count between baseline and month 9 trended higher, but was not significant; average gain of 52 vs. 28 cells/μL($p=0.297$).</p> <p>The proportion of intervention subjects who achieved UDVL increased significantly ($p=0.004$), but proportions were similar at month 9 ($p=0.218$).</p> |

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| | <p><i>Sample:</i></p> <p>119 participants (n=63) intervention and (n=56) control.</p> <p><i>Inclusion criteria:</i></p> <ol style="list-style-type: none"> 1) Receiving or initiating anti-retroviral treatment 2) 18 years or older 3) Owned own mobile phone 4) Deemed a risk for poor adherence <p><i>Exclusion criteria:</i></p> <p>Not clearly stated</p> | <p>per protocol analysis was also conducted. Intention to treat included data for all randomised subjects, with post intervention adherence.</p> <p><i>Intervention group:</i></p> <p>Upon enrolment, an on-site study coordinator gave each subject an electronic adherence monitoring container (Wisepill) for use with anti-retroviral medications. All subjects received daily reminders and were seen monthly and all received electronic adherence monitoring throughout the study.</p> <p>Intervention subjects received adherence counselling as clinically indicated and an SMS mobile phone reminder sent whenever the Wisepill system failed to detect a device-opening by 30 minutes past a scheduled dose time.</p> <p>Text messages were personalised. Subjects with <95% adherence strata received behaviourally-targeted counselling sessions with a</p> | <p>replaced by another one, similarly containing 10 allocation envelopes.</p> <p>The study subjects were re-counted at the start and completion of the study.</p> <p>The two groups were alike at baseline. Information gathering was done and the outcomes are presented clearly and accurately.</p> <p>Due to the nature of the intervention, it was impossible to blind subjects or clinicians to the subject's randomisation arm.</p> <p>The study can be applied to the setting.</p> <p><i>Score on appraisal tool:</i></p> <p>10/11</p> <p>Included</p> <p>Level of evidence I</p> | <p><i>Limitations:</i></p> <ol style="list-style-type: none"> 1) Subjects and clinicians were not blinded and bias may have affected counselling provided to control subjects. 2) Study had a relatively short duration of follow up. 3) Study design did not permit a rigorous analysis of the individual contributions of cell-phone reminders. 4) Study was not designed to measure an impact on biological endpoints. <p><i>Recommendations:</i></p> <p>Further assessment and adaptation in other patients is recommended.</p> |
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| Randomised Controlled Trials (n=15) | | | | |
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| Bibliographic detail | Methodology | Outcomes and intervention | Critical appraisal/ Level of evidence | Study findings |
| | | <p>counsellor and day-to-day adherence performance.</p> <p><i>Control group:</i></p> <p>Usual care</p> <p><i>Data analyses:</i></p> <p>Primary analysis was by intention to treat, a secondary per protocol analysis was also conducted.</p> <p>All baseline and post-intervention CD4-cell count and HIV viral load data was used in clinical outcome analyses.</p> <p>Bivariate and multivariate regression analyses to assess potential bias were conducted.</p> <p>To assess the combined effect of reminders and enhanced counselling, the mean monthly "late doses", were compared.</p> | | |

| Randomised Controlled Trials (n=15) | | | | |
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| Bibliographic detail | Methodology | Outcomes and intervention | Critical appraisal/ Level of evidence | Study findings |
| <p>Argay, M., Meskó, A., Zelkó, R. & Hankó, B.</p> <p>2015</p> <p>Therapy reminder message for Hungarian patients with type 2 diabetes</p> <p><i>Acta Poloniae Pharmaceutica - Drug Research</i></p> <p>72 (6): 1289-1293</p> | <p><i>Aim:</i></p> <p>To find a method that can improve patients' adherence in Type 2 diabetes.</p> <p><i>Design:</i></p> <p>Randomised control trial</p> <p><i>Setting:</i></p> <p>Miskolc, Borsod-Abaúj-Zemplén county.</p> <p><i>Sample:</i></p> <p>150 diabetic patients, (n=65) intervention and (n=66) control.</p> <p><i>Inclusion Criteria:</i></p> <p>1) Diagnosed type 2 diabetes</p> | <p><i>Outcomes:</i></p> <p>Glycated haemoglobin and blood glucose levels were measured.</p> <p><i>Data collection:</i></p> <p>Blood glucose levels were measured by general practitioner monthly.</p> <p><i>Intervention group:</i></p> <p>Patients in the intervention group received an SMS three times daily to take their medicine; the SMS originated from a web-based application.</p> <p><i>Control group:</i></p> <p>Usual care</p> <p><i>Data analyses:</i></p> <p>Glycated haemoglobin levels were compared for the groups.</p> | <p><i>Critical appraisal tool used:</i></p> <p>Critical Appraisal Skills Programme randomised controlled trial study tool.</p> <p>A suitable design was applied to a clearly focussed problem.</p> <p><i>Randomisation:</i></p> <p>Patients were recruited from 7 general practitioners. The participants were divided into two groups, A and B. To divide the participants into the intervention and control groups the participants' names were put into an Excel worksheet and the RAND() formula was used to assign a random number to each one. They were sorted in ascending order based on the random numbers assigned. The first half were in the intervention group and the</p> | <p><i>Outcomes:</i></p> <p>1) There was a significant difference between the initial and final values of glycated haemoglobin levels ($p= 0.047$) in the intervention group.</p> <p>2) There was no significant difference between the final values of glycated haemoglobin of the groups ($p=0.212$).</p> <p>3) Neither were there significant differences in final blood glucose values ($p=0.845$) of the groups.</p> <p><i>Limitations:</i></p> <p>The cost-effectiveness of the method is not sufficient in the case of patients showing acceptable therapeutic adherence.</p> <p><i>Recommendations:</i></p> <p>Further research is needed with larger numbers of patients, and</p> |

| Randomised Controlled Trials (n=15) | | | | |
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| Bibliographic detail | Methodology | Outcomes and intervention | Critical appraisal/ Level of evidence | Study findings |
| | 2) Oral antidiabetic therapy 3) Cell phone user 4. Regular medical check (monthly) 5. Age 30-65 years <i>Exclusion criteria:</i> Not clearly stated. | | second half t in the control group. All patients who entered the trial were accounted for at the end of the study. The intervention and control groups were similar at baseline. Data collection was done and the results are presented clearly and accurately. Application to the context is possible. <i>Score on appraisal tool:</i> 10/11 Included Level of evidence I | the study should be performed for a longer time. |

| Systematic reviews (n=2) | | | | |
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| Bibliographic detail | Methodology | Outcomes and Intervention | Critical appraisal/ Level of evidence | Study findings |
| <p>Hall, A.K., Cole-Lewis, H. & Bernhardt, J.M.</p> <p>2015</p> <p>Mobile text messaging for health: A systematic review of reviews</p> <p><i>Annual Review of Public Health</i></p> <p>36: 393-415.</p> | <p><i>Aim:</i></p> <p>To identify mobile text messaging interventions designed for health improvement and behaviour change, to derive recommendations for practice.</p> <p><i>Design:</i></p> <p>Systematic review</p> <p><i>Data sources:</i></p> <p>Systematic reviews and meta-analyses from Pubmed, CINAHL, Cochrane library, PsycINFO, EMBASE, web of Science, Communication &</p> | <p><i>Primary Outcome:</i></p> <p>All outcomes related to health status or health behaviour change</p> <p><i>Secondary outcome:</i></p> <p>SMS frequency, SMS interactivity, personalisation and/or tailoring of SMS, use of therapy in SMS composition and delivery, duration of individual studies, SMS only versus SMS plus other intervention components and statistical significance of individual studies as reported by authors of the reviews.</p> <p><i>Search strategy:</i></p> <p>To identify all systematic reviews and meta-analyses of text messaging intervention.</p> | <p><i>Critical appraisal tool used:</i></p> <p>Critical Appraisal Skills Programme Systematic Review Checklist.</p> <p>A suitable design was applied to a clearly focussed review question.</p> <p>Assessment of risk of bias and quality of evidence of research findings was conducted to determine the extent to which study findings could be confidently applied, to make recommendations for public health practice.</p> <p>Data collection was done and the results are presented clearly and accurately.</p> | <p><i>Primary outcomes:</i></p> <p>The majority of the published text-messaging interventions were effective when addressing diabetes self-management, weight loss, physical activity, smoking cessation and medication adherence for antiretroviral therapy.</p> <p><i>Secondary outcomes:</i></p> <p>The majority of studies messaged participants at least once daily, and used interactive two-way communication and tailoring or personalisation. Few utilised behaviour change therapy. Intervention duration spanned from nine days to two years with the majority lasting from three to six months.</p> |

| Systematic reviews (n=2) | | | | |
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| Bibliographic detail | Methodology | Outcomes and Intervention | Critical appraisal/ Level of evidence | Study findings |
| | <p>Mass Media Complete, Global Health Database and WHO Global Health Library. Also OpenGrey, Gray Literature Report, K4Health and Google Scholar.</p> <p><i>Review selection:</i></p> <p>Two authors independently reviewed all articles, their lists were then combined. Two authors reviewed the full articles (n=15) against the inclusion and exclusion criteria. Disagreements between authors were discussed with a third author</p> | <p>Databases searched: PubMed, CINAHL, Cochrane Library, PsychINFO, EMBASE, Web of Science, Communication & Mass Media Complete, Global Health Database and WHO Global Health Library. MeSH terms, thesaurus terms and Emtree terms were searched by using key terms in each data base.</p> <p><i>Search words:</i></p> <p>texting, SMS, short message service, mHealth, cellular phone, cell phone, smartphone and text messaging interventions</p> <p><i>Study selection:</i></p> <p>Two authors independently reviewed all article titles and abstracts identified from the electronic searches to determine if the returned articles were related to text messaging intervention reviews. Respective article lists were combined and</p> | <p>Application to the context is possible.</p> <p><i>Score on appraisal tool:</i></p> <p>10/10</p> <p>Included</p> <p>Level of evidence I</p> | <p><i>Limitations:</i></p> <p>1) The variability of outcome measures and follow-up assessment durations makes it difficult to make comparisons and reach across studies.</p> <p>2) Interpretation of the review of review findings should consider the potential omissions and errors that may be present in the coding and findings as a result of unreported errors in the original reviews.</p> <p><i>Recommendations:</i></p> <p>More rigorous study designs, including greater use of randomised control trials, larger and more representative sample sizes and inclusion of different age groups, settings, contexts and geographic locations are recommended. Assess the effectiveness of specific text</p> |

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| | <p>and resolved. Only English-language literature, narrative, systematic and meta-analytical reviews were included. Only individual studies that delivered and evaluated SMS/MMS interventions, text messaging interventions focussing on adults, outcomes related to public health, were included.</p> <p><i>Inclusion criteria:</i></p> <p>1) English-language literature reviews, narrative reviews and meta-analytical reviews</p> | <p>relevant full-text articles were reviewed by two authors and assessed against the inclusion and exclusion criteria described. Disagreements between authors were resolved through discussion with a third author.</p> <p><i>Critical appraisal:</i></p> <p>Two matrices were created, first included health issues, study design, type of literature review, number of studies and total participants, included primary and secondary outcome results, review authors' future research recommendations, risk of bias and quality of evidence. Second matrix data extracted from all relevant individual studies included health issues, study design, health or behavioural outcomes, SMS frequency interactivity, personalisation/tailoring text messaging intervention,</p> | | <p>message interventions' delivery characteristics.</p> |

| Systematic reviews (n=2) | | | | |
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| Bibliographic detail | Methodology | Outcomes and Intervention | Critical appraisal/ Level of evidence | Study findings |
| | <p>2) Assessed individual studies that delivered and evaluated SMS/MMS interventions</p> <p>3) Reviews focussed on text message interventions, targeted at adults</p> <p>4) Addressed behaviours and/or outcomes related to public health.</p> <p><i>Exclusion criteria:</i></p> <p>1) Text message interventions focussing on youth</p> <p>2) Assessed health communication modalities other than SMS/MMS</p> | <p>theoretical basis for text messaging interventions, study duration and intervention components.</p> <p><i>Data extraction:</i></p> <p>Data of studies were extracted, reviewed and reported in a systematic format.</p> <p><i>Intervention period:</i></p> <p>The intervention periods were 9 days to 2 years, with the majority research lasting 3-6 months. Health outcomes targeted individual-level disease prevention, health promotion and/or chronic disease self-management behaviours. The messaging frequency was at least daily.</p> | | |

