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Ethical issues in mHealth

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SUMMARY

This thesis studies the ethical challenges in mobile health. It is a word used for practicing medicine and public health by using mobile devices and wireless technologies in healthcare. This thesis analyses the current literature of ethical challenges in mHealth and examines the challenges by analyzing research articles. It was possible to identify five main ethical challenges, that are confidentiality and privacy, autonomy, consent, justice and conflict of interest. These most common global ethical challenges were analyzed and compared to each other, if it was possible to find some more common ethical challenges. The thesis also mirrors the global research of mHealth ethics and compares it to ethics of Finnish mHealth.

Substantiation. In this thesis it will be substantiated that more research is needed on the topic of mHealth and its ethics.

The aim of the work. The aim of the work is to identify what are the largest ethical challenges at the moment in mHealth and how they differ from each other.

Objectives. The following objects are raised to reach the aim: to identify the mostly occurring ethical themes from literature, to compare that are some ethical challenges occurring more often than others, to identify what is the current situation of mHealth in Finland and to analyze how these found literature from global research literature compare to Finnish situation.

Methods. This thesis is a literature review that used public research papers from Web of Science database.

Keywords: mHealth, mobile health, medical ethics

INTRODUCTION

Mobile health (which is later in this thesis referred as mHealth) promises to support practice of medicine and public health by using mobile devices. The global use of mHealth has been rising all over the world due to more access to mobile devices and rising trust by the users for mobile health. Mobile communications reach and power adopted to healthcare makes healthcare more personalized and versatile. It is a known fact that mHealth has many ethical issues that are not necessarily taken into account with the rapid rise of the use of mobile health globally. There are surely ethical uncertainties arising in the use of mHealth, and to understand the issues surrounding the ethical challenges in mHealth, ethical analysis and exploration of current literature is needed. And to understand these ethical instances, it is inevitable to define deeply, what do we mean when we discuss about mHealth, what is the definition of mHealth?

The research hypothesis is that there can be identified few main ethical challenges on the basis of research literature. Some ethical analysis has been probably made, but as the whole ethical field is so wide in the context of emerging mobile health, it is likely that all aspects have not been taken into account.

This thesis is a literature review which aim is to identify what are the largest ethical problems at the moment in mHealth and how they differ from each other. The objective is to identify and categorize the most commonly occurring ethical themes.

The following objectives are used to reach the aim:

- 1) To identify the mostly occurring ethical themes from scientific literature,
- 2) To compare the different ethical challenges and if some of these are occurring more often than others,
- 3) To identify what is the current situation of mHealth in Finland and to analyze how found global research literature compare to Finnish situation.

This thesis uses the following structure: chapter 1 opens the literature selection strategy. Chapter 2 aims to define what is mHealth and introduce the main applications of mobile health right now. Chapter 3 introduces the current literature done in the field to identify the

main ethical challenges of mHealth. Chapter 4 is divided in various subchapters which each introduce one main ethical challenge in the field of mHealth. Those main challenges possible to identify where privacy, autonomy, justice, conflict of interest and consent. In the last chapters the findings are discussed, analyzed and concluded to form a solid picture of what is the meaning of these ethical instances to modern mHealth.

2. LITERATURE SELECTION STRATEGY

Selected literature type was chosen on the basis of varying information from many different sources, medical specialities and countries. The goal was to get a global overview of different mHealth ethical issues. Type of literature chosen was scientific articles written in english. Articles were chosen with a criteria of being published between 2015 – 2023 and that the subject of the article was precisely with emphasis on comprehensive ethical aspects thinking to get a ethical point of view.

Keywords used in the search were mHealth, mobile health, medical ethics and mobile health Finland and all of the combinations of these words. Many articles could have fit the criteria, but lacked precise medical ethical thinking. Many articles contained aspects on psychological and medical wellbeing in relate to mHealth use, but lacked deep medical ethical aspects on the use of mHealth. Articles from Finland were not found directly with keywords of mHealth and Finland, but some considerations of ethics was made more on a side note of the articles main points.

3. WHAT IS MHEALTH

This chapter discusses what is mHealth and what the term includes. Mobile health abbreviated into mHealth is an umbrella term for all wireless technology including mobile phones, personal digital assistants (PDAs), patient monitoring devices, wearable devices such as smart watches and tablet computers in a medical healthcare setting. The term includes also lifestyle and wellbeing applications that can connect to medical devices or sensors, such as smartwatches and walking steps tracking bracelets, health information and medicine reminders, personal guidance systems and motivational tools of dietary and fitness recommendations. It includes services provided via mobile phones by SMS -messages

provided wirelessly. It also includes technological solutions that could measure vital signs such as heart rate, blood pressure, blood glucose levels, body temperature and also brain activity.

mHealth is used for supporting the treatment, tracking of patients vital signs, managing health data and disease surveillance. mHealth means service solely via mobile devices and the use of mobile health tools are increasing. The increasing availability of 4G networks and satellite services gives the possibility to increase patient autonomy and safety. One example of home setting application would be air quality meter that gives information on the air quality for persons with respiratory medical conditions. It is a field that is emerging and developing fast that has a potential to help in transforming healthcare by improving its efficiency and quality. There are seven application categories, which are diagnostic and treatment support, education and awareness, helpline, disease and epidemic outbreak tracking, communication and training for healthcare workers, remote data collection and remote monitoring. It is considered to be a tool for supporting healthcare professionals rather than a replacement as the medical professionals are central for providing healthcare (1). Telemedicine is the provision of conducting healthcare services using communication between healthcare providers or between client and healthcare provider (2).

