Turun yliopisto
University of Turku

ADHERENCE TO TREATMENT IN PSYCHOTIC DISORDERS

- Development of user-centered mobile health intervention

Kaisa Kauppi

TURUN YLIOPISTON JULKAISUJA – ANNALES UNIVERSITATIS TURKUENSIS
Sarja - ser. D osa - tom. 1227 | Medica - Odontologica | Turku 2016

University of Turku

Faculty of Medicine
Department of Nursing Science
Doctoral Programme in Nursing Science

Supervised by

Professor Maritta Välimäki, RN, PhD
Department of Nursing Science
University of Turku
Turku, Finland

Heli Hätönen, RN, PhD
Department of Nursing Science
University of Turku
Turku, Finland

Reviewed by

Professor Sami Pirkola, M.D., PhD
School of Health Sciences
University of Tampere
Tampere, Finland

Docent Kaisa Haatainen, RN, PhD
Department of Nursing Science
University of Eastern Finland
Kuopio, Finland

Opponent

Professor Wai-Tong Chien
School of Nursing
Hong Kong Polytechnic University
Hong Kong, China

ISBN 978-951-29-6461-1 (PRINT)
ISBN 978-951-29-6462-8 (PDF)
ISSN 0355-9483 (Print)
ISSN 2343-3213 (Online)
Painosalama Oy - Turku, Finland 2016

To Tuomo, Oskari
and my Mother Päivi

Kaisa Kauppi

ADHERENCE TO TREATMENT IN PSYCHOTIC DISORDERS - Development of user-centered mobile health intervention

Department of Nursing Science, Faculty of Medicine, University of Turku, Finland
Annales Universitatis Turkuensis, Painosalama Oy, Turku 2016

ABSTRACT

The aim of this study was to explore adherence to treatment among people with psychotic disorders through the development of user-centered mobile technology (mHealth) intervention. More specifically, this study investigates treatment adherence as well as mHealth intervention and the factors related to its possible usability. The data were collected from 2010 to 2013. First, patients' and professionals' perceptions of adherence management and restrictive factors of adherence were described (n = 61). Second, objectives and methods of the intervention were defined based on focus group interviews and previously used methods. Third, views of patients and professionals about barriers and requirements of the intervention were described (n = 61). Fourth, mHealth intervention was evaluated based on a literature review (n = 2) and patients preferences regarding the intervention (n = 562).

Adherence management required support in everyday activities, social networks and maintaining a positive outlook. The factors restricting adherence were related to illness, behavior and the environment. The objective of the intervention was to support the intention to follow the treatment guidelines and recommendations with mHealth technology. The barriers and requirements for the use of the mHealth were related to technology, organizational issues and the users themselves. During the course of the intervention, 33 (6%) out of 562 participants wanted to edit the content, timing or amount of the mHealth tool, and 23 (4%) quit the intervention or study before its conclusion. According to the review, mHealth interventions were ineffective in promoting adherence.

Prior to the intervention, participants perceived that adherence could be supported, and the use of mHealth as a part of treatment was seen as an acceptable and efficient method for doing so. In conclusion, the use of mHealth may be feasible among people with psychotic disorders. However, clear evidence for its effectiveness in regards to adherence is still currently inconclusive.

Keywords: adherence, mHealth, health technology, short message service, mental health, psychotic disorders, psychiatric nursing

Kaisa Kauppi

HOITOON SITOUTUMINEN PSYKOOTTISISSA HÄIRIÖISSÄ - Käyttäjälähtöisen mobiiliteknologisen intervention kehittäminen

Hoitotieteen oppiaine, Lääketieteellinen tiedekunta, Turun yliopisto, Suomi
Annales Universitatis Turkuensis, Painosalama Oy, Turku 2016

TIIVISTELMÄ

Tutkimuksen tavoitteena oli selvittää psykoottisia häiriötä sairastavien hoitoon sitoutumista, kehittämällä käyttäjälähtöinen mobiiliteknologinen interventio. Tutkimuksen kohteena olivat hoitoon sitoutuminen, mobiiliteknologinen interventio ja sen käytettävyyteen liittyvät tekijät. Aineisto kerättiin vuosina 2010–2013. Ensimmäisessä vaiheessa kuvattiin potilaiden ja hoitohenkilökunnan näkemyksiä hoitoon sitoutumisen hallinnasta ja sitä rajoittavista tekijöistä (n = 61). Toisessa vaiheessa määriteltiin intervention tavoite ja menetelmät ryhmähaastatteluiden sekä aiempien tutkimusten avulla. Kolmannessa vaiheessa kuvattiin potilaiden ja hoitohenkilökunnan näkemyksiä esteistä ja vaatimuksista intervention käytölle (n = 61). Neljännessä vaiheessa mobiiliteknologisia interventioita arvioitiin perustuen kirjallisuuskatsaukseen ja potilaiden (n = 562) mieltymyksiin.

Hoitoon sitoutumisen hallinta edellytti arkielämän, sosiaalisten verkostojen ja positiivisen näkemyksen tukemista. Hoitoon sitoutumista puolestaan rajoitti sairauteen, käyttäytymiseen ja ympäristöön liittyvät tekijät. Intervention tavoitteeksi muodostui potilaan suunnitelmallisen pyrkimyksen tukeminen hoitosuositusten ja – ohjeiden noudattamiseksi, hyödyntäen mobiiliteknologiaa. Mobiiliteknologian käytön vaatimukset ja esteet liittyivät teknologiaan, organisaatioon ja käyttäjään. Kaikkiaan 562 tutkittavasta, 33 (6 %) halusi intervention aikana sisällöllisiä, ajallisia tai määrällisiä muutoksia valitsemiinsa viesteihin, ja 23 (4 %) keskeytti intervention tai tutkimuksen. Kirjallisuuskatsauksen mukaan mobiiliteknologiset interventiot eivät edistäneet hoitoon sitoutumista.

Tutkittavat kuvasivat interventiota edeltävästi, että hoitoon sitoutumista on mahdollista tukea, ja mobiiliteknologia osana hoitoa koettiin hyväksyttäväksi ja tehokkaaksi menetelmäksi tähän. Arvioinnin perusteella mobiiliteknologia saattanee olla soveltuva osa psykoottista häiriöitä sairastavien hoitoon. Tieto mobiiliteknologian vaikuttavuudesta hoitoon sitoutumisen edistämiseksi on kuitenkin vielä tällä hetkellä puutteellinen.

Avainsanat: hoitoon sitoutuminen, mobiiliteknologia, terveysteknologia, tekstiviesti, mielenterveys, psykoottiset häiriöt, psykiatrinen hoitotyö

TABLE OF CONTENTS

ABSTRACT **4**
TIIVISTELMÄ **5**
TABLE OF CONTENTS **6**
LIST OF FIGURES AND TABLES **8**
ABBREVIATIONS **9**
LIST OF ORIGINAL PUBLICATIONS **10**
1. INTRODUCTION **11**
2. BACKGROUND **14**
2.1 Psychotic disorders 14
2.2 Psychiatric treatment and legislations 15
2.2.1 Psychiatric treatment 15
2.2.2 Legislations and policies 16
2.3 Treatment adherence of people with psychotic disorders 17
2.3.1 Treatment adherence 17
2.3.2 Factors related to adherence 20
2.3.3 Adherence management 24
2.4 Mobile technology and mobile health 28
2.4.1 Mobile technology in society 28
2.4.2 Mobile health 29
2.4.3 Development of mobile health interventions 30
2.4.4 Mobile health in supporting adherence 34
2.4.5 Barriers and requirements of using mobile health 41
2.4.6 Effectiveness of mobile health 42
2.4.7 Feasibility of mobile health 45
3. AIMS OF THE STUDY **47**
4. MATERIALS AND METHODS **48**
4.1 Theoretical and methodological approaches of the study 48
4.2 Study design and settings 50
4.3 Populations and sampling method 51
4.4 Instruments 53
4.5 Data collection 55
4.6 Data analyses 57
4.7 Ethical considerations 58
5. RESULTS **61**
5.1 Study populations 61

5.2 Adherence in people with psychotic disorders 62
5.2.1 Restrictive factors for adherence 62
5.2.2 Adherence management 63
5.3 Mobile health to support adherence in people with psychotic disorders 64
5.3.1 Objective of the intervention to support adherence 64
5.3.2 Preferred methods of delivering the intervention 65
5.3.3 Previously used methods for delivering the intervention 65
5.4 Barriers and requirements of using mobile health among people with psychotic disorders 67
5.5 Evaluation of the mobile among people with psychotic disorders 69
5.5.1 Effectiveness of mobile health 69
5.5.2 Feasibility of mobile health 70

6. DISCUSSION 71
6.1 Validity and reliability of the study 72
6.2 Discussion of the results 76
6.2.1 Adherence in people with psychotic disorders 76
6.2.2 Mobile health to support adherence in people with psychotic disorders 79
6.2.3 Barriers and requirements of using mobile health among people with psychotic disorders 80
6.2.4 Evaluation of the mobile health among people with psychotic disorders 81
6.3 Suggestions 84
6.3.1 Study suggestions 84
6.3.2 Suggestions for future research 86

7. CONCLUSIONS 87

8. ACKNOWLEDGEMENTS 88

REFERENCES 91

ORIGINAL PUBLICATIONS I – IV 103

LIST OF FIGURES AND TABLES

LIST OF FIGURES

Figure 1. Steps used from Intervention Mapping **32**
Figure 2. Screenshot of the main menu from Mobile.Net mHealth system ... **56**
Figure 3. Objectives of the intervention **64**
Figure 4. Effectiveness of the intervention for different outcomes **69**

LIST OF TABLES

Table 1. Summary of the studies evaluating mHealth and treatment adherence **36**
Table 2. Summary of methods used **49**
Table 3. Inclusion and exclusion criteria of the participants **52**
Table 4. Outcomes and instruments to assess clinical response **54**
Table 5. Search terms of databases **56**
Table 6. Demographic characteristics of the study participants **61**
Table 7. Potentiality of mHealth as a strategy to deliver the intervention **65**
Table 8. Randomized studies using electronic reminders to support adherence **66**
Table 9. Specific principles of developed mHealth intervention **66**
Table 10. Barriers and requirements of using mHealth **68**
Table 11. Preferences over time toward mHealth intervention **70**

ABBREVIATIONS

AMED	Allied and Complementary Medicine Database
CANSAS	Camberwell Assessment of Needs - Short Appraisal Schedule
CGI-SCH	Clinical Global Impression-Schizophrenia
CI	Confidence interval
CUE	Computer Use and Experience Scale
CQ-Index	Consumer Quality Index
DAI-10	Drug Attitude Inventory 10-item version
EEG	Electroencephalography
EMBASE	Excerpta Medica database
EU	European Union
Ficora	Finnish Communications Regulatory Authority
GPRS	General packet radio service
GRADE	Grades of Recommendation, Assessment, Development and Evaluation
HIV	The human immunodeficiency virus
HoNOS	The Health of the Nation Outcome Scale
IBM	International Business Machines Corporation
ICD	International Classification of Diseases
ICT	Information and communication technology
IM	Intervention Mapping
MANSA	Manchester Short Assessment of Quality of Life
MAQ	Medication Adherence Questionnaire
MD	Mean difference
Medline	Medical Literature Analysis and Retrieval System Online
mHealth	Mobile health
MOST	Multiphase Optimisation Strategy
MRC	Medical Research Council
NICE	National Institute for Health and Care Excellence
RevMan	Review Manager
RR	Risk ratio
SAS	Statistical Analysis System
SMART	Sequential Multiple Assignment Randomized Trial
SMS	Short Message Service
SPSS	Statistical Package for the Social Sciences
SUMD	Scale to Assess Unawareness in Mental Disorder
TAU	Treatment as usual
YLD	Years Lived With Disability
Valvira	The National Supervisory Authority for Welfare and Health
WAI-SR	Working Alliance Inventory-Short Revised
WHO	World Health Organization
WMA	World Medical Association

LIST OF ORIGINAL PUBLICATIONS

The dissertation is based on the following publications referred to in the text by the roman numerals I-IV.

I Kauppi K, Hätönen H, Adams CE & Välimäki M. 2015. Perceptions of treatment adherence among people with mental health problems and health care professionals. Journal of Advanced Nursing. 71(4):777-788. doi: 10.1111/jan.12567. Epub 2014 Nov 14.

II Kauppi K, Hätönen H, Adams CE, Välimäki M. SMS in psychiatric services – its opportunities and challenges in supporting patient adherence. Submitted.

III Kauppi K, Kannisto K, Hätönen H, Anttila M, Löyttyniemi E, Adams CE, Välimäki M. 2015. Mobile phone text message reminders: Measuring preferences of people with antipsychotic medication. Schizophrenia Research. Aug 17. pii: S0920-9964(15)00410-7. doi: 10.1016/j.schres.2015.07.044. [Epub ahead of print].

IV Kauppi K, Välimäki M, Hätönen HM, Kuosmanen LM, Warwick-Smith K, Adams CE. 2014. Information and communication technology based prompting for treatment compliance for people with serious mental illness. Cochrane Database of Systematic Reviews 2014, Issue 6. Art. No.: CD009960. DOI: 10.1002/14651858.CD009960.pub2

1. INTRODUCTION

Psychotic disorders are a major public health problem (Bogren et al. 2009; Perälä et al. 2007). The clinical presentation of symptoms is diverse (WHO 2015), affecting a person's thoughts and actions (Esan et al. 2012). To manage these symptoms and to prevent relapses, adherence to treatment is crucial (Current Care Schizophrenia Guideline 2013). Still, for many years, studies have pointed out the difficulties of adherence (Fenton et al. 1997; Lacro et al. 2002; Goff et al. 2010; Haddad et al. 2014). This results in repeated hospitalizations, increasing the annual costs of health care for relapsing patients to three times the amount for those who do not relapse (Ascher-Svanum et al. 2010). The various factors contributing to a predisposition for non-adherence are contradictory (Sendt et al. 2015), and include behavioral, health-related and environmental factors (Oehl et al. 2000). Moreover, the understanding of treatment adherence is poor (Piette et al. 2007), and the content is complex and multifaceted, including aspects such as patient behavior and nursing practice (Gardner 2015).

Mobile health (mHealth) refers to the use of mobile technology as a part of medical or public health care (WHO mHealth 2011). The use of mHealth may increase the efficiency and quality of health care and treatment (European Commission 2013). Overall, it supports the development of health care in becoming more patient-focused (European Commission 2014). Lately, it has been used as a method for delivering adherence-improving interventions with promising results (Pijnenborg et al. 2010; Montes et al. 2012), and it has the potential to significantly shape health care in the future (Weinstein et al. 2014).

The frequently used mobile application, Short Message Service (SMS), has the proven capability of being a useful tool in the field of health care (Kannisto et al. 2014). It can offer promising methods for treatment and communication (European Commission 2014; WHO mHealth 2011), as it is one solution for making health care more cost-effective by improving the efficiency of the system (European Commission 2014). SMS can also promote medication adherence (Montes et al. 2012) and increase health care appointment attendance (Gurol-Urganci et al. 2013). Although smartphone apps are nowadays used as a form of mHealth, including among people with psychotic disorders, with high feasibility rates (Firth & Torous 2015), traditional SMS is still the most successful and frequently used mHealth tool that supports treatment adherence

among people with chronic disorders. SMS is inexpensive and can be used with simple mobile phones, with minor technical skills. (Hamine et al. 2015.)

Little is known about patients' preferences of types of mHealth. There is also a lack of evidence determining how accepted mHealth really is (Daker-White & Rogers 2013) as well as the perceptions toward mHealth of people with psychotic disorders (Palmier-Claus et al. 2013). Therefore, it is important to evaluate whether preferences vary over time, since people with psychotic disorders can be inconsistent in their preferences (Gard et al. 2011, Strauss et al. 2011). However, it has been shown that people with psychotic disorders are able to make requests and express their preferences about their treatment (Farrelly et al. 2014). Moreover, evidence regarding the efficacy of mHealth is still needed (Black et al. 2011). To address this research need, the development process of mHealth intervention, with preferences of patients and professionals was presented. This included a description of adherence, objectives of the intervention, the intervention methods, any barriers or requirements, as well as the effectiveness and feasibility of mHealth interventions.

The aim of this study was to explore adherence to treatment among people with psychotic disorders through the development of user-centered mobile technology (mHealth) intervention. More specifically, this study investigates treatment adherence as well as mHealth intervention and the factors related to its possible usability. This dissertation has been written in the field of nursing science, and it is a part of the study, "Mobile.Net" (ISRCTN: 27704027), which evaluates the impact of SMS on the encouragement of adherence among people with psychosis (Välimäki et al. 2012).

In this study, the patient population was characterized as adults with psychotic disorders (codes F20-F29), based on ICD-10. The intervention target population was on antipsychotic medication, which is central in the treatment of psychotic disorders (Current Care Schizophrenia Guideline 2013). Each individual is understood as a whole and multidimensional person, taking his or her physical, emotional, mental, spiritual and social aspects into consideration (Gournay 2000). The environment was psychiatric outpatient care, where the treatment of psychotic disorders is primarily carried out (Current Care Schizophrenia Guideline 2013).

In this study, treatment adherence was understood as the extent that a patient follows treatment guidelines (Christensen 2004; Haynes et al. 2005) and measured by participant perceptions of adherence and the level of self-reported medication taking. The guidelines were operationalized by concentrating on the developed intervention areas corresponding to the specific areas of the Finnish Schizophrenia Current Care Guidelines (2013). In this study, patient participation in treatment (Sawada et al. 2009) and intention to follow recommendations were important. Treatment adherence covered medication adherence, participation in follow-up care and ability to conduct everyday activities. The term adherence was chosen since it is widely used, referring adherence with the treatment instructions generated through a mutual understanding of the patient and professionals (Gardner 2015).

In this study, mHealth was understood as the use of mobile technology as a part of medical or public health care (WHO mHealth 2011), especially in psychiatry outpatient care. In this study, the term mHealth includes SMS and other mobile applications. The developed mHealth intervention was an SMS, the use of which was initiated after a patient was discharged from inpatient care and continued for one year during outpatient care.

2. BACKGROUND

2.1 Psychotic disorders

Psychotic disorders are severe, impairing and, typically, chronic mental disorders (Perälä et al. 2007; Haller et al. 2014). The clinical presentations of psychotic symptoms are diverse (e.g. delusions and hallucinations) (WHO 2015) and affect a person's thoughts and actions (Esan et al. 2012). The International Statistical Classification of Diseases and Related Health Problems (ICD-10) categorizes psychotic disorders as schizophrenia, schizotypal and delusional disorders (F20-F29). More specifically, the disorders classified under this category are: schizophrenia (F20); schizotypal disorder (F21); delusional disorders (F22); brief psychotic disorder (F23); shared psychotic disorder (F24); schizoaffective disorders (F25); other psychotic disorders not due to a substance or known physiological condition (F28) and unspecified psychosis not due to a substance or known physiological condition (F29). (ICD-10 WHO Version 2015.)

The lifetime prevalence of all psychotic disorders is 3% (Perälä et al. 2007). There is urban-rural and geographical variation in prevalence (Perälä et al. 2008) as well as geographical variation in incidence rates (Kirkbride et al. 2012). For example, in Finland, people born in the East (3.99%) or the North (4.56%) have higher odds of experiencing psychosis compared to people from Southwest Finland (2.17%). In addition, some demographic factors can increase the prevalence, such as not being married, being retired, not having a higher education or a low income level. (Perälä et al. 2008.)

The humanistic burden of psychotic disorders is significant (Kitchen et al. 2012; Millier et al. 2014). This is due to chronic nature (Messias et al. 2007) and the high risk of related disability. The burden includes manifold overlapping dimensions; quality of life, depression, family burden, cognitive functioning, social impairment, mortality, suicide, homelessness, morbidity, stigmatization, violence, and problems in lifestyle and physical performance (Millier et al. 2014). Some studies have found that people with psychotic disorders are more likely to experience a poor quality of life, compared to the general population or to people with other disorders (Bobes et al. 2007; Millier et al. 2014). On the other hand, although objectively measured quality of life can be averagely lower than that of the general population, it can be averagely higher when

subjectively measured (Saarni & Pirkola 2010). Nevertheless, adherence and subjective quality of life are linked together; when adherence improves, so does quality of life (Moran & Priebe 2016).

Psychotic disorders pose a high economic burden (Frey 2014). For example schizophrenia accounts for a significant part of the financial burden for global diseases, with 2.8% of the total Years Lived With Disability (YLD) (WHO 2008) accounting for 1 – 2% of the total health care expenditures (Hu 2006). In Finland, the annual cost of schizophrenia to society is approximately EUR 900 million, including loss of productivity (Wahlbeck & Hujanen 2008). During the year after a first psychosis, the costs of medication is EUR 650 - 1038 per person and inpatient care is EUR 12 000 - 32 000 per person (Karvonen et al. 2008). Looking beyond the direct costs of health care, indirect costs of schizophrenia are also high (Tarricone et al. 2000).

Non-adherence to treatment is prevalent in half of the population of people with psychotic disorders (Goff et al. 2010; Haddad et al. 2014). An estimation of 90% of people with schizophrenia relapse within 5 years of their first psychosis (Robinson et al. 1999). The risk of relapse increases in cases when people discontinue treatment or medication. Therefore, one major predictor of an earlier relapse is poor adherence to treatment (Morken et al. 2008; Simhandl et al 2014).

2.2 Psychiatric treatment and legislations

2.2.1 Psychiatric treatment

Comprehensive treatment of psychotic disorders is characterized by several different modes of activities. The activities consist of medication, psychosocial interventions, environmental support and financial sustenance. (Haller et al. 2014.) The treatment focuses on the prevention of psychoses and the promotion of recovery, with a patient-centered approach (NICE [CG178] 2014). Each individual's overall well-being, including physical, psychological and social aspects, should be taken into account (Gournay 2000). Therapeutic alliance should be persistent, carried out in a confidential nature, and individualized treatment plans should be regularly revised, taking into account relatives and close ones. In practice, the treatment is a combination of treatment methods; antipsychotic medication, individual psychosocial treatment, psychoeducation, psychosocial rehabilitation and supported employment. In practice,

the treatment of psychotic disorders is carried out primarily in outpatient care. (Current Care Schizophrenia Guideline 2013.)

The objectives of treating psychotic disorders vary, depending on the phase of the illness. During the acute phase, treatment prevents harm and reduces psychosis (American Psychiatric Association 2010). Reducing psychotic symptoms is done with medication, therapeutic interaction, individual therapy and ensuring a safe treatment environment (Current Care Schizophrenia Guideline 2013). When the patient's condition is under the process of stabilization, treatment focuses on preventing relapses, advancing the recovery process and adapting to everyday life. During the stable phase, treatment focuses on maintaining the achieved levels of personal functionality, quality of life, and ensuring remission of symptoms and prevention of relapses (American Psychiatric Association 2010.) The greatest risk of relapses is during the two months after discharge from hospital care (Markowitz et al. 2013). To prevent relapses, good adherence to treatment is one of the key issues (Current Care Schizophrenia Guideline 2013).

2.2.2 Legislations and policies

Mental health policies and legislations provide guidelines for psychiatric care. Mental health legislation protects, promotes and improves the wellbeing of patients and gives a framework for mental health policies. (WHO 2003a.) To ensure high quality care, policies and strategies are required, creating standards for care (Faydi et al. 2011).

The actions of psychiatric services are defined in the Finnish Mental Health Act (1116/1990) and in the Health Care Act (1326/2010). The services are based on preventive, responsive and mitigative actions regarding psychiatric disorders, aiming to promote mental health well-being by supporting individuals' capabilities to cope with their illness (Mental Health Act 1116/1990). Psychiatric services are supervised and directed by the Ministry of Social Affairs and Health. The Regional State Administrative Agency is responsible for controlling, planning, supervising and directing mental health work in its own territory, guided by The National Supervisory Authority for Welfare and Health (Valvira). In practice, providing psychiatric services is under the responsibility of municipalities and hospital districts (Mental Health Act 1116/1990).

In the Finnish health care system, treatment of mental health problems is divided into primary health care and specialized public health services. Primary health care is provided by municipalities and carried out at health centers. The health centers arrange the prevention, diagnosis and treatment of mental disorders. In order to gain access to specialized care, a reference from a primary care professional is usually required. In specialized health care, which includes specialized mental health care, municipalities are organized to form hospital districts. (Ala-Nikkola et al. 2014; Sadeniemi et al. 2014.) There are 317 municipalities (Ministry of Finance 2016) and 20 hospital districts in Finland (Statistics Finland 2014). It is the responsibility of the municipalities to arrange basic level psychiatric care as a part of public health and social welfare, and hospital districts are responsible for specialized medical care (Mental Health Act 1116/1990). Preventive and equal care is a core objective (Ministry of Social Affairs and Health 2013), and to ensure this, hospital districts and municipalities work together by combining their actions (Mental Health Act 1116/1990; Ministry of Social Affairs and Health 2013).

In Finland, a reform of healthcare and social welfare is currently ongoing. This can have a high impact on the structure of the Finnish health care system in the future. (Ministry of Social Affairs and Health 2016a.) In addition, as part of the Finnish Government, the MSAH has developed a strategy for social and health policy that emphasizes the reform of the Mental Health Act (Ministry of Social Affairs and Health 2016b), which can also impact the future of mental health care in Finland.

2.3 Treatment adherence of people with psychotic disorders

2.3.1 Treatment adherence

In this context, adherence refers to the extent that a patient follows the recommendations they are given for prescribed treatments (Haynes et al. 2005). It is not limited to taking medication at the right time, frequency and dosage (Cramer et al. 2008), but more widely encompasses the treatment (Haynes et al. 2005), beyond medication taking (WHO 2003b). Christensen (2004) defines adherence as “the extent to which a person’s actions or behavior coincides with advice or instruction from a health care provider intended to prevent, monitor, or ameliorate a disorder” (Christensen 2004). This definition may include some paternalistic connotations, since the patient is advised to follow given instructions. Therefore, the World Health Organization defines adherence as the extent to which people follow the

recommendations from a health provider. (WHO 2003b.) At the core of adherence is the existing mutual understanding between a patient and a health provider, and the patient freely decides whether or not to follow the recommendations. Therefore, the recommendations of the United Kingdom National Health Service has suggested that adherence can be understood as the choices made in patient behavior regarding medicine taking. (Horne et al. 2005.) Overall, the content of adherence is complex and multifaceted, including aspects such as patient behavior and nursing practice (Lehane & McCarthy 2009; Gardner 2015).

In addition to adherence, the concepts of compliance, concordance, persistence (Hugtenburg et al. 2013), commitment, attrition, acceptance, agreement and therapeutic alliance are also associated with the phenomenon of a patient sticking to, or not sticking, to his or her prescribed treatment. Adherence includes important elements from the concepts of compliance and concordance, and is therefore currently preferred in nursing practice (Lehane & McCarthy 2009).