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| Bibliographic detail | Methodology | Outcomes and Intervention | Critical appraisal/ Level of evidence | Study findings |
| <p>Mbuagbaw, L., Van der Kop, M. L., Lester, R.T., Thirumurthy, H., Pop-Eleches, C., Ye, C., Smieja, M., Dolovich, L., Mills, E.J. & Thabane, L.</p> <p>2017</p> <p>Mobile phone text messages for improving adherence to antiretroviral therapy (ART): an individual patient data meta-analysis of randomised trials</p> <p>http://bmjopen.bmj.com/online</p> <p>3: 1-5.</p> | <p><i>Aim:</i></p> <p>To analyse the effects of text messaging versus usual care in improving adherence to antiretroviral therapy in people living with HIV using individual patient data meta-analysis.</p> <p><i>Design:</i></p> <p>Individual patient data meta-analysis</p> <p><i>Setting:</i></p> <p>3 Randomised control trials conducted in rural and urban centres</p> | <p><i>Primary outcome:</i></p> <p>Adherence to antiretroviral therapy >95%</p> <p><i>Secondary outcomes:</i></p> <p>Mortality, losses to follow-up, transfers and withdrawals.</p> <p><i>Search strategy:</i></p> <p>An independent patient data meta-analysis was conducted of 3 randomised controlled trials</p> <p><i>Search words:</i></p> <p>None stated</p> <p><i>Critical appraisal:</i></p> <p>Only anonymised data was collected and used for this study.</p> <p>A new data set was created with the following baseline covariates: age, gender, level of education</p> | <p><i>Critical appraisal tool used:</i></p> <p>Critical Appraisal Skills Programme Systematic Review Checklist.</p> <p>A suitable design was applied to a clearly focussed review question.</p> <p>Robust analytical strategies were applied that incorporate the within-study and between-study differences.</p> <p>The interventions use text - messaging communication in different ways (content, frequency and interactivity).</p> <p>Data collection was done and the results are presented clearly and accurately.</p> | <p><i>Primary outcomes:</i></p> <p>SMS text messaging significantly improved adherence to antiretroviral therapy to above 95% ($p= 0.012$).</p> <p>Text messaging did not significantly improve adherence to antiretroviral therapy in the sensitivity analysis using generalised estimation equations ($p= 0.373$).</p> <p><i>Secondary outcomes:</i></p> <p>Text messaging did not significantly reduce mortality or losses to follow-up. Transfers and withdrawals were also not significantly affected by text messaging.</p> <p><i>Limitations:</i></p> <p>1) The studies included were all conducted in Africa and may not be applicable in other settings.</p> |

| Systematic reviews (n=2) | | | | |
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| | <p>in Cameroon and Kenya were used.</p> <p><i>Sample:</i></p> <p>1 166 participants were included in this analysis (n=200 Cameroon and n=428 and 538 in Kenya).</p> <p><i>Data Sources:</i></p> <p>1) WeITel Kenyal RCT, multisite two-arm trial of weekly interactive text messaging</p> <p>2) A single-site five-arm trial conducted in Kenya, both Kenya trials ran for 12 months.</p> <p>3) Cameroon mobile phone short message system</p> | <p>and duration on antiretroviral therapy.</p> <p>The primary outcome was adherence greater than 95% as measured by authors.</p> <p>In an adjusted analysis, the effects of the baseline covariates on the primary outcomes were investigated. They were inserted as fixed effects.</p> <p>Heterogeneity statistics and forest plots for aggregate data meta-analysis were presented.</p> <p><i>Data extraction:</i></p> <p>Baseline data for all participants included were summarised as mean or median for continuous variables and number (%) for categorical variables. The level of statistical significance was set at $\alpha = 0.05$. The p values of the interaction terms are reported.</p> | <p>Application to the context is possible.</p> <p><i>Score on appraisal tool:</i></p> <p>8/10</p> <p>Included</p> <p>Level of evidence I</p> | <p>2) The generalisability of findings may also be affected by differences in the way adherence was measured in the studies that were included and the average time on antiretroviral therapy.</p> <p>3) No other randomised control trials was found and, in future, studies other such randomised control trials can be included.</p> <p>4) Only one of the studies used viral load.</p> <p><i>Recommendations:</i></p> <p>1) The use of interactive weekly text messaging to boost adherence is recommended.</p> <p>2) Further research endeavours should investigate the cost-effectiveness of text-messaging interventions and approaches to scaling up.</p> |

| Systematic reviews (n=2) | | | | |
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| Bibliographic detail | Methodology | Outcomes and Intervention | Critical appraisal/ Level of evidence | Study findings |
| | <p>trial, single site two-arm trial.</p> <p>These were the only trials identified by the Adherence Trialists Collaboration and PubMed search for randomised control trials of text messaging for antiretroviral therapy adherence.</p> <p><i>Inclusion criteria:</i></p> <p>Not stated in the article</p> <p><i>Exclusion criteria:</i></p> <p>Not stated in the article</p> | <p><i>Intervention periods:</i></p> <p>Kenya trials had a 12 month intervention and the Cameroon trial was 6 months.</p> <p>Reminder messages consisted of adherence to anti-retroviral therapy and motivational text messages. The messaging frequency was daily to weekly.</p> | | |

| Qualitative Review (n=1) | | | | |
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| Bibliographic detail | Methodology | Outcomes and Intervention | Critical appraisal/ Level of evidence | Study findings |
| <p>Leon, N., Surender, R., Bobrow, K., Muller, J. & Farmer, A.</p> <p>2015</p> <p>Improving treatment adherence for blood pressure lowering via mobile phone SMS-messages in South Africa: a qualitative evaluation of the SMS-text Adherence SuppoRt (StAR) trial</p> <p><i>BioMedCentral Family Practice</i></p> <p>16(1): 1-10</p> | <p><i>Aim:</i></p> <p>Qualitative evaluation that explored the trial participants' experiences and responses to SMS text messages and identified barriers and facilitators to delivering adherence support via patients' own mobile phones.</p> <p><i>Design:</i></p> <p>Qualitative evaluation of an individually-randomised controlled trial.</p> | <p><i>Outcomes:</i></p> <p>Understanding the patients' experience of chronic illness, adherence behaviour in general, experience and perception of the intervention, including their comfort with SMS text message delivery technology, the effect, if any, on their adherence behaviour, health and wellbeing.</p> <p><i>Data collection:</i></p> <p>Independent research team comprised researchers of the South African Medical Research Council and Department of Social Policy and Intervention</p> <p>Oxford University single semi-structured questionnaire was used.</p> <p>Focus groups and interviews were conducted in English in private spaces in the clinic</p> | <p><i>Critical appraisal instrument used:</i></p> <p>Critical Appraisal Skills Programme qualitative tool.</p> <p>The study addressed a clear statement.</p> <p>The research design was appropriate and an appropriate method of data collection was used.</p> <p>The data analysis was sufficient and clearly stated.</p> <p>Application to the context is possible.</p> <p><i>Score on appraisal tool:</i></p> <p>10/10</p> <p>Included</p> <p>Level of evidence: III</p> | <p><i>Outcomes:</i></p> <p>On a cognitive-behavioural level the SMS-text messages increased disease awareness, and helped to develop and reinforce more robust reminder systems. The intervention provided emotional support that might have increased self-responsibility for change. Specific elements of the SMS text messaging relating to content, tone and timing contributed to positive appraisal of the intervention. Adherence support for treatment of raised blood pressure, delivered by SMS-text message, was found to be acceptable, relevant and helpful.</p> <p><i>Limitations:</i></p> <p>1) Underlying reasons for particular trial outcomes could not be explained due to the</p> |

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| | <p><i>Setting:</i></p> <p>Primary care clinic in Cape Town</p> <p><i>Sample:</i></p> <p>Convenience and purposive sampling. Two focus groups of 11 patients and 15 individual interviews</p> <p><i>Inclusion criteria:</i></p> <p>General adult population attending the outpatient chronic disease services in a single public sector clinic in Cape Town</p> <p><i>Exclusion criteria</i></p> <p>Not clearly described</p> | <p>setting, digitally recorded and transcribed.</p> <p>Data collection stopped when data saturation was reached.</p> <p><i>The SMS text trial intervention:</i></p> <p>12 month programme of adherence support delivered by SMS text message. Messages were designed to address a range of common potential issues that might influence adherence. SMS text messages were delivered remotely to the patients' own cell phones. It was tested in a 3-arm randomised control trial. Frequency of messages was weekly. Patients could respond to selected messages with "please call me" or missed-calls that generated automated responses and that allowed them to cancel or change their appointments.</p> <p><i>Control group:</i></p> <p>None</p> <p><i>Data analysis:</i></p> <p>Comparative analysis and thematic analysis techniques was used. Comparative and thematic</p> | | <p>analysis carried out independently of knowledge of trial results.</p> <p>2) Interviews were carried out at the end of the trial, which might mean that some participants had difficulty recalling experiences at the start.</p> <p>3) The majority of patients were positive about the intervention, but fewer patients described positive behaviour change.</p> <p><i>Recommendations:</i></p> <p>The study showed the need to underpin future mobile-phone-based adherence interventions with behaviour change theories that take cognisance of the complex mix of psychosocial and health service influences and adherence behaviours.</p> |
|--|--|--|--|--|

| Qualitative Review (n=1) | | | | |
|---------------------------------|--------------------|---|--|-----------------------|
| Bibliographic detail | Methodology | Outcomes and Intervention | Critical appraisal/ Level of evidence | Study findings |
| | | <p>analysis approaches were used to identify themes and triangulated analysis amongst three researchers. The main tools were 3 sets of independently coded summaries, initial post interview summaries of the interviewer and the coded summaries of full transcripts. Data analysis considered themes that ran both across individual interviews and themes within individual interviews. Credibility of the findings was enhanced through iterative data collection, the use of a multi-method design and triangulation of the analysis by three qualitative researchers.</p> | | |

| Survey (n=1) | | | | |
|---|---|---|--|--|
| Bibliographic detail | Methodology | Outcomes and Intervention | Critical appraisal/ Level of evidence | Study findings |
| <p>Kothapalli, P., Bove, A.A., Santamore, W.P., Homko, C & Kashem, A.</p> <p>2013</p> <p>Factors affecting frequency of patient use of Internet-based telemedicine to manage cardiovascular disease risk</p> <p><i>Journal of Telemedicine and Telecare</i></p> <p>19(4): 205-208</p> | <p><i>Aim:</i></p> <p>To discover whether a web-based telemedicine system coupled with health status self-assessment could decrease cardiovascular disease risk factors in undeserved inner city and rural populations.</p> <p><i>Design:</i></p> <p>Survey</p> <p><i>Setting:</i></p> <p>Temple University Medical Center, Philadelphia, (urban) and the Geisinger Medical</p> | <p><i>Outcomes:</i></p> <ol style="list-style-type: none"> 1) Frequency of use, mean of use (days) 2) Cardio vascular disease risk 3) Body mass index 4) Lipids 5) Smoking <p><i>Data collection:</i></p> <p>An initial physical examination, electrocardiogram and blood and urine analysis were done.</p> <p>A health knowledge questionnaire (Cronbach's alpha = 0.70) was administered at baseline.</p> <p><i>Intervention:</i></p> <p>Patients were followed for one year. The primary end-point was a reduction in their 10-year</p> | <p><i>Critical appraisal instrument used:</i></p> <p>Critical Appraisal Skills Programme of a Survey</p> <p>The study addressed a clear statement.</p> <p>The research design was appropriate and an appropriate method of data collection was used.</p> <p>The data analysis was clearly stated.</p> <p>Application to the context is possible.</p> <p><i>Score on appraisal tool:</i></p> <p>7/12</p> <p>Included</p> <p>Level of evidence III</p> | <p><i>Outcomes:</i></p> <ol style="list-style-type: none"> 1) The lowest frequency users (Quartile I) used the system for about 17 days in one year, while the highest frequency users (Quartile IV) used the system 13 times as frequently. 2) Knowledge of cardiovascular disease increased ($p=0.014$). 3) No significant difference in body mass index. 4) Lipids improved ($p=0.017$) 5) Smoking ($p=0.036$) was associated with more frequent use of the telemedicine system. <p>More frequent users had a higher medication self-efficacy score ($p= 0.036$).</p> <p><i>Limitations:</i></p> <p>The study was conducted in a medically underserved</p> |

