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Björn Ahlskog

Exploring User Experiences of Chat Triage Efficiency Using a Self-Triage Tool: A Multifaceted Approach.

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<p>The purpose of this study was to explore health care professionals (HCPs) experiences regarding efficiency, using a self-triage tool (HTIA) in remote triage chat. In cooperation with a private health care provider, I investigate associations between using the HTIA tool and efficiency with the aim to learn if chat processing time is reduced when HCPs are using the HTIA tool in addition to what aspects of the tool is most valuable in helping to reduce chat processing time.</p> <p>Using a multifaceted approach, examining chat processing time of 22 HCPs, before and after the introduction of the HITA tool for a total duration of eight months in addition to utilizing an online questionnaire answered by 14 HCPs of the same employee group at the private health care provider offering remote triage. Thematic analysis was conducted using interviews with four HCPs that earlier participated in the questionnaire.</p> <p>The results show a decrease in chat triage processing time by 44% on average after the HTIA tool had been in use for eight months. HCPs using the tool attributed the HTIA tools' ability to present background information about the patient directly at the start of the chat conversation to the decrease in processing time. Alternatively, the user believes that the user interface (UI) is the main obstacle in optimizing chat processing time. This is due to the presented patient information, which, in some cases, was perceived as unclear.</p> <p>The study shows the HTIA tool to be effective in helping HCPs reduce chat processing time but are facing UI challenges hindering optimal efficiency. Further development of the HTIA tool by utilizing user expertise, can be beneficial for health care providers to maximize its usefulness and financial benefits.</p>	
Keywords	Self-triage, Remote triage, Digitalization, Chat triage, Efficiency

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Appendix 1. Questionnaire

List of used concepts

CDSS - Software aiding decision making by analyzing patient data, offering recommendations for diagnosis, treatment, and care based on algorithms.

E-health - Electronic health, refers to the use of information and communication technologies (ICT) in the health care sector.

HCP – health care professional. In this study HCP refers to medical doctors, registered nurses, public health nurses, paramedics and midwives.

HTIA - Self triage – The use of digital tools to evaluate health concerns based on symptoms and medical history.

Online symptom checker - Web tool providing potential diagnoses based on user-input symptoms.

Processing time – Time used from first interaction to last in triage chat.

Remote triage – Use of technology for distance-based patient assessment.

1 Introduction

Pressure on our health care system continues to rise as the population ages, and with that, people with chronic disease (Prince, M., & Wu, F. & Guo, Y. & Gutierrez Robledo, L. & O'Donnell, M. & Sullivan, R. & Yusuf, S. 2015: 549-62). Adding to this, public sector indebtedness and a growing labor shortage are putting financial pressure on our welfare system and healthcare services (Aarnia, R. et.al. 2023a). This has increased the workload on health care professionals and lowered the quality-of-care (Mohr, D. & Benzer, J. & Young, G. 2013: 108-114). There is a need for reform in our health care system as the model of care delivery today is insufficient to handle this increased pressure.

One of the key components of healthcare reform is the incorporation of technology, particularly electronic health (e-health) systems. E-health includes the use of electronic medical records, telemedicine, and other digital tools such as decision support systems, mobile health apps, remote monitoring devices, picture archiving and communication systems, secure communication platforms, data analytics and population health tools to improve healthcare delivery and outcomes. The use of e-health systems can improve the efficiency of healthcare delivery by allowing for easier access to patient information and more efficient communication between healthcare providers. (Stoffers, J. 2018: 146-148; Eysenbach, G. 2001: 20). Mobile health applications are a versatile software program designed for mobile devices and usually incorporate many of these functions and can sometimes be used offline. Mobile health apps can be used for advanced monitoring and tracking of vital signs with the help of sensors to educational purposes and accessing of medical history. (Pires, I. et.al. 2020). Recently digitalization of our health care system has involved artificial intelligence (AI) and data generated from health care services and social welfare. Data generated, refers to health data, medication information and treatment data. In a 2023 study done by the Finnish innovation fund (Suomen itsenäisyyden juhlarahasto) Sitra called "Terveysdata 2023 - projekti" it was estimated that proper handling of patient data and the involvement of AI could save an estimated EUR 770 million annually and free up to 5,000 nurses and 1,300 doctors for clinical work (Aarnio, R. et.al. 2023b).

Traditionally triage has been done by in person visit or via telephone. Triage out of hours has been done by telephone since 1992 in Denmark to reduce the home visit workload for doctors (Christensen, MB & Olesen, F. 2008). But in the age of widespread internet connectivity, other e-Health solutions have given health care professionals (HCPs) the possibility to explore other alternatives. One alternative, as this thesis explores are chat as a triage tool, but other alternatives include online symptom checkers and digital forms, that patients fill out, to be reviewed by an HCP at a later stage. (Eminovic, N. & Wyatt, J. & Tarpey, A. & Murray, G. & Grant, I. 2004a). These kinds of solutions have been piloted in a variety of environments globally with different degrees of success. Online chat is a triage tool that allows patients to communicate with healthcare providers through text-based messaging, typically through a website or a mobile app. (Bashshur, L. et.al. 2016) In the context of healthcare triage, online chat can be used to provide patients with quick and convenient access to medical advice and information.