In health care and in the relative literature, adherence is used synonymously with concordance (Gardner 2015). Concordance means that a patient and a healthcare professional have reached an agreement on treatment based on their communication with each other (Snowden et al. 2014). Interaction, which is known to have a positive association with adherence, is a key element in concordance. However, empirically measuring this is currently challenging, and therefore this term is less often used in nursing interventions (Lehane & McCarthy 2009). Adherence is also linked with the term persistence, which covers patient participation in treatment as well as following medication instructions (Sawada et al. 2009). Commitment can be defined as the state or quality of being dedicated to an activity (Oxford Dictionary), for example, to treatment. Attrition can be defined as the sum or amount that patient initiates or participates in treatment (Lamb et al. 2012). Besides these, other terms used to describe this issue are persistence (Cramer et al. 2008) and therapeutic alliance (Svensson & Hansson 1999). In this context, persistence has been defined as the duration that treatment is followed (Cramer et al. 2008), while therapeutic alliance entails collaboration between professionals and patients (Svensson & Hansson 1999).

Compliance means “the extent to which a person’s behavior coincides with medical or health advice” (Haynes et al. 1979). Similarly, medication compliance has been defined as patients following recommendations of taking medication at the right time,

frequency and dosage (Cramer et al. 2008). Compliance includes all actions aiming to follow the treatment instructions given by health care professionals. The term 'non-compliance' means that a patient does not maintain behavior that follows the instructions by the health care provider (Lubkin 1995). While the concept of compliance may include paternalistic connotations (Horne et al. 2005; Bissonette 2008), other terms are widely been used. For example, the difference between the terms compliance and adherence are, that in adherence the patient is actively involved in their own care, through his/her agreement to the treatment recommendations (WHO 2003b; Horne et al. 2005). On the other hand, there is no clear evidence that other terms would be less degrading or more favored by patients than the term compliance (Cramer et al. 2008).

Non-adherence means that an individual is not following the recommendations given by a health care professional (Haynes et al. 2005). The degrees of adherence vary, and adherence may be intentional or unintentional (Gibson et al. 2013; Hugtenburg et al. 2013). In an optimal situation, the patient takes all of the medications as recommended (Kane et al. 2013), but in most occasions, this is not achieved (Farooq & Naeem 2014). For medication adherence, a frequently used cutoff point is when a patient misses at least 20% of the medication (Karve et al. 2009; Velligan et al. 2009). A patient is considered to practice good adherence when they adhere to their treatment at least 75% of the time (Rabinovitch et al. 2009). If the patient takes 50% of the prescribed medication, she/he can be considered to be partially adhering (Velligan et al. 2009). Partial adherence is also considered to be when a patient takes medication at times, but not to the extent as prescribed. Problems with adherence may occur when a patient exceeds the frequency or dosage of medication (Karve et al. 2009; Gibson et al. 2013), but typically medication is not taken frequently enough or in dosages that are too small. (Karve et al. 2009.) In addition, if the patient has not taken medication for 1 week, she/he can be considered to be non-adherent (Velligan et al. 2009).

It has been reported that the 20% medication cutoff has validity in predicting relapses. In practice, it is problematic to evaluate whether people are fully adherent, partially adherent, or non-adherent, because adherence, in terms of dose-response, can vary over time (WHO 2003b; Kane et al. 2013). Moreover, the point that affects health outcomes varies from person to person, and even weaker non-adherence may cause poor health outcomes (Karve et al. 2009) and further relapses and hospitalizations (Robinson et al. 1999, Ascher-Svanum et al. 2010).

2.3.2 Factors related to adherence

Several factors could predispose people with psychotic disorders to be non-adherent to treatment (Leclerc et al. 2015; Sendt et al. 2015). The factors vary and are contradictory (Haddad et al. 2014; Sendt et al. 2015), and include behavioral, environmental and health-related factors (El-Mallakh & Findlay 2015). Moreover, adherence is multifactorial and an individual issue, which can change over time (Velligan et al. 2009; Haddad et al. 2014; Leclerc et al. 2015). The complexity and the interaction between the factors cause challenges for motivation and the ability to adhere (Chapman & Horne 2013; Richardson et al. 2013; El-Mallakh & Findlay 2015). Typically, some factors of adherence are such that the patient can control them themselves (Osterberg & Blaschke 2005).

Factors affecting adherence are here presented based on categories of systematic reviews by Sendt et al. (2015) and Kane et al. (2013). First, Sendt et al. (2015) divides factors related to medication adherence as follows: 1) patient-related factors, 2) medication-related factors, and 3) environment-related factors (Sendt et al. 2015). Second, Kane et al. (2013) use the following categorization: 1) patient-related factors, 2) illness related-factors, 3) medication-related factors, 4) provider/system/treatment-related factors, 5) family/caregiver-related factors, 5) other factors (Kane et al. 2013). Since the focus of this study is on treatment adherence in general, the dimension "medication-related factors" was widened to comprise treatment in general. The factors related to adherence are here presented as follows:

1) Patient-related factors
2) Illness-related factors
3) Family/caregiver-related factors
4) Treatment-related-factors

Patient-related factors

There are no demographic factors (Osterberg & Blaschke 2005) or single personality types that are constant predictors for non-adherence (Kane et al. 2013). There are, however, studies that have found that some demographic factors that make people with psychotic disorders more susceptible to poor adherence as a result in their studies. These factors include being young in age (Peuskens et al. 2010; Bressington et al. 2013), being single (Rabinovitch et al. 2009), being male (Morken et al. 2007) and having a low level of education (Huang et al. 2009). Results vary between studies; for

example, one study reported that younger patients and females are more likely to have problems with adherence (Bressington et al. 2013), while another study found that being young and being male predict poor adherence (Nosé et al. 2003). There are also studies that have found that neither gender, nor age (Lacro et al. 2002; Alene et al. 2012; Misdrahi et al. 2012; Chan et al. 2014), nor level of income, nor religion nor the level of education (Alene et al. 2012) increase the risk for non-adherence at all. A patient's history of hostility and physical violence has been found to be associated with a higher risk of not adhering to treatment (Novick et al. 2010). Likewise, being abused in childhood can also make a patient predisposed for non-adherence (Spidel et al. 2015).

The insight and awareness that patients have regarding their illness and treatment are related to adherence, at least to some degree (Kao & Liu 2010; Misdrahi et al. 2012; Kane et al. 2013; Uhlmann et al. 2014; Drake et al. 2015; Novick et al. 2015). Insight into illness can be understood as the extent that patient has adopted the illness model proposed by care provider (Linden & Godemann 2007). Significant associations have been found between increased insight into the illness, as well as good general awareness, and noticeable improvements in adherence (Misdrahi et al. 2012; Novick et al. 2015). Particularly, knowledge about the specific issues regarding the illness (e.g. cause of the illness) and the purpose and effects of the treatment can increase adherence (Misdrahi et al. 2012; Chan et al. 2014; Lau et al. 2015). Furthermore, insight and attitude toward treatment have a positive relationship with each other; when one improves, so does the other. Sometimes the attitudes related to treatment can have an even greater impact on adherence than insight (Beck et al. 2011).

Having been non-adherent in the past can indicate a higher risk of poor adherence in the future (Lacro et al. 2002; Ascher-Svanum et al. 2006; Rabinovitch et al. 2009; Lai-Ming Hui et al. 2015), and vice versa: if a patient has followed treatment recommendations previously, there is high possibility for future adherence also (Novick et al. 2010). To maintain adherence, patients should be of the mindset that the treatment benefits their health status and illness (Drake et al. 2015). Without this perceived need, adherence may be poor (Uhlmann et al. 2014). For example, not taking medication can be a result of the patient believing that she or he is not actually ill, and therefore medication is not perceived to be necessary (Lau et al. 2015). Moreover, patients themselves have expressed that one reason for not adhering is a lack of sufficient knowledge about the treatment (Alene et al. 2012).

Internalized (i.e. personal, perceived) stigma is a subjectively perceived stigma (Gerlinger et al. 2013). Perceived stigma is relatively common among people with psychotic disorders (Yilmaz & Okanli 2015); over 70% have experienced it, and over half said that they have faced discrimination by health care professionals (Brain et al. 2014). The association between perceived stigma and adherence is somewhat mixed: some studies have found an association between experiencing stigma and poor adherence (Fung et al. 2010), but others have not (Brain et al. 2014). Internalized perceived stigma is also associated with negative attitudes toward treatment (Uhlmann et al. 2014; Yilmaz & Okanli 2015), which can further lead to non-adherence (Uhlmann et al. 2014).

Illness-related factors

Illness-related factors of adherence are due to the nature and duration of a psychotic disorder. Psychotic symptoms may cause fears toward medication and treatment, further posing a loss of motivation to adherence. (Gibson et al. 2013.) When the presence and severity of psychotic symptoms are substantial, a patient can become confused, and this can lead to non-adherence (Spidel et al. 2015). Moreover, the combination of negative symptoms and poor insight is one predictor for poor adherence (Staring et al. 2011), as well as a higher severity level of psychopathology (Kao & Liu 2010; Spidel et al. 2015). Additionally, cognitive impairment is quite typical in psychotic disorders (Holthausen et al. 2002) and can make adherence challenging. On the other hand, patients with good verbal memory can be more aware of their illness and its future consequences. This can lead to denial of the illness and treatment – and thus to non-adherence (Staring et al. 2011)

In terms of substance abuse, current substance and alcohol dependence can increase the risk of non-adherence (Ascher-Svanum et al. 2006; Kamali et al. 2006; Quach et al. 2009; Novick et al. 2010; Alene et al. 2012). However, there are also results indicating no associations between these factors. It is also unclear whether or not substance abuse leads to non-adherence, or if non-adherence increases the risk of substance abuse (Spidel et al. 2015).

Regarding the duration of psychotic illness, the shorter the period of the illness is, the higher the risk of poor adherence becomes (Lacro et al. 2002; Rabinovitch et al. 2009; Peuskens et al. 2010). A patient's first episode of psychosis is particularly problematic (Rabinovitch et al. 2009; Novick et al. 2010), and the level of adherence likely increases during the treatment (Rabinovitch et al. 2009).

Family/caregiver-related factors

Patients who adhere poorly to their treatment are less likely to have a good level of social support from their families and friends (Rabinovitch et al. 2009). Respectively, a higher level of social activity corresponds to a higher level of adherence (Novick et al. 2010; Teferra et al. 2013; Sariah et al. 2014). This can be problematic, since people with psychotic disorders may avoid close relationships and activities in society because of the fear of stigma (Brain et al. 2014). Therefore, social isolation is common and patients may not be reminded about treatment, or receive support from family members or friends (Haddad et al. 2014). This can further cause memory lapses (Gibson et al. 2013). When patients are encouraged to get involved in activities (e.g. education), negative attitudes toward adherence are possibly reduced (Uhlmann et al. 2014).

Treatment-related-factors

Therapeutic alliance is an important factor for treatment adherence (McCabe et al. 2012; Misdrahi et al. 2012; Gault et al. 2013; Novick et al. 2015). Good therapeutic alliance corresponds with better adherence (Misdrahi et al. 2012; Novick et al. 2015). This can be due to the fact that a patient is more willing to accept treatment recommendations from professionals if the patient feels comfortable being with them (McCabe et al. 2012). If a patient's preferences toward his/her treatment are not taken into account, they may get frustrated, which could increase the risk of non-adherence (WHO 2003b). Therefore, the perspectives of patients should always be considered (Gault et al. 2013). Moreover, to avoid misunderstandings and thus a lack of adherence, the discussions between patients and professionals should be clear and understandable (McCabe et al. 2013). Other factors increasing non-adherence are poorly planned treatment, especially in the discharge phase (Haddad et al. 2014), and interruptions or changes in normal treatment (e.g. changes in appointment times) (Rettenbacher et al. 2004).

The occurrence of side-effects from medication is one possible reason for a patient to not take medication (Alene et al. 2012; Lau et al. 2015). The side-effects can cause significant impairments in a patient's daily life (Waterreuss et al. 2012). From the patient's point of view, side-effects impairs patient´s daily life equally with symptoms of illness (Hon 2012). On the other hand, there is also evidence that extrapyramidal side-effects, for example, do not increase the level of non-adherence (Rabinovitch et al. 2009; Kao & Liu 2010). Professionals do not always routinely screen patients for side-effects, and sometimes consciously give little information about the possible side-

effects. Professionals may do this if they are afraid of the consequences that the knowledge of the side-effects might have on the patient, such as not taking the medication (Brown & Gray 2015). Despite this, patients generally have a good understanding of the most common possible side-effects of their medication; nearly 80% are able to name these side-effects. Finally, another common reason for not taking medication can be that the patient simply forgets (Alene et al. 2012).

2.3.3 Adherence management

Adherence management refers to the promotion of adherence to treatment. According to the guidelines of the UK National Institute for Health and Care Excellence (NICE), promotion of treatment adherence includes two main tasks: assessment of adherence, and interventions to promote adherence. These are described more detail below.

Assessment of adherence aims to identify cases when a patient needs extra support in maintaining adherence. The assessment should be a part of normal routine care (Osterberg & Blaschke 2005; NICE [CG76] 2009; Gadkari & McHorney 2012; Farooq & Naeem 2014), since non-adherence can at least partly be predicted and targeted (Novick et al. 2010; Leclerc et al. 2015). Assessment can be conducted using subjective or objective measures (Haddad et al. 2014), with direct or indirect methods (Osterberg & Blaschke 2005; Farooq & Naeem 2014).

When scientifically evaluating adherence, using at least two methods of measurements, of which at least one is objective (e.g. pill count, laboratory tests), guarantees a reliable assessment of adherence (Velligan et al. 2006). Moreover, when assessing adherence from a scientific point of view, evaluation should focus not only on the level of adherence, but also on the clinical outcomes. These measures together can verify the possible effect on adherence to clinically important outcomes (Nieuwlaat et al. 2014).

Subjective assessment is a frequently used evaluation method (Velligan et al. 2006; Clifford et. al. 2014), involving the patient or professional giving an estimation of the adherence level (Haddad 2014). In practice, this can be done by directly asking patients if he/she has taken medication as recommended (NICE [CG76] 2009; Farooq & Naeem 2014). However, this method can be unreliable and often under- or overestimates the level of adherence (Velligan et al. 2006; Haddad et al. 2014). Therefore, it is important that the assessment is conducted in a way that the patient can freely express possible problems with adherence (NICE [CG76] 2009).

Objective assessment may include electronic pill counts, medication event monitoring system, biological markers, hair analysis, blood tests, and observation of the patient (Velligan et al. 2006; Kane et al. 2013). Objective assessment is more reliable than subjective, but some methods are time-consuming and expensive, and therefore less commonly used (Haddad et al. 2014). Moreover, although a variety of instruments are available, some have poor validity, and results may differ between instruments (Kikkert et al. 2008). In practice, assessment of medication adherence can be done, to name two examples, by screening medication records from the pharmacy or asking patients to return his/her untaken medicine (NICE [CG76] 2009). Assessment of adherence to follow-up care can be done by calculating the rates of missed, cancelled or rescheduled appointments (Hasvold & Wootton 2011).

Interventions that promote adherence aim to support patients in achieving adherence management. The interventions should be considered on an individual basis, corresponding to needs of the patient (NICE [CG76] 2009; Staring et al. 2011; Wouters et al. 2016). Overall, promotion can be carried out using fairly simple strategies (Haddad et al. 2014), particularly targeting patient-related factors, and taking into account the causes of non-adherence (WHO 2003b; NICE [CG76] 2009; Beck et al. 2011; Haddad et al. 2014; Wouters et al. 2016). The strategies should specifically consider the possibly contradictory feelings that people may have toward adherence and treatment (Hugtenburg et al. 2013; El-Mallakh & Findlay 2015). Adherence-supporting interventions can be divided into pharmacological (e.g. simplifying dosage) and psychosocial (e.g. psychoeducation) intervention (Farooq & Naeem 2014). The intervention can target educational interventions, simplify medication doses, ensure sufficient opening times for outpatient clinics, and improve communication between patient and professionals (Osterberg & Blaschke 2005).

In nursing practice, the interventions can be as simple as discussions with the patient; when non-adherence is recorded, a professional identifies whether the non-adherence was intentional or unintentional (NICE [CG76] 2009) and asks how often the patient usually misses taking his/her medication (Osterberg & Blaschke 2005; Farooq & Naeem 2014). Further discussion about the importance of the medication, how it can affect the disorder, as well as the medication's possible side-effects enhances understanding and can help patients be more likely to adhere (Hon 2012).

It is important to distinguish the difference between cases of intentional and unintentional non-adherence. Intentional non-adherence involves a patient actively deciding not to adhere (Hugtenburg et al. 2013) and deliberately acting contrary to the recommendations (Gibson et al. 2013). This can be a result of mislead beliefs or other problems related to treatment (NICE [CG76] 2009). The patient may be worried about the consequences of expressing non-adherent behavior, and might keep this information from professionals (Gibson et al. 2013). Therefore, in order to utilize intervention by focusing on a patient's individual reasons for non-adherence, beliefs and concerns of the patient regarding the treatment should always be identified (NICE [CG76] 2009). In unintentional cases, non-adherence may be a result of practical problems, such as forgetfulness (Hugtenburg et al. 2013). On the other hand, unintentional non-adherence can also be related to beliefs, and may eventually lead to intentional non-adherence (Gadkari & McHorney 2012).

Interventions for intentional adherence include educating, motivating and providing information (Hugtenburg et al. 2013). These types of interventions target on issues that promote adherence: self-management (Zhou & Gu 2014) and insight with a motivational approach (Hyrkas & Wiggins 2014). The interventions can also be related to attitude and insight (Beck et al. 2011; Bressington et al. 2013; El-Mallakh & Findlay 2015; Sendt et al. 2015) and can focus on increasing positive attitudes toward treatment (Mohamed et al. 2009; Bressington et al. 2013) and helping to achieve greater insight into the illness (Mohamed et al. 2009). Several psychosocial interventions aiming to increase adherence have been used. For example, psychoeducation is an educational intervention aimed at increasing insight about treatments among patients and family members (Xia et al. 2011; Kane et al. 2013). A meta-analysis, including 44 RCTs and a total of 5,142 participants, found that the incidence of non-adherence was lower for people involved in psychoeducation than it was in a control group (Xia et al. 2011). Even brief exposures to psychoeducation show promise that they might be able to promote adherence, although these results are not definite (Zhao et al. 2015). When assessing the effects of psychosocial interventions in general, there is no fully proven evidence that a certain type of intervention would be more effective than another (Hunt et al. 2013).

Interventions for unintentional adherence can include reminders, simplifying medication regimens or giving patients counselling (Hugtenburg et al. 2013). A systematic review using a meta-analysis (Fenerty et al. 2012) looked at 11 studies to

evaluate the effects of reminders to adherence to treatment. These studies used reminders in the forms of SMSs, phone calls, pager reminders, video telephone calls, audio-visual reminders and interactive voice system reminders. A meta-analysis showed that adherence improved when a patient received reminders; the adherence of people in reminder groups was 11.9% higher than that of those in control groups (95% CI mean: 0.8%-22.4%). However, these types of reminders can be challenging to implement in clinical practice, and should be combined with other strategies promoting adherence. (Fenerty et al. 2012.) Strategies can serve as therapeutic support, providing information about treatment, which can improve unintentional adherence in particular (Gibson et al. 2013; Andersson Sundell & Jönsson 2016). In addition, unintentional adherence can be pre-empted with simpler or less frequent medication dosages (Medic et al. 2013). For example, long-acting risperidone can help in cases of unintentional medication non-adherence (Baylé et al. 2015), however its actual effect compared to oral antipsychotic medication has not yet been fully proven (Kane et al. 2013).

Patient-centered care is highly recommended (NICE [SG1] 2014). Patient-related interventions for supporting adherence mainly focus on individual causes of non-adherence (NICE [CG76] 2009). These are, for example, improving a negative attitude toward treatment (Weiden 2007), reducing substance abuse (Velligan et al. 2009) or improving insight (Higashi et al. 2013). A review by Kuntz et al. (2014) summarized the patient-centered approaches into medication management and adherence. The included studies focused mainly on education, pharmacy services and decision-making. The results of this review cannot fully to say whether especially patient-centered approach would be more effective than traditional adherence interventions. (Kuntz et al. 2014).

To maintain a patient-centered approach, it is essential to focus on "a partnership among practitioners, patients and their families to ensure that decisions respect patients wants, needs and preferences and that patients have the education and support they need to make decisions and participate in their own care" (Institute of Medicine 2001). Therefore, multiple levels need to be taken into account. The levels require communication, respect and support of patients, continuity of care and well-planned treatment (Gray et al. 2014). In essence, patient-centered care, which takes note of patients' wishes, creates an optimum basis for treatment and adherence. Moreover, a patient-centered approach to improving adherence includes aspects such as shared decision-making, feedback, effective medication prescriptions (the patient understand

why and when medication needs to be taken), and applications that helps patients' adherence behavior (e.g. reminders) (McMullen et al. 2015).

Since evidence about interventions that support adherence is indefinite, intervention should be targeted as a specifically practical issue. There are, for example, encouraging (NICE [CG76] 2009), motivational and educational interventions, which aim to foster positive attitudes and sufficient levels of insight (Mohamed et al. 2009). Mostly, the effective methods to improve adherence to treatment are individually tailored, concentrating on problem-solving and identifying the reasons of non-adherence. Therefore, health care professionals and patients should first discuss the individual reasons of non-adhering. By doing so, supportive methods can be targeted correctly. (El-Mallakh & Findlay 2015.)

Health care systems have not responded adequately to the burden of psychiatric illnesses (WHO 2013), and therefore, new types of actions need to be added to existing treatments. Technology may be one solution (Osterberg & Blaschke 2005; Gray et al. 2014). Recently, it has been used as a method for delivering adherence-improving interventions with promising results (Pijnenborg et al. 2010; Montes et al. 2012) and good feasibility rates (Ben-Zeev et al. 2014; Bogart et al. 2014; Kannisto et al. 2015) without harming the self-concept of the patient (Drake et al. 2015). Nevertheless, regardless of the type of intervention method, understanding patients' needs helps personnel to design and use effective interventions to support adherence, which should be based on a mutual understanding between patients and personnel (Kikkert et al. 2006)

2.4 Mobile technology and mobile health

2.4.1 Mobile technology in society

Due to the global expansion of mobile technology, by 2012, approximately 75% of the world's population had access to mobile phones (World Bank 2012). There are currently over 7 billion mobile cellular subscriptions worldwide (International Telecommunication Union 2015). The number of mobile phone users in 2015 was 4.43 billion (The Statistics Portal 2016a), and it has been anticipated that in 2020, the number of mobile phone users will reach 1,242 million in Europe (The Statistics Portal 2016b) and 4.77 billion worldwide (The Statistics Portal 2016c). In Finland, nearly everyone has a mobile phone, with only an average of 2% of the Finnish population

over 15 years old not having a mobile cellular subscription. Finnish people most commonly use mobile phones for calling (voice application) and texting (SMSs); nearly 90% of the Finnish population uses SMSs. (Ficora 2014.)

Mobile technology devices include mobile phones, smartphones, iPod touch and tablets with mobile applications, short messaging services (SMS), as well as voice and radio service (GPRS) (WHO mHealth 2011). Globally, 6.1 trillion SMSs are sent annually (International Telecommunication Union 2010). SMSs provide a private and quick way to approach another person on the individual or group level (Lenhart et al. 2005). Moreover, SMSs hold many advantages; they are easy to use, widely accepted, cost effective (Klasnja & Pratt 2012) and are adopted regardless of socioeconomic statuses or age (Atun & Sittampalam 2006). Due to the ease and acceptance of this application, SMSs and, more generally, mobile health (mHealth) have the potential to be utilized as a part of health care systems (European Commission 2014). Smartphone ownership is currently rising (PewResearchCenter 2015), enabling the use of a multitude of applications. It is likely that in the near future, smartphones will replace traditional mobile phones (eMarketer 2014). Moreover, recently the rates of sending SMSs have decreased, at the result of being replaced by free applications such as WhatsApp and Kik (Hall et al. 2015; The Statistics Portal 2016c).

2.4.2 Mobile health

Mobile health (mHealth) is the use of mobile technology as a part of medical or public health care (WHO mHealth 2011). The level of interactivity defines the type of mobile intervention; it may include high interaction, for example discussions, or very low, such as standardized autonomous 1-way SMSs, which is considered to be "same for all" (Simon & Lundman 2009; Wald et al. 2015). Several types of interaction may be combined within the same intervention, such as providing information, discussing and sending automated messages about the same topic (Shiffman et al. 2008). On average, one reminder costs 0.41€, and the costs are higher for interactive reminders than automated ones (Hasvold & Wootton 2011).

Previously, mHealth has been used among people with chronic somatic illnesses such as diabetes, asthma, psoriasis, human immunodefiency virus (HIV), epilepsy and acne (Kannisto et al. 2014). The use may focus on prevention (European Commission 2014; Vodopivec-Jamsek et al. 2012), attendance (Gurol-Urganci et al. 2013), self-management (de Jongh et al. 2012) or adherence to treatment (Horvath et al. 2012).

mHealth has been used as a tool for reminding patients about medical appointments or medication. It can be used on its own, with no other interventions, or as a part of wider intervention system. Moreover, mHealth may include educational, informational, and supportive messages in addition to reminding messages (Kannisto et al. 2014).

2.4.3 Development of mobile health interventions

Various approaches exist for intervention development. A user-centered intervention development approach is often used when designing technological interventions in psychiatric care (Ben-Zeev et al. 2013). This means that end-users are involved in every stage of the developing process, including needs assessment, feedback of the application's prototype version and usability testing (Cafazzo et al. 2012). Development should proceed step by step, taking into account any changes in technology or health care (Konstantinidis et al. 2012). Usually, the development process is iterative or linear (Campbell et al. 2000). User-centeredness is crucial because people with mental illness often have impairments affecting their use of and engagement with technology (Ben-Zeev et al. 2013). This type of approach also ensures effective utilization of mobile health (mHealth) interventions (Arsand & Demiris 2008).

A variety of guidelines and frameworks for intervention development have been used. Intervention Mapping (IM) (Bartholomew et al. 2006) and the Medical Research Council's (MRC) framework are both commonly used for intervention development. The MRC's framework applies an iterative process, beginning with identifying the theoretical basis, modelling components, conducting exploratory trials, testing fully defined intervention with RCT over long-term implementation. (Campbell et al. 2000.)