4. ETHICAL CONSIDERATIONS IN MHEALTH

This chapter summarizes the main ethical discussions that researchers are discussing in the articles. In fifth chapter they are discussed in more detail. In reviewing current ethical and legal challenges, Nittari et al used an article review and saw that many ethical aspects in the field of telemedicine are sufficiently analyzed in the researches by the authors by strongly focusing on patient information protection and informed consent. They gave an expected discussion on the privacy and consent in focus and also discussing that many articles were focusing on the high costs of implementing telemedicine due to security, legal aspects and automation. The authors concluded that they are safe to say that any organizational or practical challenge are mastered in the end, but weighing that if the highlighted ethical issues and aspects are not corrected, telemedicine could be a risk of increasing claims for damage and malpractice (3). Further going into similar categories, but with more focus on the legal aspects as Gilmartin et al used three ethical considerations. They weighted on being sure to

ensure rights of the citizens are not violated in the pursuit of less troublesome disease management practices (4).

On the other end, some researchers focused on the values of applying ethical principles, such as Keenan et al that focused on exploring different ethical considerations or impacts in telehealth versus face-to-face health care delivery models and they found out that in many researches focused on the ethical principles of autonomy the most, secondly professional-patient relationship, then maleficence and justice the least. Conclusion that although there are many ethical issues discussed, there is limited research on how the principles of ethics could be incorporated into clinical practice, founding out that many studies proposed frameworks, guidelines or codes of conducts but lacked on how these recommendations could be implemented on improving telehealth practices to be more ethical (5).

On more practical side of ethics, with emphasis on responsibilities and informing the limitations, Chaet et al provided key points list of ethical practice in telemedicine with three points that are informing users about the service and relationship limitations, advising users of the site on how to arrange follow-up care when indicated and to encourage users to have primary care physicians to further inform their primary physicians of the online health consultation also in cases when in-person care is not needed immediately. They also emphasize that the physicians providing health content for websites and mobile applications must ensure that objectivity and accuracy of the provided information attributed to them is ensured and that fundamental ethical responsibilities do not change and different levels on accountability are risen for physicians. Following of ethical guidelines or relevant specialty societies are expected to be followed in accordance to adherence to applicable law that concerns telemedicine. Some familiar challenges but in new context were found by discussing the potential disruption of the patient-physician relationship, risks to privacy and confidentiality and the limitations of electronically mediated interactions of physical examinations and them concluding that the responsibilities of ethics of physicians do not change if new models and technologies emerge and they say that practice of medicine of a moral activity with foundations in covenant of trust between the doctor and the patients (6).

Discussion paper of Skär et al discussed the ethical aspects of eHealth service implementation to health care and they discussed on the moral responsibility of doctors and other healthcare professionals in decision-making and assessments. They discussed on the

ethical principles of nursing in the light of vulnerability, integrity, dignity and autonomy including situations where health services are used as support and also concluding that ethical issues are not well discussed in comparison to the usefulness of the services, how the services effect on the patient-doctor relationship and how accessibility for care could be increased. In conclusion they discuss that both healthcare professionals and designers have a common responsibility to develop services together with end users which are both healthcare professionals and patients, and this should include ethical perspective, but they finish that more knowledge is needed of the ethical aspects on how to improve quality of care (7). Going more into research limitations and current issues, on the topic of mobile application-mediated research in the article by Tovino discussed on the privacy and security issues and that the privacy and security used in the research are risky. The discussion includes the notion of that privacy and security are fundamentals of ethically conducted research which was declared in the Declaration of Helsinki in 1964 that was adopted by the World Medical Association (WMA) that included the phrase about protecting personal information of subjects of research (8). Interestingly, by adapting ethical considerations to sleep medicine which uses different tracking devices and sleep monitoring, from the technical aspect in the article, Fields discussed about the importance on following most accepted ethical aspects in sleep medicine (9).

4.1 ETHICAL SOLUTIONS

After introducing the general ethical discussion in the last chapter, this chapter discusses on the possible solutions to the ethical problems in mHealth more in detail.