| Survey (n=1) | | | | |
|----------------------|--|---|--|---|
| Bibliographic detail | Methodology | Outcomes and Intervention | Critical appraisal/ Level of evidence | Study findings |
| | <p>Center, Philadelphia, (rural)</p> <p><i>Sample:</i></p> <p>192 subjects, Quartile I (n=48), Quartile II (n=51), Quartile III (n=46) Quartile IV (n=47).</p> <p><i>Inclusion criteria:</i></p> <p>1) Either sex, aged 18-85 years</p> <p>2) 10% or greater 10-year risk of cardiovascular disease</p> <p>3) Able to read and access to a telephone</p> <p><i>Exclusion criteria:</i></p> <p>1) Overt coronary artery disease</p> | <p>cardiovascular risk determined by the Farmingham Risk Score.</p> <p>All patients were able to read and had access to a telephone. Patients were provided with a digital sphygmomanometer, pedometer and bodyweight scale, if needed. All subjects received training in use of the Internet and instructions on use of the telemedicine reporting system.</p> <p>They were asked to record home blood pressure, daily steps, bodyweight and cigarette use, and report the data via the Internet communication system once a week. Telemedicine system was web-based and allowed patients to enter information and correspond with health practitioners.</p> <p><i>Data analysis:</i></p> <p>Multiple linear regression was used to evaluate the effect of</p> | | <p>population over 1 year. The results may not be generalisable.</p> <p><i>Recommendations:</i></p> <p>None made by authors</p> |

| Survey (n=1) | | | | |
|-----------------------------|--|--|--|-----------------------|
| Bibliographic detail | Methodology | Outcomes and Intervention | Critical appraisal/ Level of evidence | Study findings |
| | 2) Class 3 or 4 heart failure 3) Angina 4) Significant cognitive deficits 5) End stage renal disease on dialysis 6) Patients in nursing homes or boarding homes 7) Pregnancy 8) Patients unable to understand the study protocol and not competent to sign the consent | health knowledge, behaviour, demographics and health measures on Internet use. A standard package was used for the analysis (SPSS version 19.0). | | |

Rigour in Step 4

The researcher compiled a data chart to ensure that the critical appraisal of studies was thoroughly documented. Doing so will enable other researchers to replicate the study and come to the same conclusion as the researcher if they appraise the same studies. The final selection of studies was compiled by three independent reviewers, the researcher and two researchers experienced in systematic reviews, in order to ensure rigour. Standardised tools, specific to each study design, were used to ensure only high quality studies were included. A round-table discussion was held by the researcher and two researchers experienced in systematic reviews; any discrepancies were discussed and consensus was reached on the exclusion of studies.

During this step, the researcher and two researchers experienced in systematic reviews extracted the data from the selected studies. The outcomes of interest to the review question was achieved by compiling an information collection chart (Higgins & Green, 2008: 2011: online).

The researcher, with the assistance of two researchers experienced in systematic reviews, compiled the comprehensive data extraction sheet depicted in Table 3.5. This table depicts the studies included in the study and the data applicable to the review question. The sheet was compiled in an organised manner and is transparent. This ensures that other researchers who duplicate the study will come to an identical conclusion as the researcher, thereby ensuring rigour in the study.

3.3 SUMMARY

The PICO principle, search words and data sources were discussed during this chapter. Supporting tables and figures are included to illustrate the data. In this chapter, the first four steps of a systematic review were discussed and the rigour of the steps explained.

In the following chapter, Step 5, information synthesis, and Step 6, describing the findings and outlining the deductions, will be discussed.

CHAPTER 4: SYNTHESIS AND FINDINGS

4.1 INTRODUCTION

In this chapter, the synthesis and findings will be discussed. The objective of the study was to identify high quality studies and to extract data from these studies in order to determine how mobile health devices support a compliant lifestyle in patients with chronic diseases. In the previous chapter, the first four steps of a systematic review were discussed, namely, outlining the review question and identifying the principles for including studies, searching for studies and gathering information, choosing the studies, and appraisal and selection of studies. In this chapter, the emphasis will be on Steps 5 and 6 of the systematic review, namely, information synthesis and describing the findings and outlining the deductions (see Figure 4.1).

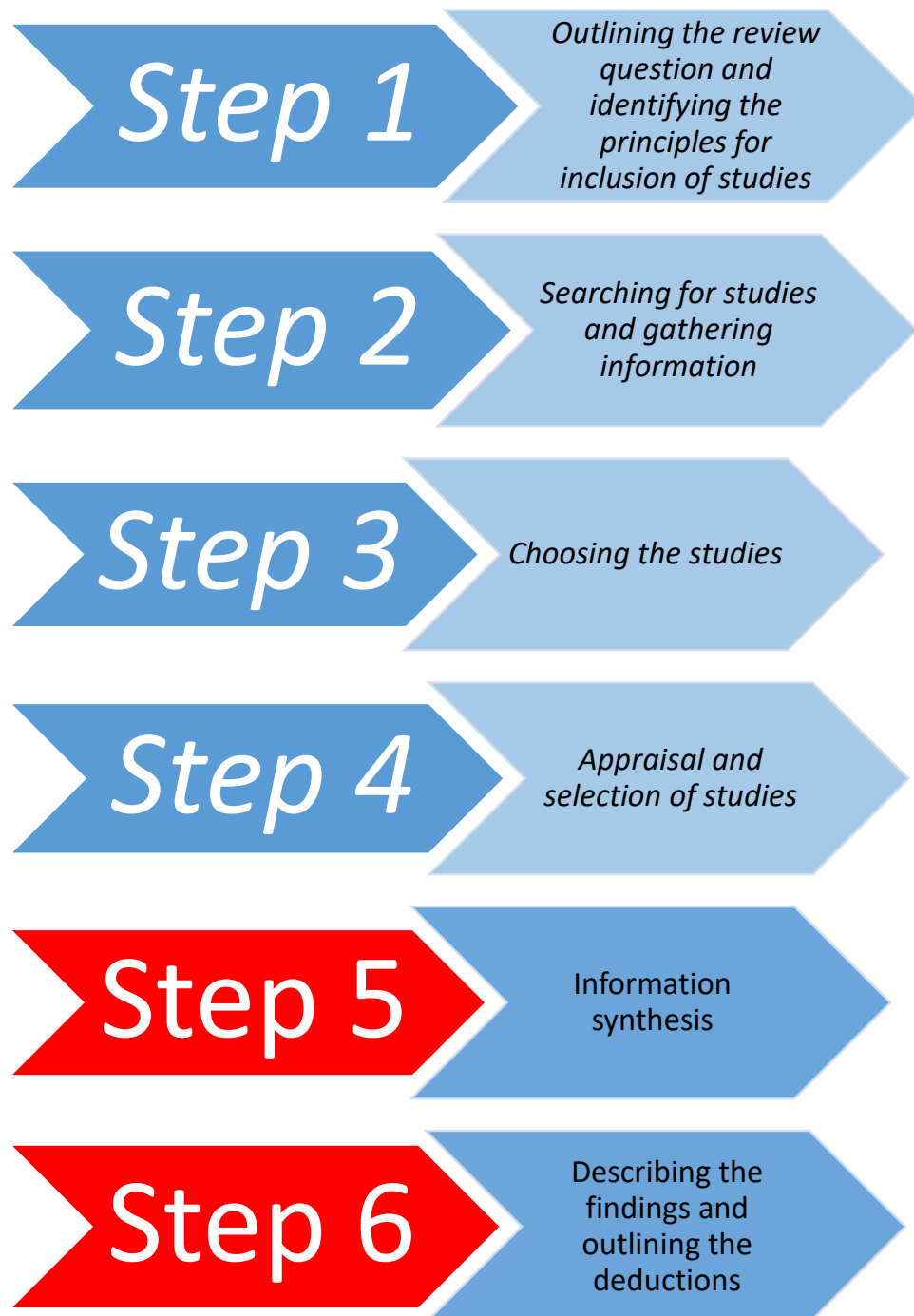


Figure 4.1: Steps of a systematic review adapted to Higgins and Green (2011: online), with the emphasis on Steps 5-6

4.2 STEP 5 INFORMATION SYNTHESIS

The researcher conducted an academic synthesis of the 20 studies that were selected, as listed in Table 3.5, by doing a systematic analysis of the studies according to Higgins and Green (2011: online). The synthesis was aligned with PICO principles and

the review question (Higgins & Green, 2011: online). The studies are depicted in Table 4.1 according to the type of chronic disease, mobile health device used, and a compliant lifestyle, which indicates evidence of self-efficacy. The information was meticulously synthesised and is presented in Table 4.1.

Table 4.1: Summary of outcome of the review question of studies used for data collection

| Reference to article and level of evidence | Type of chronic disease | Mobile health device used | Compliant lifestyle Self-efficacy |
|--|-------------------------------|---|--|
| <p>Tian, M, Ajay, V.S., Dunzhu, D., Hameed, S.S., Li, X., Liu, Z., Li, C., Chen, H., Cho, K., Li, R., Zhao, X., Jindal, D., Rawal, I., Ali, M.K., Peterson, E.D., Ji, J., Amarchand, R., Krishnan, A., Tandon, N., Xu, L.Q., Wu, Y., Prabhakaran, D. & Yan, L.L.</p> <p>2015.</p> <p>A cluster-randomized, controlled trial of a simplified multifaceted management program for individuals at high cardiovascular risk (simcard trial) in rural Tibet, China, and Haryana, India</p> <p><i>Circulation</i></p> <p>139(9): 15-824</p> <p>Level of evidence: I</p> | <p>Cardiovascular disease</p> | <p>Device used:</p> <p>Smartphone</p> <p>What was communicated:</p> <p>Prompts regarding the patient’s current lifestyle habits, blood pressure measurements, current medication use, new conditions, contra-indications and side effects.</p> <p>Frequency:</p> <p>Monthly follow-up</p> <p>Origin of message:</p> <p>Community health workers</p> <p>Intervention period:</p> <p>12 months</p> | <ul style="list-style-type: none"> • Self-efficacy evidenced through a significant increase in medication adherence. • Self-efficacy not evidenced in lifestyle, since lifestyle did not change. |

| Reference to article and level of evidence | Type of chronic disease | Mobile health device used | Compliant lifestyle Self-efficacy |
|--|--|--|--|
| <p>Tabak, M., Vollenbroek-Hutten, M.M. R., van der Valk, P. D. L. P. M., van der Palen, J., & Hermes, H. J. 2014.</p> <p>A telerehabilitation intervention for patients with Chronic Obstructive Pulmonary Disease: A randomized controlled pilot trial</p> <p><i>Clinical Rehabilitation</i></p> <p>28(6): 582-591</p> <p>Level of evidence: I</p> | <p>Chronic Obstructive Pulmonary Disease</p> | <p>Device used:</p> <p>Smartphone</p> <p>What was communicated:</p> <p>Promotion of an active lifestyle</p> <p>Frequency:</p> <p>Daily</p> <p>Origin of message:</p> <p>Researcher</p> <p>Intervention period:</p> <p>4 weeks</p> | <ul style="list-style-type: none"> • Self-efficacy evidence was increased activity over the short term. |
| <p>Hunkeler, E.M., Hargreaves, W.A., Fireman, B., Terdiman, J., Meresman, J.F., Porterfield, Y., Lee, J., Dea, R., Simon, G.E., Bauer, M.S., Unützer, J., & Taylor, C.B.</p> <p>2012</p> <p>A web-delivered care management and patient self-management program for recurrent depression: A randomized trial</p> | <p>Chronic depression</p> | <p>Device used:</p> <p>Cellphone</p> <p>What was communicated:</p> <p>Personalised self-monitoring, depression education, behavioural activation and social support, and problem specific advice.</p> | <ul style="list-style-type: none"> • Evidence suggesting self-efficacy was minor, and related to being less depressed, improved mental health, coping skills and confidence in managing depression. |