Online chat, equipped with the ability to receive images through the software, offers a significant benefit in enabling the patients to obtain medical advice and information without the necessity of visiting a physical healthcare facility, thereby mitigating the risk of contaminating other patients or oneself in the case of infectious diseases. This is particularly pertinent in cases such as the evaluation of conditions like chickenpox. (Eldh, A.C. & Sverker, A. & Bendtsen, P. & Nilsson, E. 2020) Other benefits include the possibility to get instructions in written form, that patients can review again if needed. This also benefits patients that has auditory impairment. Furthermore, remote triage is particularly beneficial for patients who live in remote or underserved areas, or who have mobility or transportation issues, hindering them from a in person visit with an HCP.

It can be argued that the optimal design for tools used to communicate with patients remotely is still not found and there are a lot of different aspects around e-health solutions that requires further research and development. Another challenge is developing e-health communication tools that are user-friendly and accessible to patients with varying levels of technological literacy. The tools should be designed in a way that is easy for patients to navigate and understand, regardless of their level of familiarity with technology. Additionally, there is a need for further research to determine the most effective

ways to integrate e-health communication tools into existing healthcare systems and processes. This includes identifying the best ways to incorporate these tools into clinical workflow and ensuring that they are compatible with other digital tools and systems used by healthcare providers. (Eldh, A. & Sverker, A. & Bendtsen, P. & Nilsson, E. 2020: e19085).

The study was conducted in Northern Ostrobothnia region in Finland with approximately 400.000 habitants. The chat triage service is provided by a private health care provider in the region. In Finland, private health providers have a significant role in the healthcare system, besides the public sector.

Private health care providers including companies, independent practitioners, organizations, and foundations, contribute to more than a quarter of all social and health services in the country. They can offer their services to the public sector, occupational health for companies, but also directly to citizens, covering both primary healthcare and specialized medical care. Private health services in Finland receive partial subsidies from public funds, with Kela offering reimbursements for medical expenses. To operate, private healthcare companies are required to obtain a license from a Regional State Administrative Agency or the National Supervisory Authority for Welfare and Health called Valvira. (Finnish national contact point. 2023)

This study compares the processing time for patient contacts before and after a self-triage tool (HTIA; Hoidon tarpeen Itse Arviointi) was introduced to the triage chat. The tool itself is a questionnaire that patients fill out before he/she virtually meets the HCP. The questionnaire involves questions around the patient's health history, medications, and symptoms. The self-triage tool presents all this information to the HCP and an open chat dialoged is then established. HCP that takes part in this study works for a private health care provider that handles chat contacts from patients in the Northern Ostrobothnia region continuously.

This study aims to explore the experiences regarding efficiency of health care professionals using a self-diagnostic tool.

2 Background

Studies have been done in Finland and abroad to get a better understanding of the software tools used in remote triage and other types of decisions making, mainly to address the overcrowding in the emergency departments (Bunn, F. & Byrne, G. & Kendall, S. 2005: 956-961). The word triage comes from the French word “trier” and means “to sort”. In a health care setting the word triage refers to the act of prioritizing patients, often in a manner of color, number, or letters, to get an overview of who are in most urgent need of medical attention. This is routinely done by HCPs at emergency rooms with the intention of “doing the greatest good for the greatest number” (Christian, M. 2019). Remote triage is triage done at a distance and often is referred to as telehealth or telemedicine triage. Telemedicine is a subset of telehealth and refers to the delivery of a clinical service in place of an in person visit, while telehealth is a broader term and can refer to a service that does not provide any clinical decisions. Telemedicine then, is a real time digital interaction with the possibility to diagnose and treat health condition. (Kobeissi, M. & Ruppert, S. 2021). For this thesis I choose to use the word remote triage as the chat interactions between HCPs and patients in the study will include both telehealth and telemedicine aspects, but the focus on chat interactions is to make a triage decision.

The Cambridge English dictionary defines efficiency as:

The quality of achieving the largest amount of useful work using as little energy, fuel, effort, etc. as possible (Cambridge university press. n.d)

In this study, efficiency is defined as the pace at which an HCP can process a chat contact with a patient, focusing on gathering the relevant information more quickly for potential triage evaluation, rather than the expectation for the HCP to perform the triage evaluation itself at a faster rate. At the private health care provider where this study takes place, there is no clearly defined processing time, or time an HCP could be in contact with a patient to be regarded as fast, of efficient. But contacts over 10 minutes was usually seen as slow by the HCPs and under 10 minutes as fast. At this department that

handles the triage chats, the chat process before the HTIA introduction was an open dialog between the HCP and the patient.