Some frameworks have been designed specifically for mobile health (mHealth) intervention development, such as the Multiphase Optimization Strategy (MOST), the Sequential Multiple Assignment Randomized Trial (SMART) (Collins et al. 2007) and the mHealth Development and Evaluation framework. In the framework of mHealth Development and Evaluation, conceptualization is first conducted, following the formative research and pilot testing of the intervention. Lastly, the intervention is evaluated, for example, by using qualitative methods (Whittaker et al. 2012). MOST includes the development of an intervention and its components, which are evaluated using an RCT. After this, post hoc analyses are conducted, and, if needed, intervention is refined and tested again with a new RCT. SMART is a beneficial framework,

especially for time-varying adaptive interventions. It may include several randomizations, and study participants can be randomized into different intervention conditions several times. This may help select rules and variables, including the timing, of the intervention. At the end, a larger RCT is often conducted to test the final intervention. (Collins et al. 2007.)

Common aspects of the development frameworks are to include the assessment of needs of the end-users, including those of stakeholders (e.g. health professionals, managers), the consideration of end-users' opinions about possible benefits of the intervention, and an evaluation of limitations of the intervention as well as the use of the intervention (Darlow & Wen 2015). Typical issues also include the integration of information sources into intervention design, published evidence and using theories as a framework (Fjeldsoe et al. 2012).

As a framework for this study, Intervention Mapping (IM) by Bartholomew et al. (2006) was considered to be an appropriate guideline to structure the development of the intervention. IM provides a framework and a systematic approach for developing empirical and theoretical-based interventions (Bartholomew et al. 2006). The framework of IM is based on specific steps with tasks of the development, starting from the assessment of needs and ending with the evaluation of the developed intervention (Figure 1) (see Bartholomew et al. 2006; Schaalma & Kok 2009). Thus, in this study, IM structures the phases with a user-centered approach, systematically involving the end-users of the intervention. This is important, especially when developing technology-based interventions for psychiatric care (Ben-Zeev et al. 2013). Further, since adherence is complex and multifaceted, including aspects such as patient behavior and nursing practice (Gardner 2015), IM gives guidelines for taking these aspects into account throughout the study.

Following the steps of IM, this study focused on the following questions: 1) What is the problem and causes? How to support? 2) What are we aiming to change and how can the changes be accomplished? 3) What are the sensible ways to make these changes? 5) How should we facilitate implementation and adoption? 6) Did the intervention work? (see Schaalma & Kok 2009). The study was conducted by using mixed method study design, in order to capture a comprehensive view of the topic (Wisdom et al. 2012). As mixed method is suitable for complex phenomena (Burns & Grove et al. 2009), it supported the development of intervention (Campbell et al. 2000)

by providing a better view of this topic than using only one method would have done (Creswell & Plano Clark 2011).

Products	Tasks
Step 1 Needs Assessment	What are the restrictive factors of adherence among the long-term mentally ill? How could adherence be supported?
Step 2 Matrices of change objectives	What is the objective of our intervention?
Step 3 Intervention components and material	What will be the intervention methods?
Step 4 Adoption, implementation and sustainability	What are the barriers for using our intervention? What are the requirements for using our intervention?
Step 5 Evaluation	Are these types of interventions effective? Was our intervention feasible?

Figure 1. Steps used from Intervention Mapping (Bartholomew et al. 2006)

First, a needs assessment identifies factors leading to the health problem as well as those that affect the management of the health problem (Bartholomew et al. 2006). In this study, this referred to 1) factors related to adherence, and 2) how to manage adherence. This was done in order to understand the problem of adherence in clinical reality, since the factors related to adherence are contradictory, various (Sendt et al. 2015) and individual (Velligan et al. 2009). Moreover, adherence includes aspects such as patient behavior and nursing practice (Gardner 2015), and therefore, the participatory planning group included people who face these health problems daily: health professionals, nurses and patients (McEwen et al. 2015). By using focus group interviews, the health problems can be discussed (Bartholomew et al. 2006) in order to for the participants to be able to identify issues related to adherence from their own perspective (Filipetto et al. 2014).

Second, the objective of the intervention is defined, based the question of what behavior needs to change in order to improve the health outcome (adherence). Specific actions and cognitive processes that should lead to the desired behavior are defined and connected as personal and external determinants. By defining determinants, actions aimed at accomplishing performance objectives are able to be demonstrated

(Bartholomew et al. 2006). As a result of this combination, the objective of the intervention is defined considering the following: treatment adherence may be intentional or unintentional (Horne et al. 2005), and the complexity of and interaction between the factors cause challenges for motivation and the ability to adhere (Chapman & Horne 2013). The objective needs to be measurable in regards to what was hoped to be accomplished (Ovretveit 2014).

Third, generation of intervention methods are then generated, including the preferred methods of intervention delivery and any previously used methods of delivery (Bartholomew et al. 2006). These can include focus group discussions, having the participatory planning group and literature review to further "delineate" these ideas into possible methods (Egger et al. 2001).

Fourth, optimal intervention delivery is ensured. This includes identification of potential adopters and users, implementation plan and selection of methods and strategies. (Bartholomew et al. 2006.) For example, in our study it was decided that the intervention would be implemented in outpatient care, since that is the place where treatment is primarily carried out (Current Care Schizophrenia Guideline 2013). It was also decided, that every hospital would have own research nurses. These nurses personally recruited patients for the intervention to increase personal contact possibilities between patients and recruiting nurses, so that the eligibility could be evaluated immediately and patients would easily be able to ask questions about the study (Howatson-Jones 2007). As a part of implementation plan in this tudy, barriers and requirements of using SMS in psychiatric care is then identified.

Fifth, evaluation is conducted as the last phase of IM. The focus of the evaluation should be based on the objective of the intervention, its implementation and the methods selected. Randomized trials may be used to measure the outcomes of the intervention. The use of the intervention may be evaluated by asking the users what they thought about using it and if they used the intervention in the correct manner. (Bartholomew et al. 2006.)

In this study, one publication was done in collaboration with Cochrane Schizophrenia Group. Cochrane Collaboration is a non-profit network, aiming to provide and promote high-quality scientific evidence about health and care. The Cochrane Schizophrenia Group concentrates on evaluating the treatment of people with psychotic disorders. Currently, an average of 900 reviewers in over 40 countries are involved in the

Schizophrenia Group. (Cochrane Schizophrenia 2016.) A Cochrane Review is a scientific study, including a protocol with pre-planned methods and actions. The review pre-defines the types of studies (clinical trials or RCTs) included as well as expected outcomes. The literature search is based on a systematic search, and is carried out at the Cochrane Center. Results of the included trials are synthesized with specific strategies. (Cochrane Community 2016.)

2.4.4 Mobile health in supporting adherence

To gain understanding of the previous studies regarding mobile technology to improve treatment adherence among people with psychotic disorders, a literature search was conducted. The search was conducted using PubMed (MEDLINE), Cinahl and Embase electronic databases. The following search terms were used in various combinations: psychiatric disorder, severe mental, serious mental, psychosis psychotic, schizophrenia, smartphone, mobile phone, cell phone, SMS, mobile application, text messaging and short message service. The search was limited to adults and to papers written in English or Finnish and supplemented with a search of journals and reference lists pertaining to relevant literature.

Empirical studies about using mobile technology to support treatment adherence of adults with psychotic disorders were included. These were divided into two groups: trials evaluating the effectiveness of mobile health (mHealth) reminders and studies evaluating the feasibility of mHealth. Studies including people other than adults with psychotic disorders were left out. In order to get a wider understanding of the topic, an additional search was performed, and reviews and/or meta-analyses concerning mobile technology aimed at supporting adherence in chronic disease cases in general, were included. Studies found in the search are described in Table 1.

mHealth interventions to support treatment adherence of psychotic disorders can be divided into automated reminders and more interactive reminders. The interventions can be standardized (e.g. Montes et al. 2012) or personally tailored (e.g. Granholm et al. 2012). The elements of adherence that mHealth mainly targets are medication adherence and attendance to appointments. Both of these can also be supported with the same intervention (Pijnenborg et al. 2010). mHealth can also be used as a part of wider intervention with various functions (e.g. Xu et al. 2016).

One-way automated or semi-automated mHealth is a standard or tailored reminder sent to a patient, without the requirement and/or possibility to reply. In RCT, including 254 outpatients with schizophrenia, adherence was supported via one-way daily SMS reminders for taking medication. The SMS was always the same, "Please remember to take your medication." The SMSs were sent at either 11.a.m. or 2 p.m., depending on the participant's preference (Montes et al. 2012). In another RCT, one-way semi-automated SMS reminders were used for one year to support adherence to medication and appointments. The intervention was tailored: participants had 85 different SMS options to choose from. In addition, participants were free to choose the timing of the messages (Välimäki et al. 2012; Kannisto et al. 2015). A similar type of intervention was used in a quasi-randomized study, where participants set their own goals, and SMSs were programmed to fit to these goals. Two reminders were sent for each goal. Generally, the goals were related to medication taking and attending appointments (Pijnenborg et al. 2010).

Two-way mHealth can refer to reminders which typically request a respond. In a study by Ben-Zeev et al. (2014) two-way supportive SMSs were used to support participants' medication adherence. SMSs were received every weekday, and participants were instructed that they could answer the messages. If a participant replied, they received up to two SMSs on the same day. The content of these SMSs depended on the replies of the participant. In another RCT, SMS reminders included text exchanges 3 times a day (morning, afternoon, evening) (Depp et al. 2010). Every SMS that a participant received included a question, such as "Have you taken your medication?" Participants were asked to reply to these SMSs. Based on participants' answers (have taken, have not taken), a second SMS with a question was sent. In cases where a participant did not reply to an SMS, the follow-up message was not sent. (Granholm et al. 2012.)

Table 1. Summary of the studies evaluating mHealth and treatment adherence

Studies evaluating the effectiveness of mHealth on treatment adherence among people with psychotic disorders						
Authors(s) Year Country	**Method**	**Participants**	**Intervention (length)**	**Measurement for adherence**	**Length of follow-up**	**Effectiveness on adherence**
Pijnenborg et al. 2010 Netherlands	A waiting list controlled trial, quasi-randomized	Schizophrenia or related psychotic disorders (n=62)	Semi-automated goal directed SMSs vs. delay instigation waiting list control full stop (7 weeks)	Observations and scores provided the professionals and family members about medication taking and attendance	1) Baseline 2) 7 weeks 3) 9 weeks	Adherence to follow-up care improved. Medication adherence remained at the same level
Granholm et al. 2012 USA Depp et al. 2010 USA	Pilot trial	Schizophrenia or schizoaffective disorder (n=55)	Two-way SMSs containing questions for participants to answer (12 weeks)	Participants' responses to questions about medication taking via SMS	1) Baseline 2) 12 weeks	Medication adherence improved (for those living independently)
Montes et al. 2012 Spain	RCT	Schizophrenia (n=254)	One-way medication reminder SMSs (12 weeks)	1) Morisky Green Adherence Questionnaire (MAQ) 2) Drug Attitude Inventory 10-item (DAI-10)	1) Baseline 2) 12 weeks 3) 24 weeks	Medication adherence improved
Xu et al. 2016	RCT	Schizophrenia (aims n=250)	LEAN-intervention	1) Pill count / pharmacy records	Every 2 months over the 6	Study is ongoing,

China			1) e-reminders, e-monitor 2) e-platform 3) Award system 4) iNtegration	2) Morisky Medication Adherence Scale 3) Brief Adherence Rating Scale (BARS) 4) Drug Attitude Inventory (DAI-10)	months follow-up period	protocol has been published

Reviews evaluating the effectiveness of mHealth on treatment adherence among people with chronic disorders

Authors(s) Year Type of review	Type of adherence studied	Number of included studies	Main review results	Author recommendations
Hasvold & Wootton 2011 Systematic review	Hospital visit attendance	29	Manual phone calls were more effective on attendance than automatically sent reminders. Attendance rates were similar regardless of the time the reminders were sent (a day or week before the appointment). The average cost per reminder was 0.41€	Future studies should include such outcomes as costs and possible savings when using reminders, the benefits of sending multiple reminders and the rates of cancellations or rescheduling of appointments
Fenerty et al. 2012 Meta-analysis	Medication adherence	11	No statistical differences in medication adherence between people receiving reminders via SMSs and people receiving other types of electronic reminders. The average adherence rate	More studies are needed to determine which reminders most significantly improve adherence. Additionally, complex intervention approaches should be compared to

			for people receiving SMS reminders was ~ 50%	single-intervention approaches and evaluate the differences in effectiveness between these.
Guy et al. 2012 Systematic review Meta-analysis	Appointment attendance	18	There is some evidence that SMS reminders may increase the likelihood of appointment attendance	Further studies are needed to investigate clinical reasons for attendance. Moreover, studies should report whether visits are first-time or follow-up appointments.
Vervloet et al. 2012 Systematic review	Medication adherence	13	Electronic reminders may increase short-term medication adherence. However, the long-term effectiveness of reminders cannot currently be evaluated.	In the future, studies should focus on examining unintentionally non-adherent patients. Studies should also consider what kind of patients may best benefit from the reminders. Long-term effects of the electronic reminders should be studied.
Gurol-Urganci et al. 2013 Systematic review Meta-analysis	Appointment attendance	8	SMS reminders may improve attendance compared to postal reminders or to no reminders.	More RCTs are needed to evaluate the effectiveness of SMSs, including outcomes related to costs, health outcomes, perceptions of users, safety issues, possible harms and adverse events.
Lin & Wu 2014 Systematic	Follow-up care attendance	13	SMS reminders can improve attendance. However, phone call reminders can have an even better probability of	More studies are needed that focus on intervention strategies to support adherence to follow-up

review Meta-analysis			effectiveness	appointments
Wald et al. 2015 Meta-analysis	Medication adherence	8	Two-way messaging may improve medication adherence better than one-way messaging (20% more likely to be adherence)	There is currently no single study which directly compares the effects of one-way messaging to those of two-way messaging
Boksmati et al. 2016 Meta-analysis	Appointment attendance	28	SMSs are effective in supporting adherence to appointments	More studies are needed to find out the optimal timing to send SMSs before appointments. The use of SMSs among culturally and linguistically diverse people should be examined in more detail

Studies evaluating feasibility and acceptability of mHealth among people with psychotic disorders

Authors(s) Year Country	Method	Participants	Type of mHealth to be evaluated	Outcomes	Data collection method	Main results
Ben-Zeev et al. 2014	Single-arm trial	Schizophrenia or schizoaffective disorder and substance abuse (n=17)	Two-way supportive SMSs (12 weeks)	Feasibility Usability Engagement Satisfaction	Questionnaire	The intervention was considered useful and rewarding by participants

Bogart et al. 2014 UK	Cross-sectional trust-wide survey	People taking antipsychotic medication (n=85)	SMS reminders about medication after discharge from inpatient care. Actual reminders were not sent	Feasibility Acceptability Past adherence Attitudes to medication	Self-report questionnaire	Over half perceived that SMSs were an acceptable medication reminding method
Kannisto et al. 2015 Finland	Cross-sectional survey	People taking antipsychotic medication (n=569 response rate 72% = 403 participants)	Tailored one-way SMS reminders (12 months)	Satisfaction regarding SMSs Usefulness Ease of use Intention to use the SMSs in the future	Interview or questionnaire depended on whether the participant answered the telephone call	The majority perceived that SMSs were easy to use and not harmful, over a half would use them in the future

2.4.5 Barriers and requirements of using mobile health

Barriers for the use of mobile health (mHealth) may be technological or related to utilization. Technological problems may exist when using mobile phones or applications which are too burdensome or problematic to use (Palmier-Claus et al. 2013). Therefore, it is important that the technology used is simple enough, in order to minimize patients' possible confusion and disengagement (Bakker et al. 2016). Moreover, mobile phones that are too old or have limited functions, a limited number amount of memory space for messages or a poor battery or signal restrict use. (Palmier-Claus et al. 2013.)

Barriers to the utilization of mHealth include issues of ability and finance. Not owning a mobile phone (Nundy et al. 2013; Bigna et al. 2014), worrying about costs or a technical inability to use mobile phones (Parker et al. 2013) are some examples. Possible problems in oral or written communication may also restrict the use of mHealth (Bigna et al. 2014). A lack of confidence in mHealth has been proven, especially in older people and people with low cognitive function (Cook et al. 2014). Whenever utilizing mHealth solutions, patients' perceptual abilities as well as motor and cognitive skills should be taken into consideration (Dinesen et al. 2016). Therefore, sufficient skills (Dinesen et al. 2016) and the possibility for mHealth training should be guaranteed before implementing mHealth as part of care (Turner 2016).

Ease of use of mHealth should be ensured (Arsand & Demiris 2008). By allowing people to use their own familiar mobile phones, the barrier created by devices seen as too complicated may be prevented (Palmier-Claus et al. 2013; Torous et al. 2014). For example, if a patient is not familiar with smartphones and the intervention requires more advanced technology, using the technology may prove too difficult (Palmier-Claus et al. 2013). This also applies to using pictures or videos. If these applications are necessary in the intervention, it should be possible for the application to be used with basic mobile phones, not only smartphones (Klasnja & Pratt 2012). However, currently smartphones are widely used, even among people with psychiatric illnesses (Torous et al. 2014), and they are willing and able to utilize smartphone apps correctly (Firth & Torous 2015).

mHealth should be incorporated into intervention in ways that clearly appreciate users' personal values and meanings. Without a perceived value, the user is not motivated to use the technology. (Palmier-Claus et al. 2013; Bakker et al. 2016; Dinesen et al. 2016.) To ensure this, the style and content of the intervention should be considered carefully; the information obtained should be relevant and useful (Arsand & Demiris 2008), serving patients on a personal level (Dinesen et al. 2016). Since the feelings that the intervention has the potential to cause are individual, and range from positive to negative, the content of the intervention should be selectable by the user. Some may want more neutral content than others (Palmier-Claus et al. 2013). This supports the conclusion that tailored approaches are recommended when using mHealth (Bakker et al. 2016). It should also be ensured that the target population is willing to and capable of adopting and utilizing mHealth (McGillicuddy et al. 2013). This can be achieved by understanding users' needs, which helps providers to design and use effective interventions; the use of the interventions should be based on shared-understanding between users and providers (Kikkert et al. 2006).

Utilization in the clinical practice of mHealth should be carefully planned. Preferences of time intervals in the intervention process may vary among users. Therefore, individual timing is important (Tran & Houston 2012). There should also be enough variation inside the application, as especially long-term interventions may result in tiredness or boredom from encountering the same content multiple times (Curioso et al. 2009; Palmier-Claus et al. 2013). Moreover, possible changes in telephone number should be taken into account, since prepaid cellular service is quite usual (Crankshaw et al. 2010). Finally, security and privacy issues should be carefully considered (Turner 2016), although the network and data encryption security works and is and constantly advancing (Torous et al. 2014).

2.4.6 Effectiveness of mobile health

By searching literature, eight systematic reviews and/or meta-analyses of using mobile health (mHealth) to support treatment adherence among people with chronic illnesses were included. Of those, three (Fenerty et al. 2012; Vervloet et al. 2012; Wald et al. 2015) focused on medication adherence, and the rest (Hasvold & Wootton 2011; Guy et al. 2012; Gurol-Urganci et al. 2013; Lin & Wu 2014; Bosmati et al. 2016) dealt with adherence to appointments. In the reviews, the number of included studies varied from 8 to 29. More detailed descriptions of each systematic review and/or meta-analysis is presented in Table 1.

The evaluation of an intervention focuses on assessing whether or not the intervention made any difference in the outcome (Bartholomew et al. 2006). These types of evaluations can be done using subjective or objective measures. It is commonly done using surveys, interviews, login information or asking the patient to use the application and simultaneously express their thoughts about it aloud. The methods can be used individually or in combination with others, as in, for example, conducting a survey and an interview. (Zapata et al. 2015.)

In the studies found in the literature search, four types of outcome measurements were found. First, medication and follow-up care adherence was measured by observations and scorings provided by the mental health workers and the family members (Pijnenborg et al. 2010). Second, the intervention itself was the method of measurement, as participants' responses via SMSs about medication taking were measured (Granholm et al. 2012). Third, pill counting was used to measure whether people had taken his/her medication as prescribed. In practice, this was done when people got their prescriptions refilled (Xu et al. 2016). Fourth, three different instruments (MAQ, DAI-10, BARS) were used in two different studies (Montes et al. 2012; Xu et al. 2016). In addition to what was found in the literature search, evaluation tools may also be an EEG or measure physical activity, heart rate, blood pressure or blood glucose (Beatty et al. 2013).

According to the reviews and meta-analyses, electronic reminders may improve treatment adherence among people with chronic illnesses (Hasvold & Wootton 2011; Fenerty et al. 2012; Guy et al. 2012; Vervloet 2012; Gurol-Urganci et al. 2013; Lin & Wu 2014; Wald et al. 2015; Boksmati et al. 2016). However, there is no clear answer for what type of reminder could be most beneficial. When comparing reminders with higher interactivity (phone calls, two-way messaging) to standardized possible autonomous reminders (one-way messaging), more interactive reminders were more effective (Hasvold & Wootton 2011; Lin & Wu 2014; Wald et al. 2015). On the other hand, one-way messaging was found to be more effective in promoting attendance to appointments than, for example, postal reminders, or no reminders at all (Gurol-Urganci et al. 2013). Regarding medication adherence, when comparing different types of electronical reminders, no statistical differences between reminder types were found (Fenerty et al. 2012).

The literature search showed that using mHealth to improve treatment adherence among people with psychotic disorders has been studied with various results. All four included studies had an outcome of medication adherence (Pijnenborg et al. 2010; Granholm et al. 2012; Montes et al. 2012; Xu et al. 2016), one study had an outcome of appointment attendance in addition to medication adherence (Pijnenborg et al. 2010). Of these, the paper by Xu et al. (2016) was a protocol of the study, and therefore results had not yet been provided. Two studies (Granholm et al. 2012; Montes et al. 2012) reported significant differences in medication adherence between study groups, and one study (Pijnenborg et al. 2010) reported significantly higher appointment attendance rates during the intervention than at the baseline, but not when it came to medication adherence. More detailed descriptions of each study are presented below and in Table 1.

Pijnenborg et al. (2010) reported significant improvement in appointment attendance during the use of a scheduled semi-automated SMS reminder. The mean the success rate rose from a baseline of 39% (SD 32.1) to 65% (SD 26.2). However, when measuring attendance again after the intervention, the mean success rate dropped to 56% (37.5). For medication adherence, the success rate was 8% higher during the intervention (baseline 57% (28.8); intervention 65% 25.3), but decreased to 48% (33.4) after the intervention. In this study, participants initially had problems with adherence; when non-adherence was observed, they were asked to participate to the study (Table 1).

Granholm et al. (2012) found, that after using daily two-way SMSs, medication adherence improved significantly. However, this improvement was observed only in people living independently. Every SMS that each participant received included a question, such as, “Have you taken your medication?” Participants were asked to answer these SMSs. Out of 55 study participants, 13 participants were defined as non-completers, since they did not reply to the SMSs within two weeks (Granholm et al. 2010) (Table 1). When comparing the effectiveness of one-way and two-way messaging in general, it was found that two-way messaging is more effective in improving medication adherence (20% more likelihood to adhere). In cases where non-adherence was unintentional (e.g. forgetting to take medications) one-way messaging worked as a reminder. However, if more detailed reasons for not taking medication were required, two-way messaging was better suited, since it could provide further support for patients. (Wald et al. 2015.)

Montes et al. (2012) reported that medication adherence improved significantly in a group that received daily one-way SMS reminding to take medications compared to a group receiving treatment as usual. The mean changes from baselines between groups immediately after the intervention were –1.0 (–1.02, –0.98) vs. –0.7 (–0.72, –0.68) p=0.02, and 3 months after the intervention, –1.1 (–1.12, –1.08) vs. –08 (–0.81, –0.78), p=0.04. Of the 166 participants in the intervention group, 66 did not properly receive SMSs. The study therefore only included in their analysis those participants who had successfully finalized the intervention (Table 1).

Xu et al. (2016) reported the study protocol of their LEAN study. The study includes four parts (lay health supporter, e-platform, award, iNtegration), and mHealth messaging delivered either by texting or by sending voice messages. Texting or voice reminders about medication taking will be sent to participants, and they will be instructed to confirm that the medication is taken. Reminders will be sent at 15 minute intervals, until this conformation is received (Table 1).

2.4.7 Feasibility of mobile health

Mobile health (mHealth) may be feasible and its use acceptable in psychiatric care (Alvarez-Jimenez et al. 2014; Bogart et al. 2014; Kannisto et al. 2015). Generally, mobile technology is widely used among people with mental health problems (Sanghara et al. 2010), the extent and prevalence of the use on par with that of the general population (Ennis et al. 2012). People with psychoses are able to utilize mHealth effectively, perceiving it as useful and having a positive attitude about it (Alvarez-Jimenez et al. 2014). People with psychotic disorders have expressed, that mHealth promotes their social activities (Miller et al. 2015), and that they can utilize mHealth in their daily life, understanding the benefits for clinical care. People with mental disorders were also in the opinion that mHealth was not stigmatizing, and they were familiar with using it on a daily basis. They felt that communication with a health care professional was more comfortable to conduct by mHealth than face-to-face contact, especially pertaining to sensitive topics. (Palmier-Claus et al. 2013.)

The literature search showed that people with psychotic disorders perceive mHealth reminders to be feasible and acceptable methods to use, and their perceptions were largely positive. There were three studies included, and the studies evaluated feasibility of mHealth reminders aiming to support medication adherence. Of those, two studies (Ben-Zeev et al. 2014; Kannisto et al. 2015) explored the feasibility of a specific

mHealth intervention after using it, and one study (Bogart et al. 2014) evaluated people's perceptions about the general feasibility of mHealth, but no actual messages were sent. More detailed descriptions of each study are presented below and in Table 1.

Ben-Zeev et al. (2014) evaluated the feasibility and acceptability of two-way supportive SMSs as a part of a single-arm trial. The intervention aimed to support participants' medication adherence. SMSs were received every weekday, and participants were instructed that they could answer the messages. If a participant replied, they received up to two SMSs on the same day. The content of these SMSs depended on the replies of the participant. Out of 17 participants, 90% (n=15) perceived that the intervention was useful and easy to use. The majority of the participants were satisfied with the intervention (87%, n=14) and perceived that a need for this type of intervention does exist. In this study, less than half of the participants had previously used SMSs, and they were trained to use this technology without difficulties (Table 1).

Bogart et al. (2014) explored the feasibility and acceptability of SMS reminders as a part of care after inpatient discharge. The study reported that out of 85 participants, 59% would be interested in receiving SMS reminders about medication taking. Almost every participant owned a mobile phone (n=70, 82%) and 80% were familiar with SMSs and knew how to use them. Of those who reported that they were unintentionally non-adherent (e.g. forgot to take medication), 56% were interested in receiving reminders. For past adherence and interest in using SMS reminders, no predictive interests were found.