On the topic of mobile devices and their ethics, Scott et al discussed the framework of cellphones for health care providers and it could be used to describe and encompass many ethical, regulatory and legal issues that require debate, routine practice and resolutions so that the use of cellphones by health care practitioners are appropriately thought through from ethical aspects. In the framework for health care provider cellphone stewardship and ethical aspects were force of acceptable societal and health profession norms followed by examples informed consent, privacy, equity, confidentiality, security and veracity, with findings that the least ethical issues discussed were autonomy, transparency and individual travel empowerment. They compared the cohort studies and qualitative/narrative analysis and found out that both of the cohort studies focused more on the importance of protecting the privacy of the users, further discussing that privacy laws are not fully implemented in applications

and secondary purposes of data privacy are important, further discussing about consent and concept of fairness, so that access to mobile device should be given to participants that do not have one. Qualitative and narrative papers had more ethical issues with emphasis of data anonymization for preserving user privacy and those papers also mentioned transparency, solidarity, public benefit, harm minimization and safety. With giving more concrete ideations in their paper, they discussed on the difference of legal and ethical issues and that ethical moral principles like autonomy (freedom of choice), beneficence (do good), nonmaleficence (do no harm) and justice (equity) are acceptable actions in a larger societal context and there is no clarity in the terms and that confuses, using example word of regulations that have legal aspect but in health-profession setting it has also ethical aspects. They discussed that the framework of Cellphone Stewardship Framework for Health Care Providers (CSF-HCP) as a simple device that supports and helps in framing future ethical tools and social norms, guidelines and laws, for example, and that the tool would be modifiable in the future (10).

Also in the light of concrete tools for implementing ethical considerations in real life applications, in the review article on Symptom Checker Applications (SCA) by Müller et al discussed ethical aspects of ethical, legal and social aspects (ELSA) and they concluded that empirical data is poorly supporting the ethical discussion and most of the reflections that are used are more from the perspective of widespread usage of applications and article literature on the topic often use arguments that are based on hypothetically broad deployment of SCA and the arguments should be used with caution (11).

4.2. ASPECTS FROM DIFFERENT MEDICAL SPECIALITIES

This chapter takes a closer look to ethical aspects in different medical specialities.

Going more into detail about medical specialities and travel medicine, systematic review of Ferretti et al found out that in travel medicine, 16 ethical issues were mentioned in their review, with most of them discussing about privacy issues, following classification of citizenship, ability, neurotypicality or neurodiversity, disability, age, literacy, fluency, size, BMI, or body hiatus) and they further discusses that one common ethical topic was also storage of data and its data security in the perspective of cyber-attack risks and efficiency for energy saving (12).

From the ophthalmological perspective, Shahbaz et al discussed about smartphones that are continuing to be used more and more in ophthalmology to result into cost-saving and delivering best plans for treatment. They discuss on the misuse that the medicine and technology evolution has been led into. They list the basic principles of ethics, such as [1] Justice, so that medical care should be distributed equally regardless if its a remote or routine, [2] Non-maleficence, medical practitioners should always act on the best for the patient also in a remote setting, [3] Autonomy, patient should have autonomy on choosing their preferred medical intervention also in teleophthalmology, [4] Confidentiality and Privacy, they discuss that teleophthalmology is at risk of being pirated, broken or hacked during the processing of care, [5] Informed consent, they emphasize that is should never be withdrawn as informed consent protects both the patients and the healthcare providers further suggesting a electronical form or electronical signature to be created and approver for teleophthalmology, [6] Medical errors disclosure. In their discussion they also add that doctor-patient relationship might be affected by when composing a remotely-delivered healthcare as eye-contact and fundamental basics of relationship could not be expected to be implemented in a remote care setting compared to a routine face-to-face visiting by the patient to healthcare provider. In their ethical discussion they conclude that in ophthalmological specialty, it will be difficult to apply teleophthalmology as it could not replace a clinical routine visit. They placed impact on the most important aspect which they discussed on being confidentiality. In their discussion, confidentiality is said to be an important aspect of ethics by healthcare professionals and they discuss that it is also a main focus point of information protection imposed by states and laws. In their discussion on the importance of encryption of the data they emphasized to ensure confidentiality and state that higher levels of encryption (data anonymization) should be designed to prevent information leaks. They list Hi-Ethics consortium as a volunteer group that has a goal for merging information of most important health information providers and websites to pursue more trust from users of digital health services.

They further emphasized that combination of technology and ophthalmology will not be achieved fast as there are many advantages and disadvantages that are needed to be balanced, further discussing that during clinical trials, teleophthalmological effectiveness has been proven, but during those clinical trials, a variety of weaknesses and right ways of implementation, delivery and satisfaction ensuring has been brought into the attention and discussing that as remotely delivered ophthalmological services has been emerging already 20 years ago, no unified global ethical and legal standardization has been implemented yet and

the rapid development has made the regulation of the services difficult to implement with finalizing about the significant advancements in screening of diabetic retinopathy that developing countries has benefited of teleophthalmological distance learning (13).

In his article in medical speciality of gastroenterology with focusing more on smart devices and wearables, Kernebeck et al, discusses on the ethical aspects of mobile health in gastroenterology by focusing on mobile health apps and medical apps that are increasing in popularity also in clinical practice of gastroenterology, with risks of weakening the traditional patient-physician interaction relationship, the small dominant marketplace of two dominant smart phone ecosystems that give access only for people who can buy these tools and they discuss implications of inequality for real-life doctors becoming only affordable for patients with financial resources or insurance, which is a part that users would need to understand more on the negative and positive implications that this technology could bring, further concluding that there is no international regulation of mobile health applications, even if they are used as medical apps, therapeutical or diagnostical tools with considering legal and data privacy to be most important and that products would need to be highly safe before widespread market use and they implicate that also health care professionals are critical towards the privacy and security of mobile digital solutions in medicine (14).