2.1 Computerized decision software

The HTIA tool can be interpreted as a computerized decision software (CDSS). Previous studies have focused primarily on the safety on these tools and the user and patient satisfaction when using CDSS in a remote triage setting. It has been used by physicians to gather patient information and health data to get a better overview and improve triage outcome. (Osheroff, J. et al. 2012). CDSS are a software not intended to replace the HCPs clinical assessment, but to support the decision making and reasoning. CDSS is primarily used, besides to support decision making, to reduce workload and medical errors, to standardize triage decision making and avoid unnecessary hospital visits and costs (Huibers, L. & Smits, M. & Ranaud, V. & Giesen, P. & Wensing, M. 2011: 198-209), Huibers, L. & Moth, G. & Carlsen, AH. & Christensen, MB. & Vedsted, P. 2016: 667-673), (Monaghan, R. & Clifford, C. & McDonadl, P. 2003: 209-216). While CDSS has been useful in primary care to support decision making and the triage process, their effectiveness is still not clear. There are reported barriers to the use of CDSS efficiency as it can interrupt workflow, increase cognitive load, reduces the time HCPs have physically with their patients, make data entry more complex and increases the time required to complete their task (Harada, T. & Miyagami, T. & Kunitomo, K. & Shimizu, T. 2021:16a).

2.2 Triage chat

Chat as an online tool to aid with triage and diagnosis has been developed for a decade, but it is still to be determined where and when it is appropriate to use. A study in Sweden done in a primary health care setting confirms other globally done studies of the complexity of implementation. Chat software implemented in health care organizations has been perceived as easy to use by health care professionals and patients but has been complicated to utilize. Advantages in the use of chat has been the possibility for asynchronous communication, the use of pictures to help triage and enabling of resources for clinical work. Barriers was shown to be a lack of health and digital literacy for accuracy

and requires in-house solutions to be developed for optimal use (Eldh, AC. & Phil, D. & Sverker, A. Bendtsen, P. & Nilsson, E. 2020).

In a small study by Aminovic, K. & et.al. in England 2004, processing time has been observed to be twice as long compared to telephone calls when observing a pilot project in the National health service (NHS) and the introduction of chat as a triage tool for non-urgent patients. The patients in this study also filled in a questionnaire about their health before they met an HCP that assessed their problem with the help of information gathered previously (Aminovic, K. & et.al 2004: 17.)

2.3 Online symptom checkers

Online symptom checkers as a tool by patients to seek guidance about their health before they get in contact with the health care professionals has been studied in Finland in 2020. Online symptom checkers usually serves two functions for the patient. One of them is to facilitate a self-diagnosis in addition to function as a triage tool. In primary care these tools functions to relieve the telephone triage line. The symptom checkers usually provides a list of probable diagnosis in the rank of likelihood and guides the patient to seek care at the right lever of urgency, if at all. (Semigran, HL. & Linder, JA. & Gidengil, C. & Mehrotra, A. 2015) Previous studies have focused on nurse's experiences using this tool, and the results have been mixed. For some HCPs the symptom checker tool has caused a bigger workload, but they see the opportunity for self-triage tools to save resources and minimize the workload. The study concludes that the symptoms checker was useful as it provided the HCP with information about the patient before meeting them, but less than half concluded that the tool would not be efficient in their work. (Kujala, S. & Hörhammer, I. & Hänninen-Ervarsti, T. & Heponiemi, T. 2020: 966-170). A 2021 study has evaluated the efficiency of a e-triage tool used by an operative spinal care provider to determine patients in need of a spinal surgeon consultation and clinical evaluation. The study concluded that the e-triage tool was efficient as it assisted the health care provider in avoiding thousands of unnecessary clinical visits, about 30% of all contacts were deemed not to need surgical intervention under a four-year period (Cui, S. & et.al. 2021: 779-784.)

Much of these aspects of remote triage has been explored by researchers for over a decade by studying remote triage by telephone in different settings, chat triage, symptoms checkers and self-diagnostic tools to Artificial intelligence (AI) assisted remote triage in a mass casualty setting. Remote triage studies have increased in the last few years as the Covid-19 pandemic demanded alternative solutions to assess patients' well-being without physical contact. The implementation of remote triage in large health care systems has also been researched by Lewinski, A. & et.al in 2021 by doing a qualitative evidence synthesis of 32 studies. The study concluded the importance of pre-implementation planning as well as the evaluation of remote triage by collecting data pre and post remote triage implementation to ensure success and continued adoption of remote triage in health care systems (Lewinski, A. & et.al. 2021).

2.4 HTIA tool

The HTIA introduced in this study enables the use pre-filled data about the patient, including name, social security number, location, and age. In addition to this the patient has the use of filling out their symptoms and relevant information about them. This enables the software to work as a CDSS for the health care professional with suggestions of possible diagnosis in the form of ICD-10 (International Classification of Diseases 2010) and ICPC-2 (International Classification of Primary Care). In addition to this the patient can write an open text about their health concern. This information is presented to the HCP when they accept the chat request, and the triage process begins.

3 Purpose, aim and research questions

The purpose of this study is to investigate the association between the introduction of the HTIA self-diagnostic tool in a remote triage chat and its influence on efficiency in the triage chat process. This to get insight to what could be improved, helping HCP in the chat triage process and subsequently help more patients.