Kannisto et al. (2015) explored feedback of participants who received one-way SMS reminders for one year. The intervention was tailored; participants had 85 different SMS options to choose from. In addition, participants were free to choose the timing of the messages. It was reported that the majority perceived that SMSs were easy to use (n=392, 98%) and not harmful (n=350, 87%), most were satisfied with the intervention (n=274, 72%) and over a half felt that SMSs were useful (n=236, 61%) and that they would use them again in future (n=247, 64%). The reported harmful effects on participants (n=51, 13%) caused by the intervention were being awoken or being in some other way irritated about the alert sound of receiving an SMS.

3. AIMS OF THE STUDY

The aim of this study was to explore adherence to treatment among people with psychotic disorders through the development of user-centered mobile technology (mHealth) intervention. More specifically, this study investigates mHealth intervention and the factors related to its possible feasibility.

The detailed research questions of the study were:

Factors related to adherence and its management in people with psychotic disorders

1. What are the behavioral, health-related and environmental factors restricting adherence?
2. How should adherence management be supported?

Objectives and methods of intervention to support adherence in people with psychotic disorders

1. What is the objective of the intervention to support adherence?
2. What are the preferred methods of delivering the intervention, based on end-users?
3. What types of methods for delivering the intervention have been used, based on literature review?

Barriers and requirements of using mHealth intervention in people with psychotic disorders

1. What are the barriers of using mHealth to support adherence?
2. What kind of requirements exists when using mHealth to support adherence?

Effectiveness and feasibility of mHealth intervention to support adherence in people with psychotic disorders

1. How effective is mHealth to support adherence?
2. What kind of usage preferences of mHealth do end-users have?
3. How have the preferences of end-users in usage of mHealth changed over time?
4. How do the preferences of end-users regarding mHealth vary by demographic factors?

4. MATERIALS AND METHODS

4.1 Theoretical and methodological approaches of the study

Materials and methods of this study are described for each study method used:
1) Focus group interview
2) Survey
3) Literature review

For a summary of the study types and methods, see Table 2.

The theoretical approach of the study is based on Intervention Mapping (IM). IM starts with intervention design and implementation, and ends with the evaluation or an evaluation plan. (Bartholomew et al. 2006.) In this study, the intervention development was divided as follows: 1) needs assessment, i.e. factors related to adherence and its management; 2) matrices of change objectives, i.e. objectives of the intervention, and components and materials, i.e. methods of the intervention; 3) adoption, implementation and sustainability, i.e. barriers and requirements of the intervention; and 4) evaluation, i.e. effectiveness and feasibility of the intervention.

The methodological approach of this study was a mixed method study design. Qualitative and quantitative approaches were integrated, with two types of participants: patients and health care personnel. Integration occurred at three levels. First, at the study design level, the intervention mixed method framework was used, and the qualitative data was collected prior to the intervention to support the development of the intervention. Second, at the method level, qualitative and quantitative data were each used in the development of the intervention. The qualitative data included the perceptions of professionals and service users regarding factors related to the use of the intervention. Third, at the reporting level, a staged approach was used, as the results of qualitative and quantitative data were originally analyzed and reported separately, but combined in this study (Fetters et al. 2013).

Table 2. Summary of methods used

Method	Focus group interview	Survey	Literature review
Study design	Descriptive	Sub-sample	Meta-analyses
Setting	Psychiatric wards Patient associations	Psychiatric wards	Databases
Population	Service users Mental health care professionals	Psychiatric in-patients	RCT-studies
Sampling	Convenience	Random	Selective
Instruments	Specific questions	Structured questionnaire	Cochrane guidelines Instruments
Data collection and time frame	Focus group interviews 2010-2011	Survey 2011-2012	Systematic search 2011-2012
Data analysis	Inductive content analysis	Statistical methods	Statistical methods

4.2 Study design and settings

In this section a description of designs and settings are presented for each study method used:

1) Focus group interview
2) Survey
3) Literature review

Three types of designs with four types of settings were used.

Focus group interview Descriptive study design with inductive content analysis was used to describe participants' perceptions of adherence and mobile health (mHealth), prior to the intervention. Study settings were: 1) adult closed acute inpatient wards and rehabilitation wards in Finnish mental health care organizations (n = 5), and 2) Finnish mental health patient associations (n = 4).

Survey A sub-study design was used to explore the feasibility of mHealth. The study setting included 24 sites with 45 psychiatric hospital wards, located in 14 hospital district areas in Finland. All Finnish hospital district areas (n = 20) had the possibility to participate, with the exception of one hospital district area, due to its operational language being different than that of sites in other parts of Finland (Swedish language, the Åland hospital district).

Literature review A meta-analysis study design with a Cochrane systematic review was used to measure the effects of mHealth on adherence, compared to the effectiveness of standard care. The standard format and guidelines of Cochrane systematic reviews were followed throughout the study. Meta-analysis was applied to multiple randomized controlled trials, combining and analysing their statistical findings in order to observe their overall results (Higgins & Green 2011.) The data was collected by using a systematic electronic database search and a hand-search (registries of clinical trials, hand-searches, grey literature, and conference proceedings). The search was conducted from databases (The Cochrane Schizophrenia Group's Register of Trials, Amed, Biosis, Cinahl, Embase, Medline, Pubmed, PsycInfo and registries of clinical trials).

4.3 Populations and sampling method

In this section, a description of populations and sampling methods are presented for each study method used:

1) Focus group interview
2) Survey
3) Literature review

Four types of participants and three types of sampling methods were used (Table 3).

Focus group interview Two types of participants were recruited by using convenience sampling. First, service users (n = 19) were recruited from patient associations, which were contacted and offered the possibility to participate in this study. Those associations that were willing to participate received more information on the study in paper format. After this, managers of the associations informed service users of the possibility to participate. Second, mental health care professionals (n = 42) were recruited. The professionals were registered nurses, clinical nursing specialists, mental health nurses, practical nurses and psychiatrists. Psychiatric hospitals managers were contacted and informed about the study and possibility to participate. The psychiatric hospitals that were willing to participate, received more information on the study in paper format. Psychiatric hospital managers informed the mental health care professionals of the possibility to participate in this study.

Survey Psychiatric inpatients (n = 562) were recruited by using random sampling. Patients who fulfilled inclusion criteria were randomized by using a computer generated 4 block random design and sealed envelopes. Randomizations were conducted by research nurses (Välimäki et al. 2012). Those patients who were randomly assigned to the intervention group were included in this phase. At the time of recruitment, participants were in a psychiatric hospital and their time of discharge was near.

Literature review Two randomized controlled trials were systematically selected from nine databases and other resources. Selective sampling was used to obtain the randomized controlled trials (n = 2). There were no limitations for language, date, document type, or publication status, and all relevant randomized controlled trials considering adults with severe mental health problems or related disorders having ICT-based prompting were included.

Table 3. Inclusion and exclusion criteria of the participants

Study type	Participants	Inclusion criteria	Exclusion criteria
Focus group interview	Service users (n = 19)	Age 18 years or older Ability to speak Finnish Voluntary participation Willing and able to provide informed consent	Does not fulfil the inclusion criteria
Focus group interview	Mental health care professionals (n = 42)	Working at the included psychiatric hospital Willing to participate to the study	Not working with patients Insufficient Finnish language skills
Survey	Psychiatric inpatients (n = 562)	Age 18-65 Have continuous antipsychotic medication Discharge from a psychiatric hospital Have mobile phone Sufficient Finnish language skills Able and willing to provide informed consent Is included in study (ISRCTN: 27704027) being in intervention group	Forensic psychiatric patient In non-acute treatment period
Literature review	RCT studies (n = 2) (total 358 participants)	Randomized controlled trials investigating; Adult patients Having majority of the participants diagnosed with schizophrenia or related disorders Investigating information and communication technology based prompting as a sole method, added to standard care or combined with different prompt types	Quasi-randomized study

4.4 Instruments

In this section, a description of instruments is presented for each study method used:

1) Focus group interview
2) Survey
3) Literature review

Altogether there were 17 instruments used.

Focus group interview Semi-structured focus group interviews based on specific questions were used. These questions were aimed to show firstly, the needs assessment of adherence from the service users' and mental health care professionals' points of view, and second, barriers and requirements for the use of mobile health (mHealth) in psychiatric care in order to obtain successful adoption and implementation of SMS intervention. The interview questions were: 1) How to best support treatment adherence of patients with mental health problems, 2) What restrictive factors of treatment adherence occur in outpatient and inpatient mental health care, 3) How could patient adherence be supported by using mHealth in psychiatric care, 4) What are the problems of using mHealth prompting to support adherence in psychiatric care, and 5) What are the requirements of using mHealth in psychiatric care.

Survey Structured questionnaire were used to describe the types of the mHealth selected, how the selections changed over time and to identify mediators of the relationship between inpatients' demographic characteristics. The instrument was a paper format booklet, including instructions, contact information, 85 different mHealth message options and a page where the patient was able to define the timing of messages. Information about patients' socio-demographic information was collected with a structured questionnaire (age, gender, marital status and age at first contact to psychiatric services).

Literature review Cochrane guidelines and The Cochrane Handbook for Systematic Reviews of Interventions (Higgins & Green 2011) were used to manage and extract the data. In the included studies, an assessment of clinical response was measured for six outcomes and by 13 instruments (Table 4). Of those 13 instruments, two measured treatment adherence. Acceptability of the intervention was evaluated by measuring how many patients prematurely quit the study for any reason

Table 4. Outcomes and instruments to assess clinical response

Outcome	Instrument	Author	Instrument used
Adherence	Morisky Green Adherence Questionnaire (MAQ)	Morisky et al. 1986	Montes et al. 2012
	Drug Attitude Inventory 10-item version (DAI-10)	Hogan et al. 1983	Montes et al. 2012
Functioning	Computer Use and Experience Scale (CUE)	Potosky & Bobko 1998	Hulsbosch et al. 2008
	Working Alliance Inventory-Short Revised (WAI-SR)	Hatcher & Gillaspy 2006	Hulsbosch et al. 2008
	Psychological and social functioning (HoNOS)	Royal College of Psychiatrists 1996	Hulsbosch et al. 2008
Insight	Unawareness of Mental Disorder (SUMD)	Amador et al.1991, 1994	Montes et al. 2012
Mental state	Clinical Global Impressions Scale (CGI-SCH-SI and CGI-SCH-DC)	Guy 1976	Montes et al. 2012
Satisfaction with treatment	Camberwell Assessment of Needs - Short Appraisal Schedule (CANSAS)	Slade et al. 1999	Hulsbosch et al. 2008
	CQ-Index	Centrum Klantervaring Zorg 2014	Hulsbosch et al. 2008
	GGZ Thermometer	Kerzman et al. 2003	Hulsbosch et al. 2008
Quality of life	Euroquol 5D, visual analogue scale (Euroquol VAS)	Brooks 1996	Montes et al. 2012
	Quality of life (MANSA)	Nieuwenhuizen et al. 1998	Hulsbosch et al. 2008
	Loneliness Scale	de Jong Gierveld & van Tilburg 1999	Hulsbosch et al. 2008

4.5 Data collection

In this section, a description of data collection is presented for each study method used:

1) Focus group interview
2) Survey
3) Literature review

There were 3 types of data collection methods.

Focus group interview The data was collected using focus group interviews. The focus groups were held on June 2010 to March 2011. A total of nine focus group interviews were conducted. Altogether, 61 participants were interviewed: 42 health care providers and 19 service users participating in association activities. Each group had 1 to 2 interviewers, and altogether there were 4 researchers who participated as an interviewer for these focus groups. Interviews were semi-structured, but the topics were kept quite general. This ensured that participants were able to discuss their perceptions freely (Lakshman et al. 2000). Focus groups were organized by first distributing written and verbal information to psychiatric hospitals or managers of the patient associations. After that, the managers recruited possible focus group participants. The timetable was designed together with the managers. Those who were willing to participate in these interviews received information on the study in paper and verbal format. Written informed consent was received from all participants. Since the recruitment was done by managers, it was not possible to calculate how many refused to participate.

Survey The data was collected via a survey between September 2011 and November 2012. When inpatient participants were in the process of being discharged from a psychiatric hospital, they were randomly assigned to the intervention group or the control group. The intervention group was included in this study. The participants from the intervention group selected mHealth messages from a paper format instrument together with a research nurse. Messages selected were documented in two booklets: one for the patient to use to identify their own text messages in case they wanted to change the content or frequency of the messages, and one for a research nurse, who collected data by coding the selected text messages in a web browser electronic semi-automatic system (Figure 2).

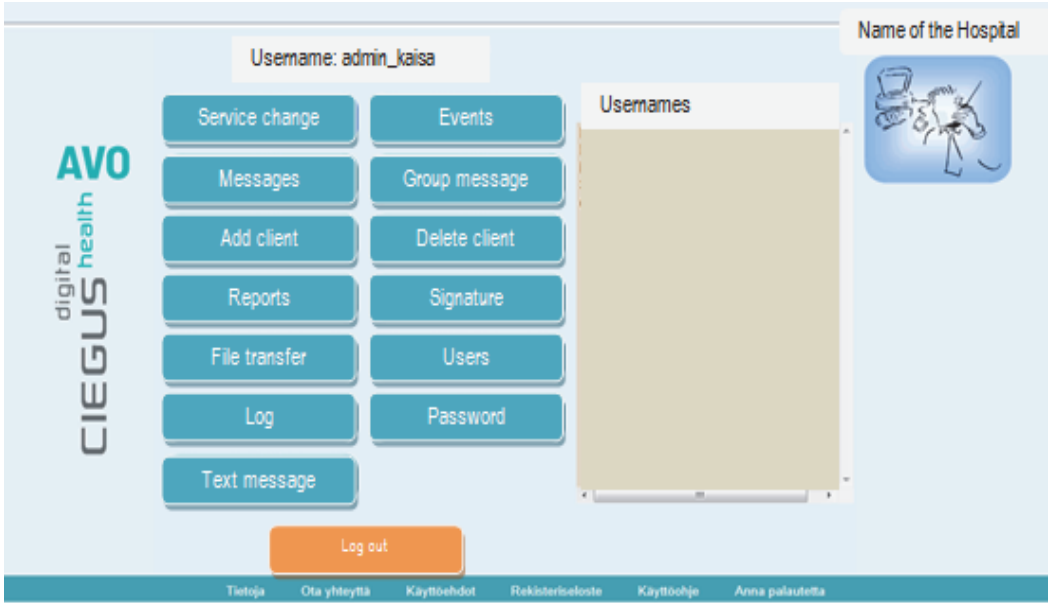

Figure 2. Screenshot of the main menu from Mobile.Net mHealth system

Literature review The data was collected by using a systematic database search and a hand-search. The following electronic databases (n = 9) were used for systematic literature search: The Cochrane Schizophrenia Group's Register of Trials, Amed, Biosis, Cinahl, Embase, Medline, Pubmed, PsycInfo and registries of clinical trials. The database search was compiled by hand-searches, grey literature, and conference proceedings. Database searches were conducted on 31st of May 2011 and supplemented on 9th of July 2012. The search terms were structured by following PICO terms (Table 5). The database search was conducted by a librarian from the Cochrane Center and search terms were constructed with the assistance of another librarian

Table 5. Search terms of databases

Date	Search terms
31st May 2011	[((*appointment* or *attend* or *remind* or *prompt* in title, abstract and index terms of Reference) AND *letter* or *phone* or *text* or *e-mail* or *e-mail* or *sms* or *visit* or call* or *system* *messeng* OR *MSN*)) AND (*computer* OR *internet* OR *ICT* OR *electronic* OR *online* OR *virtual* OR *world wide web* OR *second life* OR *facebook* OR *twitter* OR *blog* OR *messeng* OR *MSN* OR *SMS* in title, abstract, index terms of REFERENCE)].
9th July 2012	"mobile phone" AND "schizophrenia"

4.6 Data analyses

In this section, a description of data analyses is presented for each study method used:

1) Focus group interview
2) Survey
3) Literature review

There were 3 types of data analysis methods.

Focus group interview A manifest qualitative inductive content analysis (Graneheim & Lundman 2004) was used to analyze the data from the focus group interviews. This ensured that participants' perceptions of needs were derived from the data. The oral interviews were audio recorded and transcribed into written format. The texts were then read several times to get impression of the data and its content. Codes were selected and named. Codes were combined into sub-themes according to subject matter. Then, sub-themes were named and combined into themes.

Survey Descriptive statistics were calculated to demographics information (SPSS version 21.0 for Windows). The Poisson regression model with SAS software (version 9.3 for Windows) was used to analyze how patients' demographic information was associated with the amount of and timing of mobile health (mHealth) messages selected. In all analysis, p-values of less than 0.05 (two-tailed) were interpreted as statistically significant.

Literature review Review Manager (RevMan 5.2) was used to analyze the effectiveness of mHealth compared to that of standard care, by following the Cochrane standards (Higgins & Green 2011). Relative risks (RR) and 95% confidence intervals (CI) were calculated using a fixed effects model. For continuous outcomes, the mean difference (MD) between groups and their 95% confidence intervals were estimated. A table of the summary of findings was created using GRADE and used to assess the included studies for risk of bias. The following information of trials was extracted: methodology, instruments and outcomes. In addition, the quality of trials was assessed, by assessing the possible biases; selection bias, performance bias, detection bias, attrition bias and reporting bias. This was done by assessing 1) random sequence generation, 2) allocation concealment, 4) blinding of participants and personnel, 5) blinding of outcome assessment, 6) incomplete outcome data, 7) selective reporting, 8) other biases.

4.7 Ethical considerations

The ethical principles for medical research involving human subjects (WMA Declaration of Helsinki 2008) were followed. In every phase, participant autonomy was respected (Council for International Organizations of Medical Sciences 2002), and their privacy, dignity and integrity were protected (Personal Data Act 523/1999). In this study, ethical considerations were taken into account as follows: 1) permission of ethical committee was requested for the empirical data, 2) study approval was requested from each included organization, 3) participants received information about the study in written and in oral format, 4) written informed consent was requested from every participant, 5) participants were told they had a right to refuse to participate, 6) each participant's right to leave the study was respected, 7) a sufficient mental health condition of patient participants was ensured, 8) those who had a trustee were excluded, 9) the empirical data were coded in such a way that no single person could be identified in the results, 10) data protection was ensured and the data were kept in locked place (in the University of Turku premises). To archive or destroy the data after the study, regulations from Archive Act 831/1994 were followed.

The importance of the patients' perspective and service-user involvement in the development of treatment has been acknowledged (NHS Institute for Innovation and Improvement 2008), and it is also important that patients treated in a psychiatric hospital have the opportunity to participate in studies (Davies 2005). However, mental illness may affect a person's competence in decision-making (Institute of Medicine, Committee on Crossing the Quality Chasm 2006). Therefore, careful attention was given to evaluating participants' capacity to participate. Participants were informed both orally and with written material. The voluntary nature of participation was underlined, as was the fact that neither participation nor refusal would affect their treatment (Medical Research Act No. 488/1999).

On 16th December, 2010 the Ethics Committee of the Hospital District of Southwest Finland gave their approval to conduct the study focused on in focus group interviews (ETMK 109/180/2010). Permits were granted from the patient associations (n = 4) and from the mental health care organizations (n = 5) in Southwest Finland, Satakunta and South Karelia. Written informed consent of participants was requested (n = 61). Participants were given sufficient information regarding the study in paper format and in verbally. Their understanding was ensured (Council for International Organizations of Medical Sciences 2002) as well as their right to refuse or withdraw of the study

without having to give any reason. To ensure competence of participants, they were recruited from patient associations; inpatient settings were not used for recruitment. The study participants had possibility to quit the interview whenever wanting so, but no participants wanted.

For the research carried out as survey in psychiatric hospitals, the Ethical Committee at the Hospital District of Turku University Hospital approved the protocol on 16th December, 2010 (ETMK109/180/2010). Permissions from organizations (n = 24) were granted. Written informed consent from participants was requested. Research nurses gave information to participants about the study orally and in paper format. It was ensured that participants had enough time to consider their participation. If participants were willing to be involved, written informed consent was requested. Inpatients were recruited near the time of hospital discharge to ensure their capacity to provide informed consent. It was also advised that a patient's primary nurse would not ask for consent, as a method of ensuring voluntarily participation. Patients who had a trustee were excluded. In cases where the research nurse was unsure of a participant's capability to participate, psychiatrists were consulted. Contact information (email, phone number) of the researchers was given to participants to make sure that they could withdraw from the study if necessary. All the needed contact information of researchers was given to the participants. They were told that they could contact to researcher whenever wanting so. Some participants contacted the researchers and wanted to discuss about the study and/or the intervention. The specific amount of these contacts is reported elsewhere. In addition, other important issues were taken into account: the research would not have been as successfully carried out with less vulnerable subjects, and the study intended to obtain knowledge that will lead to improved treatment (Medical Research Act No. 488/1999).

Moreover, this whole study had an independent committee for data safety and monitoring. The members of the committee were experts from psychiatric care, member from a patient association and a statistician. (Välimäki et al. 2012.) The committee had regularly meetings, and the study progression was monitored as well as any possible adverse events.

Literature review consisted of studies previously conducted, and therefore, no permission was needed. The extraction and analyses of the studies were done by six authors to ensure reliable extraction and review. To minimize the misinterpretation of

data, the authors of the trials were contacted when necessary. In cases of contrary results being found in the trial versus the review, authors were also contacted and agreement was maintained.

5. RESULTS

The results are reported in the order that the research questions were presented. 1) A description of factors related to adherence and its management are presented, including factors restricting adherence and supporting methods of adherence management. 2) The objectives and methods of the intervention are defined, including the objective to support adherence, preferred methods of delivering the intervention, and previously used types of methods of delivering the intervention. 3) Barriers and requirements of using mobile health (mHealth) to support adherence are then presented. 4) Effectiveness and feasibility of mHealth are evaluated, including the effectiveness of mHealth in supporting adherence, preferences of end-users regarding mHealth, changes of end-users' preferences regarding mHealth over time, and variation of preferences of end-users regarding mHealth by demographic factors.

5.1 Study populations

This study included four types of participants (Table 6). First, service users (n = 19) were service users participating in activities of a patient association. The second group was made up of health care professionals (n = 42) who worked in psychiatric hospitals participating in clinical work. Of these, two were psychiatrists, and 40 were registered nurses, clinical nursing specialists, mental health nurses or practical nurses. The third group of participants included in-patients with antipsychotic medication (n = 562) from psychiatric hospitals during their discharge phase, who used the intervention in their outpatient treatment period. Fourth, two selected randomized controlled trials with a total of 358 adult psychiatric outpatients with schizophrenia, schizoaffective, depressive or bipolar disorders were included.

Table 6. Demographic characteristics of the study participants

	Service users	**Health care professionals**	**In-/outpatients**	**Outpatients**
Study type	Focus group interview	Focus group interview	Survey	Literature review
Setting	Patient associations	Psychiatric hospitals	Psychiatric hospitals	RCT-studies
N	n = 19	n = 42	n = 562	n = 358
Age, mean (SD)	Not available	Not available	38.6 (12.7)	41.4 (3.3)
Gender (%) Male Female	 13 (68%) 6 (32%)	 13 (31%) 29 (69%)	 267 (47%) 296 (53%)	 217 (63%) 130 (37%)

5.2 Adherence in people with psychotic disorders

5.2.1 Restrictive factors for adherence

According to the findings of the inductive content analysis, restrictive factors of patient adherence to treatment were described using four themes: reluctance to take medication, problems in functioning, symptoms caused by the illness and lack of a sufficient treatment process.

Common reasons for reluctance to take medication were a lack of insight and forgetting. Professionals also reported that patients' negative attitudes toward treatment, which may be due to a lack of insight or a low level of motivation, can predict poor medication adherence. Some participants described the feeling of being overly medicated, which lead to them abandoning their medication. Although medication was seen as an important element of the care, it was sometimes overemphasized by the health care workers, according to service users. Based on the interviews with the participants, other reasons for reluctance to take medication were its potential and actual side-effects, the fear of addiction, the fear of overmedication and the notion that the medications were not effective.

Problems in functioning were common and participants reported that everyday activities (e.g. going to the grocery store) may be difficult to conduct. Further, other difficulties occurring in everyday life (e.g. unbalanced daily rhythm) limited adherence. Patients said that loneliness is a typical problem, and they felt they had nobody to talk with. They also reported that it was difficult to adhere and cope independently without sufficient support. Moreover, according to professionals, patients who have a good social network, with close ones who give support, adhere better than patients who lack social networks.

Symptoms related to psychiatric illnesses also complicated adherence. These types of symptoms included paranoid thoughts, depression and anxiety. Participants described that the occurrence of these symptoms may lead to a situation where they feel it becomes too difficult to adhere to treatment, despite being aware that they should. On the other hand, according to the participants, when health outcomes were at a good level and no symptoms were presented, patients sometimes opted to quit their medication and treatment, because they felt that medication was no longer necessary. According to the analysis, a lack of a sufficient treatment process causes problems with adherence. The lack of a sufficient treatment process refers to instances where

treatment is not patient-centered or individualized enough, that is, situations where a patient does not have the possibility to participate in their own treatment. Several examples of this were presented: a lack of access to treatment, a lack of communication with health care professionals, changes in treatment including changing professionals, and patients becoming confused due to too many different organizations/health care professionals being involved. In addition to this, the first appointment for follow-up care was found to be too long after the point of hospital discharge, which limited adherence.

5.2.2 Adherence management

Based on the codes and themes of the inductive content analysis, adherence management included supporting sufficient treatment for patients and helping them achieve a satisfying life.

Participants described several supportive methods that made treatment sufficient: easy access to treatment, individually tailored treatment methods, well-structured treatment and continuity of care. Looking beyond treatment methods, the existence of a well-supported personal and social life was considered to be a strength.

Participants identified how adherence management would be possible to achieve: first, by helping patients structure and schedule their daily lives, for example, by encouraging participants to take part in reasonable activities; second, by strengthening the patient's positive attitudes toward treatment and life in general; third, by supporting the patient's social life and social networks, including family, friends, peers and health care professionals, all of whom could encourage patients to adhere.

Patients described that daily life can be difficult with unstructured daily activities and rhythm. In this context, health care professionals and patients suggested that in outpatient care or at the time of discharge from the hospital, health care staff and patients could jointly make a structured weekly program, like a timetable, for the patient. According to the analysis, this could encourage patients' positive attitudes toward the future and moving forward in life. Other activities that helped bring daily structure were thought to be important.