In their discussion, they also point out that there is no single certification that can make the users to understand and choose which applications are safe to use and which are not and also discuss on the multiple silos of data storage that interoperability is challenging to make if eg. Patient records his data with wearable device that stores the data on multiple systems and in different file formats and they discuss that electronic health records should use common interfaces and similar standards and that would be one of the most important aspects for implementing digital medical innovations. Further emphasizing the sufficient proof of benefit for being based on evidence-based medicine and that standards should be followed when given mobile healthcare. Finalizing about the need for clear rules and standardization of evidence-based medicine that would lead into a better interpretation and understanding of the actual evidence of digital interventions (14).

On behalf of psychiatry, Chin et al discussed about the privacy, autonomy, beneficence and justice by concluding that assurance of access for everyone which is secure, is needed to be done diligently by studying also the efficacy (15). From the perspective of increasing field of

tele-orthopedics, Ferorelli et al discussed more on the legal aspects about liability but also concluding that privacy, safety and quality of care and patient satisfaction are also important themes to take in to account (16). On the topic of informed consent, Arias et al discussed on the topic of teledermatology and the ethical aspects (17). Salerno et al discussed on the digital technologies that drive ethical challenges in epidemiology with identifying ethical issues such as privacy and confidentiality (18). Kaplan summarized and identified ethical issues in relation to technological healthcare solutions such as telemedicine with findings on autonomy (19). Kaplan also discussed on the topic of autonomy that it can be compromised when community or family pressures exist and that could limits to alternatives of care could occur. (20).

4.3 FINNISH CONSIDERATIONS

After reviewing the global perspective on ethics in mHealth, the focus of this chapter is on one single country and its situation in the ethics of mHealth, Finland.

In reviewing the scientific literature of mHealth in Finland, no large quantities of research literature were found. It appears to be that the research on ethical instances of mHealth are comparatively new subjects in Finland and there should be more research done. It appears that there is need for that kind of research, if mHealth devices are getting more common also in Finland.

It was still possible to find some some research about Finnish mHealth field. In his article, Holopainen discussed about the vast number mHealth applications and that they are available for smart phones and tablets, with analysis on the role of security, safety and reliability. In the discussion, an example is given of a heart electrocardiogram sending real time sensory information to patients mobile phone that runs a game that changes the game main character on the basis of heart electrocardiogram in real time and motivates the patients on developing their main character to be more healthy (21), but with no further ethical analysis or considerations. Some of the scientific articles, such as in their instrumental case study about potential health technology assessment, Giunti et al used digital questionnaire to guide the development of a multiple sclerosis application, and while the aspect is very technical, they still considered confidentiality of data, but not other ethical considerations were made (22).

It was possible to note an interesting fact about Finnish literature, that mHealth is widely used in Finland in psychiatry and in therapeutic interventions. Discussing on the psychotherapeutic field, Stenberg et al discussed on the therapeutic programs that are used in care of the patients empathy, thought remodeling, behavior and exposure activation, relationship and motivation strengthening and supporting self-reflection. These type of online therapies are part of the Finnish treatment guidelines in depression. In their article, no exact details on the ethical considerations were made but they conclude that online therapies should be based on scientific proofs when used in the context of psychotherapy (23). On the perspective of psychological therapy using mobile app was discussed by Mattel et al, with no further ethical analysis in research or in their clinical trial, the authors were more focused on the usage metrics with improvement identifications (24). Kuhlberg et al discussed on a online tool for recognizing chronic disease risk factors and making an impact of change to unhealthy lifestyle choices in unemployed population with focus on the capacity to recognize risks with online tool, user experience evaluation and discuss on the impact of online tool. In their discussion, they discussed no ethical aspects of online health examinations (25). In Finland, there cannot be found enough research in the field of mHealth and especially about the ethical challenges in mHealth. On the basis of literature, it indicates that the research of mHealth in Finland is still a new field of research and not highly developed. It seems that security, safety and reliability are for now the most discussed topics in the field of ethics about mHealth in Finland.

5.0 MAIN ETHICAL CHALLENGES IN MHEALTH

This chapter takes a closer look to specific ethical challenges found from literature. The division is made based on analysis of wide research literature concerning modern mHealth and its ethics. Next subchapters introduce these main themes, which are privacy, autonomy, justice, conflict of interest and consent. In the last chapter the findings are concluded and analysed to form a solid picture of what is the meaning of these ethical instances to modern mHealth. They are getting a closer look in following subchapters.

5.1 CONFIDENTIALITY AND PRIVACY

This ethical theme was highlighted in the research literature.

In their discussion about confidentiality, Nittari et al they found out that there are many hypotheses for maximal data protection, such as anonymization of online data and encrypted transmission. The articles were found by the authors to focus especially on ensuring the security of the data transmission of minors and families and found out that some authors concluded that no system is absolutely safe and discussed about ethical aspect of right to oblivion and cancellation of the data, but they found out that universal format of data protection lacks that exposes it to misuse (3).