In order to achieve the aim of this study the following objective have been established:

1. Examine the chat processing time pre and post introduction of the HTIA self-diagnostic tool to get an understanding of its efficiency in the triage process.
2. Study aspects of the tool HCPs perceive as beneficial to the efficiency of the triage process.
3. Gain deeper insights into the tool's pain-points and aspects HCPs find helpful.
4. Identify key aspects that can provide guidance for the future development of these tools.

These objectives collectively aim to provide a thorough assessment of the effects resulting from the introduction of the HTIA self-diagnostic tool in a remote triage setting, particularly regarding its impact on efficiency and the HCP perceived experience of using it.

Research questions are:

1. In remote triage, is the chat processing time reduced after the introduction of a self-triage tool?
2. According to Health Care Professionals, what aspects of the self-triage tool have been efficient in reducing chat processing time?

4 Setting

The study was conducted for a private health service provider under contract of Northern Ostrobothnia Hospital district with around 400.000 habitants. The private health care provider has a digital division, giving health care services to patients remotely. One of the digital services are a triage division, where patients can be in contact via telephone or chat to get help with triage in emergency and urgent situations. The HCP does remote triage and refers the patient to the right level of care. This is a 24/7 service and are free of charge for the patient. The unit have ~30 HCPs and approximately 8000 remote triage

contacts every month in 2022 of which 650 was via chat. The HCP doing remote triage chat will also do triage via telephone and other digital channels online, during their working hours. The author has worked as an HCP for the health care provider in this study and have experience in using the self-triage tool.

5 Methodological approach

Methodology describes in detail how the researcher gathers data, what methods is used to gather statistics, how the data is interpreted and what conclusions is draw about the research data. Murthy and Bhojanna describes methodology in research as a blueprint followed throughout the study until completion. (Murthy & Bhojanna, 2009, p. 32).

5.1 Design and sampling

The design of the study is a quasi-experimental intervention study (sometimes referred to as 'natural experiment study') with a single difference impact method, as the intervention can't be assigned randomly, and a control group is not available. Quasi-experimental study was chosen as it allows for retrospective evaluation (Craig, Katikireddi, Leyland, Popham 2017: 39-56.) Furthermore, QES is a valued method of study as it also enables the researcher to evaluate changes to a system that otherwise is difficult to manipulate (Bärninghausen, Röttingen, Rockers, Shemilt, Tugwell 2017a: 4-11.) (Bärninghausen, et al. 2017b.)

5.1.1 The quasi-experimental intervention study

The study design is an interrupted time series with 50 pre and 50 post measurements from the Ninchat platform, used for the chat interaction in triage, to strengthen the design (Shadish, Cook, Campbell 2002: 157-170.) 50 pre and post measurements was deemed sufficient to get reliable data. Data gathered in the intervention study was gathered from HCPs with experience of the chat triage process and those who was newly employed or still under mentorship was excluded. The Chat process times gathered manually from the Ninchat platform was calculated in excel to get an average and standard deviation

from the data. Ninchat is a secure platform for chat, phone, multimedia sharing possibilities and videocalls with integrated statistics that allow the users to follow up on processing times, chat transcripts, chat lengths and customer satisfaction. The single impact method is the introduction of the HTIA tool. At the time of the introduction the HCPs had been using Ninchat as a software tool in triage for 9 months. When gathering data post introduction, it was gathered 4 months after introduction in to avoid unreliable data based on user error or lack of familiarity and give HCPs time to acclimatize to the HTIA tool.

5.1.2 Online questionnaire

To complement the single difference impact method, a usability study in form of a questionnaire was conducted to support the findings in form of a Heuristic evaluation. The questionnaire was sent to HCPs familiar with the chat software, and after the introduction of the HTIA tool. The questionnaire was sent by e-mail for the participants to answer anonymously. The questionnaire was designed with the aim to fill the gaps left by previous research, by answering questions that were not addressed regarding efficiency. (Kujala, S. & Hörhammer, I. & Hänninen-Ervarsti, T. & Heponiemi, T. 2020: 966-170).

5.1.3 Structured interview

Lastly, it was seen as necessary to further interview HCPs regarding what aspects of the HTIA tool they deemed efficient and what needs further development to optimize their function in their health care organization. This was seen as necessary to get a better understanding of the specifics regarding their answers. To gather participants the same group of HCPs was used when sending out the questionnaire. HCPs that had not answered the questionnaire beforehand was excluded. This interview with HCPs was structured to reduce the risk for bias and take advantage of standardized questions to maximize reliability and limit evaluation errors due to inconsistency when conducting the thematic analysis (Pettersen, N. & Durivage, A. 2008. 8-10.)

5.2 Data collection instrument

The study utilized three data collection instruments: Ninchat, interviews and a questionnaire. The chat processing time data was gathered from Ninchat as it's the only place where chat processing time data is stored. Online questionnaire was used to gather opinion about HCPs experience in using the HTIA tool. An online questionnaire was used for convenience as participants works from home and lives in different parts of Finland, and most importantly, to avoid potential personal influence in verbally asking these questions, as we are former colleagues. The eight questions asked was constructed by the author with the approval of working partners at the private hospital for this thesis.