| Reference to article and level of evidence | Type of chronic disease | Mobile health device used | Compliant lifestyle Self-efficacy |
|---|-------------------------|---|--|
| <p><i>Psychiatric Services</i> 63(11): 1063-1071</p> <p>Level of evidence: I</p> | | <p>Frequency: 24 hours X 7 days</p> <p>Origin of message: Psychiatric care manager</p> <p>Intervention period: 12 months</p> | |
| <p>Chiu, C. W. & Wong, F. K. Y. 2010</p> <p>Effects of 8 weeks sustained follow-up after a nurse consultation on hypertension: A randomised trial</p> <p><i>International Journal of Nursing Studies</i> 47(11):1374-1382.</p> <p>Level of evidence: I</p> | <p>Hypertension</p> | <p>Device used: Cell phone</p> <p>What was communicated: Patient's health condition, assessment of blood pressure readings, healthy lifestyle and goals, reinforcing health self-management, health advice and assessing the need for referrals, reviewing and revising goals, encouraging and arranging time for next telephone call.</p> <p>Frequency: Two phone calls to patients every 2-3 weeks</p> | <ul style="list-style-type: none"> • Self –efficacy was minor and related to improvement in medication adherence, improvement in home blood pressure measurement, reduction in systolic and diastolic blood pressure, and diet. |

| Reference to article and level of evidence | Type of chronic disease | Mobile health device used | Compliant lifestyle Self-efficacy |
|--|---------------------------------------|--|---|
| | | Origin of the message: Nurse Intervention period: 8 weeks | |
| Liu, W.T., Wang, C.H., Lin, H.C., Lin, S.M., Lee, K.Y., Lo, Y.L., Hung, S.H., Chang, Y.M., Chung, K.F., & Kuo, H.P. 2008 Efficacy of a cell phone-based exercise programme for COPD <i>The European Respiratory Journal</i> 32(3): 651-659. Level of evidence: I | Chronic Obstructive Pulmonary Disease | Device used: Cell phone What was communicated: Patients were asked to take daily endurance exercise training. Frequency: Assessed every 4 weeks for 3 months and then every 3 months for the next 9 months Origin of message: Nurse Intervention period: 12 months | <ul style="list-style-type: none"> Self- efficacy was displayed by patient increasing the distance walked. |

| Reference to article and level of evidence | Type of chronic disease | Mobile health device used | Compliant lifestyle Self-efficacy |
|--|---|---|---|
| <p>Thompson, N.J., Patel, A.H., Selwa, L.M., Stoll, S.C., Begley, C. E., Johnson, E. K., & Fraser, R. T.</p> <p>2015</p> <p>Expanding the efficacy of Project UPLIFT: Distance delivery of mindfulness-based depression prevention to people with epilepsy</p> <p><i>American Psychological Association, Journal of Consulting and Clinical Psychology</i></p> <p>83 (2): 304-313</p> <p>Level of evidence: I</p> | <p>Major depressive disorder and epilepsy.</p> | <p>Device used:</p> <p>Cell phone</p> <p>What was communicated:</p> <p>Knowledge about coping strategies</p> <p>Frequency:</p> <p>Weekly</p> <p>Origin of message:</p> <p>Facilitators</p> <p>Intervention period:</p> <p>20 weeks</p> | <ul style="list-style-type: none"> • Self-efficacy evidenced provided by patients having fewer symptoms of depression. |
| <p>Gellis, Z.D., Kenaley, B.L. & Have, T.T.</p> <p>2014</p> <p>Integrated telehealth care for chronic illness and depression in geriatric home care patients: The integrated telehealth education and activation of mood (I-TEAM) study</p> <p><i>Journal of the American Geriatrics Society</i></p> | <p>Chronic illness (congestive heart failure and COPD) and depression</p> | <p>Device used:</p> <p>Cell phone</p> <p>What was communicated:</p> <p>Problem-solving treatment for depression, chronic illness care, symptom monitoring, medication adherence and monitoring of body weight.</p> | <ul style="list-style-type: none"> • Improved self-efficacy in the patient managing their medical condition, improvement in problem-solving skills and decrease in depression. |

| Reference to article and level of evidence | Type of chronic disease | Mobile health device used | Compliant lifestyle Self-efficacy |
|--|------------------------------|--|---|
| <p>62(5): 889-895</p> <p>Level of evidence: I</p> | | <p>Frequency:</p> <p>Daily telemonitoring, 8 weekly problem-solving treatment</p> <p>Origin of message:</p> <p>Tele-health nurse</p> <p>Intervention period:</p> <p>3 months</p> | |
| <p>Ferrante, D., Varini, S., Macchia, A., Soifer, S., Badra, R., Nul, D., Grancelli, H. & Doval, H.</p> <p>2010.</p> <p>Long-term results after a telephone intervention in chronic heart failure: DIAL (Randomized Trial of Phone Intervention in Chronic Heart Failure) follow-up.</p> <p><i>Journal of the American College of Cardiology</i></p> <p>56(5): 372-378.</p> <p>Level of evidence: I</p> | <p>Chronic heart failure</p> | <p>Device used:</p> <p>Cell phone</p> <p>What was communicated:</p> <p>Diet improvement and medication compliance, promotion of exercise, regularly symptoms monitoring, weight and oedema. Promotion of early visits if signs of clinical deterioration were detected.</p> <p>Frequency:</p> <p>Initially patient were called every 14 days, then calls were made as needed</p> <p>Origin of message:</p> | <ul style="list-style-type: none"> The evidence suggests self-efficacy in improved medication adherence, but evidence of self-efficacy was minor regarding diet, physical domain and daily weight control. |

| Reference to article and level of evidence | Type of chronic disease | Mobile health device used | Compliant lifestyle Self-efficacy |
|---|---------------------------------------|--|--|
| | | Specialised nurses Intervention period: 3 years | |
| Nguyen, H.Q., Gill, D.P., Wolpin, S., Steele, B.G. & Benditt, J.O. 2009 Pilot study of a cell phone-based exercise persistence intervention post-rehabilitation for COPD <i>International Journal of Chronic Obstructive Pulmonary Disease</i> 4: 301-313. Level of evidence: I | Chronic Obstructive Pulmonary Disease | Device used: Cell phone What was communicated: Reinforcement text messages, on exercise performance Frequency: Weekly Origin of message: Nurse Intervention period: 6 months | <ul style="list-style-type: none"> Evidence of self-efficacy was minor in relation to improved physical activity. |
| Young, H., Miyamoto, S., Ward, D., Dharmar, M., Tang-Feldman, Y & Berglund, L. 2014 | Diabetes | Device used: Cell phone or video conferencing What was communicated: | <ul style="list-style-type: none"> The evidence of self-efficacy was minor in improved physical health. |

| Reference to article and level of evidence | Type of chronic disease | Mobile health device used | Compliant lifestyle Self-efficacy |
|--|--|--|---|
| <p>Sustained effects of a nurse coaching intervention via telehealth to improve health behavior change in diabetes</p> <p><i>Telemedicine Journal And E-Health: The Official Journal of The American Telemedicine Association</i></p> <p>20 (9): 828-34</p> <p>Level of evidence: I</p> | | <p>Guidance to meet self-identified goal (nutrition and physical activity most often chosen)</p> <p>Frequency:</p> <p>2 weekly for 5 weeks, 30 minute sessions</p> <p>Origin of message:</p> <p>Nurse coaches</p> <p>Intervention period:</p> <p>10 weeks</p> | |
| <p>Lee, H., Yoon, J.Y., Lim, Y., Jung, H. Kim, S., Yoo, Y., Kim, A. J-J. & Park, H-K.</p> <p>2015</p> <p>The effect of nurse-led problem-solving therapy on coping, self-efficacy and depressive symptoms for patients with chronic obstructive pulmonary disease: a randomised controlled trial</p> <p><i>Journal Article - research, tables/charts, randomized controlled trial</i></p> <p>44: 397-403</p> | <p>Chronic Obstructive Pulmonary Disease</p> | <p>Device used:</p> <p>Cell phone</p> <p>What was communicated:</p> <p>Individualised problem-solving therapy sessions</p> <p>Frequency:</p> <p>2 weekly</p> <p>Origin of message:</p> <p>Registered nurse</p> | <ul style="list-style-type: none"> • Self-efficacy evidenced by a decrease in depressive symptoms. |

| Reference to article and level of evidence | Type of chronic disease | Mobile health device used | Compliant lifestyle Self-efficacy |
|---|-------------------------|--|--|
| Level of evidence: I | | Intervention period: 6 months | |
| <p>Dale, L. P., Whittaker, R., Jiang, Y., Stewart, R., Rolleston, A. & Maddison, R. 2015</p> <p>Text message and internet support for coronary heart disease self-management: Results from the Text4Heart randomized controlled trial</p> <p><i>Journal of Medical Internet Research</i> 17(10): 1-11.</p> <p>Level of evidence: I</p> | Coronary heart disease | <p>Device used: Short Message System</p> <p>What was communicated: Educating patients about their cardiovascular risk factors and supporting them to make lifestyle changes</p> <p>Frequency: Daily and from week 13-24 only 5 days a week</p> <p>Origin of message: Text messages from a centralized server</p> <p>Intervention period: 24 weeks</p> | <ul style="list-style-type: none"> • Self-efficacy was apparent by improved lifestyle changes and medication adherence. |
| <p>Akhu-Zaheya, L.M. & Shiyab, W.Y. 2017</p> | Cardiovascular disease | <p>Device used: Short Message System</p> <p>What was communicated:</p> | <ul style="list-style-type: none"> • Self-efficacy evidenced by the patient's improved medication adherence and healthy diet. |

| Reference to article and level of evidence | Type of chronic disease | Mobile health device used | Compliant lifestyle Self-efficacy |
|---|-------------------------------------|---|---|
| <p>The effect of short message system (SMS) reminder on adherence to a healthy diet, medication, and cessation of smoking among adult patients with cardiovascular diseases.</p> <p><i>International Journal of Medical Informatics</i> 98: 65-75</p> <p>Level of evidence: I</p> | | <p>Reminders regarding medication, diet and smoking cessation</p> <p>Frequency: Daily short messages.</p> <p>Origin of message: Automated messaging system</p> <p>Intervention period: 3 months</p> | <ul style="list-style-type: none"> No apparent self-efficacy regarding smoking cessation. |
| <p>Sabin, L.L., Bachman D.M., Gill, C.J., Zhong, L., Vian, T., Xie, W., Cheng, F., Xu, K., Lan, G., Haberer, J.E., Bangsberg, D.R., Li, Y., Lu, H., & Gifford, A.L.</p> <p>2015</p> <p>Improving adherence to antiretroviral therapy with triggered real-time text message reminders: The China Adherence Through Technology Study</p> <p><i>Journal of Acquired Immune Deficiency Syndromes</i> 69(5): 551-559</p> | <p>Human immunodeficiency Virus</p> | <p>Device used: Cell phone (electronic adherence monitoring container - Wisepill)</p> <p>What was communicated: Reminders and adherence counselling</p> <p>Frequency: Daily reminders</p> <p>Origin of message: Adherence counsellor</p> <p>Intervention period:</p> | <ul style="list-style-type: none"> Self-efficacy displayed by the patients improving medication adherence. |