Gilmartin et al discussed that are there infringements of privacy through covert monitoring, by using a monitoring device at persons home that might be forgotten at some point, leading into a situation where dementia patient inadvertently monitors guests at home, with also discussing about secure data transfer of personal data via data networks and their risks, even using words like Orwellian assault on civil liberties, concluding that monitoring of health would not be allowed in circumstances that the patient health records are held ownership by tech-giants, telecommunications companies, the state, or even being openly freely available for all parties that are interested. It is important to integrate ethical concerns to the development processes of these devices (4).

Chaet et al also discussed on the obligation to protect privacy and confidentiality and that the topic is least as important in telemedicine setting than in hospital or office settings having the specific responsibilities in interactions. They further discussed that health information websites are expected to publish privacy policies on their websites and therefore refraining physicians on participating on websites that do not publish these policies available for everyone on the websites. They also discussed that physicians should be aware that they must be confident on the website that it has appropriate mechanisms to protect the confidentiality or individual information that is exchanged through the website and that they should also inform the patients of the risks to privacy for example by writing a disclaimer on the website. The authors also emphasize the responsibility of the physicians that provide the services to adhere to sound privacy practices themselves also and that other health care professionals that they possibly collaborate with do the same. Authors also discuss that physicians should alert patients of telemedicine and their surrogates that issues in privacy can occur and that they should inform the patient of the steps that are taken for protection of confidential information (6).

Scott et al discussed use of aspects of ethics on mobile devices such as WhatsApp and that security related issues such as automatical saving of images by some software to the users library and were commonly assessed with also notions of consent and confidentiality followed by use of photographs further from the consent that it was given to or if it was not given at all (10).

In the discussion by Shahbaz et al, they discuss on privacy that following guideline principles should be followed on the subject of privacy: [1] Privacy principles, meaning that user should have control and freedom on the settings on privacy, [2] Privacy preservation model, meaning that as some applications have public default settings that can be forgotten by the users, [3] Privacy settings enable to customize eg. Social online profiles but they do not let users to control on what applications or websites reveals about them. They discuss that a standardized global model should be implemented for integration of privacy and security in various applications and websites and to prevent further conflict (13).

Kernebeck et al discusses that mobile applications data and privacy considerations are not well understood and implemented yet. They discuss that healthcare professionals are also sceptical in the security of the health data and that many health applications provide little or no data security for the end users. They discuss on the fact also that many health and fitness applications finance themselves using advertisements, with payment by individual patients or by selling data. They discuss on the importance of guidelines and regulations are not well established to bring more privacy and security for the patients data (14).

Salerno et al discussed on the integrity and privacy with summarizing those with more nuanced ethical issues such as misinformation and data sharing. In their paper, it was concerned ethically that privacy and confidentiality could be infringement when personal data is shared via cell phones or geolocation (18).

5.2 AUTONOMY

In this thesis, autonomy refers to the right to self-govern. Patient autonomy concerns by Gilmartin et al of wearable devices was also discussed by saying that the use can lead to stigma that wearing any device may alter their own or others perception of themselves by

using a group study that showed that using devices to assess with frailty can lead to a perception of them being frail (4).

Fields discussed about autonomy: Patient has the right to make decision of his or her care, meaning that the patient should be educated about all the care that is provided and how it is provided, comparing telemedical practices and in-person care. He discusses that patient need to be the decision maker in choosing either telemedicine or in-person care even in cases where telemedicine would be most optimal way of providing care due to illness or disability. He also discusses that the autonomy is on the patient on switching from telemedicine practices to in-person care whenever they found it suitable and choosing telemedicine first will not exclude the option for in-person medical care. He discusses also that autonomy should be respected in the privacy manner so that information of the patient would not be shared forward to others without specified by the patient, with also emphasis on other possible persons in the telemedicine room so that patient makes the decision on the information shared to other persons also in his or her room and vice versa with the medical doctor providing the care. He discusses that the autonomy part of ethics is eroded if anyone sees the health data without his or hers permission and knowledge (9).

Skär et al discuss on the issue of electronic patient records that ethical issues should be noted and that patient information that is accessible may threaten the integrity of the patient from the ethical point of view with talking about the issue of patient not having control of that where the health information is passed and that the patients do not have control over aspects of information flow such as frequency, who receive the information and what information the healthcare professionals are using from the patient (7).

Chaet et al concluded that responsibility of the physician is to assess the skillset of the patient or family on the use of telehealth and telemedicine over other ways of providing care to patients, especially in the cases of telehealth websites or mobile applications that connect the physician and patient in a possible circumstance that there is no prior relationship between the patient and the physician and there is no possibly a expectation of follow-up (6).

In the research by Kaplan, it was discussed that meaningfulness of autonomy when choice is limited by privacy policies that are difficult to understand or community and family pressures and this could have limitations on the alternatives of care (20).