The questionnaire and questions were specifically constructed to shed light on how the HTIA tool influence the chat triage process with a specific focus on efficiency. The tool's primary task is to provide background information about the patient and their current health status during the chat contact, aiming to minimize the amount of text HCPs need to generate while handling the chat interaction. The initial four questions in the questionnaire were formulated to capture which aspects of the information presented at the beginning of the triage process have the most significant impact on efficiency (Appendix 1). Concurrently, the remaining four questions were tailored to gain insights into the reasons HCPs might assign a low score in the initial part of the questionnaire. This approach helps identify aspects of the tool that were perceived as ineffective. In addition, the questionnaire construction was formed to identify possible design problems in the HTIA tool which could influence further development of the tool.

Since there was no suitable pre-existing questionnaire available at the time of the construction the author took the initiative to construct the questionnaire. This was done to effectively address and answer the specific aspects of the HTIA tool in consultation with partners at the private health provider to ensure their relevance.

In addition to the questionnaire, structured interviews were conducted with the same participants. This approach aimed to complement the questionnaire findings while avoiding potential biases introduced by the author. The structured format ensured consistency in responses across participants, contributing to the overall reliability of the study.

5.3 Usability testing

The usability study for the online questionnaire was unsuccessful as no participants from the test group answered the questionnaire. The test group consisted of 4 HCP working in the same department but was excluded from the main study as their employment had started after the HTIA tool was introduced. Two attempts were made by the author to perform a usability study for the questionnaire.

5.4 Data collection procedure

Dependent variable, the chat processing time, was collected retrospectively from Ninchat. To reduce the potential for research bias in pre-test and post-test of the HCPs chat processing time, every 5th contact from the Ninchat software was included until data from 50 contacts were gathered pre and post introduction of the independent variable, the HTIA tool. The data was then exported to Microsoft Excel. Data regarding the nurse's experience in using the HTIA tool was gathered by a questionnaire with questions specifically about the efficiency of the HTIA tool. The questionnaire was made by the author and accepted by working partners at the private hospital before being published. The questionnaire was answered between 24.4.2023 and 13.5.2023.

Interviews were conducted from 18.10.2023 - 10.11.2023 and e-mail invitations were sent out beforehand to HCP that already answered the online questionnaire. 4 HCP participated in the interviews. The HCPs got time allocated in their work schedule to participate in the interviews.

5.4.1 Processing time

Data regarding chat processing time was manually extracted from the Ninchat software and every fifth chat contact was analyzed regarding processing time. Data was collected manually as extractions of all data from the Ninchat software to another platform was deemed to risk patient privacy. All data was then imported to Microsoft Excel where the average processing time and standard deviation was calculated. The same process was performed for pre and post analysis of the data.

5.4.2 Questionnaire

The questionnaire was an online scaling questionnaire via the E-lomake system and composed of 8 statements regarding the HTIA tool and its efficiency. The selection of E-lomake as the platform was done as the author has access through Metropolia and it facilitated the distribution of the questionnaire to participants via a direct link and ensured privacy through password protection.

A scaling questionnaire was used as it gives the opportunity to gather the data regarding opinions in terms of numbers and the frequency of occurrence of opinions. The scaling questionnaire gives uncomplicated data to survey a specific situation and recognize overall patterns. In order to get a measurement of the variable a scaling questionnaire is helpful when trying to measure a complex variable as the statements in the questionnaire (Appendix 1) (Rowley, J. 2014). Online questionnaire was chosen as participants are located in different locations around Finland.

The HCP can choose from a scale of 1-5 if they are of the same opinion as the statement in the questionnaire or not. The scaling model has been chosen to get an understanding of how much of an impact the HTIA tool has had on the different ways it reduces chat processing time and HCP's will be excluded who have not used the chat tool at a minimum of 10 working days, before and after the introduction to reduce the maturation effect. (Appendix 1.)

The scaling questionnaire was chosen as a data collecting instrument with the focus on efficiency as previous studies have not done so to date. In addition, as this study is done in partnership with a private hospital, the aim is to get an insight into the efficiency of the HTIA tool in use and possible pain points.

5.4.3 Interviews

Interview invitations were sent out by e-mail and executed on Microsoft Teams. The audio from the interviews was recorded on an external recording device and the transcripts

written in Microsoft word. The In vivo coding and thematic analysis were also done in Microsoft word.

5.5 Analysis

Processing time data analyzed from the period without the HTIA tool in use was between the dates 1.9.2022 and 12.9.2022. Data analyzed with the HTIA tool in use was between the dates 27.2.2023 and 13.3.2023. All data was manually collected. The processing time was calculated between when the first message was sent to the last one. All data was imported and calculated in Microsoft Excel.

Information regarding nurses' experiences using the HTIA tool was gathered by a questionnaire hosted by e-lomake. Answers on the scale from 1-5 was calculated in excel to present the average number answered by the participants and standard deviation.

Interviews was transcribed in Microsoft word and the simple thematic analysis was also done in Microsoft word. In vivo coding was utilized to gather insight into HCPs thoughts regarding efficiency and ideas for development.