| Reference to article and level of evidence | Type of chronic disease | Mobile health device used | Compliant lifestyle Self-efficacy |
|--|--|---|---|
| Level of evidence: I | | 6 months | |
| <p>Argay, M., Meskó, A., Zelkó, R. & Hankó, B. 2015</p> <p>Therapy reminder message for Hungarian patients with type 2 diabetes</p> <p><i>Acta Poloniae Pharmaceutica - Drug Research</i></p> <p>2 (6): 1289-1293</p> <p>Level of evidence: I</p> | Type 2 Diabetes | <p>Device used:</p> <p>Short Message System</p> <p>What was communicated:</p> <p>Reminder messages to take medicine</p> <p>Frequency:</p> <p>3 times daily</p> <p>Origin of message:</p> <p>A web-based application</p> <p>Intervention period:</p> <p>12 months</p> | <ul style="list-style-type: none"> Self-efficacy was evidenced by improved medication adherence. |
| <p>Hall, A.K., Cole-Lewis, H. & Bernhardt, J.M. 2015</p> <p>Mobile text messaging for health: A systematic review of reviews.</p> <p><i>Annual Review of Public Health</i></p> | Chronic diseases: diabetes, physical activity, smoking cessation | <p>Device used:</p> <p>Short Message System.</p> <p>What was communicated:</p> <p>Individualised health promotion and disease management</p> | <ul style="list-style-type: none"> Self-efficacy was evidenced by improved diabetes-self management, weight loss, physical activity, smoking cessation and medication adherence. |

| Reference to article and level of evidence | Type of chronic disease | Mobile health device used | Compliant lifestyle Self-efficacy |
|--|-------------------------------------|---|--|
| <p>36: 393-415</p> <p>Level of evidence: I</p> | | <p>Frequency: At least daily</p> <p>Origin of message: Not specified</p> <p>Intervention period: 9 days to 2 years, with the majority of research lasting 3-6 months</p> | |
| <p>Mbuagbaw, L., van der Kop, M. L., Lester, R.T., Thirumurthy, H., Pop-Eleches, C., Ye, C., Smieja, M., Dolovich, L., Mills, E.J. & Thabane, L.</p> <p>2017</p> <p>Mobile phone text messages for improving adherence to antiretroviral therapy (ART): an individual patient data meta-analysis of randomised trials</p> <p>http://bmjopen.bmj.com/ on</p> <p>3: 1-5</p> <p>Level of evidence: I</p> | <p>Human immunodeficiency virus</p> | <p>Device used: Short Message System.</p> <p>What was communicated: Reminder messages on adherence to antiretroviral therapy and motivational text messages</p> <p>Frequency: Daily and weekly</p> <p>Origin of Message: Not specified</p> <p>Intervention period:</p> | <ul style="list-style-type: none"> • Self-efficacy was apparent in improved medication adherence. |

| Reference to article and level of evidence | Type of chronic disease | Mobile health device used | Compliant lifestyle Self-efficacy |
|--|---|---|--|
| | | Kenya trials 12 months Cameroon trial 6 months | |
| <p>Leon, N., Surender, R., Bobrow, K., Muller, J. & Farmer, A.</p> <p>2015</p> <p>Improving treatment adherence for blood pressure lowering via mobile phone SMS-messages in South Africa: a qualitative evaluation of the SMS-text Adherence SuppoRt (StAR) trial</p> <p><i>BioMedCentral Family Practice</i></p> <p>16(1): 1-10</p> <p>Level of evidence: III</p> | Hypertension | <p>Device used: Short Message System.</p> <p>What was communicated: Adherence behaviour strengthening.</p> <p>Frequency: Weekly</p> <p>Origin of message: Researchers compiled a library of SMS text messages delivered remotely</p> <p>Intervention period: 12 months</p> | <ul style="list-style-type: none"> • Self-efficacy displayed by increased disease awareness and self-responsibility for change. |
| <p>Kothapalli, P., Bove, A.A., Santamore, W.P., Homko, C & Kashem, A.</p> <p>2013</p> | Cardiovascular disease risk factors (hypertension, dyslipidaemia and smoking) | <p>Device used: Internet</p> <p>What was communicated: Information of cardio vascular disease risk</p> | <ul style="list-style-type: none"> • Self-efficacy evidenced higher medication self-efficacy. • Self-efficacy not evidenced in improved body mass index. |

| Reference to article and level of evidence | Type of chronic disease | Mobile health device used | Compliant lifestyle Self-efficacy |
|--|-------------------------|---|--------------------------------------|
| <p>Factors affecting frequency of patient use of Internet-based telemedicine to manage cardiovascular disease risk</p> <p><i>Journal of Telemedicine And Telecare</i></p> <p>19(4): 205-208</p> <p>Level of evidence: III</p> | | <p>Frequency:</p> <p>Weekly</p> <p>Origin of message:</p> <p>Health practitioners</p> <p>Intervention period:</p> <p>12 months</p> | |

4.3 STEP 6: DESCRIBING FINDINGS AND OUTLINING DEDUCTIONS

The studies identified consisted of randomised controlled trials (n=16), systematic reviews (n=2), a qualitative review (n=1) and a survey (n=1). The findings were grouped according to chronic diseases, mobile health services and compliant lifestyle/self-efficacy. After a discussion of the findings, concluding statements will be presented.

Chronic diseases

Six of the synthesised studies addressed *Cardiovascular diseases* via mobile health devices in (Aku-Zaheya & Shiyab, 2017; Dale et al., 2015; Ferrante et al., 2010; Gellis et al. 2014, Kothapalli et al., 2013; Tian et al., 2015), with five studies referring to *chronic pulmonary disease* (Gellis et al., 2014, Lee et al., 2015; Liu et al., 2008, Nguyen et al., 2009; Tabak et al., 2014); a further three studies refer to *depression* (Gellis et al., 2014; Hunkeler et al., 2012; Thompson et al., 2015); and two studies refer to *hypertension* (Chiu & Wong, 2010, Leon et al., 2015). In one study the *chronic disease* was not specified (Hall et al., 2015); two studies addressed *diabetes* (Argay et al., 2015; Young et al., 2014); and another two studies referred to *HIV* (Mbuagbaw et al., 2013; Sabin et al., 2015).

Cardiovascular disease represents a large and increasing burden on society, and patients diagnosed with the disease need continuous support to manage the disease by changing their lifestyles and, thereby, prevent complications (Piepoli, Corrà, Adamopoulos, Benzer, Bjarnason-Wehrens, Cupples, Dendale, Doherty, Gaita, Höfer, McGee, Mendes, Niebauer, Pogossova, Garcia-Porrero, Rauch, Schmid & Gianuzzi., 2014: 664). There is a movement to increase patient self-monitoring at home; patients submit the results of the monitoring, via the Internet, to the treating doctor or clinic, thereby optimising monitoring and early detection of abnormalities (Goode, 2014: 175). According to Pietrzak, Cotea and Pullman (2014: 303), Internet-based intervention is becoming increasingly popular for managing chronic diseases.

Chronic Obstructive Pulmonary Disease (COPD) causes financial strain and is a primary cause of disease and death worldwide. Support of patients is necessary to prevent and treat the disease (Vestbo, Hurd, Agusti, Jones, Vogelmeier, Anzueto,

Barnes, Fabbri, Martinez, Nishimura, Stockley, Sin & Rodriguez-Roisin, 2013: 347-365). *COPD* patients experience dyspnoea in the course of their daily activities, which has a negative impact on their quality of life. When a patient does not have easy access to resources, such as education, support for self-management, and skills training, it is difficult to maintain pulmonary rehabilitation to increase quality of life. Using mobile devices can improve access to resources and support patients (Nguyen et al., 2008: 2).

Depression has a high relapse risk and these patients need lifelong medication adherence, follow-up and support. Patients living with depression also experience loss of quality of life and represent a major financial liability for society. Mobile devices can support patients by providing easy access to healthcare providers and peers (Kordy, Backenstrass, Hüsing, Wolf, Aulich, Bürgy, Puschner, Rummel-Kluge & Vedder, 2013: 328).

Hypertension is the principal risk factor responsible for cardiovascular and associated diseases. By controlling blood pressure, it is possible to reduce cardiovascular disease, and this can be done by supporting patients through clinics and other means, such as text messages (Bobrow, Brennan, Springer, Levitt, Rayner, Namane, Yu, Tarassenko & Farmer, 2014: 1-17). It is difficult to control patients' blood pressure if patients do not adhere to medication prescriptions, if they neglect to fill their prescriptions fail to report for follow-up visits to doctors or clinics. It has become clear that a personalised approach is the best way to persuade patients to change their lifestyles and adhere to medication, and this can be achieved by mHealth technology (Logan, 2013: 579;584).

Chronic disease has a significant effect on the population in general, and a huge impact on people's lives over an extended period of time. Long-term and effective management of chronic diseases is essential to prevent and manage them and to reduce their costly impact on the community (De Jongh, Gurol-Urganci, Vodopivec-Jamsek, Car & Atun, 2012: 6-7). More and more patients are being diagnosed with chronic diseases, such as diabetes, which can be prevented by lifestyle and behaviour changes. Patients with diabetes need lifelong support and monitoring, constituting a complex set of services. These patients require interventions that promote diabetes

education and lifestyle changes, because they must understand their disease and be able to solve problems when they arise (Cotterez et al., 2015: 2, Kaufman, 2012: 40). mHealth can support a patient who has been diagnosed with a chronic disease by providing easy access to educational literature and to the healthcare provider. Feedback to the patient can be immediate and personalised (Fischer, Moore, Gonosar, Davidson, Rice-Peterson, Durfee, Thomas, MacKenzie, Estacio & Steele., 2012: e45; Lu et al., 2013: 811; Salisbury, O’Cathain, Edwards, Thomas, Gaunt, Hollinghurst, Nicholl, Large, Yardley, Lewis, Foster, Garner, Horspool, Man, Rogers, Pope, Dixon & Montgomery, 2016: 522-523).

It is essential that patients with *Human Immunodeficiency Virus (HIV)* adhere to the treatment regime, in order to have good health outcomes and a good quality of life. These patients need lifelong social support, education counselling and monitoring, in order to have an optimally healthy life (Rodrigues, Shet, Antony, Sidney, Arumugam, Krishnamurthy, D’Souza & DeCosta, 2012: 1). Mobile health provides direct contact with the healthcare provider, and two-way communication is possible, providing support of and feedback to patients (Arora, Peters, Argay & Mechine, 2012: 492; Lu et al., 2013: 815-817).

4.3.1 Mobile health services

The mobile health services identified by the synthesised studies will be presented according to mobile device used, messages communicated, frequency of the messages, origin of the messages and the intervention period.

4.3.1.1 Mobile devices used

Cell phones were used in 12 of the synthesised studies (Chiu and Wong, 2010; Ferrante et al., 2010; Gellis et al., 2014; Hunkeler et al., 2012; Lee et al., 2015; Liu et al., 2008; Nguyen et al., 2009; Sabin et al., 2015; Tabak et al., 2014; Tian et al., 2015; Thompson et al., 2015; Young et al., 2014). *Text messages* were used in 6 of the synthesised studies (Argay et al., 2015; Dale et al., 2015; Hall et al., 2015; Mbuagbaw et al., 2013; Leon et al., 2015) and the *internet* was used in 1 of the synthesised studies (Kothapalli et al., 2013).

Cell phone was the mHealth tool used in most of the studies in the synthesised studies. Wellness coaching through use of a cell phone had a positive effect on the lifestyle changes of patients (Temmingh et al., 2013: 983-984). The portability of a cell phone contributed to the effectiveness of the support provided to patients with chronic disease, because cell phones are not restricted to location and can be utilised anywhere. mHealth is effective, efficient and affordable (Fitzner & Moss, 2013: 169-170).

Text messages was identified as the second-most used mode of mHealth by the synthesised studies. Text messages support patients with chronic diseases through reminder messages sent to their cell phones, and this leads to improved medication adherence (Sarabi, Sadoughi, Orak & Bahaadinbeigy, 2016: e25183). Text messages can support patients to self-monitor and manage their chronic diseases through reminder messages, other supportive messages and by offering a way to communicate with healthcare professionals and receive feedback (De Jongh et al., 2012: 3;19).

Internet interventions were used least in the synthesised studies. The Internet enables patients to self-monitor their diseases and communicate symptoms and results to healthcare professionals remotely; doing so improves the quality and safety of healthcare (De Jong, Ros & Schrijvers, 2014: e19).