5.3 Mobile health to support adherence in people with psychotic disorders

5.3.1 Objective of the intervention to support adherence

The objective of the intervention was defined based on focus group with inductive content analysis. First, since the first appointment for follow-up care was stated to be too long after the time of discharge, it was decided that the intervention would be directed at the time of discharge. Second, since intention to adhere was central, this guided the objective of the intervention. Third, regarding how people in the patient's environment help them accomplish adherence, it may be increased by providing extra support for patients, in terms of reminding the patient of taking their medication, encouraging an active social life, supporting daily care and treatment, and providing information.

The objective of the intervention was to support patients' optimal intentions to adhere (Figure 3). This was considered to be possible by supporting patients' medication taking, follow-up treatment and daily care, which were found based on focus groups. Since taking medication was perceived to be challenging, encouragement for regular, correct dosages of medication may help patients adhere better. Encouragement included medications that are taken every day or less often, such as long-lasting injections. The intervention aimed to encourage adherence to follow-up treatment by reminding patients to participate in their outpatient visits. It was equally important to actively encourage patients to participate just before a specific visit or, in cases where a patient did not keep the appointment, to re-engage that person. Intervention also aimed to support patients' daily lives. Supporting could be conducted by keeping in contact with patients or by encouraging patients to engage in everyday activities, such as cleaning, taking care of their personal hygiene or encouraging them to have a clear weekly or daily structure. Daily life encouragement also required sufficient insight into a patient's symptoms.

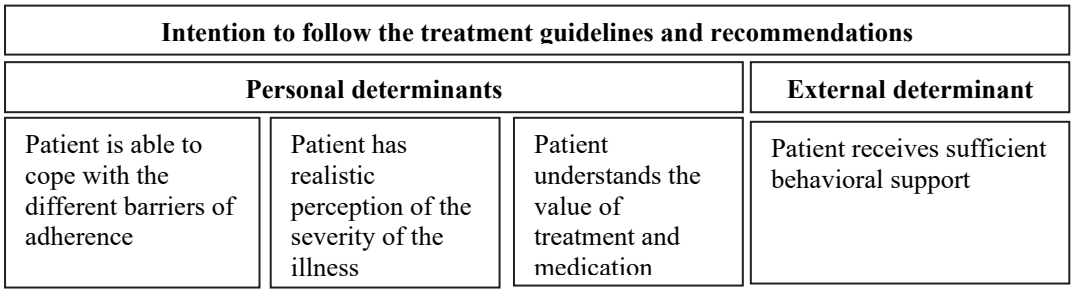

Figure 3. Objectives of the intervention

5.3.2 Preferred methods of delivering the intervention

According to findings from focus group interviews, one potential method of delivering the intervention was stated to be reminding, using mobile health (mHealth). The potentiality of using mHealth was described in terms of promotion of communication, patient empowerment, strengthening of treatment adherence and facilitation of daily activities (Table 7).

Table 7. Potentiality of mHealth as a strategy to deliver the intervention

Promotion of communication	**Patient empowerment**	**Strengthening of treatment adherence**	**Facilitation of daily activities**
Easy, flexible and gentle way to approach Replacement of telephone call Possible to combine telephone call and SMS	Individual way to approach Encouraged Feeling of being remembered Reduce loneliness Feeling of being trusted Increase the feeling of responsibility	Helps patient remember medication taking Possible to verify issues of medication Facilitates participation in follow-up care Provides extra support at the time of discharge	Motivates to perform daily activities Creates a structure for the day Reminds about important issues

5.3.3 Previously used methods for delivering the intervention

Based on the included and excluded studies of the systematic literature review conducted, improvement of treatment adherence by using electronic reminders has been studied for many years. The interventions of the studies have ranged from simple telephone calls to more advanced devices. More detailed, the types of methods of delivering the intervention were forms of therapy including a technology aspect (n = 1), electronic devices (n = 2), traditional telephone calls (n = 5), telemonitoring (n = 1) and SMS (n = 2) (Table 8). The studies were conducted from 1984 - 2011. The intervention of the studies aimed to support either medication adherence or adherence to follow-up care.

Table 8. Randomized studies using electronic reminders to support adherence

Intervention	Participants	Study
Cognitive adaptation training	Schizophrenia (n = 95)	Velligan et al. 2008
Electronic assistant device	Schizophrenia, schizoaffective, depressive or bipolar disorders (n = 81)	Cramer & Rosenheck 1999
Electronic assistant device	Schizophrenia, schizoaffective, depressive or bipolar disorders (n = 93)	Hulsbosch et al. 2008
SMS	Schizophrenia (n = 320)	Montes et al. 2012
SMS	Schizophrenia or related (n = 62)	Pijnenborg et al. 2010
Telephone call	Psychiatric illness (n = 214)	Crespo-Iglesias et al. 2006
Telephone call	Psychiatric illness (n = 141)	Kluger & Karras 1983
Telephone call	Schizophrenia (n = 865)	Montes et al. 2009
Telephone call	Mental illness (n = 308)	Rossi et al. 1994
Telemonitoring	Schizophrenia (n = 108)	Frangou et al. 2005

Based on focus group interviews, specific principles for mobile health (mHealth) intervention were formed (Table 9). The principles were jointly created with patients and health care professionals. The principles related to content, frequency, amount, duration and updating the messages. Based on these principles, the mHealth intervention was implemented and evaluated.

Table 9. Specific principles of developed mHealth intervention

mHealth to support treatment adherence	
Content Maximum 160 characters No pictures or videos Informative, positive and humorous 85 text messages from 3 themes: medication, treatment appointments, daily life	**Duration and amount** Duration 1 year Maximum amount 12 SMSs / month or 1 / week Minimum amount 2 SMSs / month
Frequency Possibility to select messages Mon-Sun 0-24 hours Weekly or monthly basis	**Updating** Possibility to stop or change content and timing of SMS whenever Possibility to change mobile phone number

5.4 Barriers and requirements of using mobile health among people with psychotic disorders

Based on focus group interviews, four types of barriers related to the use of mobile health (mHealth) were found: technological problems, problems related to mHealth, problems related to the organization and problems related to the patient. The requirements that must be met in order for a patient to participate in the intervention were related to technological issues as well as content and usage of mHealth (Table 10).

Technological problems were related to security and privacy issues. Problems occurred, for example, in cases where an incorrect phone number had been given. Therefore, participants highlighted the importance of checking and updating phone numbers. One possibility for doing this was a system where the patient could log in and update the information or messages by themselves. Also the content of the mHealth might be incorrect. For example, if a medication reminder has the wrong timing or dosage in it, this can lead to medication errors. In addition, participants felt that the use of mHealth should not cost the patient anything. This may be a problem for forms of mHealth which generate the need or the likelihood of replies.

Problems related to mHealth means difficulties in its actual use. The problems were related to mHealth frequency, amount and content. When forms of mHealth are received too often, for example every day, participants felt that it could disturb them after some time. Further, if the content of the SMS is always the same, it may cause irritation. Therefore, participants suggested the possibility of choosing mHealth content from a list with plenty of possibilities.

Organizational problems may occur when there is a lack of motivation or resources to use mHealth, and lead to scattered implementation. Organizations should be reliable, ensuring that enough providers are committed to use SMSs. According to participants, clear roles and responsibilities for updating mHealth systems should be formed. The optimal situation would be that mHealth would be automatically updated when there are changes in treatment. This requires a reliable connection between the mHealth system and the health record or appointment system.

Problems related to patient (or end-user) were related to a lack of motivation, fears, negative attitudes or a lack of technical skills. Therefore, sufficient technical skills as well as the reading and writing skills of patients should be ensured. In addition, patients should be well aware of the mHealth and know how to contact someone for help if needed. Patients need to be asked for their consent to use mHealth as well as to inform the mHealth system services if phone numbers change.

Table 10. Barriers and requirements of using mHealth

Barriers of using mHealth in psychiatric care			
Technology	**mHealth**	**Organization**	**User**
Security and privacy issues Wrong phone number Possible costs for patients Change of phone number	Impersonal or difficult method for communication Lack of variation in messages Amount of messages is not appropriate	Lack of resources Question of which responsible agency will send and update the messages Lack of the motivation of staff	Lack of information Poor motivation Negative attitude Lack of technical skills
Requirements of using mHealth in psychiatric care			
Technology	**mHealth**	**Organization**	**User**
Secure and flexible system System where patient can log in for update messages or other information Does not cost patients anything	Positive messages, avoiding paternalistic tone Individually tailored Linked to treatment plan Variety of message options Regular and individual frequency	Regularly checking relevance of messages Connection between mHealth system and health records Reliable organizations, ensuring professionals are committed to using the mHealth	Clearly informed and instructed Sufficient technical skills Training technical skills if necessary Reading and writing skills

5.5 Evaluation of the mobile among people with psychotic disorders

5.5.1 Effectiveness of mobile health

The effectiveness of mobile health (mHealth) on treatment adherence was evaluated as a part of systematic literature review. Two studies were included. Of those, one study measured effectiveness of mHealth for treatment adherence, by using the Morisky Green Adherence Questionnaire (MAQ) and the Drug Attitude Inventory 10-item version (DAI-10), in three time intervals; at the baseline, at 3 months and at 6 months. For the results of all outcomes measured in both of the included studies, see Figure 4.

Based on the meta-analysis conducted, there was no clear evidence that the use of mHealth would improve medication adherence for people with psychotic disorders. No differences found between groups in their self-reported medication taking measured with MAQ at 3 months (MD 0.30, 95% CI 0.27 to 0.33) and when measured at 6 months (MD 0.30, 95% CI 0.27 to 0.33). When asking from participants if they would stop taking their medication, no differences were found between groups (RR 1.11 CI 0.96 to 1.29).

Moreover, there were no mean differences in subjective responses to medication, measured with DAI-10, between groups (MD 1.40, 95% CI 1.32 to 1.48). In other words, intervention groups and patients receiving treatment as usual (TAU) were similarly satisfied with treatment and understood how treatment affects them. The numbers of people who quit the study early were similar in both the intervention and TAU group. Therefore, it can be assumed that neither intervention nor TAU is less or more acceptable than the other (relative risk (RR) 1.46 CI 0.70 to 3.05).

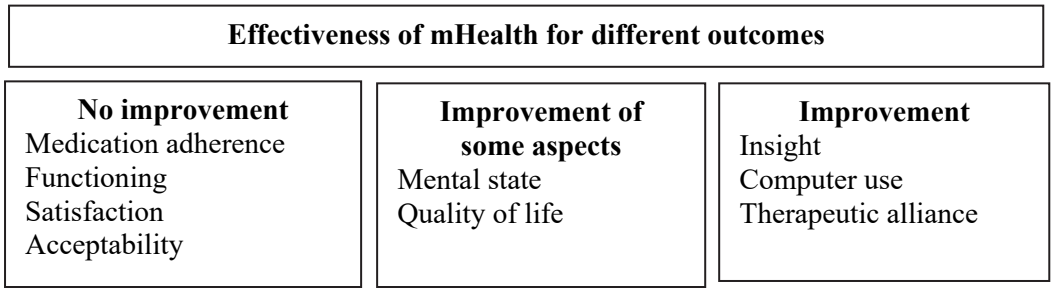

Figure 4. Effectiveness of the intervention for different outcomes

5.5.2 Feasibility of mobile health

Based on patients preferences toward mobile health (mHealth), mHealth related to medication was the most popular, followed by messages related to supporting follow-up care. Mondays and Tuesdays were the most popular times to receive the mHealth intervention. On weekends, mHealth intervention was not regarded as so necessary. The most preferred time to receive mHealth intervention was during the morning hours (06-12 am), followed by afternoons (12-06 pm), then evenings (06-24 pm) and lastly, night time (12 pm-06 am).

Out of 562 participants, 6% (n = 33) wanted to make some changes to their selections of mHealth intervention and 4% (n = 23) wanted to discontinue the intervention. Out of the 23 drop-outs, 8 gave a reason for discontinuing. The changes concerned content, timing or amount of mHealth intervention. Common reasons for wanting changes were mistakes in the mHealth system. Altogether, it was found that 98 participants received text messages with mistakes in them, of which 22 participants wanted to change their selections to correspond to their original selections (Table 11).

Table 11. Preferences over time toward mHealth intervention

Reason for changing the intervention	**n**
Uncorrected mHealth intervention in the system (mistakes)	22
Desire to change the content of the mHealth intervention	4
Desire to change the timing of the mHealth intervention	3
Add an mHealth intervention	3
Stop one mHealth intervention	1
Reason to discontinue the intervention	**n**
Annoyed by the mHealth intervention	2
mHealth intervention was not useful	2
No longer necessary to have mHealth intervention	2
Unsatisfied with one-way messaging	1
Unsatisfied with the information regarding the study	1

6. DISCUSSION

This study furthers the knowledge about treatment adherence and the development process of mobile health (mHealth) intervention aimed at supporting adherence in psychiatric care. More specifically, this study provides insight into the difficulties and management of treatment adherence, as well as the factors related to the usability and effectiveness of mHealth. This knowledge can be used in promoting treatment adherence in psychiatric care as well as in developing and using mHealth in psychiatric care.

In the discussion section the validity and reliability of the entire study are first explored, and then the validity and reliability of each study method:

1) Focus group interviews
2) Survey
3) Literature review

Second, a discussion of the study results is presented, following the order in which the research questions were presented:

1) A description of factors related to adherence and its management
2) The objectives and methods of the intervention
3) Barriers and requirements of using mobile health to support adherence
4) Effectiveness and feasibility of mobile health

Third, study suggestions are presented for:

1) Nursing practice
2) Management
3) Technology
4) Future research

6.1 Validity and reliability of the study

This was a mixed method study using qualitative and quantitative approaches (Creswell & Plano Clark 2011). As both of these approaches include limitations in their methodologies, using more than one method, although beneficial, can potentially create some challenges. The challenges can occur if quantitative and qualitative methods are not equally emphasized, or if different methods lead to opposite results (Foss & Ellefsen 2002). In this study, research questions dictated the study designs and methods. This ensured that both of these methods were equally and justifiably used.

The validity of a mixed method study is evaluated using inference quality and inference transferability. Inference quality refers to the accuracy of study conclusions, and can be seen as internal validity and credibility (Teddlie & Tashakkori 2009). In this study, the interpretations of qualitative data were done by a small research group (3 people), where one person was responsible for handling and analyzing the data. The analysis and its categorization were checked together and ensured that interpretations were actually derived from the data. Credibility was ensured by collecting, analyzing and reporting in a way that results reflected the reality of study participants. Inference transferability refers to how reasonable the results and their conclusions are in similar contexts (Teddlie & Tashakkori 2009). This study was done in a wide geographical area, without any specific criteria for diagnosis. This supports the generalization of the results within similar types of milieu.

Intervention Mapping (IM) (Bartholomew et al. 2006) was used as a framework to structure the development process of the intervention. Although IM is time-consuming and profound (Jacobs et al. 2014), it was found to be workable in this study. IM allowed the creation of comprehensive and tightly focused intervention, where perceptions of end-users (patients and health care professionals) were taken into account. This ensured that the focus of the intervention corresponded to the reality. Applicable parts of IM were used to promote the specific purposes of this study. This study differs from IM in some ways: this study does not include one specific theory (e.g. Health Belief Model), this study did not use ecological levels in the development phase, the intervention was pre-tested but not published as a part of this dissertation, the implementation plan was not published as a part of this dissertation, and the effectiveness of this specific intervention is also reported elsewhere.

Focus group interview

The validity of focus groups is evaluated using primary criteria: integrity, authenticity, credibility and criticality (Whittemore et al. 2001).

Integrity relates to the validity of interpretation (Whittemore et al. 2001). In this study, the interpretations were done by three people; the codes and categories were derived by one person and checked by another. In cases of dissenting opinions, a third person was involved. However, to improve homogeneity, the analyses were conducted by one person (Krueger & Casey 2009). The interviews were also conducted primarily by these three people.

Authenticity concerns the methods that reveal the realities of participants' situations (Whittemore et al. 2001). In this study, this was ensured by interviewing the professionals separately from the patients. By doing this, participants were free to express their thoughts in a group consisting of their peers. The interview questions were also kept quite general, to make free conversation possible.

Credibility pertains to the realities of the study participants being accurately represented in the results (Whittemore et al. 2001). In this study, this was ensured by: first, using quotes from participants to support the findings; second, analyzing the data by using inductive content analyses; third, by recording the interviews so that it was possible to listen the interviews afterwards; and fourth, by transcribing the interviews verbatim and taking notes during the interviews.

Criticality relates to the decisions of the study being critically appraised (Whittemore et al. 2001). In this study, all decisions concerning methodology were made by a group of people. The design was descriptive. The study processes of each organization involved were conducted similarly, and everyone had equal possibility to participate. Interview questions were the same for every focus group.

Survey

Statistical conclusion validity considers whether or not the relationship between cause and effect is real and that reality is reflected accuracy (Garcia-Perez 2012). Data were collected from 562 participants, which satisfy the amount of statistical power needed to detect real effects. Unreliable implementation of intervention may weaken the validity (Polit & Beck 2012). In this study, although overall, the intervention was attempted to be kept as similar as possible for each participant, there was still variability. However, the intervention was tailored, so that there were 85 options from three themes from which to choose. The themes of medication and treatment appointments were compulsory, and the third theme was optional. Perhaps if all or none of the themes had been compulsory, results may have been different.

Internal validity assesses whether or not an empirical relationship really exists between the intervention and outcome (Slack & Draugalis 2001). To minimize selection bias, participants were randomly allocated into two groups. This study included only the intervention group. Therefore, the intervention and TAU groups were not compared in this phase. The inclusion and exclusion criteria of the participants were simple and, to the best of our knowledge, they were followed. The participants were recruited and the content and timing of mobile health (mHealth) were selected together with research nurses. It is impossible to say whether or not this influenced to the selections. However, the research nurses were trained and their actions were monitored systematically.

External validity concentrates on the generalizability of the findings (Polit & Beck 2012). In this study, participants were people using antipsychotic medication. This may cause challenges when comparing to a group that involves only one diagnosis. However, this may also make findings more generalizable. An age limitation (18-65 years old) was defined and adolescent and geriatric psychiatric hospital wards were excluded. The fact that non-acute patients and forensic patients were left out, may weaken the generalizability. This study was conducted over a wide geographical area in Finland (45 psychiatric hospital wards, located in 14 hospital district areas in Finland). This also supports the generalization of the results.

To ensure that interaction between relationship and people or causal effect and treatment would not threaten bias (Shadish 2002), a couple of measures were taken. First, the inclusion criteria were kept quite simple and general. For example, all

diagnoses and both genders were included. Second, the intervention was quite simple, and it would be possible to replicate. Also the content of the messages of the intervention are such that it may be easily adapted for another patient group.

Literature review

During the selection and searching process of the literature, the review protocol in study selection, data extraction and analysis were followed. This minimized bias, since methods were written, carefully planned and published beforehand. To increase validity, trustworthiness and to decrease bias, a group of authors was involved in every step of the review. (Bettany-Saltikov 2012.) At least two authors conducted the following: protocol production, searching the literature, data extraction, analysis, data interpretation and writing the final report of the review. The selection of studies was done by five people. Each person first read the studies independently and used a template to systematically score the studies. After this, inclusion and exclusion of studies were discussed based on the completed templates (Glasziou et al. 2001).

Two studies were included, and both of them were published. However, one of the included studies was from the Netherlands, and published only in Dutch. In addition, this study had not been published in a peer-reviewed journal (Hulsbosch et al. 2008). The author of the study translated the needed parts of the study, and extraction of the data needed for the review was possible to do. This may have resulted in crucial parts of the study being omitted.

To evaluate the risk that the review would overestimate or underestimate the true intervention effects (Higgins & Green 2011), the quality of methods was assessed for both included studies. This was done by using the 'Risk of bias' by RevMan. The evaluation was done by a group of people, first independently and then by discussing together. The risk was assessed to be 'low risk,' 'high risk,' or 'unclear risk' (Higgins & Green 2011). The biases which were assessed were selection, performance, detection, and attrition or reporting biases. The following issues were addressed: 1) how the random sequence generation was done, 2) how allocation concealment was done, 3) if and how there was blinding of participants or personnel, 4) if there was blinding of outcome assessment, 5) if there were incomplete outcome data, 6) if there were any other biases. The overall quality of the included studies was not as good as it could have been. The included studies (Hulsbosch et al. 2008; Montes et al. 2012) were randomized, but not blinded. Both of the studies had some weaknesses related to reporting methodology, and therefore the assessment of quality may be incomplete.

6.2 Discussion of the results

According to our qualitative analysis, patients want to be treated as individuals with individualized treatment methods, and when these desires are met, adherence is more likely. Patients perceive that, in addition to support for medication and follow-up care, they need support in everyday activities. To ensure this support, collaboration between patients and health care professionals was seen as essential.

Based on our qualitative content analysis, prior to the intervention patients and professionals perceived that mobile health (mHealth) may be a potential and efficient method for supporting adherence. Participants described that it can be used for several purposes, including medication, follow-up care and everyday activities. Based on a literature search, previously, these types of methods have mainly been used to support medication taking or participation in follow-up care.

Our study participants from the qualitative study perceived that when using mHealth, privacy and confidentiality issues need to be considered. This was seen as especially important if the content of mHealth includes personal information. According to our sub-study, which evaluated the actual use and feasibility of mHealth, we found that mHealth may be an acceptable and feasible method to be used in psychiatric care. Due to the complexity and individuality of adherence, the content of mHealth should be individualized. Moreover, based on our study, positive and humorous content in mHealth was preferred. Although the effectiveness of mHealth on treatment adherence was found to be inconclusive in our review, we found that mHealth promoted insight, satisfaction with treatment and quality of life – all essential to treatment adherence.

6.2.1 Adherence in people with psychotic disorders

In the qualitative part of this study, the objective was to describe factors related to adherence and adherence management. According to our qualitative content analysis, the factors leading to poor adherence were mainly related to patients' internal factors (e.g. symptoms caused by illness) partly due to external causes (e.g. lack of continuity of care). In agreement with previous literature, the factors that participants described were individual and varied over time (Velligan et al. 2009; Haddad et al. 2014; Leclerc et al. 2015). The associations between factors related to adherence can be bi-directional. For example, when insight improves, so does therapeutic alliance, and vice versa (Novick et al. 2015). In our study, the directional issue was not as strongly

presented. However, participants clearly presented issues which they thought caused non-adherence and factors which helped patients adhere.

In our focus groups, participants described situations when they had no possibility to participate in their own treatment, due to a lack of communication with health care professionals. Patients described situations with complicated communication with professionals, without mutual understanding about treatment, and expressed that they had found it very stressful and even fear-inducing. This coincides with the previous studies reporting on the importance of therapeutic alliance to treatment adherence (McCabe et al. 2012; Misdrahi et al. 2012; Gault et al. 2013; Novick et al. 2015). Moreover, if the preferences that patients have regarding their treatment are not taken into account, patients may get frustrated, which can increase the risk for non-adherent behavior (WHO 2003b). In our study, patients said that their adherence would be supported if they would be taken seriously and given treatment without a long delay, from familiar health care professionals.

According to our qualitative content analysis, the time between discharge and the first outpatient follow-up appointment is crucial and currently too long. Professionals expressed feeling pressure to discharge patients, but at the same time they felt it wrong to leave a patient without contact. Patients had similar experiences, and according to them, outpatient appointments are difficult to get without enough low threshold places. Moreover, patients described, that once you get an appointment, the professional changes all the time. Previous studies have also claimed this, reporting that poorly planned treatment, especially in the discharge phase (Haddad et al. 2014) and interruptions or changes in normal treatment increase the risk of non-adherence (Rettenbacher et al. 2004). Based on previous literature, professionals in health care practice do not always know who is responsible for promoting adherence (Brown & Gray 2015).

In our study, having a lack of insight was seen as one risk factor for non-adherence. Professionals in our study described, that patients' negative attitudes toward treatment may be due to a lack of insight. This is consistent with previous literature, concluding that a patient's insight into the illness and treatment are related to adherence, at least to some extent (Kao & Liu 2010; Misdrahi et al. 2012; Kane et al. 2013; Uhlmann et al. 2014; Drake et al. 2015; Novick et al. 2015), and that sometimes a patient's attitudes

toward treatment can have an even greater impact on adherence than insight (Beck et al. 2011).

Patients from our study described that health care workers overemphasize medication, which can lead to a discontinuing of medication. However, they still understood the importance of medication as a part of care. According to Karve et al. 2009, problems in medication adherence typically involve patients taking their medication less often than prescribed. Therefore, professionals should discuss the importance of medication with patients and ensure that patients understand why medication is important. To make people understand the value of medication, motivation and patient education are central (NICE Guidelines [CG76] 2009; Hyrkas & Wiggins 2014). Moreover, to promote treatment adherence, sufficient insight is essential (Mohamed et al. 2009; Bressington et al. 2013).

In this study, the importance of individual care and patient-centeredness related to adherence management was discussed. These factors may increase satisfaction with care and further promote adherence. Therefore, patients should be involved throughout the treatment planning, ensuring patient-centered care. This means that the patient's individual needs are considered, and nursing care is carried out holistically (NICE [SG1] 2014), taking into account physical, psychological and social aspects of the patient (Gournay 2000).

In this study, the supporting of physical aspects is described as supporting their daily lives and activities. Beyond medication taking and attendance, our study participants suggested the need to receive support in their daily lives and activities. It is known that co-morbidity is one main cause for premature death among people with psychotic disorders (Auquier et al. 2007), partly because of problems in adopting healthy life habits (Millier et al. 2014). In this study, participants recommended that health care professionals could help patients to structure their everyday lives with reasonable activities. This could also promote coping among patients. This structuring could be done, for example, by making a simple and concrete schedule.

In this study, support for psychological aspects was described as the support for a patient to achieve a positive attitude toward treatment and life. In our study, familiar and adherent health care professionals as well as continuity of care were actions that helped to achieve this. Support of social aspects of patients by health care workers was described as involving patients' close ones to be a part of care. Moreover, these people

can encourage patients to adhere. The results are parallel to those of previous studies, where the importance of social networks has been acknowledged (e.g. Coldham et al. 2002; McCann et al. 2008). Being married and living with another adult are positively related to adherence (DiMatteo 2004). This may mean that people who receive active social support adhere better. Therefore, those people who do not have this kind of social network should especially receive support as a social aspect.

6.2.2 Mobile health to support adherence in people with psychotic disorders

The objective and methods of the intervention were defined based on the focus groups conducted as a part of needs assessment. The objective of the intervention was the intention to follow the treatment guidelines and recommendations. This was formed by combining personal and external determinants. By taking into account the patient's own intention to adhere, we wanted to include here the core element of adherence: the free will and choice of a patient to adhere (Horne et al. 2005).