5.6 Ethical aspects

A consent form was sent to all HCP that were eligible to participate in the questionnaire before the questionnaire forms were sent. In the questionnaire there is an option for the participants to approve their participation based on the consent form sent beforehand.

A research permit was acquired and approved from the company beforehand, and all data is stored in line with the data protective law (L1050/2018) and TENK guidelines of the Finnish National Board on Research Integrity (Responsible conduct of research and procedures for handling allegations of misconduct in Finland 2012.) (Finnish advisory board on research integrity)

The questionnaire was chosen as a method to collect further information regarding the efficiency of the HTIA tool instead of a semi-constructed interview to exclude a personal

impact on the interviewee. The software used to gather processing time data of each chat contains patient's personal information like name, social security number and address, but this information was not gathered, recorded, or documented in any regard, likewise, the HCP information was not documented. Information regarding processing time was not gathered for the purpose of this study. All information gathered from the private health care provider is used for statistical purposes and management, which makes the information gathered regarding processing time secondary data in this study. However, the study proposal was sent for evaluation to the The Human Sciences Ethics Committee of the Helsinki Region Universities of Applied Sciences. The data gathered about processing time was stored on an external hard drive with password protection. When the external hard drive is used the computer is also protected via the private health care providers virtual private network (VPN).

6 Results

Results are presented in three sections, starting with the data from the chat processing time done with and without the HTIA tool, results of the questionnaire regarding nurse's experience of the HTIA tool and the efficiency, and lastly a thematic analysis of the interviews conducted.

6.1 Processing time

Processing time before the HTIA introduction was on average 14 minutes and 22 seconds per chat interaction. The processing time was calculated from the moment the HCP accepted the chat request until the last message was sent. Average was calculated on 50 interactions under 3 weeks. Standard deviation was 7,66 based on the same data.

After the introduction of HTIA the average processing time was 12 minutes and 11 seconds based on 50 chat interactions post HTIA introduction. A reduction in processing time by 2 minutes and 11 seconds. A decrease of 16% in processing time and the standard deviation with the HTIA tool in use was 6,59 (Figure 1).

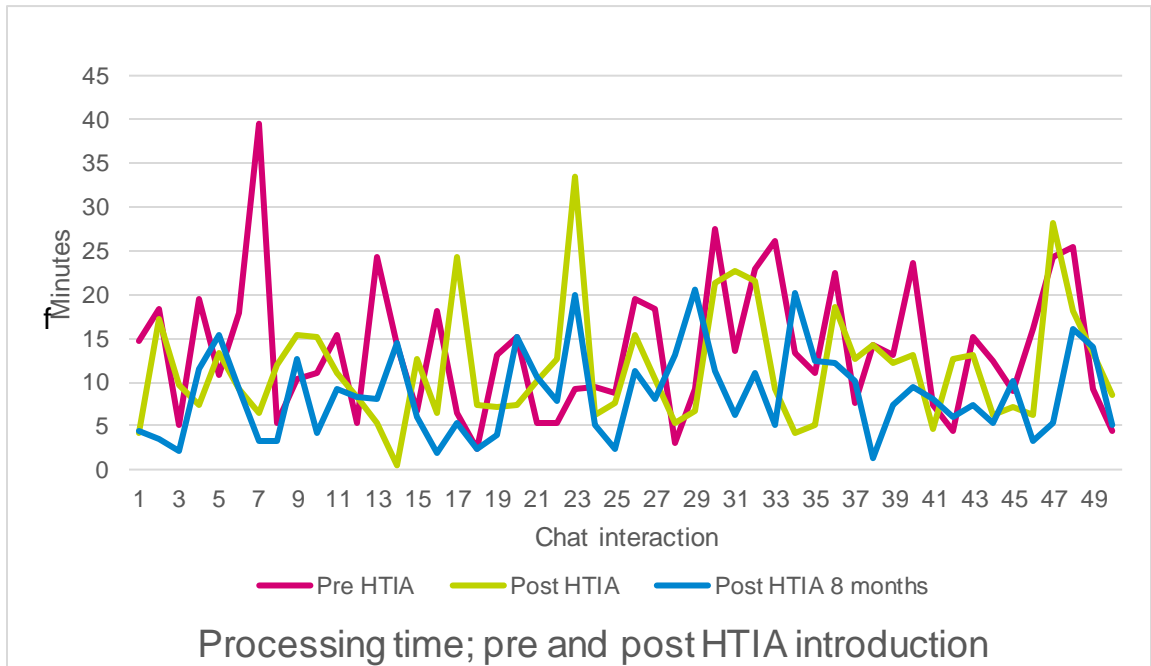


Figure 1. Processing time; pre and post HTIA introduction

After 8 months in use, the average processing time was 9 minutes and 1 seconds based on 50 contacts in September 2023. This is a decrease in processing time by 3 minutes and 1 second in average, in percent, an 29% decrease. Standard deviation was 4,94. When calculating the decrease from pre introduction of the HTIA toll, the processing time had reduced by 5 minutes and 12 seconds after 8 months of use, a 44% decrease. (Figure 1).