4.3.1.2 Messages communicated

Various messages were communicated in the synthesised studies. The change in *lifestyle behaviours* was communicated in seven of the synthesised studies (Chiu and Wong, 2010; Ferrante et al., 2010; Gellis et al., 2014; Liu et al., 2008; Leon et al., 2015; Tabak et al., 2014; Tian et al., 2015; Thompson et al., 2015). *Reminder messages to adhere to medication use* was communicated by the authors of seven the synthesised studies (Aku-Zaheya & Shiyab, 2017; Argay et al., 2015; Gellis et al., 2014; Ferrante et al., 2010; Mbuagbaw et al., 2013; Sabin et al., 2015; Tian et al., 2015). *Self monitoring* of goals, body weight, blood glucose, blood pressure and depression symptoms was communicated in six synthesised studies (Chiu & Wong, 2010, Ferrante et al., 2015; Gellis et al., 2014; Hall et al., 2015; Hunkeler et al., 2012, Tian et al., 2015). *Reinforcement and encouraging messages* were communicated

regarding lifestyle behaviours, health self-management, problem-solving treatment and adherence behaviour by five of the synthesised studies (Chiu & Wong, 2010; Dale et al., 2015; Nguyen et al., 2008; Thompson et al., 2015; Young et al., 2014). *Educational* messages were communicated in eight of the synthesised studies (Dale et al., 2015; Hall et al., 2015; Gellis et al., 2014; Kothapalli et al., 2013; Lee et al., 2015; Sabin et al., 2015; Tian et al., 2015; Thompson et al., 2015).

Communication related to *lifestyle behaviour change* was reported in six of the synthesised studies (Chiu & Wong, 2010; Ferrante et al., 2010; Leon et al., 2015; Liu et al., 2008; Tabak et al., 2014; Tian et al., 2015). These studies showed that mobile health devices support patients in living healthier lives and reduce the harmful effects of unhealthy lifestyles, which helps to improve the symptoms of various chronic diseases (Franc et al., 2014: 64-65, Kuijpers, Groen, Aaronson & Van Harten., 2013: e37; Paneroni, Colombo, Papalia, Colitta, Borghi, Saleri, Cabiaglia, Azzalini & Vitacca., 2015: 222).

Reminder messages to adhere to medication use were reported in seven of the synthesised studies (Aku-Zaheya & Shiyab, 2017; Argay et al., 2015; Ferrante et al., 2010; Gellis et al., 2014; Mbuagbaw et al., 2013; Sabin et al., 2015; Tian et al., 2015). Reminder messages encourage patients to take medication and improve self-management of chronic diseases by improving medication adherence (Lewis, Uhrig, Bann, Harris, Furberg & Coomes., 2013: 248,252, Patel, Jacobus-Kantor, Marshall, Ritchie, Kaplinski, Khurana & Katz, 2013: 637-638).

Self-monitoring messages imply that patients monitor their chronic disease symptoms at home, and support is provided through mobile health devices when abnormalities are identified. Self-monitoring messages was reported in six of the synthesised studies (Chiu and Wong, 2010; Ferrante et al., 2010; Gellis et al., 2014; Hall et al., 2015; Hunkeler et al., 2012; Tian et al., 2015). Self-monitoring messages have a positive outcome on managing symptoms, improving clinical outcomes, improving quality of life and improving compliance (Maeder, Poultney, Morgan & Lippiatt, 2015: 441; Nguyen et al., 2013: 6-8).

Reinforcement and encouraging messages were reported by five of the synthesized studies (Chiu & Wong, 2010; Dale et al., 2015; Nguyen et al., 2009; Thompson et al.,

2015; Young et al., 2014). The messages support patients by reinforcing positive behaviour and encouraging them to continue the behaviour. These messages improve patients' quality of life, improve adherence, completion and improvement in physical and psychological well-being (Varnfield, Kasrunanithi, Lee, Honeyman, Arnold, Ding, Smith & Walters., 2014: 1773-1778).

Educational messages was reported in eight of the synthesised studies (Dale et al., 2015; Gellis et al., 2014; Hall et al., 2015; Kothapalli et al., 2013; Lee et al., 2015; Sabin et al., 2015; Tian et al., 2015, Thompson et al., 2015). Educational messages support patients to understand the chronic disease and how to manage it and prevent complications (Bernocchi, Scalvini, Galli, Paneroni, Baratti, Turla, La Rovere, Volterrani & Vitacca., 2016: 7-8, Temmingh, Claassen, Van Zyl, Carrara, Dayakalash, Myer & Stein, 2013: 983-984).

4.3.1.3 Frequency of messaging

There was a huge variability in the frequency of communication, ranging from 24 hours a day in one synthesised article (Hunkeler et al., 2012), to 3 times a day in another synthesised article (Argay et al., 2015). Messages (n=11) were sent daily and weekly (Aku-Zaheya & Shiyab, 2017; Dale et al., 2015; Gellis et al., 2014; Hall et al., 2015; Leon et al., 2015; Kothapalli et al., 2013; Mbuagbaw et al., 2013; Nguyen et al., 2009; Sabin et al., 2015; Tabak et al., 2014; Thompson et al., 2015), one synthesised article stipulated 5 times weekly (Dale et al., 2015), one synthesised study reported 2-3 times weekly (Chiu & Wong, 2010), three studies specified twice weekly (Ferrante et al., 2010; Lee et al., 2015; Young et al., 2014), one study used monthly messages (Tian et al., 2015), and another one study used 3 times monthly messages (Lee et al., 2015).

Most of the messages were sent daily and weekly, through mobile devices, with positive outcomes. Self-efficacy was apparent in all the synthesised studies, although some results showed only a small improvement in outcome. The lowest improvement was in physical health, although some improvement was evident, while medication adherence showed significant improvement, especially in patients receiving daily reminder messages (Sphor, Nandy, Gandhiraj, Vemulapalli, Anne & Walters., 2015: 8-9, Thakkar, Kurup, Laba, Santo, Thiagalingam, Rodgers, Woodward, Redfern & Chow, 2016: 348-349).

4.3.1.4 Origin of message

There were a variety of origins for the messages of the synthesised studies. Messages originating from healthcare workers was evident in 12 of the synthesised studies (Chiu & Wong, 2010; Ferrante et al., 2010; Gellis et al., 2014; Hunkeler et al., 2012; Kothapalli et al., 2013; Lee et al., 2015; Liu et al., 2008; Nguyen et al., 2009; Sabin et al., 2015; Tian et al., 2015; Thompson et al., 2015; Young et al., 2014). Messages originating from researchers was evident in two synthesised studies (Leon et al., 2015; Tabak et al., 2014). In two studies the origin was not specified (Hall et al., 2015, Mbuagbaw et al., 2013) and three messages originated from a centralised server, web-based app and automated messages respectively (Aku-Zaheya & Shiyab, 2017; Argay et al., 2015; Dale et al., 2015).

The source of the message did not have a significant influence on the outcome (Eller, Lev, Yuan & Watkins et al., 2016: 42-44; Fischer et al., 2012: e45).

4.3.1.5 Intervention period

The intervention periods varied from weeks to years. Two synthesised studies had a 4 and 8 week intervention period (Chiu & Wong, 2010; Tabak et al., 2014), one study had a 3 month intervention period (Gellis et al., 2014). Six studies had a 6 month intervention period (Dale et al., 2015; Hall et al., 2015; Lee et al., 2015; Mbuagbaw et al., 2013; Nguyen et al., 2009; Sabin et al., 2015), and seven synthesised studies had a 12 month intervention period (Argay et al., 2015; Hunkeler et al., 2012; Kothapalli et al., 2013; Leon et al., 2015; Liu et al., 2008; Mbuagbaw et al., 2013; Tian et al., 2015). Another two studies had a 10 week and 20 week intervention period respectively (Young et al., 2014, Thompson et al., 2015); and one study had a 3 year intervention period (Ferrante et al., 2010).

Lifestyle changes were more apparent in the 12 month intervention period study, although some of the effects were small and one outcome measured showed no improvement. The improvements in symptom management and medication adherence were more apparent with longer intervention periods. Longer intervention periods enabled patients to adapt to healthy habits and make it them part of their lifestyles, while the shorter intervention periods enabled patients to sustain the

changes for a period (Jacobs, Lou, Ownby & Cabellero, 2014: 81, Zulman, Jenchura, Cohen, Lewis, Houston & Asch., 2015: 1063).

4.3.2 Compliant lifestyle

A compliant lifestyle, evidenced by self-efficacy, was apparent in all the synthesised studies.

Eight of the synthesised studies showed a compliant lifestyle through an improvement in *medication adherence* (Aku-Zaheya & Shiyab, 2017; Argay et al., 2015; Dale et al., 2015; Ferrante et al., 2010; Kothapalli et al., 2013; Mbuagbaw et al., 2013, Sabin et al., 2015; Tian et al., 2015), and one synthesised study showed only a small improvement in medication adherence (Chiu & Wong, 2010).

In four synthesised studies a compliant lifestyle was evident in *lifestyle behaviour changes* (Aku-Zaheya & Shiyab, 2017; Dale et al., 2015; Hall et al., 2015; Kothapalli et al., 2013), in two synthesised studies only a small effect was evident in lifestyle behaviour changes (Ferrante et al., 2010, Young et al., 2014), and one synthesised study showed no effect in lifestyle behaviour changes (Tian et al., 2015).

A compliant lifestyle was evident in *improved activity* in three synthesised studies (Hall et al., 2015; Liu et al., 2008; Tabak et al., 2014) and one synthesised study showed only a small effect on improved activity (Nguyen et al., 2009).

In three of the synthesised studies a compliant lifestyle was evident in *depression management* (Gellis et al., 2014; Hunkeler et al., 2012, Thompson et al., 2015).

Two synthesised studies showed a compliant lifestyle in the *self-management of the chronic disease* (Aku-Zaheya & Shiyab, 2017, Hall et al., 2015).

In one synthesised study, a compliant lifestyle was evident in *smoking cessation* (Hall et al., 2015) and one synthesised study showed no effect on smoking cessation (Aku-Zaheya & Shiyab, 2017).

A compliant lifestyle is essential for the management of all chronic diseases, to ensure positive outcomes and improve healthy lifestyle. When a patient has a compliant lifestyle, the improvement is evident in the patient's symptoms and adherence to healthy behaviour. Patients make the choice to adhere to the goals set, and aim to

achieve the goals in order to improve their health (Eller et al., 2016: 46). Patient wellbeing can be achieved with a compliant lifestyle and support by mobile health devices, which enforce the compliant lifestyle by reminding patients of goals, and providing support and reinforcement that leads to positive outcomes (Eller et al., 2016: 45).

4.3.3 Concluding statements

Concluding statement 1:

Cell phones were used to support compliant lifestyles for patients with various chronic diseases, and had positive results.

Concluding statement 2:

Messages addressing specific information, such as lifestyle changes, reminders, self-monitoring and education, were communicated to patients with chronic diseases, and had positive results in managing chronic diseases.

Concluding statement 3:

Frequency of messages varied in the synthesised studies, from 24 hours a day to 3 times monthly having positive outcomes and effectively managing patients' chronic diseases.

Concluding statement 4:

Messages originated from researches, healthcare workers, automated messages and a centralised server and accomplished effective management of the chronic disease.

Concluding statement 5:

Positive outcomes were achieved regardless of the varied intervention periods, which lasted from 4 weeks to 3 years.

Concluding statement 6:

Compliant lifestyle was evident in all the synthesised studies, although some results measured showed a small impact. Self-efficacy was evident in all synthesised studies, with improvement in chronic disease management.

4.3.4 Rigour in Steps 5 and 6

The information synthesis and findings was done by the researcher and two researchers experienced in systematic reviews, ensuring rigour and transparency of the study. All discrepancies were discussed and consensus reached by the researcher and two researchers experienced in systematic reviews. The findings are clearly depicted in Table 4.1, thereby ensuring transparency. By adhering to the PICO principle and using a systematic method the researcher rigour in the study. Including all relevant studies and doing an extensive search for studies, with the assistance of a qualified librarian, ensured further rigour in this study. Concluding statements were formulated on the basis of a high level of methodological rigour, as defined by the critical appraisal process (Higgins & Green, 2011: online).