Personal determinants, that is, coping with the barriers of adherence, having a realistic picture of the illness and understanding the value of treatment, were essential for adherence management. Barriers of adherence are often related to poor motivation, forgetting (Gibson et al. 2013) or poor insight (Uhlmann et al. 2014). Therefore, the intervention aimed to reduce these barriers. Moreover, the nature of psychotic disorders with its chronicity (Haller et al. 2014) impairs the sense of reality, and functionality (Marder 2006) was taken into account. The intervention was intended to remind people how important the treatment is by emphasizing the importance of treatment, the severity of the symptoms, and the meaning of everyday life.

In this study, the intervention method was mobile health (mHealth) intervention (SMS). It is feasible and accepted in psychiatric care (Alvarez-Jimenez et al. 2014; Ben-Zeev et al. 2014; Kannisto et al. 2015) and widely used among patients with mental health problems (Sanghara et al. 2010). It has been shown that long-term mHealth interventions may cause tiredness or boredom from dealing with same content time and again (Curioso et al. 2009; Palmier-Claus et al. 2013). Therefore, in this study, variety of SMS options was ensured and participants were free to choose how often and when they wanted to receive SMSs. However, some limitations on the amount of messages were set. Without these limitations, the amount of messages could have been overwhelming. There are also studies where same-for-all messages have been used. Montes et al. (2012) assessed impacts of SMSs among individuals with

schizophrenia. Over three months, 254 outpatients received SMSs on a daily basis. The intervention was same-for-all, without variation in timing or content. Out of 166 participants, 66 were not properly exposed to the intervention (Montes et al. 2012). This may say something about the challenges related to this type of same-for-all intervention. On the other hand, two-way messaging can be more effective than one-way-messaging (Wald et al. 2015) and individual goal-orientated mHealth interventions have been tested (Granholm et al. 2012). Even so, this study used one-way messaging, because participants in our focus group interviews underlined the importance of cost-free intervention for patients.

6.2.3 Barriers and requirements of using mobile health among people with psychotic disorders

By using focus groups, we explored possible barriers and requirements of using mobile health (mHealth). Our main findings were that, from the point of view of patients and professionals, the technology should be easy, secure, and accurate, with individually tailored content, and that training for the use of mHealth should be included in the intervention if needed.

People with mental illness often have impairments affecting their use of and engagement in technology (Ben-Zeev et al. 2013). Therefore, careful planning with a user-centered approach helps identify possible barriers of the utilization of mHealth intervention (Arsand & Demiris 2008). On the other hand, it is known that people with mental health problems, including schizophrenia, use mobile technology as much as the general population (Ennis et al. 2012), and they are able to utilize these interventions properly (Alvarez-Jimenez et al. 2014). Therefore in this study, requirements based on participants and literature was taken into account in the development process, and the intervention content was based on their preferences.

If the technology of mHealth is too difficult, utilization of the intervention may be limited (Palmier-Claus et al. 2013). To avoid possible confusion and disengagement of patients, mHealth should be easy enough to use (Bakker et al. 2016). In our study, it was ensured that the intervention would not require smartphones, and the participants were able to use the intervention even with older models of mobile phones. One way to ensure the ease of use is to allow people to use their own phones (Palmier-Claus et al. 2013). In our study, patients used their own familiar mobile phones and knew their functions in practice. However, the use of smartphones has been steadily increasing

(Statistics Portal 2015), and smart phone applications have been tested with positive results among people with schizophrenia (Ben-Zeev et al. 2014). Therefore, in addition to traditional methods, new innovations and technology should also be used in psychiatric care.

The focus and content of mHealth should consistent with users' personal values (Palmier-Claus et al. 2013; Bakker et al. 2016; Dinesen et al. 2016). This coincides with results from our focus groups. Participants described that the content of mHealth should be individual at least on some aspects. This means that the content, timing and frequency should be selectable and easily modified if needed. Moreover, our study participants preferred 2-way messaging. On the other hand, it may be problematic to find free and secure methods for this type of communication.

6.2.4 Evaluation of the mobile health among people with psychotic disorders

Finally, an evaluation of the intervention was conducted. First, the effectiveness of the mobile health (mHealth) interventions was evaluated using a systematic review with meta-analysis, and second, the preferences regarding the developed mHealth intervention were examined.

The main result of our review was that there is no clear evidence that mHealth improves medication adherence among people with psychotic disorders. This result is quite consistent with some previous studies (Pijnenborg et al. 2010; Granholm et al. 2012), which used SMS reminders to support medication adherence. One study found that medication adherence stayed at the same level as it was at the baseline (Pijnenborg et al. 2010), and in another study, medication adherence improved, but only among those who were living independently (Granholm et al. 2012). It is also important to note that the results of our review were based on two included studies. In the future, when updating the review and hopefully being able to include more studies, this result may change.

More promising results can be found when the patient group is widened to include chronic diseases in general. For example, a systematic review by Vervloet et al. (2012) found that after using electronic reminders, short-term medication taking improved and another study found that adherence to appointments improved after receiving SMSs (Boksmati et al. 2016). Moreover, manual phone call reminders can be more effective than automated one-way SMSs (Hasvold & Wootton 2011) and two-way messaging

improves adherence better than one-way messaging (Wald et al. 2015). This coincides with the fact that interaction between patients and professionals have a positive association with adherence (Lehane & McCarthy 2009).

No single empirical study has evaluated the difference in effectiveness between one-way and two-way messaging. Based on a meta-analysis however (Wald et al. 2015) two-way messaging is more effective for improving adherence than is one-way messaging. However, unintentionally non-adherent patients may benefit more from one-way messaging, because they "only" need to be reminded about medication taking (Vervloet et al. 2012). On the other hand, unintentional non-adherence can be related to beliefs, which can lead to future intentional non-adherence (Gadkari & McHorney 2012). Therefore, in order to provide personally tailored mHealth intervention, clinical reasons for non-adherence should be asked of the patients. This may partially answer the ongoing question: what type of people would mostly benefit from this type of intervention? (Guy et al. 2012).

Our review including the meta-analysis found that adding an mHealth intervention to treatment as usual yielded an improved quality of life and insight among people with psychotic disorders. Poor quality of life is typical for people with psychotic disorders (Bobes et al. 2007; Millier et al. 2014), and the disorder is further associated with stigma (Millier et al. 2014) and non-adherence (Fung et al. 2010). In this study, it was found that general quality of life improved, but quality of life in regards to the feeling of loneliness did not. However, this is still an encouraging result, since adherence and subjective quality of life are linked together (Moran & Priebe 2016) and quality of life is one factor which further helps to achieve adherence management (Mohamed et al. 2009). Besides quality of life, insight was gained during the intervention. This also may further increase adherence (Beck et al. 2011; Bressington et al. 2013; Sendt et al. 2015).

It was concluded that outcomes of the included studies varied as well as instruments used. The studies (Hulsbosch et al. 2008, Montes et al. 2012) used different instruments and generally had different outcomes also. The combined results were not as complete as they would have been if these would have been same. It is also inconclusive how effective and suitable mHealth interventions really are in the treatment among people with psychotic disorders (Naslund et al. 2015). The studies are mainly heterogeneous (Kannisto et al. 2014) and more studies are needed (Naslund et

al. 2015). Therefore, the choice of outcomes and instruments in interventions for the treatment of psychotic disorders still remains a challenge.

When we evaluated the feasibility of mHealth through a survey, we found that, during the intervention period (12 months), out of 562 participants, 4% (n = 23) wanted to discontinue the intervention. This may reveal something about the acceptance of the mHealth intervention and shed a little light on how accepted new SMSs really are (Daker-White & Rogers 2013). This conclusion was supported when asking for feedback from the participants. Participants felt that the intervention was easy to use (n=392, 98%), was not harmful (n=350, 87%). Most of them were satisfied with the intervention (n=274, 72%), and over half felt that the intervention was useful (n=236, 61%). Over half also said that they would use the same intervention in future (n=247, 64%). The disturbances caused by the intervention, as reported by the participants (n=51, 13%), included being awoken or being in other way irritated by the SMS alert sound of the mobile phone (Kannisto et al. 2015). In further support of the view that it is an acceptable intervention, previous literature has shown that people with psychotic disorders perceive mHealth interventions as useful, have positive attitudes about them (Alvarez-Jimenez et al. 2014) and are familiar with using mHealth on a daily basis (Palmier-Claus et al. 2013).

On the other hand, in our survey we found that only 6% of the 562 participants requested to change their selections to correspond to their original selections during the 12 months. Perhaps requesting the changes requires too much effort, and therefore, the intervention may not have been fully utilized. The study intervention was sent from a semi-automated system without the possibility to reply. However, participants were informed how they could contact the researchers (email, phone number, address). Still, perhaps if there had been a possibility for two-way messaging, or the semi-automated system would have been connected with other records, it would have been more workable. In this study, the low rate of participants discontinuing the intervention is considered to be a positive result, because effective utilization of mHealth requires willing and capable users (McGillicuddy et al. 2013).

Previous literature has identified several areas that should be studied more when using a mHealth to improve adherence, posing a question: what is still missing? First, only a few studies about mHealth have calculated the costs or possible savings that could occur from using mHealth, and this outcome should be included in future studies

(Hasvold & Wootton 2011; Gurol-Urganci et al. 2013). This is consistent with our findings from the review. Cost was one expected outcome in our review protocol, but neither of the included trials measured this outcome. Second, effectiveness and use of the mHealth has been studied with quite short-term interventions and follow-up measures. The length of the interventions in trials in the previous studies and in our systematic review was only a few months. In one study (Välimäki et al. 2012) the intervention lasted for one year, but the results have not been published yet. It would be important to measure long-term effects of mHealth interventions. Currently, it is known that mHealth can improve adherence in the short-term. However, after ending the intervention, these improvements start to fade (Montes et al. 2012). Therefore, to confirm long-term effects, longer interventions with an extended continuation of follow-ups would be highly needed.

6.3 Suggestions

The results of this study have suggestions for various fields related to mobile health (mHealth) interventions to support adherence in psychiatric care. This study generated new knowledge about the patients' and professionals' perceptions and preferences of mHealth intervention development in psychiatric care. These areas have previously been less commonly studied, and knowledge has been inconclusive. The suggestions are presented from the perspectives of nursing practice, nursing management, health care technology and future research.

6.3.1 Study suggestions

Suggestions for nursing practice

In the field of nursing practice the study findings can be used to guide actions that promote treatment adherence. Nursing care should support patients by providing individually tailored treatment methods. Even though medication is essential in psychiatric care, other aspects, including everyday activities and social networks, should be taken into account also. This should already be considered in the planning stages of treatment. Moreover, adherence is an issue which needs to be paid attention to in everyday nursing practice and measured systematically to promote adherence. A systematic evaluation of adherence should be done as a part of normal care, which can help identify people who need extra support. Due to limited resources of health care, nursing practice cannot always be a part of patients' everyday life. mHealth can be

used to partly fill this gap. It can be used as a reminder or encouragement method to support both adherence and everyday activities. When using mHealth as a part of care, nursing practice should ensure that patients have the technical skills and equipment needed for the use of the intervention.

Suggestions for management

This study enriched the body of knowledge on how to involve patients in practice when developing intervention. Although this study provided knowledge about developing intervention together with patients, this knowledge can be used also when managers develop daily clinical practice. Patients should be involved throughout the development process, and their needs should be taken into account when defining objectives of daily clinical practice. The aspects of daily clinical practice should be individually designed according to the preferences and needs of patients as well as a mutual understanding between patients and professionals. Involvement itself may contribute the promotion of adherence, and therefore, organizations should systematically implement guidelines that promote the involvement of patients.

Suggestions for technology

People with psychotic disorders are able to utilize mHealth, and they are able to express their preferences related to its use. Therefore, when developing mHealth interventions in psychiatric care, the end-users should be involved. Additionally, mHealth interventions should be based on theories and during development, theoretical frameworks should be followed. mHealth intervention methods should be clear, well-instructed and well-explained, and they shouldn´t burden the patient with any financial costs. The content should be individually tailored and there should be easy ways for patients to log in to the system for update messages or other information. Two-way-messaging should be carefully considered and, if necessary, made possible.

6.3.2 Suggestions for future research

1. mHealth interventions should be studied more in a clinical nursing practice setting rather than in a test setting. This would enable its examination in its real context. Moreover, studies should investigate aspects of knowledge, beliefs, and preferences related to mHealth.

2. The role of health care professionals in using mHealth should be studied to provide sufficient support and guidelines for professionals.

3. A number of interventions should be tested alongside mHealth intervention. This could provide a comprehensive intervention, which could benefit people who are intentionally or unintentionally non-adherent.

4. This study generated knowledge on preferences of patients toward mHealth. However, patients' actual experiences using mHealth should be studied more. In other words, after using mHealth to support adherence, the reasons of adherence or non-adherence should be inquired about. This would provide knowledge that could help develop mHealth interventions to be more feasible and contribute the development of mHealth interventions in general.

5. mHealth and its related apps are generally affordable to use. However, there is not enough evidence regarding the costs of mHealth. Therefore, more studies are needed to evaluate the cost-effectiveness of mHealth in psychiatric care.

6. A mHealth intervention system that enables the end-user to easily modify the content and timing of the intervention should be tested. This would give a more realistic picture of end-users' preferences toward the intervention and the areas in which they would prefer to use these types of interventions.

7. CONCLUSIONS

Patients want to be treated as individuals with individualized treatment methods. When these desires are met, adherence is more likely. Patients and health care professionals perceived that adherence could be supported, and the use of mobile health (mHealth) as a part of treatment was seen as an acceptable and efficient method for doing so. From the point of view of patients and health care professionals, the mHealth technology should be easy, secure, and accurate, with individually tailored content. Moreover, training for the use of mHealth should be included if needed. The use of mHealth may be feasible among people with psychotic disorders. However, clear evidence for its effectiveness in regards to adherence is still currently inconclusive.

8. ACKNOWLEDGEMENTS

I owe my sincerest gratitude to my supervisors, Professor Maritta Välimäki, PhD and Heli Hätönen, PhD. You have believed in me and guided me through this process from the very beginning of my studies. Maritta, thank you for sharing your knowledge and providing me great opportunities during these years. Without her encouragement, as well as practical and scientific wisdom, this process would not have been possible to conduct. It has been a true privilege to work with her. Heli, thank you for always being there when I needed your support and help. Thank you for sharing your scientific knowledge and helping me to find answers whenever needed.

I wish to express my profound gratitude to the official reviewers of the dissertation, Professor Sami Pirkola, PhD and docent Kaisa Haatainen, PhD. Their excellent and careful review and constructive criticism helped me to improve the whole thesis.

I owe my warm gratitude to Professor Helena Leino-Kilpi, PhD, the Head of the Department and the Head of the Doctoral Programme in Nursing Science, for ensuring a great and inspiring work, learning and research facilities in the Department. I also want to thank all the people in the Department of Nursing Science. I am proud and grateful for being a part of this academic community, thank you all.

I warmly thank the co-authors involved. Professor Clive Adams, from the University of Nottingham, docent Lauri Kuosmanen, PhD, from the University of Turku, Katja Warwick-Smith MNSc, from the University of Turku and Minna Anttila, PhD, from the University of Turku. Their contribution, valuable help and expertise has been important to work with my manuscripts. Special thanks goes to my co-author Kati Kannisto, MNSc, from the University of Turku. Our co-operation has worked so well and it is a privilege to have a people with shared research interest. I want to thank my co-author, Biostatistician Eliisa Löyttyniemi, MSc, for patiently explaining and helping me to survive with the statistics in Paper III. I also express my sincere thanks to Leigh Ann Lindholm, MA, and Virginia Mattila MA, for revision of the English language.

My sincere thanks go to my co-workers, but most importantly friends, Tella Lantta, MNSc and Virve Pekurinen, MNSc. Without you this process would not have been as fun and joyful as it was. I am so happy that I have you in my life. I hope to havee many more years ahead working together. I warmly thank my fellow students attending

Professor Maritta Välimäki's seminars during the years 2010-2016. Mari Lahti, PhD, Marjo Kurki, PhD, Päivi Soininen, PhD, Anja Hottinen, PhD, Anu Vähäniemi, MNSc, Katja Warwick-Smith, MNSc, Christina Athanasopoulou, MNSc, Milla Bergman, MNSc, Katriina Anttila, MNSc, Ninni Ihalainen-Tamlander, MNSc, Pihla Markkanen, MNSc and Anna Laine MNSc. Our discussions have motivated me and together we have learned so much – thank you.

My warmest thanks go to all the organizations where this study was carried out. I want to express my gratitude for all the professionals and patients, who participated in this study. Without your valuable participation this study would not have been possible to conduct.

I want to express my lovable thanks to my mother, Päivi. She has always supported me and I know I can always rely on her. She has taught to me the value of education and its appreciation. I also want to thank Jorma, for helping whenever I needed. I owe my warm gratitude to parents and grandparents of my spouse, Tuomo. Thank you Päivi and Hannu for all the support during these years. Without your help this process would have been impossible to carry out. Anja and Pauli, I respect you greatly and I thank for encouraging me. Moreover, I want to thank Elina and Lotta as well as Pekka, Pia and Veeti for their lovely company. In addition, I wish to send my thanks to Viola and Lauri. I am sure that if they could see me now, they would be so proud and happy for me.

I thank all my friends for their joyful company during these years. Noora, Antti, Teija, Hannu, Tatu, Laura, Juha, Anna, Arja, Iida M, Iida L, Ida, Heli, Annina, Sara, Milla, Satu, Eveliina, Nina, Markku, Kimmo, and many mores: thank you for the unforgettable times! Thank you Kangaspelto Pony Girls for our long, joyous trips with horses. These trips kept me in my sane during this process. My special thanks go to Monty. You will always stay in my heart, I miss you so much.

Finally, I owe my deepest gratitude to my soulmate, Tuomo. Thank you for your unconditional love. You are the best company ever and I am so grateful for your support during these years. Moreover, our common achievement, Oskari, is the best thing ever happened to me.

This study was a part of the study MobileNet, which was funded by the Academy of Finland. MobileNet was also financially supported by the Turku University Hospital, Satakunta Hospital District, State Subsidy System, Finnish Cultural Foundation, Foundations' Professor Pool, and University of Turku. I was personally granted by the TYKS Foundation and the Turku University Foundation, which I am very grateful.

Turku, April 2016

Kaisa

REFERENCES

Ala-Nikkola T., Pirkola S., Kontio R., Joffe G., Pankakoski M., Malin M., Sadeniemi M., Kaila M. & Wahlbeck K. (2014) Size matters - determinants of modern, community-oriented mental health services. International Journal of Environmental Research and Public Health 11(8), 8456-8474.

Alene M., Wiese MD., Angamo MT., Bajorek BV., Yesuf EA. & Wabe NT. (2012) Adherence to medication for treatment of psychosis: rates and risk factors in an Ethiopian population. BMC Pharmacology and Taxicology 12:10.

Alvarez-Jimenez M., Alcazar-Corcoles M.A., Gonzalez-Blanch C., Bendall S., McGorry P.D. & Gleeson J.F. (2014) Online, social media and mobile technologies for psychosis treatment: a systematic review on novel user-led interventions. Schizophrenia Research 156, 96-106.

Amador X.F., Flaum M., Andreasen N.C., Strauss D.H., Yale S.A., Clark S.C. & Gorman J.M. (1994) Awareness of illness in schizophrenia and schizoaffective and mood disorders. Archives of General Psychiatry 51, 826-836.

Amador X.F., Strauss D.H., Yale S.A. & Gorman J.M. (1991) Awareness of illness in schizophrenia. Schizophrenia Bulletin 17, 113-132.

American Psychiatric Association (2010) Practice guideline for the treatment of patients with schizophrenia. Available at: http://psychiatryonline.org/guidelines (accessed 2/28 2016).

Andersson Sundell K. & Jönsson A.K. (2016) Beliefs about medicines are strongly associated with medicine-use patterns among the general population. International Journal of Clinical Practice 70(3), 277-285.

Archive Act (831/1994) National Archives Service, Finland. Available at: http://www.finlex.fi/fi/laki/ajantasa/1994/19940831 (accessed 02/02 2016).

Arsand E. & Demiris G. (2008) User-centered methods for designing patient-centric self-help tools. Informatics for Health & Social Care 33, 158-169.

Ascher-Svanum H., Zhu B., Faries D., Lacro J.P. & Dolder C.R. (2006) A prospective study of risk factors for nonadherence with antipsychotic medication in the treatment of schizophrenia. The Journal of Clinical Psychiatry 67, 1114-1123.

Ascher-Svanum H., Zhu B., Faries D.E., Salkever D., Slade E.P., Peng X. & Conley R.R. (2010) The cost of relapse and the predictors of relapse in the treatment of schizophrenia. BMC Psychiatry 10, 2-244X-10-2.

Atun R & Sittampalam S. (2006) A Review of the Characteristics and Benefits of SMS in Delivering Healthcare. The Role of Mobile Phones in Increasing Accessibility and Efficiency in Healthcare Report. Vodafone.

Auquier P., Lancon C., Rouillon F. & Lader M. (2007) Mortality in schizophrenia. Pharmacoepidemiology and Drug Safety 16, 1308-1312.

Bakker D., Kazantzis N., Rickwood D. & Rickard N. (2016) Mental Health Smartphone Apps: Review and Evidence-Based Recommendations for Future Developments. JMIR Mental Health 1;3(1):e7.

Bartholomew, L. K., Parcel, G. S., Kok, G., Gottlieb, N. H., & Fernández, M.E. (2006) Planning health promotion programs; an Intervention Mapping approach. Jossey-Bass, San Francisco, CA.

Baylé FJ., Tessier A., Bouju S. & Misdrahi D. (2015) Medication adherence in patients with psychotic disorders: an observational survey involving patients before they switch to long-acting injectable risperidone. Patient Preference and Adherence 16(9), 1333-1341.

Beatty A.L., Fukuoka Y. & Whooley M.A. (2013) Using mobile technology for cardiac rehabilitation: a review and framework for development and evaluation. Journal of the American Heart Association 2, e000568.

Beck E.M., Cavelti M., Kvrgic S., Kleim B. & Vauth R. (2011) Are we addressing the 'right stuff' to enhance adherence in schizophrenia? Understanding the role of insight and attitudes towards medication. Schizophrenia Research 132, 42-49.

Ben-Zeev D., Kaiser S.M., Brenner C.J., Begale M., Duffecy J. & Mohr D.C. (2013) Development and usability testing of FOCUS: a smartphone system for self-management of schizophrenia. Psychiatric Rehabilitation Journal 36, 289-296.

Ben-Zeev D., Kaiser S.M. & Krzos I. (2014) Remote "hovering" with individuals with psychotic disorders and substance use: feasibility, engagement, and therapeutic alliance with a text-messaging mobile interventionist. Journal of Dual Diagnoses 10(4), 197-203.

Bettany-Saltikov J (2012) How To Do A Systematic Literature Review In Nursing: A Step-By-Step Guide. McGraw-Hill Education, UK.

Bigna J.J., Noubiap J.J., Plottel C.S., Kouanfack C. & Koulla-Shiro S. (2014) Barriers to the implementation of mobile phone reminders in pediatric HIV care: a pre-trial analysis of the Cameroonian MORE CARE study. BMC Health Services Research 14, 523-014-0523-3.

Bissonnette J.M. (2008) Adherence: a concept analysis. Journal of Advanced Nursing 63, 634-643.

Black A.D., Car J., Pagliari C., Anandan C., Cresswell K., Bokun T., McKinstry B., Procter R., Majeed A. & Sheikh A. (2011) The impact of eHealth on the quality and safety of health care: a systematic overview. PLoS medicine 8, e1000387.

Bobes J., Garcia-Portilla M.P., Bascaran M.T., Saiz P.A. & Bousono M. (2007) Quality of life in schizophrenic patients. Dialogues in Clinical Neuroscience 9, 215-226.

Bogart K., Wong SK., Lewis C., Akenzua A., Hayes D., Prountzos A., Okocha CI. & Kravariti E. (2014) Mobile phone text message reminders of antipsychotic medication: is it time and who should receive them? A cross-sectional trust-wide survey of psychiatric inpatients. BMC Psychiatry 22, 14:15.

Bogren M., Mattisson C., Isberg P.E. & Nettelbladt P. (2009) How common are psychotic and bipolar disorders? A 50-year follow-up of the Lundby population. Nordic Journal of Psychiatry 63, 336-346.

Boksmati N., Butler-Henderson K., Anderson K. & Sahama T. (2016) The Effectiveness of SMS Reminders on Appointment Attendance: a Meta-Analysis. Journal of Medical Systems 40(4), 90.

Brain C., Sameby B., Allerby K., Quinlan P., Joas E., Lindström E., Burns T. & Waern M. (2014) Stigma, discrimination and medication adherence in schizophrenia: results from the Swedish COAST study. Psychiatry Research 220(3), 811-817.

Bressington D., Mui J. & Gray R. (2013) Factors associated with antipsychotic medication adherence in community-based patients with schizophrenia in Hong Kong: a cross sectional study. International Journal of Mental Health Nursing 22, 35-46.

Brooks R. (1996) EuroQol: the current state of play. Health Policy (Amsterdam, Netherlands) 37, 53-72.

Brown K. & Gray R. (2015) Tackling medication non-adherence in severe mental illness: where are we going wrong? Journal of Psychiatric and Mental health Nursing 22, 192-198.

Burns N. & Grove S. (2009) The practice of nursing research, Appraisal, synthesis, and generation of evidence. Saunders Elsevier, St. Louis Missouri.

Cafazzo J.A., Casselman M., Hamming N., Katzman D.K. & Palmert M.R. (2012) Design of an mHealth app for the self-management of adolescent type 1 diabetes: a pilot study. Journal of Medical Internet Research 14, e70.

Campbell M., Fitzpatrick R., Haines A., Kinmonth A.L., Sandercock P., Spiegelhalter D. & Tyrer P. (2000) Framework for design and evaluation of complex interventions to improve health. BMJ (Clinical research ed.) 321, 694-696.

Centrum Klantervaring Zorg – CKZ (2014) Wat is de cq index?. Available at: http://www.centrumklantervaringzorg.nl/ (accessed 10/16 2015).

Chan KW., Hui LM., Wong HY., Lee HM., Chang WC. & Chen YH. (2014) Medication adherence, knowledge about psychosis, and insight among patients with a schizophrenia-spectrum disorder. Journal of Nervous and Mental Disease 202(1), 25-29.

Chapman S.C. & Horne R. (2013) Medication nonadherence and psychiatry. Current Opinion in Psychiatry 26, 446-452.

Christensen A.J. (2004) Patient adherence to medical treatment regimens: bridging the gap between behavioural science and biomedicine. Yale University Press, New Haven and London.