5.3 CONSENT

This chapter analyses the term consent, which refers to right to give permission to something to handle personal data. The researchers Chaet et al found also that transparency and informed consent is a topic of their own and they found out that physicians should be transparent with patients and patients should have information of what are the distinctive measures of telemedicine on top of the information they receive on the medical issues and possible treatment options. The authors further conclude that patients need to be informed on the credentials of the physicians and other healthcare professionals providing medical services and the patients may be asked to play a different role in traditional care and in telemedicine practices. The authors further gives an example that family members that are asked to learn to use monitoring devices on behalf of patient at home, it can influence the patients decision making (6). On the other perspective, Tovino discuss that if individuals are not reading or understanding their ethical guidelines and concerns, they are not obviated them from the ethical obligations (8).

Shahbaz et al discussed in their review article about ophthalmologists using smartphones and telecommunication. With further discussing that due to rapid development of such technologies is ongoing, technology use has become difficult to regulate and control and continuing that informed consent should never be withdrawn as a informed consent protects both the patient and healthcare providers. They further discuss about the methodology for patients rights, further emphasizing that a informed consent should be given by the patient online together with the right to refuse or choose treatment and discussing about the guidelines for smartphone recording in a clinical setting so that smartphones differ compared to face-to-face and paper consent as it is signed remotely digitally Further setuping guidelines for consent so that patient should have right to withhold the consent at any time, meaning before, during or after the recording and emphasize that this should not have any impact on the care they will be given or that it should not affect to the patient-doctor relationship in any way (13). In the analysis of aspects of ethical topics of tele dermatology, Arias et al discussed that informed consent should be implemented in similar way than in any other form of care. Current codes of ethics in use are now deemed ethical when patient is informed and patient agrees (17).

5.4 JUSTICE

Justice is a larger term that is used to cover various terms, such as equality, obligations and informed consent. Ferretti et al make a conclusion minimal attention for justice and equity were made, so that health information should be available to all population groups and the individual needs should be met and the risk that a one size fits all applications are developed and not made from more individual perspective. They also discusses the informed consent and that it has been used as a task to be completed and not that much of a real ethical concern and they also found out that there is a real potential for harm if application developers, poor data accuracy or the background of users are not inclined to work together. They concluded that justice, risks and fairness are just mentioned or disregarded on the 1159 articles they studied but on the other hand some ethical issues are more well discussed such as privacy and that implementation of oversight mechanisms to support ethically aligned decision making should be made (12). It seems that justice is clearly the least commonly mentioned ethical challenge in the literature.

According to Nittari et al, informed consent was a topic that would need more focus on and were shown that many articles were discussing on this topic. They discussed that researches that focused more on the hardware or telemedicine, was not focusing to cover adequately the topic of ethics, but in the other end the researches by telesurgery or those with juridical and philosophical nature, considered ethical topics in a significant way with discussion that many authors spoke on the explicit informed consent when medical health images are transmitted. Some articles in the topic of informed consent expressed that form of consent can be in both oral or written form in some circumstances and that disruptive behaviour disorders of a child provides a informed consent of the whole family. Some hypotheses was talked that informed consent would be possibly in every telemedical transmission unless it is a situation of emergency with conclusion that purely uniformal leads to concerns in vulnerability and validity in telemedicine. Malpractice and liability was discussed extensively in articles and talking of fundamental rights of the patient and issues in malpractice, by dividing malpractice into two segments: [1] telemedicine introduces a new form of malpractice or [2] there is no difference with the normal malpractice with the patient being present (3).

Chaet et al discussed that obligation of competence requires that physicians helping patients have appropriate clinical qualifications and experience for offering a well-considered professional recommendation to the patient and those physicians who use that technology should also be proficient in the use of the technologies and being comfortable in the use not forgetting to know about the limitations of telemedicine technologies they use and recognising that individual patient in some circumstances may not be treated by using telehealth practices, therefore they conclude that judgment of what modality to use on the treatment of care for the patient that is the best, needs to be done by the physician and including the decision on when to possibly more from telemedicine to traditional in-person care is on the responsibility of the physician using telemedicine practices to provide care to the patient (6).

Fields discussed that provider (here a medical doctor) has the duty for benefiting the patient in all situations, discussing that telemedical practices should follow the highest standards and he discusses that education of clinicians is a important part for doctors to transit from in-person practicing to telemedical practice, because studies has shown that 75% of doctors without telemedicine doctors are uncomfortable in the evaluation of new patients and 95% are uncomfortable in the diagnosis making and treatment, but emphasizes that if a doctor has more experience then the doctor has more positive attitude on telemedical practices. Further discussing that subtle adaptations to telemedicine from in-person care can be used to ensure that the quality measures are ensured as good as with more traditional in-person studies. As the last and his fourth part, he discusses that a medical provider has to obey laws, provide medicines and provide resources equally in a fair manner, with emphasis on the socioeconomical aspects of justice so that patients with more disadvantaged position has the same access to telemedicine care for patients that do or do not possess the equipment such as tablet, computer or smartphone for the telemedicine connection, further saying that rural patients travel long distances and geographics has affect on the justice. He further says that in some programs the computer equipment are sent to patients (9).