4.4 ETHICAL CONSIDERATIONS: STEPS 1 TO 6

During the entire research process, the following ethical principles were considered: adherence to regulations, research records, research methods, integrity, honesty, respect and accuracy (Botma et al., 2010: 4; Pozgar et al., 2014: 39-46). The following steps were taken to ensure ethical considerations were adhered to:

- **Adherence to regulations:** Approval was obtained from the Health Sciences research ethics committee of the University of the Free State, see Addendum 6.
- **Research records, respect and accuracy:** In a systematic review, the researcher handles the data selected with **respect** and conveys it with **accuracy** and **honesty**. Accurate and complete references are recorded, to ensure that the researcher respects the intellectual property and does not commit plagiarism. The researcher ensured that all the literature used is traceable, accessible and rigorous. An accurate record was kept of reasons

why certain studies were excluded or included in the study (Bak, 2012: 28, Higgins & Green, 2011: online).

- **Research methods:** The researcher was directed by two researchers experienced in systematic reviews, to ensure that data was collected methodically and to ensure that the best research method was used to conduct the study. The researcher ensured that precise referencing was done throughout the literature study, to give credit due to the authors and to endorse the validity of the literature (Polit & Beck, 2012: 656).
- **Honesty:** All studies used were referenced and the data that was collected is portrayed accurately by the researcher, thereby preventing plagiarism (Higgins & Green, 2011: online). A traceable record was kept of all the studies used, together with reasons for inclusion and exclusion.

4.5 SUMMARY

In this chapter, the researcher synthesised good quality information to answer the review question, Do mobile health devices support a compliant lifestyle in patients with chronic diseases? Concluding statements were formulated. The conclusion reached after synthesis was that mobile devices supported a compliant lifestyle in patients with chronic diseases. The mobile devices used were successful in improving chronic disease outcomes. The mobile health tools supported self-efficacy/compliant lifestyle and the outcomes reached were positive, while the intervention lasted. In some of the studies, long-term effects were measured and the positive effect of the intervention did last for up to three years after the intervention.

CHAPTER 5: LIMITATIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

In the previous chapter, the synthesis and findings were described and the concluding statements depicted. In this chapter, the limitations and recommendations will be discussed.

5.2 LIMITATIONS

- Chronic pain and chronic musculoskeletal diseases were not included in the search for this study. This exclusion should not have an impact on the results, because a number of other chronic diseases were included and will minimise the effect of excluding chronic pain and chronic musculoskeletal diseases on the results.
- The researcher was inexperienced in systematic reviews and this could have had an influence on the quality of the study. The effect of the limitation was minimised by the supervision of two researchers experienced in systematic reviews.
- The researcher and the two experienced researchers in systematic reviews were not blinded when studies were selected and critical appraisal was carried out. There were no conflicts of interest, because none of the researchers knew the authors of the studies. The effect of the limitation was minimised by three researchers conducting the critical appraisal and reaching consensus after discussions.

5.3 RECOMMENDATIONS

The recommendations will be discussed according to the concluding statements.

Concluding statement 1:

Cell phones were used to support a compliant lifestyle for patients with various chronic diseases, with *positive* results.

- A compliant lifestyle was evident in the patients with chronic diseases who used mobile devices. The accessibility of this technology should be investigated and integrated into the public healthcare system so that it can benefit more patients who find it difficult to visit health clinics regularly.
- Since mobile devices proved to be beneficial for managing chronic diseases, a more effective infrastructure should be developed on regional, local, national and international level in order to manage chronic diseases effectively.

Concluding statement 2:

Messages providing specific information, such as on lifestyle changes, reminders, self-monitoring and education, were communicated to patients, with positive results in relation to managing chronic diseases.

- Since the messages were unique to each study reported, it is recommended that messages are adapted according to the condition targeted and the needs of the patients concerned.
- Self-monitoring delivered good results and it is recommended that patients are provided with tools to self-monitor their symptoms, with support staff providing feedback and support if the symptoms are out of normal limits.

Concluding statement 3:

Frequency of messages varied, from 24 hours a day to 3 times monthly, with all reporting positive outcomes and effective management of patients' chronic diseases.

- Since the frequency of messages communicated differs in different studies, the researcher and healthcare worker should take the frequency of the information needed by the patient into consideration and adapt the frequency of messages according to the needs of the patients.

Concluding statement 4:

The messages originated from researchers, healthcare workers, automated message systems and a centralised server and accomplished effective management of the chronic disease.

- Since the staff involved in the intervention were not always trained in the use of mobile devices, it is essential that these persons are thoroughly trained in the intervention and use of the mobile technology.

Concluding statement 5:

Positive outcomes were achieved, regardless of the varied intervention periods, which ranged from 4 weeks to 3 years.

- A researcher needs to determine the best intervention period to achieve the best results, depending on the patients' understanding of the mobile device and the use of the intervention.

Concluding statement 6:

Compliance to lifestyle guidelines was evident in all the studies and, although some results showed a minor impact, all the studies did produce a positive result.

- The results varied from study to study, but all studies did produce a positive outcome. More studies are needed to determine which interventions provide optimal results for the chronic disease(s) researched.
- More studies are needed to determine what components in the study rendered positive results and what can be discarded or can be improved.

5.4 SUMMARY

In this study, the researcher synthesised good quality information to answer the review question, Do mobile devices support a compliant lifestyle in patients with chronic diseases? The most frequently diagnosed chronic diseases, their effect on the global

population and the management of these diseases, were discussed in Chapter 2. The researcher discussed the steps of a systematic review in Chapters 3 and 4. The inclusion and exclusion criteria, the selection of studies and the critical appraisal were discussed and demonstrated with figures and tables. The conclusion reached after synthesis was that mobile devices supported a compliant lifestyle in patients with chronic diseases. The mobile devices used were successful in improving chronic disease outcomes.

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11 QUESTIONS TO HELP YOU MAKE SENSE OF A TRIAL



11 questions to help you make sense of a trial

How to use this appraisal tool

Three broad issues need to be considered when appraising the report of a randomised controlled trial:

- Are the results of the trial valid? (Section A)
- What are the results? (Section B)
- Will the results help locally? (Section C)

The 11 questions on the following pages are designed to help you think about these issues systematically.

The first three questions are screening questions and can be answered quickly. If the answer to both is "yes", it is worth proceeding with the remaining questions.

There is some degree of overlap between the questions, you are asked to record a "yes", "no" or "can't tell" to most of the questions. A number of prompts are given after each question. These are designed to remind you why the question is important. Record your reasons for your answers in the spaces provided.

There will not be time in the small groups to answer them all in detail!

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(A) Are the results of the review valid?

Screening Questions

1. Did the trial address a clearly focused issue? Yes Can't tell No

HINT: An issue can be 'focused' in terms of

- The population studied
- The intervention given
- The comparator given
- The outcomes considered

2. Was the assignment of patients to treatments randomised? Yes Can't tell No

HINT: Consider

- How was this carried out?
- Was the allocation sequence concealed from researchers and patients?

3. Were all of the patients who entered the trial properly accounted for at its conclusion? Yes Can't tell No

HINT: Consider

- Was the trial stopped early?
- Were patients analysed in the groups to which they were randomised?

Is it worth continuing?



Detailed questions

4. Were patients, health workers and study personnel 'blind' to treatment?

Yes

Can't tell

No

HINT: Think about

- Patients?
- Health workers?
- Study personnel?

5. Were the groups similar at the start of the trial?

Yes

Can't tell

No

HINT: Look at

- Other factors that might affect the outcome such as age, sex, social class

6. Aside from the experimental intervention, were the groups treated equally?

Yes Can't tell No

(B) What are the results?

7. How large was the treatment effect?

HINT: Consider

- What outcomes were measured?
- Is the primary outcome clearly specified?
- What results were found for each outcome?

8. How precise was the estimate of the treatment effect?

HINT: Consider

- What are the confidence limits?

(C) Will the results help locally?

9. Can the results be applied in your context?
(or to the local population?)

Yes Can't tell No

HINT: Consider whether

- Do you think that the patients covered by the trial are similar enough to the patients to whom you will apply this?, if not how do they differ?

10. Were all clinically important outcomes considered?

Yes Can't tell No

HINT: Consider

- Is there other information you would like to have seen?
- If not, does this affect the decision?

11. Are the benefits worth the harms and costs?

Yes Can't tell No

HINT: Consider

- Even if this is not addressed by the review, what do you think?

C



10 questions to help you make sense of a review

How to use this appraisal tool

Three broad issues need to be considered when appraising the report of a systematic review:

- **Are the results of the review valid?** (Section A)
- **What are the results?** (Section B)
- **Will the results help locally?** (Section C)

The 10 questions on the following pages are designed to help you think about these issues systematically.

The first two questions are screening questions and can be answered quickly. If the answer to both is "yes", it is worth proceeding with the remaining questions.

There is some degree of overlap between the questions, you are asked to record a "yes", "no" or "can't tell" to most of the questions. A number of italicised prompts are given after each question. These are designed to remind you why the question is important. Record your reasons for your answers in the spaces provided.

There will not be time in the small groups to answer them all in detail!

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(A) Are the results of the review valid?

Screening Questions

1. Did the review address a clearly focused question? Yes Can't tell No

HINT: An issue can be 'focused' in terms of

- The population studied
- The intervention given
- The outcome considered

2. Did the authors look for the right type of papers? Yes Can't tell No

HINT: 'The best sort of studies' would

- Address the reviews question
- Have an appropriate study design (usually RCTs for papers evaluating Interventions)

Is it worth continuing?



Detailed questions

3. Do you think the important, relevant studies were included?

Yes Can't tell No

HINT: Look for

- Which bibliographic databases were used
 - Follow up from reference lists
 - Personal contact with experts
 - Search for unpublished as well as published studies
 - Search for non-English language studies
-

4. Did the review's authors do enough to assess the quality of the included studies?

Yes Can't tell No

HINT: The authors need to consider the rigour of the studies they have identified. Lack of rigour may affect the studies' results. ("All that glisters is not gold" Merchant of Venice – Act II Scene 7)

5. If the results of the review have been combined, was it reasonable to do so?

Yes Can't tell No

HINT: Consider whether

- The results were similar from study to study
- The results of all the included studies are clearly displayed
- The results of the different studies are similar
- The reasons for any variations in results are discussed

(B) What are the results?

6. What are the overall results of the review?

HINT: Consider

- If you are clear about the review's 'bottom line' results
 - What these are (numerically if appropriate)
 - How were the results expressed (NNT, odds ratio etc)
-

7. How precise are the results?

HINT: Look at the confidence intervals, if given

(C) Will the results help locally?

8. Can the results be applied to the local population? Yes Can't tell No

HINT: Consider whether

- The patients covered by the review could be sufficiently different to your population to cause concern
- Your local setting is likely to differ much from that of the review

9. Were all important outcomes considered? Yes Can't tell No

HINT: Consider whether

- Is there other information you would like to have seen

10. Are the benefits worth the harms and costs? Yes Can't tell No

HINT: Consider

- Even if this is not addressed by the review, what do you think?

10 QUESTIONS TO HELP YOU MAKE SENSE OF QUALITATIVE RESEARCH



10 questions to help you make sense of qualitative research

How to use this appraisal tool

Three broad issues need to be considered when appraising the report of a qualitative research:

- Are the results of the review valid?
- What are the results?
- Will the results help locally?

The 10 questions on the following pages are designed to help you think about these issues systematically. The first two questions are screening questions and can be answered quickly. If the answer to both is "yes", it is worth proceeding with the remaining questions.

There is some degree of overlap between the questions, you are asked to record a "yes", "no" or "can't tell" to most of the questions. A number of italicised prompts are given after each question. These are designed to remind you why the question is important. Record your reasons for your answers in the spaces provided.

There will not be time in the small groups to answer them all in detail!

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Screening Questions

1. Was there a clear statement of the aims of the research?

Yes Can't tell No

HINT: Consider

- What was the goal of the research?
- Why it was thought important?
- Its relevance

2. Is a qualitative methodology appropriate?

Yes Can't tell No

HINT: Consider

- If the research seeks to interpret or illuminate the actions and/or subjective experiences of research participants
- Is qualitative research the right methodology for addressing the research goal?