Clifford S., Perez-Nieves M., Skalicky A.M., Reaney M. & Coyne K.S. (2014) A systematic literature review of methodologies used to assess medication adherence in patients with diabetes. Current Medical Research and Opinion 30, 1071-1085.

Cochrane Community (2016) Cochrane Community Archive. Available at: http://community-archive.cochrane.org/ (accessed 02/10 2016).

Cochrane Schizophrenia (2016) Cochrane Schizophrenia Group. Availabe at: http://schizophrenia.cochrane.org/ (accessed 02/10 2016).

Coldham E.L., Addington J. & Addington D. (2002) Medication adherence of individuals with a first episode of psychosis. Acta Psychiatrica Scandinavica 106, 286-290.

Collins L.M., Murphy S.A. & Strecher V. (2007) The multiphase optimization strategy (MOST) and the sequential multiple assignment randomized trial (SMART): new methods for more potent eHealth interventions. American Journal of Preventive Medicine 32, S112-8.

Cook E.J., Randhawa G., Large S., Guppy A., Chater A.M. & Ali N. (2014) Barriers and facilitators to using NHS Direct: a qualitative study of 'users' and 'non-users'. BMC Health Services Research 14, 487-014-0487-3.

Council for International Organizations of Medical Sciences (2002) International Ethical Guidelines for Biomedical Research Involving Human Subjects. Available at: http://www.cioms.ch/publications/guidelines/guidelines_nov_2002_blurb.htm (accessed 10/16 2015).

Cramer J.A. & Rosenheck R. (1999) Enhancing medication compliance for people with serious mental illness. The Journal of Nervous and Mental Disease 187, 53-55.

Cramer J.A., Roy A., Burrell A., Fairchild C.J., Fuldeore M.J., Ollendorf D.A. & Wong P.K. (2008) Medication compliance and persistence: terminology and definitions. Value in Health: The Journal of the

International Society for Pharmacoeconomics and Outcomes Research 11, 44-47.

Crankshaw T., Corless I.B., Giddy J., Nicholas P.K., Eichbaum Q. & Butler L.M. (2010) Exploring the patterns of use and the feasibility of using cellular phones for clinic appointment reminders and adherence messages in an antiretroviral treatment clinic, Durban, South Africa. AIDS Patient Care and STDs 24, 729-734.

Crespo-Iglesias JM, Gonzalez Garcia A, Santos Miguelez B, Naya Fernandez S. (2006) Improvement of the attendance to the first psychiatric appointments after telephone reminder [Mejoria de la asistencia a las primeras citas en psiquiatria tras aviso telefonico]. Anales de Psiquiatria 22, 95-101.

Cresswell JW & Plano-Clark VL. (2011) Designing And Conducting Mixed Methods Research. SAGE Publications, Inc, Thousand Oaks, CA.

Curioso W.H., Alex Quistberg D., Cabello R., Gozzer E., Garcia P.J., Holmes K.K. & Kurth A.E. (2009) "It's time for your life": How should we remind patients to take medicines using short text messages?. AMIA Annual Symposium proceedings / AMIA Symposium 2009, 129-133.

Current Care Schizophrenia Guideline (2013) Schizophrenia. Available at: http://www.kaypahoito.fi/web/kh/suositukset/suositus?id=hoi35050 (accessed 10/16 2015).

Daker-White G. & Rogers A. (2013) What is the potential for social networks and support to enhance future telehealth interventions for people with a diagnosis of schizophrenia: a critical interpretive synthesis. BMC Psychiatry 13, 279-244X-13-279.

Darlow S. & Wen K.Y. (2015) Development testing of mobile health interventions for cancer patient self-management: A review. Health Informatics Journal. Apr 27. pii: 1460458215577994. [Epub ahead of print]

Davies B.R. (2005) Coercion or collaboration? Nurses doing research with people who have severe mental health problems. Journal of Psychiatric and Mental Health Nursing 12, 106-111.

de Jong Gierveld J. & van Tilburg T. (2011) Manual of the Loneliness Scale. Available at: http://home.fsw.vu.nl/tg.van.tilburg/manual_loneliness_scale_1999.html (accessed 10/16 2015).

de Jongh T., Gurol-Urganci I., Vodopivec-Jamsek V., Car J. & Atun R. (2012) Mobile phone messaging for facilitating self-management of long-term illnesses. The Cochrane Database of Systematic Reviews 12, CD007459.

Depp C.A., Mausbach B., Granholm E., Cardenas V., Ben-Zeev D., Patterson TL., Lebowitz B.D. & Jeste D.V. (2010) Mobile interventions for severe mental illness: design and preliminary data from three approaches. Journal of Nervous and Mental Disease 198(10), 715-721.

DiMatteo M.R. (2004) Social support and patient adherence to medical treatment: a meta-analysis. Health psychology: Official Journal of the Division of Health Psychology, American Psychological Association 23, 207-218.

Dinesen B., Nonnecke B., Lindeman D., Toft E., Kidholm K., Jethwani K., Young H.M., Spindler H., Oestergaard C.U., Southard J.A., Gutierrez M., Anderson N., Albert N.M., Han J.J. & Nesbitt T. (2016) Personalized Telehealth in the Future: A Global Research Agenda. Journal of Medical Internet Research 1;18(3):e53.

Drake R.J., Nordentoft M., Haddock G., Arango C., Fleischhacker W.W., Glenthøj B., Leboyer M., Leucht S., Leweke M., McGuire P., Meyer-Lindenberg A., Rujescu D., Sommer I.E., Kahn R.S. & Lewis SW. (2015) Modeling determinants of medication attitudes and poor adherence in early nonaffective psychosis: implications for intervention. Schizophrenia Bulletin 41(3), 584-596.

Egger M., Smith G.D. & Altman D.G. (2001) Systematic Reviews in Health Care: Meta-analysis in Context. British Medical Journal. Publishing Group. UK.

El-Mallahk P. & Findlay J. (2015) Strategies to improve medication adherence in patients with schizophrenia: the role of support services. Neuropsychiatric Disease and Treatment 11, 1077-1090.

eMarketer (2014) 2 Billion Consumers Worldwide to Get Smart(phones) by 2016. Available at: http://www.emarketer.com/Article/2-Billion-Consumers-Worldwide-Smartphones-by-2016/1011694 (accessed 04/02 2016).

Ennis L., Rose D., Denis M., Pandit N. & Wykes T. (2012) Can't surf, won't surf: the digital divide in mental health. Journal of Mental Health (Abingdon, England) 21, 395-403.

Esan O.B., Ojagbemi A. & Gureje O. (2012) Epidemiology of schizophrenia--an update with a focus on developing countries. International Review of Psychiatry (Abingdon, England) 24, 387-392.

European Commission (2013) eHealth Action Plan 2012-2020 Innovative healthcare for the 21st century. European Union, Luxembourg.

European Commission (2014) Green Paper on mobile health. European Union, Luxembourg.

Eysenbach G. (2001) What is e-health?. Journal of Medical Internet Research 3, E20.

Farrelly S., Brown G., Rose D., Doherty E., Henderson R.C., Birchwood M., Marshall M., Waheed W., Szmukler G. & Thornicroft G. (2014) What service users with psychotic disorders want in a mental health crisis or relapse: thematic analysis of joint crisis plans. Social Psychiatry and Psychiatric Epidemiology 49, 1609-1617.

Farooq S. & Naeem F. (2014) Tackling nonadherence in psychiatric disorders: current opinion. Neuropsychiatriac Disease and Treatment 12;10, 1069-1077.

Faydi E., Funk M., Kleintjes S., Ofori-Atta A., Ssbunnya J., Mwanza J., Kim C. & Flisher A. (2011) An assessment of mental health policy in Ghana, South Africa, Uganda and Zambia. Health Research Policy and Systems / BioMed Central 9, 17-4505-9-17.

Fenerty S.D., West C., Davis S.A., Kaplan S.G. & Feldman S.R. (2012) The effect of reminder systems on patients' adherence to treatment. Patient Preference and Adherence 6, 127-135.

Fenton W.S., Blyler C.R. & Heinssen R.K. (1997) Determinants of medication compliance in schizophrenia: empirical and clinical findings. Schizophrenia Bulletin 23, 637-651.

Fetters M.D., Curry L.A. & Creswell J.W. (2013) Achieving integration in mixed methods designs-principles and practices. Health Services Research 48, 2134-2156.

Ficora (2014) Viestintäpalveluiden kuluttajatutkimus 2014. Available at: https://www.viestintavirasto.fi/attachments/Viestintapalveluiden_kuluttajatutkimus_2014.pdf (accessed 10/16 2015).

Filipetto F.A., Fulda K.G., Holthusen A.E., McKeithen T.M. & McFadden P. (2014) The patient perspective on overactive bladder: a mixed-methods needs assessment. BMC Family Practice 15, 96-2296-15-96.

Firth J. & Torous J. (2015) Smartphone Apps for Schizophrenia: A Systematic Review. Journal of Medical Internet Research Mhealth and Uhealth. 6;3(4):e102.

Fjeldsoe B.S., Miller Y.D., O'Brien J.L. & Marshall A.L. (2012) Iterative development of MobileMums: a physical activity intervention for women with young children. The International Journal of Behavioral Nutrition and Physical Activity 9, 151-5868-9-151.

Foss C. & Ellefsen B. (2002) The value of combining qualitative and quantitative approaches in nursing research by means of method triangulation. Journal of Advanced Nursing 40(2), 242-248.

Frangou S., Sachpazidis I., Stassinakis A. & Sakas G. (2005) Telemonitoring of medication adherence in patients with schizophrenia. Telemedicine Journal and e-health: The Official Journal of the American Telemedicine Association 11, 675-683.

Frey S. (2014) The economic burden of schizophrenia in Germany: a population-based retrospective cohort study using genetic matching. European psychiatry: The Journal of the Association of European Psychiatrists 29, 479-489.

Fung K.M., Tsang H.W. & Chan F. (2010) Self-stigma, stages of change and psychosocial treatment adherence among Chinese people with schizophrenia: a path analysis. Social Psychiatry and Psychiatric Epidemiology 45, 561-568.

Gadkari A.S. & McHorney C.A. (2012) Unintentional non-adherence to chronic prescription medications: how unintentional is it really? BMC Health Services Research 14(12), 98.

Garcia-Perez M.A. (2012) Statistical conclusion validity: some common threats and simple remedies. Frontiers in Psychology 3, 325.

Gard D.E., Cooper S., Fisher M., Genevsky A., Mikels J.A. & Vinogradov S. (2011) Evidence for an emotion maintenance deficit in schizophrenia. Psychiatry Research 187, 24-29.

Gardner C.L. (2015) Adherence: a concept analysis. International Journal of Nursing Knowledge 26, 96-101.

Gault I., Gallagher A. & Chambers M. (2013) Perspectives on medicine adherence in service users and carers with experience of legally sanctioned detention and medication: a qualitative study. Patient Preference and Adherence 9(7), 787-799.

Gerlinger G., Hauser M., De Hert M., Lacluyse K., Wampers M.& Correll C.U. (2013) Personal stigma in schizophrenia spectrum disorders: a systematic review of prevalence rates, correlates, impact and interventions. World Psychiatry 12(2), 155-164.

Gibson S., Brand S.L., Burt S., Boden Z.V. & Benson O. (2013) Understanding treatment non-adherence in schizophrenia and bipolar disorder: a survey of what service users do and why. BMC Psychiatry 13, 153-244X-13-153.

Glasziou P., Irwig l., Bain C., Colditz G. (2001) Systematic reviews in health care A practical guide. Cambridge University Press, NY.

Goff D.C., Hill M. & Freudenreich O. (2010) Strategies for improving treatment adherence in schizophrenia and schizoaffective disorder. The Journal of Clinical Psychiatry 71 Suppl 2, 20-26.

Gournay K (2000) Schizophrenia. In: Mental health nursing an evidence-based approach (ed. Newell R GK), pp. 147. Harcourt Publisher.

Graneheim U.H. & Lundman B. (2004) Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. Nurse Education Today 24, 105-112.

Granholm E., Ben-Zeev D., Link PC., Bradshaw K.R. & Holden J.L. (2012) Mobile Assessment and Treatment for Schizophrenia (MATS): a pilot trial of an interactive text-messaging intervention for medication adherence, socialization, and auditory hallucinations. Schizophrenia Bulletin 38(3), 414-425.

Gurol-Urganci I., de Jongh T., Vodopivec-Jamsek V., Atun R. & Car J. (2013) Mobile phone messaging

reminders for attendance at healthcare appointments. The Cochrane Database of Systematic Reviews 12, CD007458.

Guy W. (1976) Clinical Global Impression (CGI). ECDEU Assessment Manual for Psychopharmacology. Rockville, MD, U.S. Department of Health, Education, and Welfare.

Guy R., Hocking J., Wand H., Stott S., Ali H. & Kaldor J. (2012) How effective are short message service reminders at increasing clinic attendance? A meta-analysis and systematic review. Health Services Research 47, 614-632.

Haddad P.M., Brain C. & Scott J. (2014) Nonadherence with antipsychotic medication in schizophrenia: challenges and management strategies. Patient Related Outcome Measures 5, 43-62.

Hall A.K., Cole-Lewis H. & Bernhardt J.M. (2015) Mobile text messaging for health: a systematic review of reviews. Annual Review of Public Health 18(36), 393-415.

Haller C.S., Padmanabhan J.L., Lizano P., Torous J. & Keshavan M. (2014) Recent advances in understanding schizophrenia. F1000 Prime Reports 6, 57-57. eCollection 2014.

Hamine S., Gerth-Guyette E., Faulx D., Green B.B. & Ginsburg A.S. (2015) Impact of mHealth chronic disease management on treatment adherence and patient outcomes: a systematic review. Journal of Medical Internet Research 24;17(2):e52.

Hasvold P.E. & Wootton R. (2011) Use of telephone and SMS reminders to improve attendance at hospital appointments: a systematic review. Journal of Telemedicine and Telecare 17, 358-364.

Hatcher RL. & Gillaspy AJ. (2006) Development and validation of a revised short version of the working alliance inventory. Psychotherapy Research 16, 12-25.

Haynes RB, Sackett DL, Taylor DW (1979) Compliance in health care. John Hopkins University Press, Baltimore.

Haynes R.B., Yao X., Degani A., Kripalani S., Garg A. & McDonald H.P. (2005) Interventions to enhance medication adherence. The Cochrane Database of Systematic Reviews (4), CD000011.

Health Care Act (1326/2010) Edita Publishing oy. Available at: https://www.finlex.fi/fi/laki/kaannokset/2010/en20101326.pdf (accessed 10/16 2015).

Higashi K., Medic G., Littlewood K.J., Diez T., Granstrom O. & De Hert M. (2013) Medication adherence in schizophrenia: factors influencing adherence and consequences of nonadherence, a systematic literature review. Therapeutic Advances in Psychopharmacology 3, 200-218.

Higgins J.P.T. & Green S. (2011) Cochrane handbook for systematic literature reviews of interventions. Wiley-Blackwell

Hogan T.P., Awad A.G. & Eastwood R. (1983) A self-report scale predictive of drug compliance in schizophrenics: reliability and discriminative validity. Psychological Medicine 13, 177-183.

Holthausen E.A., Wiersma D., Sitskoorn M.M., Hijman R., Dingemans P.M., Schene A.H. & van den Bosch R.J. (2002) Schizophrenic patients without neuropsychological deficits: subgroup, disease severity or cognitive compensation?. Psychiatry Research 112, 1-11.

Hon A. (2012) Factors influencing the adherence of antipsychotic medication (Aripiprazole) in first-episode psychosis: findings from a grounded theory study. Journal of Psychiatric and Mental Health Nursing 19(4), 354-361.

Horne R, Weinman J, Barber N, Elliott R.A, Morgan M. (2005) Concordance, Adherence and Compliance in Medicine Taking: A conceptual map and research priorities. National Institute for Health Research Service Delivery and Organisation R&D, London.

Horvath T., Azman H., Kennedy G.E. & Rutherford G.W. (2012) Mobile phone text messaging for promoting adherence to antiretroviral therapy in patients with HIV infection. The Cochrane Database of Systematic Reviews 3, CD009756.

Howatson-Jones I.L. (2007) Dilemmas of focus group recruitment and implementation: a pilot perspective. Nurse Researcher 14, 7-17.

Hu T.W. (2006) Perspectives: an international review of the national cost estimates of mental illness, 1990-2003. The Journal of Mental Health Policy and Economics 9, 3-13.

Huang W.F., Cheng J.S., Lai IC. & Hsieh C.F. (2009) Medication compliance in outpatients with schizophrenia in one veterans hospital in Taiwan. Journal of Food and Drug Analysis 17, 401-407.

Hugtenburg J.G., Timmers L., Elders PJ.., Vervloet M. & van Dijk L. (2013) Definitions, variants, and causes of nonadherence with medication: a challenge for tailored interventions. Patient Preference and Adherence 10(7), 675-682.

Hulsbosch L, Tamis-ten Cate P, Nugter A, Kroon H (2008) Zorg op afstand in de langdurende geestelijke gezondheidszorg. Een Randomised Controlled Trial naar telezorg bij GGZ Noord-Holland-Noord. Trimbos-institute, Utrecht.

Hunt G.E., Siegfried N., Morley K., Sitharthan T. & Cleary M. (2013) Psychosocial interventions for people with both severe mental illness and substance misuse. The Cochrane Database of Systematic Reviews 3, CD001088.

Hyrkas K. & Wiggins M. (2014) A comparison of usual care, a patient-centred education intervention and

motivational interviewing to improve medication adherence and readmissions of adults in an acute-care setting. Journal of Nursing Management 22, 350-361.

ICD-10 WHO Version (2015) International Statistical Classification of Diseases and Related Health Problems 10th Revision, WHO Version. Available at: http://apps.who.int/classifications/icd10/browse/2015/en#/F20-F29 (accessed 02/02 2016).

Institute of Medicine (2001) Envisioning the National Health Care Quality Report Committee on the National Quality Report on Health Care Delivery, Board on Health Care Services.

Institute of Medicine, Committee on Crossing the Quality Chasm 2006 (2006) Improving the Quality of Health Care for Mental and Substance-Use Conditions: Quality Chasm Series. Available at: http://www.ncbi.nlm.nih.gov/books/NBK19831/ (accessed 10/16 2015).

International Telecommunication Union (2010) The world in 2010. Available at: http://www.itu.int/ITU-D/ict/material/FactsFigures2010.pdf (accessed 07/11 2013).

International Telecommunication Union (2015) The world in 2015. Available at: http://www.itu.int/en/ITU-D/Statistics/Pages/facts/default.aspx (accessed 02/03 2016).

Jacobs N.C., Vollink T., Dehue F. & Lechner L. (2014) Online Pestkoppenstoppen: systematic and theory-based development of a web-based tailored intervention for adolescent cyberbully victims to combat and prevent cyberbullying. BMC Public Health 14, 396-2458-14-396.

Kamali M., Kelly B.D., Clarke M., Browne S., Gervin M., Kinsella A., Lane A., Larkin C. & O'Callaghan E. (2006) A prospective evaluation of adherence to medication in first episode schizophrenia. European psychiatry: The journal of the Association of European Psychiatrists 21, 29-33.

Kane J.M., Kishimoto T. & Correll C.U. (2013) Non-adherence to medication in patients with psychotic disorders: epidemiology, contributing factors and management strategies. World Psychiatry 12, 216-226.

Kannisto K.A., Koivunen M.H. & Välimäki M.A. (2014) Use of mobile phone text message reminders in health care services: a narrative literature review. Journal of Medical Internet Research 16, e222.

Kannisto K.A., Adams C.E., Koivunen M., Katajisto J. & Välimäki M. (2015) Feedback on SMS reminders to encourage adherence among patients taking antipsychotic medication: a cross-sectional survey nested within a randomised trial. BMJ Open 5:e008574.

Kao Y.C. & Liu Y.P. (2010) Compliance and schizophrenia: the predictive potential of insight into illness, symptoms, and side-effects. Comprehensive Psychiatry 51, 557-565.

Karve S., Cleves M.A., Helm M., Hudson T.J., West D.S. & Martin B.C. (2009) Good and poor adherence: optimal cut-point for adherence measures using administrative claims data. Current Medical Research and Opinion 25, 2303-2310.

Karvonen M, Peltola M, Isohanni M, Pirkola S, Suvisaari J, Lehtinen K, Hella P, Häkkinen U (2008) PERFECT - skitsofrenia Skitsofrenian hoito, kustannus ja vaikuttavuus. Stakes, Helsinki.

Kerzman T, Kok I, Wijngaarden B. (2003) De GGZ Thermometer Nader Onderzocht: De Evaluatie van een Vragenlijstvoor Cliëntwaardering in de Volwassenenzorg. Trimbos-instutute, Utrecht.

Kikkert M.J., Schene A.H., Koeter M.W., Robson D., Born A., Helm H., Nose M., Goss C., Thornicroft G. & Gray R.J. (2006) Medication adherence in schizophrenia: exploring patients', carers' and professionals' views. Schizophrenia Bulletin 32, 786-794.

Kikkert M.J., Barbui C., Koeter M.W., David A.S., Leese M., Tansella M., Gieler A., Puschner B. & Schene A.H. (2008) Assessment of medication adherence in patients with schizophrenia: the Achilles heel of adherence research. Journal of Nervous and Mental Disease 196(4), 274-281.

Kirkbride J.B., Errazuriz A., Croudace T.J, Morgan C., Jackson D., Boydell J., Murray R.M. & Jones P.B. (2012) Incidence of schizophrenia and other psychoses in England, 1950-2009: a systematic review and meta-analyses. PLoS One. 7(3):e31660.

Kitchen H., Rofail D., Heron L. & Sacco P. (2012) Cognitive impairment associated with schizophrenia: a review of the humanistic burden. Advances in Therapy 29, 148-162.

Klasnja P. & Pratt W. (2012) Healthcare in the pocket: mapping the space of mobile-phone health interventions. Journal of Biomedical Informatics 45, 184-198.

Kluger M.P. & Karras A. (1983) Strategies for reducing missed initial appointments in a community mental health center. Community Mental Health Journal 19, 137-143.

Konstantinidis G., Anastassopoulos G.C., Karakos A.S., Anagnostou E. & Danielides V. (2012) A user-centered, object-oriented methodology for developing Health Information Systems: a Clinical Information System (CIS) example. Journal of Medical Systems 36, 437-450.

Krueger R.A. & Casey M.A. (2009) Focus Groups: A Practical Guide for Applied Research (4th Edition). Thousand Oaks, CA: Sage Publications.

Kuntz J.L., Safford M.M., Singh J.A., Phansalkar S., Slight S.P., Her Q.L., Lapointe N.A., Mathews R., O'Brien E., Brinkman W.B., Hommel K., Farmer K.C., Klinger E., Maniam N., Sobko H.J., Bailey S.C., Cho I., Rumptz M.H., Vandermeer M.L. & Hornbrook M.C. (2014) Patient-centered interventions to improve medication management and adherence: a qualitative review of research findings. Patient Education and Counseling 97, 310-326.

Lacro J.P., Dunn L.B., Dolder C.R., Leckband S.G. & Jeste D.V. (2002) Prevalence of and risk factors for medication nonadherence in patients with schizophrenia: a comprehensive review of recent literature. The Journal of Clinical Psychiatry 63, 892-909.

Lai-Ming Hui C., Wing-Yan Poon V., Shuk-Kuen Kwok V., Chang W.C., Kit-Wa Chan S., Ho-Ming Lee E.& Yu-Hai Chen E. (2015) Prevalence and predictors of medication non-adherence among Chinese patients with first-episode psychosis. Psychiatry Research 228, 680-687.

Lakshman M., Charles M., Biswas M., Sinha L. & Arora N.K. (2000) Focus group discussions in medical research. Indian Journal of Pediatrics 67, 358-362.

Lamb M.R., El-Sadr W.M., Geng E. & Nash D. (2012) Association of adherence support and outreach services with total attrition, loss to follow-up, and death among ART patients in sub-Saharan Africa. PLoS One 7(6):e38443.

Lau K.C., Lee E.H., Hui C.L., Chang W.C., Chan S.K. & Chen E.Y. (2015) Psychosis patients' knowledge, adherence and attitudes towards the naming of antipsychotic medication in Hong Kong. Early Intervention in Psychiatry 9, 422-427.

Leclerc E., Noto C., Bressan R.A. & Brietzke E. (2015) Determinants of adherence to treatment in first-episode psychosis: a comprehensive review. Revista Brasileira de Psiquiatria 37(2), 168-176.

Lehane E. & McCarthy G. (2009) Medication non-adherence--exploring the conceptual mire. International Journal of Nursing Practice 15(1), 25-31.

Lenhart A, Hitlin P, Madden M (2005) Teens and Technology. Part 4: Communications Tools and Teens. Available at: http://www.pewinternet.org/2005/07/27/part-4-communications-tools-and-teens/#fn-906-21 (accessed 10/16 2015).

Lin H. & Wu X. (2014) Intervention strategies for improving patient adherence to follow-up in the era of mobile information technology: a systematic review and meta-analysis. PLoS One 6;9(8):e104266.

Linden M. & Godemann F. (2007) The differentiation between 'lack of insight' and 'dysfunctional health beliefs' in schizophrenia. Psychopathology 40(4), 236-241.

Lubkin I (1995) Chronic Illness: Impact and Interventions. Jones & Bartlett, Boston.

Marder S.R. (2006) Initiatives to promote the discovery of drugs to improve cognitive function in severe mental illness. The Journal of Clinical Psychiatry 67, e03.

Markowitz M., Karve S., Panish J., Candrilli S.D. & Alphs L. (2013) Antipsychotic adherence patterns and health care utilization and costs among patients discharged after a schizophrenia-related hospitalization. BMC Psychiatry 13, 246-244X-13-246.

McCabe R., Bullenkamp J., Hansson L., Lauber C., Martinez-Leal R., Rössler W., Salize H.J., Svensson B., Torres-Gonzalez F., van den Brink R., Wiersma D. & Priebe S. (2012) The therapeutic relationship and adherence to antipsychotic medication in schizophrenia. PLoS One 7(4), e36080.

McCabe R., Healey PG., Priebe S., Lavelle M., Dodwell D., Laugharne R., Snell A. & Bremner S. (2013) Shared understanding in psychiatrist-patient communication: association with treatment adherence in schizophrenia. Patient Education and Counselling 93(1), 73-79.

McCann T.V., Boardman G., Clark E. & Lu S. (2008) Risk profiles for non-adherence to antipsychotic medications. Journal of Psychiatric and Mental Health Nursing 15, 622-629.