Müller et al discuss that due to lack of empirical data, the discussion remains hypothetical and they usually base on the few similar studies which results in a bias risk so that results may be amplified. Their results indicate that there is no consensus on the negative and positive effects of symptom checker application (SCA) and there are widely different thoughts on the topic, giving an example of argument against SCA that there is a additional

burden for healthcare systems and end-users, but they discuss that there is not enough empirical data from the perspective of varying healthcare systems and regulations (11).

5.5 CONFLICT OF INTEREST

Conflict of interest describes the compromising of decisions or actions by gaining benefit. Fidelity was discussed by Chaet et al so that in any model of care, the patients and their surrogates need to be able to trust that physician puts the welfare of patients above other interests and that physicians should disclose financial or other interests that may interfere their roles by disclosing those on commercial health websites and also take active steps for managing and eliminating conflicts of interest (6).

The topic was also discussed by Fields and he discusses about the cost of the telemedicine and the conflicts of interests in a situation that the patient wants to use in-person providing of care but the provider challenges the patients autonomy. He discusses that it is not yet to be seen how to health care reimbursement affects on nonmaleficence ethical principle. In the discussion, he emphasize that providers of sleep medicine should adhere to same federal standards in perceived or real conflict of interests as they would in in-person sleep providing, also including the situations for accepting or providing services or goods to simply encourage referrals. They discuss on the potential situations of telemedicine providers leveraging their programs in order to increase business traffic to their own businesses. They discuss that about situations of providers selling patients medical equipments from a company they have a financial stakes on. They further emphasize that regarding conflicts of interest, medical providers has the responsibility to be familiar on the applicable laws (9).

6. DISCUSSION

In the research literature, there is a wide consensus for the need of more ethical thinking and taking into account the whole area of ethics in the field of mHealth. The emphasis in different analyses studies has differed - some studies have focused solely on the privacy and security aspect, while others discuss more broader of usefulness and user experience. Some authors find some ethical aspects more important, while others emphasize more of the other aspects. For example it is evident that authors Barry G. Fields (9) and Richard E. Scott (10) discussed more on the topics of nonmaleficence and their ideas challenge us to think more broadly on

the topic from patients perspective in a thorough way. Moreover, the Gilmartin et al reminded us that there are many aspects on privacy, patient autonomy and incorporating ethical considerations to the development cycle of the devices that are used. The research showed that wearing a device can even alter the patients perception of themselves by making them think of themselves more frail.

In comparison, Nittari et al (3) gave a interesting perspective of the need to tackle the challenge of ethical issues so that malpractice can be prevented. Interesting perspective was the informed consent of the whole family, if a one person of the family is monitored and they gave a thought on that every transmission could be indeed be a event that informed consent should be needed, excluding medical emergencies. Tovino (8) brought the attention for the ethical considerations in mobile application-mediated health research and disclosed six interesting measures for the federal lawmakers an policymakers.

It is important to keep in mind that in many medical fields, it is not possible to completely replace face to face meetings by mHealth practices. For example the ophthalmological discussion by Rawan Shahbaz (13) reminded that in some specialities such as teleophthalmology, the implementation of mHealth would never overwrite the basic meeting of face-to-face by the doctor and the patient and that the ethical guidelines are still needed to be implemented across the whole ophthalmological speciality as currently the guidelines are not yet precise enough and taking into account all the varying aspects of medical ethics.

Interestingly, Kernebeck et al (14) discussed on the aspects of security and privacy by implying that medical professionals are not trusting the mobile applications to be secure enough and privacy concerns are still existing. They discussed on the fact that universal standardization of security is lacking and that user-perceived value of the applications and their value is not well understood yet. Finally, it is evident that the work of theses authors has given a wide contribution for the understanding of the wide topic of ethical issues in mHealth. Their perspectives and discussions show us that in our complex world we live in, their perspectives remain important and relevant as ever.

The information discussed in this thesis can be very useful for healthcare professionals, mHealth developers and medical ethicists that are working on the topic. Important areas of the ethical issues are informed consent, privacy and autonomy of the patient. It is important

for the professionals to be aware of the varying perspectives on the topic, from both the healthcare professional side and the side of the patient. Circumstances can vary depending on the modality and the location of the use, such as being in a patient's home. These discussions give a clear sense of the main areas of ethical considerations to be used where necessary.

Doctors use these tools to track vital signs, collect data and make important decisions on the health of human beings. Therefore, doctors and healthcare professionals should be widely aware of the issues on the ethical aspects in providing mHealth services. They should be clear to the patient of the challenges, concerns and ethics that arise on the topic. Additionally, doctors should be proactive on being the manager of the patient-doctor relationship with open data, boundaries and limitations of the mHealth services. Doctors should engage in practices that promote better emotional and physical health together with medical ethics.

Healthcare and patients are in need for more clear guidelines on ethical issues to be taken care of as the mobile health industry is growing rapidly and humans are more connected to each other by mobile technology. More research on ethical issues is needed to fully understand the whole complex ethical landscape of the large umbrella of mHealth.