Is it worth continuing?



Detailed questions

3. Was the research design appropriate to address the aims of the research?

Yes

Can't tell

No

HINT: Consider

- if the researcher has justified the research design (e.g. have they discussed how they decided which method to use)?

4. Was the recruitment strategy appropriate to the aims of the research?

Yes

Can't tell

No

HINT: Consider

- if the researcher has explained how the participants were selected
- if they explained why the participants they selected were the most appropriate to provide access to the type of knowledge sought by the study
- if there are any discussions around recruitment (e.g. why some people chose not to take part)

5. Was the data collected in a way that addressed the research issue? Yes Can't tell No

HINT: Consider

- If the setting for data collection was justified
 - If it is clear how data were collected (e.g. focus group, semi-structured interview etc.)
 - If the researcher has justified the methods chosen
 - If the researcher has made the methods explicit (e.g. for interview method, is there an indication of how interviews were conducted, or did they use a topic guide)?
 - If methods were modified during the study. If so, has the researcher explained how and why?
 - If the form of data is clear (e.g. tape recordings, video material, notes etc)
 - If the researcher has discussed saturation of data
-

6. Has the relationship between researcher and participants been adequately considered? Yes Can't tell No

HINT: Consider

- If the researcher critically examined their own role, potential bias and influence during
 - (a) Formulation of the research questions
 - (b) Data collection, including sample recruitment and choice of location
- How the researcher responded to events during the study and whether they considered the implications of any changes in the research design

7. Have ethical issues been taken into consideration?

Yes

Can't tell

No

HINT: Consider

- If there are sufficient details of how the research was explained to participants for the reader to assess whether ethical standards were maintained
- If the researcher has discussed issues raised by the study (e.g. issues around informed consent or confidentiality or how they have handled the effects of the study on the participants during and after the study)
- If approval has been sought from the ethics committee

8. Was the data analysis sufficiently rigorous?

Yes

Can't tell

No

HINT: Consider

- If there is an in-depth description of the analysis process
- If thematic analysis is used. If so, is it clear how the categories/themes were derived from the data?
- Whether the researcher explains how the data presented were selected from the original sample to demonstrate the analysis process
- If sufficient data are presented to support the findings
- To what extent contradictory data are taken into account
- Whether the researcher critically examined their own role, potential bias and influence during analysis and selection of data for presentation

9. Is there a clear statement of findings?

Yes Can't tell No

HINT: Consider

- If the findings are explicit
 - If there is adequate discussion of the evidence both for and against the researchers arguments
 - If the researcher has discussed the credibility of their findings (e.g. triangulation, respondent validation, more than one analyst)
 - If the findings are discussed in relation to the original research question
-

10. How valuable is the research?

HINT: Consider

- If the researcher discusses the contribution the study makes to existing knowledge or understanding e.g. do they consider the findings in relation to current practice or policy?, or relevant research-based literature?
- If they identify new areas where research is necessary
- If the researchers have discussed whether or how the findings can be transferred to other populations or considered other ways the research may be used

CRITICAL APPRAISAL OF A SURVEY



Critical Appraisal of a Survey

| Appraisal questions | Yes | Can't tell | No |
|--|-----|------------|----|
| 1. Did the study address a clearly focused question / issue? | | | |
| 2. Is the research method (study design) appropriate for answering the research question? | | | |
| 3. Is the method of selection of the subjects (employees, teams, divisions, organizations) clearly described? | | | |
| 4. Could the way the sample was obtained introduce (selection) bias? | | | |
| 5. Was the sample of subjects representative with regard to the population to which the findings will be referred? | | | |
| 6. Was the sample size based on pre-study considerations of statistical power? | | | |
| 7. Was a satisfactory response rate achieved? | | | |
| 8. Are the measurements (questionnaires) likely to be valid and reliable? | | | |
| 9. Was the statistical significance discussed? | | | |
| 10. Are confidence intervals given for the main results? | | | |
| 11. Could there be confounding factors that haven't been accounted for? | | | |
| 12. Can the results be applied to your organization? | | | |

Adapted from Franche. *The Ficker Guide to Critical Appraisal*, the critical appraisal approach used by the Oxford Centre for Evidence Medicine, checklists of the Dutch Cochrane Centre, BMJ editor's checklist and the checklists of the EPPI Centre.

EVIDENCE-BASED PRACTICE TOOL

SN2017

Levels of Evidence - Evidence Based Practice Toolkit - Research Hub at Wilfrid Laurier University

Original Library > Research Hub > Research & Resource Guides > Evidence Based Practice Toolkit > Levels of Evidence

Evidence Based Practice Toolkit

Understanding Evidence Based Practice

What is EBP?

Asking Your Question

Levels of Evidence

Levels of Evidence

Research study designs

Types of evidence: TRIP

Levels of Evidence

TRIP Guidelines

Evidence Appraisal

Resources

Levels of Evidence

Levels of evidence forms used and ranked by evidence are assigned to studies based on the methodologic quality of the design, validity, and applicability to patient care. These studies serve as the "backbone" to a weight of recommendations.

| Level of evidence (LOE) | Description |
|-------------------------|---|
| Level I | Evidence from a systematic review or meta-analysis of all relevant RCTs (randomized controlled trials) or other evidence or from practice guidelines based on systematic reviews of RCTs of three or more RCTs of good quality that have similar results. |
| Level II | Evidence obtained from at least one well-designed RCT (or a large multiple RCT). |
| Level III | Evidence obtained from one or two good controlled trials without randomization or, in quasi-experimental. |
| Level IV | Evidence from well designed case-control or cohort studies. |
| Level V | Evidence from systematic reviews of descriptive and quantitative studies (prevalence, etc.). |
| Level VI | Evidence from a single descriptive or qualitative study. |
| Level VII | Evidence from the opinion of authorities and/or reports of expert committees. |

This level of evidence ranking scheme is based on the following: Achey, B. J., Swan, B. A., Jackson, G., & Tuckey, S. (2008). Evidence Assessment of Guidelines: Methodological considerations. *PLoS ONE*, 3(10), e3769.

Research study designs

Determine if clinical questions have been answered by different types of research studies. You might not always find the highest level of evidence (i.e. systematic review or meta-analysis) to answer your question. When this happens, work your way down to the next highest level of evidence.

The table suggests study designs associated to answer each type of clinical question.

| Clinical Question | Suggested Research Design(s) |
|------------------------|---|
| All Clinical Questions | Systematic review, meta-analysis |
| Therapy | Randomized controlled trial (RCT), meta-analysis Also: cohort study, case-control study, case series |
| Diagnosis | Randomized controlled trial (RCT), meta-analysis Also: cohort study |
| Prognosis | Randomized controlled trial (RCT), meta-analysis Also: retrospective cohort study, case-control study, case series |
| Prevention | Cohort study Also: case-control study, case series |
| Meaning | Qualitative study |
| Quality Improvement | Randomized controlled trial (RCT) Also: qualitative study |
| Cost | Economic evaluation |

Types of resources: TRIP



When searching for evidence-based information, one should select the highest level of evidence possible—systematic reviews or meta-analyses. Systematic reviews, meta-analyses, and critically appraised topic/articles have all gone through an evaluation process; they have been “filtered.” Information that has not been critically appraised is considered “unfiltered.”

As you move up the pyramid, however, fewer studies are available; it's important to recognize that high levels of evidence may not exist for your clinical question. If this is the case, you'll need to move down the pyramid if your quest for resources at the top of the pyramid is unsuccessful.

- **Meta-Analysis:** A systematic review that uses quantitative methods to summarize the results.
- **Systematic Review:** Authors have systematically searched for, appraised, and summarized all of the medical literature for a specific topic.
- **Critically Appraised Topic:** Authors evaluate and synthesize multiple research studies.
- **Critically Appraised Articles:** Authors evaluate and appraise individual research studies.
- **Randomized Controlled Trials:** Include a randomized group of patients in an experimental group and a control group. These groups are followed up for the variable/outcome of interest.
- **Cohort Study:** Identifies two groups (cohorts) of patients, one which did receive the exposure of interest, and one which did not, and following these cohorts forward for the outcome of interest.
- **Case-Control Study:** Identifies patients who have the outcome of interest (cases) and control patients without the same outcome, and looks for exposure of interest.
- **Background Information/Expert Opinion:** Handbooks, encyclopedias, and textbooks often provide a good foundation or introduction and often include generalized information about a condition. While background information presents a convenient summary, often it takes about three years for this type of literature to be published.
- **Animal Research/Lab Studies:** Information begins at the bottom of the pyramid; this is where ideas and laboratory research takes place. Ideas turn into therapies and diagnostic tests, which then are tested with lab models and animals.

Use the TRIP database to find unfiltered and filtered information sources online.

Source:

Greenough, Peter. How to Read a Paper: The Basics of Evidence Based Medicine. London: 2001, 2006.

Source: Jari Van, David Clark, Karen & Lei Wang. EBEM Pyramid. York: York University/University of Toronto, 2006.

Levels of Evidence

The following organizations describe levels of evidence:

- **Oxford Centre for Evidence-Based Medicine: Levels of Evidence**
- **Essential Evidence Plus: Levels of Evidence**

ESP Glossaries

Consult these resources to understand the language of evidence-based practice and terms used in clinical research.

- Quantitative Research Terms (NHS Trust)
- Qualitative Research Terms (NHS Trust)
- Glossary of Cochrane Terms
- Oxford Centre for Evidence Based Medicine Glossary
- Toronto Centre for Evidence Based Medicine Glossary
- Agency for Healthcare Research and Quality Glossary of Terms

[← Previous: Asking Your Question](#)[Next: Evidence Appraisal →](#)

ETHICS COMMITTEE APPROVAL



IRB nr 00006240
 REC Reference nr 230408-C11
 IDRG0005187
 FWA00012784

26 February 2016

MRS LR VAN DER WALT
 C/O DR M REID
 SCHOOL OF NURSING
 IDALIA LOOTS BUILDING
 UFS

Dear Ms Van Der Walt

HSREC 30/2016

PROJECT TITLE: **MOBILE HEALTH DEVICES USED TO SUPPORT A COMPLIANT LIFESTYLE IN PATIENTS WITH CHRONIC DISEASES: A SYSTEMATIC REVIEW**

1. You are hereby kindly informed that, at the meeting held on 23 February 2016, the Health Sciences Research Ethics Committee (HSREC) approved the above project.

***Dr Reid recused herself from the meeting for the duration of this discussion and decision*

2. The Committee must be informed of any serious adverse event and/or termination of the study.
3. Any amendment, extension or other modifications to the protocol must be submitted to the HSREC for approval.
4. A progress report should be submitted within one year of approval and annually for long term studies.
5. A Final report should be submitted at the completion of the study.
6. Kindly use the **HSREC NR** as reference in correspondence to the HSREC Secretariat.

7. The HSREC functions in compliance with, but not limited to, the following documents and guidelines: The SA National Health Act No. 61 of 2003; Ethics in Health Research Principles, Structures and Processes (2015); SA GCP(2006); Declaration of Helsinki; The Belmont Report; The US Office of Human Research Protections 45 CFR 46.1 (for non exempt research with human participants conducted or supported by the US Department of Health and Human Services (HHS); 21 CFR 50, 21 CFR 56, CIOMS; ICH-GCP-E6 Sections 1-4, The International Conference on Harmonization and Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH Tripartite), Guidelines of the SA Medicines Control Council as well as Laws and Regulations with regard to the Control of Medicines, Constitution of the HSREC of the Faculty of Health Sciences.

Yours faithfully

DR SM LE GRANGE
 CHAIR, HEALTH SCIENCES RESEARCH ETHICS COMMITTEE



Declaration

1 October 2018

Hester Sophia Human
PO Box 86602
Eros
Windhoek
Namibia

Student: Lezelle Ruanda van der Walt

Study: Mobile health devices used to support a compliant lifestyle in patients with chronic diseases: A systematic review

I confirm that I edited this mini dissertation. I made recommendations for changes and audited the references.



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