Table 1. Average processing time and standard deviation

	Average processing time	Standard deviation
Pre HTIA introduction	14min 22 sec	7,66
Post HTIA introduction	12min 11 sec	6,59
Post HTIA introduction 8 months	9min 1 sec	4,94

As seen in figure 1 and table 1, processing time decreases over time when the HTIA tool is in use, as does the standard deviation.

6.2 Scaling questionnaire

The online scaling questionnaire was answered by 14 participants. The results of the scaling questionnaire show consistency in participants responses when compared to each other, presented in the table below (Table 2).

Table 2. Average and standard deviation calculated based on scaling questionnaire

Do you agree with the following statement. Strongly agree – 5 Strongly disagree - 1	Average	SD
In my opinion, HTIA helps me make triage decisions quicker.	3,79	0,89
The presentation of patient history at the start of the interaction helps reduce chat processing time	4,07	0,83
Patients writes less text overall in the open chat dialogue when HTIA is in use.	4,07	1,21
I need to ask fewer questions overall when HTIA is in use.	4,18	0,60
In my opinion, open dialogue without the HTIA tool is quicker	1,9	1,00
In my opinion, HTIA makes the triage process more ineffective.	2,0	1,11
Reading and understanding the information presented by the HTIA takes more time than asking for the information in the open dialogue	2,35	1,01
I have the impression that HTIA consumes more of my time than it contributes when in use.	2,21	1,19

6.3 HTIA efficiency insights

Interview findings reflects results from Ninchat data gathered regarding processing time and the online questionnaire sent out before the interviews was conducted. The interview sheds light on what aspects of the HTIA tool was most beneficial regarding efficiency and so, answering the second research question. Aspects of the tool that presented information about the patient's medical history and relevant symptoms was seen as most beneficial and mentioned the most by all participants. Overall, there was 8 themes that

HCPs mentioned in the interviews overall, helping them to be more efficient. Five themes were identified concerning aspects of the HTIA tool that negatively impact its efficiency, although these were mentioned infrequently in comparison to the positive aspects.

6.3.1 Aspects of HTIA improving efficiency

Themes of aspects improving efficiency presented in here in table 3. In addition to how many times each theme was mentioned overall in all 4 interviews and by how many participants it was mentioned. Some themes overlap each other, but it was deemed necessary to distinguish between 8 different themes to give a comprehensive overview.

Table 3. Aspects of HTIA improving efficiency.

Improving Efficiency	f	N
Improved display of symptoms	10	4
Fewer questions required	8	4
Quick overview of patient status	5	4
Identification of absent symptoms	5	3
Assist is prioritizing triage cases	4	1
Capability to guide patient directly to appropriate location	3	2
Medical background presented makes triage quick	3	3
More detailed presentation	2	1

The most common theme mentioned was the improved display of the patients' symptoms that the HTIA tool provided. HCPs mentioned how it helps them to be more efficient when all symptoms were presented at once when they first meet the patient, providing a great overview without having to ask a lot of questions. One HCP said:

"The greatest impact is that the customer describes their symptom more clearly. So, when I open the chat, I already see that the question is about ... a sudden rise in temperature ... and they describe other symptoms that help, so I don't have to ask each one, thus the initial situation is described clearly. They have already outlined their symptoms."

This was mentioned by all 4 participants expressed in different ways and was an occurring theme throughout the interviews. The HCPs participating all also mentioned that they are required to ask fewer questions when HTIA is in use. This reflects the results in the online questionnaire where the average score was 4,18/5 when asked their opinion about the need to ask fewer questions when HTIA is in use. There are multiple reasons for this and relates in part to the presented symptoms mentioned above. When asked in what areas the HCP can leave out questions she mentioned:

"Symptoms... background information, well, those patient details, background information, anamnesis, underlying conditions, medications, if they have been entered, they assist in that."

These same aspects were mentioned by all participants when they talked about how HTIA provided a quick overview of the patient situation as all information was presented at once and it requires little time to get a first impression of what type of help the patient need. Once participant mentioned another point of view, that HTIA can help to assist in prioritizing triage cases, not mentioned by others when speaking of the benefits of a quick overview of the patient situation, besides efficiency.

"If you consider that you are on the phone (Phone triage) and managing a chat simultaneously, and during the phone call, there might be even two chats coming in, so you can immediately glance at the HTIA tool when you pick up those chats to see what this person's urgency is. If, for instance, it's a flu, you can see that this person is not in a life-threatening situation, or you can see that there is a serious issue here, so you can take maybe the latter chat as this is a more urgent matter... So, you can prioritize, ensuring that customers who genuinely need assistance get it more quickly. If there are multiple chats open, you can quickly identify which ones are most urgent."

Highlighting the importance of quickly getting information about patient's symptoms, all participants, except for one, mentioned the significance of also knowing about the symptoms the patient does not have. Asking what symptoms, the patient does not have often helps the HCP in triage.

“Well, there the customer has made the assessment themselves, like they've pre-filled all the symptoms, and most people have even included details about how many days the symptoms have been present. Also, they've indicated what they don't have, with most specifying the absence of certain symptoms. This way, there's no need to ask if they still have those. For instance, if someone indicates having the flu, they mention having a cough and note the absence of shortness of breath. Then there's no need to ask further.”