McGillicuddy J.W., Weiland A.K., Frenzel R.M., Mueller M., Brunner-Jackson B.M., Taber D.J., Baliga P.K. & Treiber F.A. (2013) Patient attitudes toward mobile phone-based health monitoring: questionnaire study among kidney transplant recipients. Journal of Medical Internet Research 15, e6.

McEwen S.E., Davis A.M., Jones J.M., Martino R., Poon I., Rodriguez A.M. & Ringash J. (2015) Development and preliminary evaluation of a rehabilitation consult for survivors of head and neck cancer: an intervention mapping protocol. Implementation Science 9;10:6.

McMullen C.K., Safford M.M., Bosworth H.B., Phansalkar S., Leong A., Fagan M.B., Trontell A., Rumptz M., Vandermeer M.L., Centers for Education and Research on Therapeutics Patient-Centered Medication Management Workshop Working Group, Brinkman W.B., Burkholder R., Frank L., Hommel K., Mathews R., Hornbrook M.C., Seid M., Fordis M., Lambert B., McElwee N. & Singh J.A. (2015) Patient-centered priorities for improving medication management and adherence. Patient Education and Counseling 98, 102-110.

Medic G., Higashi K., Littlewood K.J., Diez T., Granström O. & Kahn R.S. (2013) Dosing frequency and adherence in chronic psychiatric disease:

systematic review and meta-analysis. Neuropsychiatric Disease and Treatment 9, 119-1131.

Medical Research Act (488/1999) Ministry of Social Affairs and Health, Finland. Available at: http://www.finlex.fi/fi/laki/kaannokset/1999/en19990488.pdf (accessed 11/1 2015).

Meier C.A., Fitzgerald M.C. & Smith J.M. (2013) eHealth: extending, enhancing, and evolving health care. Annual Review of Biomedical Engineering 15, 359-382.

Mental Health Act 1116/1990. Ministry of Social Affairs and Health, Finland. Available at: https://www.finlex.fi/fi/laki/kaannokset/1990/en19901116 (accessed 10/16 2015).

Messias E.L., Chen C.Y. & Eaton W.W. (2007) Epidemiology of schizophrenia: review of findings and myths. The Psychiatric Clinics of North America 30, 323-338.

Miller B.J., Stewart A., Schrimsher J., Peeples D. & Buckley P.F. (2015) How connected are people with schizophrenia? Cell phone, computer, email, and social media use. Psychiatry Research 225, 458-463.

Millier A., Schmidt U., Angermeyer M.C., Chauhan D., Murthy V., Toumi M. & Cadi-Soussi N. (2014) Humanistic burden in schizophrenia: a literature review. Journal of Psychiatric Research 54, 85-93.

Ministry of Finance (2016) Kuntien lukumäärä. Available at: http://vm.fi/kuntien-lukumaara (accessed 02/28 2016).

Ministry of Social Affairs and Health (2013) Health care in Finland. Available at: https://www.julkari.fi/bitstream/handle/10024/110284/URN_ISBN_978-952-00-3395-8.pdf?sequence=1 (accessed 10/13 2015).

Ministry of Social Affairs and Health (2014) Sosiaali- ja terveysministeriön strategian ja hallitusohjelman toimeenpanosuunnitelma 2012–2015. Päivitys vuodelle 2014 Sosiaali- ja terveysministeriön raportteja ja muistioita 2014:21.

Ministry of Social Affairs and Health (2016a) Sote-uudistus. Available at: http://stm.fi/sote-uudistus/ukk (accessed 02/02 2016).

Ministry of Social Affairs and Health (2016b) Mielenterveyspalvelut. Available at: http://stm.fi/mielenterveyspalvelut (accessed 02/02 2016).

Misdrahi D., Petit M., Blanc O., Bayle F. & Llorca P-M. (2012) The influence of therapeutic alliance and insight on medication adherence in schizophrenia. Nordin Journal of Psychiatry 66:1, 49-54.

Mohamed S., Rosenheck R., McEvoy J., Swartz M., Stroup S. & Lieberman J.A. (2009) Cross-sectional and longitudinal relationships between insight and attitudes toward medication and clinical outcomes in chronic schizophrenia. Schizophrenia Bulletin 35, 336-346.

Montes J, Saiz Ruiz J, Claret J, Maurino J, Diez T. (2009) Effect of a nurse telephone follow-up on therapeutic adherence of patients with schizophrenia. World Psychiatry 8.

Montes J.M., Medina E., Gomez-Beneyto M. & Maurino J. (2012) A short message service (SMS)-based strategy for enhancing adherence to antipsychotic medication in schizophrenia. Psychiatry Research 200, 89-95.

Moran K. & Priebe S. (2016) Better quality of life in patients offered financial incentives for taking anti-psychotic medication: Linked to improved adherence or more money? Quality of Life Research Feb 5. [Epub ahead of print].

Morisky D.E., Green L.W. & Levine D.M. (1986) Concurrent and predictive validity of a self-reported measure of medication adherence. Medical Care 24, 67-74.

Morken G., Grawe R.W. & Widen J.H. (2007) Effects of integrated treatment on antipsychotic medication adherence in a randomized trial in recent-onset schizophrenia. The Journal of Clinical Psychiatry 68, 566-571.

Morken G., Widen J.H. & Grawe R.W. (2008) Non-adherence to antipsychotic medication, relapse and rehospitalisation in recent-onset schizophrenia. BMC Psychiatry 8, 32-244X-8-32.

Naslund J.A., Marsch L.A., McHugo G.J. & Bartels S.J. (2015) Emerging mHealth and eHealth interventions for serious mental illness: a review of the literature. Journal of Mental Health (Abingdon, England), 1-12.

NICE Guidelines [CG76] (2009) National Institute for Health and Clinical Excellence, Medicines adherence: involving patients in decisions about prescribed medicines and supporting adherence. Clinical Guideline Clinical guidelines, London, UK. Available at: https://www.nice.org.uk/guidance/cg76/chapter/1-guidance (accessed 10/16 2015).

NICE Guidelines [CG178] (2014) National Institute for Health and Clinical Excellence, Psychosis and schizophrenia in adults: treatment and management. Available at: https://www.nice.org.uk/guidance/cg178 (accessed 10/16 2015).

NICE guidelines [SG1] (2014) National Institute for Health and Clinical Excellence, Safe staffing for nursing in adult inpatient wards in acute hospitals. Available at: https://www.nice.org.uk/guidance/sg1/chapter/patient-centred-care (accessed 02/02 2016).

NHS Institute for Innovation and Improvement (2008) Patient Experience Network. Available at:

http://www.institute.nhs.uk/share_and_network/pen/welcome.html (accessed 11/12 2015).

Nieuwenhuizen C.V, Schene A, Boevink W, Wolf J. (1998) The Lancashire Quality of Life Profile: First experiences in The Netherlands Community Mental Health Journal 34, 513-524.

Nieuwlaat R., Wilczynski N., Navarro T., Hobson N., Jeffery R., Keepanasseril A., Agoritsas T., Mistry N., Iorio A., Jack S., Sivaramalingam B., Iserman E., Mustafa R.A., Jedraszewski D., Cotoi C. & Haynes R.B. (2014) Interventions for enhancing medication adherence. The Cochrane Database of Systematic Reviews 11, CD000011.

Nosé M., Barbui C. & Tansella M. (2003) How often do patients with psychosis fail to adhere to treatment programmes? A systematic review. Psychological Medicine 33(7), 1149-1160.

Novick D., Haro J.M., Suarez D., Perez V., Dittmann R.W. & Haddad P.M. (2010) Predictors and clinical consequences of non-adherence with antipsychotic medication in the outpatient treatment of schizophrenia. Psychiatry Research 30;176(2-3), 109-113.

Novick D., Montgomery W., Treuer T., Aguado J., Kraemer S. & Haro J.M. (2015) Relationship of insight with medication adherence and the impact on outcomes in patients with schizophrenia and bipolar disorder: results from a 1-year European outpatient observational study. BMC Psychiatry 15:189.

Nundy S., Razi R.R., Dick J.J., Smith B., Mayo A., O'Connor A. & Meltzer D.O. (2013) A text messaging intervention to improve heart failure self-management after hospital discharge in a largely African-American population: before-after study. Journal of Medical Internet Research 15, e53.

Oehl M., Hummer M. & Fleischhacker W.W. (2000) Compliance with antipsychotic treatment. Acta psychiatrica Scandinavica.Supplementum (407), 83-86.

Osterberg L. & Blaschke T. (2005) Adherence to medication. The New England Journal of Medicine 4;353(5), 487-497.

Ovretveit J (2014) Evaluating Improvement And Implementation For Health. Open University Press, New York.

Palmier-Claus J.E., Rogers A., Ainsworth J., Machin M., Barrowclough C., Laverty L., Barkus E., Kapur S., Wykes T. & Lewis S.W. (2013) Integrating mobile-phone based assessment for psychosis into people's everyday lives and clinical care: a qualitative study. BMC Psychiatry 13, 34-244X-13-34.

Parker S.J., Jessel S., Richardson J.E. & Reid M.C. (2013) Older adults are mobile too! Identifying the barriers and facilitators to older adults' use of mHealth for pain management. BMC Geriatrics 13, 43-2318-13-43.

Personal Data Act (523/1999). Ministry of Social Affairs and Health, Finland. Available at: http://www.finlex.fi/en/laki/kaannokset/1999/en19990523.pdf (accessed 11/1 2015)

Perälä J., Suvisaari J., Saarni S.I., Kuoppasalmi K., Isometsa E., Pirkola S., Partonen T., Tuulio-Henriksson A., Hintikka J., Kieseppa T., Harkanen T., Koskinen S. & Lonnqvist J. (2007) Lifetime prevalence of psychotic and bipolar I disorders in a general population. Archives of General Psychiatry 64, 19-28.

Perälä J., Saarni S.I., Ostamo A., Pirkola S., Haukka J., Härkänen T., Koskinen S., Lönnqvist J. & Suvisaari J. (2008) Geographic variation and sociodemographic characteristics of psychotic disorders in Finland. Schizophrenia Research 106(2-3), 337-347.

Peuskens J., Olivares J.M., Pecenak J., Tuma I., Bij de Weg H., Eriksson L., Resseler S., Akhras K. & Jacobs A. (2010) Treatment retention with risperidone long-acting injection: 24-month results from the Electronic Schizophrenia Treatment Adherence Registry (e-STAR) in six countries. Current Medical Research and Opinion 26, 501-509.

PewResearchCenter (2015) U.S. Smartphone Use in 2015. Available at: http://www.pewinternet.org/2015/04/01/us-smartphone-use-in-2015/ (accessed: 02/05 2016).

Piette J.D., Heisler M., Ganoczy D., McCarthy J.F. & Valenstein M. (2007) Differential medication adherence among patients with schizophrenia and comorbid diabetes and hypertension. Psychiatric Services (Washington, D.C.) 58, 207-212.

Pijnenborg G.H., Withaar F.K., Brouwer W.H., Timmerman M.E., van den Bosch R.J. & Evans J.J. (2010) The efficacy of SMS text messages to compensate for the effects of cognitive impairments in schizophrenia. The British Journal of Clinical Psychology / the British Psychological Society 49, 259-274.

Polit D.F. & Beck C.T. (2012) Nursing research: generating and assessing evidence for nursing practice. Wolters Kluwer Health/Lippincott Williams & Wilkins, Philadelphia Pa.

Potosky D. & Bobko P. (1998) The Computer Experience and Understanding Scale: a self-report measure of computer experience. Computers in Human Behavior 14, 337-348.

Quach P.L., Mors O., Christensen T.O., Krarup G., Jorgensen P., Bertelsen M., Jeppesen P., Petersen L., Thorup A. & Nordentoft M. (2009) Predictors of poor adherence to medication among patients with first-episode schizophrenia-spectrum disorder. Early Intervention in Psychiatry 3, 66-74.

Rabinovitch M., Bechard-Evans L., Schmitz N., Joober R. & Malla A. (2009) Early predictors of nonadherence to antipsychotic therapy in first-

episode psychosis. Canadian Journal of Psychiatry. Revue canadienne de psychiatrie 54, 28-35.

Rettenbacher M.A., Hofer A., Eder U., Hummer M., Kemmler G., Weiss E.M. & Fleischhacker W.W. (2004) Compliance in schizophrenia: psychopathology, side effects, and patients' attitudes toward the illness and medication. The Journal of Clinical Psychiatry 65, 1211-1218.

Richardson M., McCabe R. & Priebe S. (2013) Are attitudes towards medication adherence associated with medication adherence behaviours among patients with psychosis? A systematic review and meta analysis. Social Psychiatry and Psychiatric Epidemiology 48, 649-657.

Robinson D.G., Woerner M.G., Alvir J.M., Geisler S., Koreen A., Sheitman B., Chakos M., Mayerhoff D., Bilder R., Goldman R. & Lieberman J.A. (1999) Predictors of treatment response from a first episode of schizophrenia or schizoaffective disorder. The American Journal of Psychiatry 156, 544-549.

Rossi E (1994) Effects of a simple strategy on attendance and satisfaction with medication clinic services in the chronically mentally ill. PhD dissertation submitted to the United States International University, USA.

Royal College of Psychiatrists 1996 (2015) Health of the Nation Outcome Scales. Available at: http://www.rcpsych.ac.uk/clinicalservicestandards/honos.aspx (accessed 10/16 2015).

Saarni S.I. & Pirkola S. (2010) Psykiatristen potilaiden elämänlaatu [Quality of life of psychiatric patients]. Duodecim. 126(19), 2265-2273.

Sadeniemi M., Pirkola S., Pankakoski M., Joffe G., Kontio R., Malin M., Ala-Nikkola T. & Wahlbeck K. (2014) Does primary care mental health resourcing affect the use and costs of secondary psychiatric services? International Journal of Environmental Research and Public Health 11(9), 8743-8754.

Sanghara H, Kravariti E, Jakobsen H, Okocha C. (2010) Using short message services in mental health services: assessing feasibility Mental Health Review Journal 15(2): 28-33.

Sariah A.E., Outwater A.H. & Malima K.I. (2014) Risk and protective factors for relapse among individuals with schizophrenia: a qualitative study in Dar es Salaam, Tanzania. BMC Psychiatry 14, 240-014-0240-9.

Sawada N., Uchida H., Suzuki T., Watanabe K., Kikuchi T., Handa T. & Kashima H. (2009) Persistence and compliance to antidepressant treatment in patients with depression: a chart review. BMC Psychiatry 9, 38-244X-9-38.

Schaalma H. & Kok G. (2009) Decoding health education interventions: the times are a-changin'. Psychology & Health 24, 5-9.

Sendt K.V., Tracy D.K. & Bhattacharyya S. (2015) A systematic review of factors influencing adherence to antipsychotic medication in schizophrenia-spectrum disorders. Psychiatry Research 225, 14-30.

Shadish W.R. (2002) Revisiting field experimentation: field notes for the future. Psychological Methods 7, 3-18.

Showell C. & Nohr C. (2012) How should we define eHealth, and does the definition matter?. Studies in Health Technology and Informatics 180, 881-884.

Simhandl C., Konig B. & Amann B.L. (2014) A prospective 4-year naturalistic follow-up of treatment and outcome of 300 bipolar I and II patients. The Journal of Clinical Psychiatry 75, 254-62; quiz 263.

Simon G.E. & Ludman E.J. (2009) It's time for disruptive innovation in psychotherapy. Lancet (London, England) 374, 594-595.

Slack M.K. & Draugalis J.R. (2001) Establishing the internal and external validity of experimental studies. American Journal of Health-System Pharmacy: AJHP: Official Journal of the American Society of Health-System Pharmacists 58, 2173-81; quiz 2182-3.

Slade M., Beck A., Bindman J., Thornicroft G. & Wright S. (1999) Routine clinical outcome measures for patients with severe mental illness: CANSAS and HoNOS. The British journal of Psychiatry: The Journal of Mental Science 174, 404-408.

Snowden A., Martin C., Mathers B. & Donnell A. (2014) Concordance: a concept analysis. Journal of Advanced Nursing 70, 46-59.

Spidel A., Greaves C., Yuille J. & Lecomte T. (2015) A comparison of treatment adherence in individuals with a first episode of psychosis and inpatients with psychosis. International Journal of Law and Psychiatry 39, 90-98.

Staring A.B., van der Gaag M., Duivenvoorden H.J., Weiden P.J.& Mulder C.L. (2011) Why do patients with schizophrenia who have poor insight still take antipsychotics? Memory deficits as moderators between adherence belief and behavior. Journal of Psychiatric Practice 17(5), 320-329.

Statistics Finland (2014) Hospital District. Available at: http://www.stat.fi/meta/luokitukset/sairaanhoitop/001-2014/index_en.html (accessed 10/16 2015).

Statistics Portal 2015 (2015) Statistics and facts about Smartphones. Available at: http://www.statista.com/topics/840/smartphones/ (accessed 10/16 2015).

Steele Gray C., Miller D., Kuluski K. & Cott C. (2014) Tying eHealth Tools to Patient Needs: Exploring the Use of eHealth for Community-Dwelling Patients With Complex Chronic Disease and Disability. JMIR Research Protocols 3(4):e67.

Strauss G.P., Robinson B.M., Waltz J.A., Frank M.J., Kasanova Z., Herbener E.S. & Gold J.M. (2011) Patients with schizophrenia demonstrate inconsistent preference judgments for affective and nonaffective stimuli. Schizophrenia Bulletin 37, 1295-1304.

Svensson B. & Hansson L. (1999) Relationships among patient and therapist ratings of therapeutic alliance and patient assessments of therapeutic process: a study of cognitive therapy with long-term mentally ill patients. The Journal of Nervous and Mental Disease 187, 579-585.

Tarricone R., Gerzeli S., Montanelli R., Frattura L., Percudani M. & Racagni G. (2000) Direct and indirect costs of schizophrenia in community psychiatric services in Italy. The GISIES study. Interdisciplinary Study Group on the Economic Impact of Schizophrenia. Health policy (Amsterdam, Netherlands) 51, 1-18.

Teddlie C.H. & Tashakkori A. (2009) Foundations of Mixed Methods Research: Integrating Quantitative and Qualitative Approaches in the Social and Behavioral Sciences. Thousand Oaks, CA: Sage.

Teferra S., Hanlon C., Beyero T., Jacobsson L. & Shibre T. (2013) Perspectives on reasons for non-adherence to medication in persons with schizophrenia in Ethiopia: a qualitative study of patients, caregivers and health workers. BMC Psychiatry 13, 168-244X-13-168.

The Statistics Portal (2016a) Mobile phone users worldwide 2013-2019. Available at: http://www.statista.com/statistics/274774/forecast-of-mobile-phone-users-worldwide/ (accessed 03/02 2016).

The Statistics Portal (2016b) Forecast: mobile users in Europe 2010-2020. Available at: http://www.statista.com/statistics/218977/number-of-mobile-users-in-europe-since-2010/ (accessed: 02/04 2016).

The Statistics Portal (2016c) Forecast: mobile users worldwide 2010-2020. Available at: http://www.statista.com/statistics/218984/number-of-global-mobile-users-since-2010/ (accessed: 02/04 2016).

Tran B.X. & Houston S. (2012) Mobile phone-based antiretroviral adherence support in Vietnam: feasibility, patient's preference, and willingness-to-pay. AIDS and Behavior 16, 1988-1992.

Turner C. (2016) Use of mobile devices in community health care: barriers and solutions to implementation. British Journal of Community Nursing 21(2), 100-102.

Torous J., Friedman R. & Keshavan M. (2014) Smartphone ownership and interest in mobile applications to monitor symptoms of mental health conditions. JMIR Mhealth Uhealth 21;2(1):e2.

Uhlmann C., Kaehler J., Harris M.S., Unser J., Arolt V. & Lencer R. (2014) Negative impact of self-stigmatization on attitude toward medication adherence in patients with psychosis. Journal of Psychiatric Practice 20, 405-410.

Velligan D.I., Lam YW., Glahn D.C., Barrett J.A., Maples N.J., Ereshefsky L. & Miller A.L. (2006) Defining and assessing adherence to oral antipsychotics: a review of the literature. Schizophrenia Bulletin 32(4), 724-742.

Velligan D.I., Diamond P.M., Mintz J., Maples N., Li X., Zeber J., Ereshefsky L., Lam Y.W., Castillo D. & Miller A.L. (2008) The use of individually tailored environmental supports to improve medication adherence and outcomes in schizophrenia. Schizophrenia Bulletin 34, 483-493.

Velligan D.I., Weiden P.J., Sajatovic M., Scott J., Carpenter D., Ross R., Docherty J.P. & Expert Consensus Panel on Adherence Problems in Serious and Persistent Mental Illness (2009) The expert consensus guideline series: adherence problems in patients with serious and persistent mental illness. The Journal of Clinical Psychiatry 70 Suppl 4, 1-46; quiz 47-8.

Vervloet M., Linn AJ., van Weert J.C., de Bakker D.H., Bouvy ML. & van Dijk L. (2012) The effectiveness of interventions using electronic reminders to improve adherence to chronic medication: a systematic review of the literature. Journal of the American Medical Informatics Association 19(5), 696-704.

Vodopivec-Jamsek V., de Jongh T., Gurol-Urganci I., Atun R. & Car J. (2012) Mobile phone messaging for preventive health care. The Cochrane Database of Systematic Reviews 12, CD007457.

Välimäki M., Hatonen H. & Adams C.E. (2012) Mobile.net: Mobile Telephone Text Messages to Encourage Adherence to Medication and to Follow up With People With Psychosis: Methods and Protocol for a Multicenter Randomized Controlled Two-Armed Trial. JMIR Research Protocols 1, e8.

Wahlbeck K Hujanen T. (2008) Ulkomaiset selvitykset skitsofrenian taloudellisesta merkityksestä. Current Care of Schizophrenia. Available at: http://www.kaypahoito.fi/web/kh/suositukset/suositus;jsessionid=2BA3516A5B08E3664D7F29D5AB309D04?id=nix00193 (accessed 10/16 2015).

Wald D.S., Butt S. & Bestwick J.P.. (2015) One-way versus two-way text messaging on improving medication adherence: meta-analysis of randomized trials. American Journal of Medicine 128(10), 1139.e1-5.

Waterreus A., Morgan V.A., Castle D., Galletly C., Jablensky A., Di Prinzio P. & Shah S. (2012) Medication for psychosis--consumption and consequences: the second Australian national survey of psychosis. Australian and New Zealand Journal of Psychiatry 46(8), 762-773.

Weiden P.J. (2007) Understanding and addressing adherence issues in schizophrenia: from theory to practice. The Journal of Clinical Psychiatry 68 Suppl 14, 14-19.

Weinstein R.S., Lopez A.M., Joseph B.A., Erps K.A., Holcomb M., Barker G.P. & Krupinski E.A. (2014) Telemedicine, telehealth, and mobile health applications that work: opportunities and barriers. The American Journal of Medicine 127, 183-187.

Whittaker R., Merry S., Dorey E. & Maddison R. (2012) A development and evaluation process for mHealth interventions: examples from New Zealand. Journal of Health Communication 17 Suppl 1, 11-21.

Whittemore R., Chase S.K. & Mandle C.L. (2001) Validity in qualitative research. Qualitative Health Research 11, 522-537.

WHO (2003a) World Health Organization, Mental health policy and service guidance package, mental health legislation & human rights. Available at: http://www.who.int/mental_health/resources/en/Legislation.pdf (accessed 10/16 2015).

WHO (2003b) World Health Organization, Adherence to long-term therapies. Evidence for action. Available at: http://www.who.int/chp/knowledge/publications/adherence_report/en/ (accessed 02/02 2016).

WHO (2008) World Health Organization, The global burden of disease 2004 update. Available at: http://www.who.int/healthinfo/global_burden_disease/GBD_report_2004update_full.pdf?ua=1 (accessed 10/16 2015).

WHO mHealth (2011) World Health Organization, mHealth: New horizons for health through mobile technologies: second global survey on eHealth. Available at: http://www.who.int/goe/publications/goe_mhealth_web.pdf (accessed 13/10 2015).

WHO (2013) World Health Organization, Mental Health Care Action Plan. Available at: http://www.who.int/mental_health/publications/action_plan/en/ (accessed 10/16 2015).

WHO (2015) World Health Organization, Schizophrenia. Available at: http://www.who.int/mental_health/management/schizophrenia/en/ (accessed 10/16 2015).

Wisdom J.P., Cavaleri M.A., Onwuegbuzie A.J. & Green C.A. (2012) Methodological reporting in qualitative, quantitative, and mixed methods health services research articles. Health Services Research 47, 721-745.

WMA Declaration of Helsinki (2008) Ethical Principles for Medical Research Involving Human Subjects. Available at: http://www.wma.net/en/30publications/10policies/b3/ (accessed 10/16 2015).

World Bank (2012) Mobile Phone Access Reaches Three Quarters of Planet's Population. Available at: http://www.worldbank.org/en/news/press-release/2012/07/17/mobile-phone-access-reaches-three-quarters-planets-population (accessed 02/03 2016).

Wouters H., Van Dijk L., Geers H.C., Winters N.A., Van Geffen E.C., Stiggelbout A.M. & Bouvy M.L. (2016) Understanding Statin Non-Adherence: Knowing Which Perceptions and Experiences Matter to Different Patients. PLoS One 11(1):e0146272.

Yilmaz E & Okanli A. (2015) The Effect of Internalized Stigma on the Adherence to Treatment in Patients With Schizophrenia. Archives in Psychiatric Nursing 29(5), 297-301.

Xia J., Merinder L.B. & Belgamwar M.R. (2011) Psychoeducation for schizophrenia. Cochrane Database Syst Rev. 2011 Jun 15;(6):CD002831. doi: 10.1002/14651858.CD002831.pub2. Review.

Xu D.R., Gong W., Caine E.D., Xiao S., Hughes J.P., Ng M., Simoni J., He H., Smith K.L., Brown H.S. & Gloyd S. (2016) Lay health supporters aided by a mobile phone messaging system to improve care of villagers with schizophrenia in Liuyang, China: protocol for a randomised control trial. BMJ Open 6(1):e010120.

Zapata B.C., Fernandez-Aleman J.L., Idri A. & Toval A. (2015) Empirical studies on usability of mHealth apps: a systematic literature review. Journal of medical systems 39, 1-014-0182-2. Epub 2015 Jan 20.

Zhao S., Sampson S., Xia J. & Jayaram M.B. (2015) Psychoeducation (brief) for people with serious mental illness. Cochrane Database Syst Rev. 2015 Apr 9;4:CD010823. doi: 10.1002/14651858.CD010823.pub2.

Zhou B. & Gu Y. (2014) Effect of self-management training on adherence to medications among community residents with chronic schizophrenia: a singleblind randomized controlled trial in Shanghai, China. Shanghai Archives of Psychiatry 26, 332-338.