After analyzing the literature, it was possible to recognize quite clearly five main challenges in the field of mHealth. However, some ethical aspects were most occurring themes. After analyzing all the articles, security and privacy were the most cited challenges and thought it can be concluded, that it would be necessary to improve especially these instances in mHealth. In the future it would be necessary for mHealth applications to be able to ensure its users that their personal health data is carefully secured and there is no danger of data leaks. It would be also important to define the limits even more carefully, who is authorized to look at one's personal health data, and there should always be a justified reason to look or distribute the data. Also it should be carefully supervised, to which third parties the data is distributed and there should always be a justified reason to do so.

Even though privacy and security could be identified as the most important aspects of ethics, we cannot minimize the significance of the other three ethical challenges identified for the mHealth. For example mHealth application user's consent should always be taken into account. Though it was mentioned in the analyzed literature, it wasn't clearly defined, what should be

done to enhance users consent to use his/hers personal data. In the execution of mHealth applications, it should be always ensured that user is aware of what he/she has given consent, where his/her personal data is stored and what it is used for. This is the reason why mHealth service providers should inform their customers clearly, where their data is being used to, who has the permission to watch the data and when sets the limits for the data. In complex environments, conflict of interest occurring because the consent given doesn't always guarantee that the care by mHealth for example is made with no further intensions in business for example.

6.1. CONCLUSIONS AND SUGGESTIONS

It can be concluded that this thesis was able to fulfill the targeted objects to reach the aim. This thesis was able to form a picture of what is mHealth and identify current main ethical challenges of mHealth in the field of research literature and compare them to Finnish context. This thesis also was able to evaluate possible ethical challenges that can be identified in the field of mHealth and to analyze different discussions and literature of ethics landscape of mHealth.

Based on the research literature about mHealth and its ethics, this thesis was able to find, identify, categorize and crystallize the main ethical challenges in the field of mHealth, although the authors occasionally disagreed about the main ethical challenges. These main categories are privacy, security, conflict of interest, justice and consent. Some researchers discussed very selectively about the ethical concerns they found most important, but it was clearly that privacy and confidentiality were the most common ethical challenges discussed in many of the articles. For example autonomy and conflict of interest were not found in every research, so it can be concluded that these ethical challenges are not as commonly identified among researchers. Also the theme justice was not very commonly found in the literature.

It is in any case important to keep in mind, that all these ethical aspects of mHealth are tightly intertwined together and are mirroring each others. It is not easy to differentiate and analyze only one ethical aspect and it is even not a fruitful approach. Considering the safety and ethics of mHealth, all these different aspects of ethics should always be taken into account in developing new mHealth applications or enhancing the existing ones. It can be though concluded that more efforts should be put to enhance the ethics of mHealth and safety of their

users. In conclusion mirroring the analyzed literature, it can be said that ethics are really important aspect of mHealth and should be always be taken account carefully.

Concerning the Finnish literature, it was possible to notice an interesting fact, that mHealth is used in Finland in psychiatry and in therapeutic interventions. It was not possible to find as strong connections with mHealth devices and psychiatry from global literature. It was notable that in Finland the ethical discussions has not focused on other than depression treatment on the basis of scientific literature, which is not surprising as the amount of academic researchers and academic resources in Finland are limited and research mostly about depression follows the national challenges in the society and in healthcare of Finland.

Though the Finnish literature was small and limited, it is possible to see that mHealth has already been a good help in this medical field. Especially online therapy on depression is already a used type of care. This example shows that mHealth has a lot of potential in Finnish healthcare and would also be useful in other medical specialities than psychiatry. It is also likely that different mobile devices will get more common in Finnish medicine, also in other medical specialities. On the basis of analysis, Finnish healthcare professionals and user patients should take into account these challenges. I concluded two examples. For example security would be really important: An example of breach of privacy and confidentiality, a case of private company security breach.

As said earlier, two most occurring global ethical themes were found which were privacy and confidentiality. They are the most commonly occurring through in most of the literature in this thesis but with the distinction that in Finland there is no further ethical discussions about this topic. Still it was possible to find some discussion on confidentiality also in Finnish context. It can be concluded that from the Finnish perspective, not many research articles were made on the subject of mHealth ethics in Finland. Articles focused more on the confidentiality, but not on the autonomy, consent, justice perspectives or conflict of interest. Some discussion on the cost-saving aspect was made and concluded that mobile health applications could be a supporting technology in healthcare. There is a need for more further research of ethics in mobile health in Finland. The situation of mHealth ethics is still not well researched topic in Finland, so now would be a good opportunity to develop more ethically planned applications to Finnish context. Developers and medical professionals should take into consider these globally found ethical challenges in their work.

This thesis was a deepening overview of the literature done in recent years about mHealth and its ethical challenges. It opened a clear look for the main research literature. While this thesis was a good opening, additional research is important to make. Interesting subjects for future research would be to identify, how these ethical challenges vary depending on the application of mHealth used. The other interesting research topic could be to deepen the knowledge about the different ethical challenges observed in the field of mHealth: it would be interesting to research, how these detected different ethical challenges could be fixed in the field of mHealth.

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ANNEXES

No annexes.