Two participants mentioned that when the HTIA is used by the patient in a way that gives the HCP all relevant information, it is possible to guide the patient directly to the right place without asking any additional questions.

“Often, the HTIA questions can be so comprehensive that based on it, you can directly inform the customer, "Hey, I'll guide you straight to the emergency room," without necessarily needing any additional questions. So, it's possible to decide directly just based on that. Sometimes, additional questions may be asked, but quite often, it can be done solely on that basis.”

That the HTIA tool gave the possibility to present their medical history was also mentioned by all but one participant, not only what is their current condition.

“He (The patient) might have the flu, and then he mentions that he might have chronic obstructive pulmonary disease or asthma, for example. Well, that helps to consider it, so that someone with asthma is more likely in need to be directed to a doctor, whereas someone who is fundamentally healthy (without any significant underlying health issues or chronic conditions). It assists in that way.”

Lastly one participant mentioned that she had the impression that patients was giving the HCPs more detailed presentation of their situation and what they needed help with when HTIA is in use.

“The patient writes, in my opinion, more text when this is in use (HTIA) because they describe the symptoms a bit more precisely. If it's not in use, and the patient begins with 'I have had a fever today,' I ask if they have any other symptoms, and they respond, 'maybe a little sore throat.' So when this tool is in use, they describe more details, for example, that 'I don't have... like... a sore throat or a headache,'

or other things, so you can see it right away. You don't need to kind of extract those symptoms multiple times with many questions."

6.3.2 Aspects of HTIA tool with negative impact on efficiency

While most themes regarding efficiency was positive in the participants opinion there was a few themes that was recurring in the interview with negative impact on efficiency. There were only 5 themes overall and two om them mentioned only by one participant. None of the themes was mentioned by all participants. The themes are presented in table 4 below.

Table 4. Aspects of HTIA weakening efficiency

Weakens Efficiency	f	N
Copying HTIA text to patient register involves challenges	3	2
Challenges understanding context of symptoms presented by patient	3	2
Unnecessary information	2	1
HTIA presented text can be confusing	1	4
Differences in HTIA presented info and what patient writes in open dialogue	1	1

It was mentioned by 2 HCP that copying text the HTIA tool provided caused issues when pasting it into patient journals. When writing in the patient journal about the triage and guidance the HCP has given the patient, the participants usually copied the text directly from the chat into the patient journal to save time, but text from the HTIA tool was perceived as too confusing and usually had a lot of extra signs, letters, and numbers not relevant to the text.

“When, for example we are talking about patients in healthcare and HTIA seems to be intended for occupational health care mostly, as it talks about clients. And then there's the part that, for example, a cough has been for three days, a runny nose for two days. Then if you adjust the text, like removing the commas and parentheses, it takes time. Some specific things need to be removed, so that it's like fluent Finnish.”

When doing triage by telephone the participants mentioned that they often emphasize that the patient tells what symptoms they have at this moment, what is the situation right now. Patients use the HTIA it has happened that patients mentions symptoms that are not relevant at the time of the triage chat contact. This can be difficult for the HCP to understand the context of. One participant talking about how patients could be urged to use the HTIA tool as when they would tell their symptoms by telephone when in need of urgent care.

“A bit like in phone calls, asking why are you calling now? What's the reason for calling now? So, it doesn't start describing that their shoulder has been sore for three weeks, but now they also have a fever.”

Participants also noted instances where patients expressed symptoms during the open dialogue that were not included in the symptoms presented in the HTIA. Additionally, there were cases where the HTIA displayed information, such as parents appearing as adult patients due to logging in via online banking authentication, but in the open dialogue, they provided symptoms for their child.

“What mainly comes to mind when writing on behalf of someone else, for example, on behalf of a child. It's quite a thing where you must look at... um... there is the mother's information and there is the child's information, and you must be very careful about who the patient is and who is handling the matter, and so on.”

These last three themes mentioned by participants is intertwined in the quotations mentioned above. Unnecessary information, confusing text presented by the HTIA tool and the differences in presented information by the patient in the open dialogue versus by the HTIA tool was mentioned only one or two times. The theme mentioned by all the participants was the fact that the text presented by the HTIA tool can be confusing. It is presented by the participants as an issue in the HTIA software itself, that numbers and symbols are added in the text by the software that has no relation to the patient information.

“Well, yes, you must read that text a couple of times, or even three times, to understand what the patient means, when there are indeed those commas and parentheses ... But yes, when you read it a couple of times, it does become clear.”

7 Discussion

The findings in this study are in line with the hypothesis and answers the first research question. Triage is more efficiently done by participants in this study when the HTIA tool is in use. By reducing the processing time by 44% on average after the introduction of the HTIA tool, it's effect on HCPs work is quite clear. The online questionnaire and the follow up interviews support this statement as majority of HCPs participating in the questionnaire believed the HTIA tool helped them make triage decisions faster and could process chats faster based on the information the HTIA tool gave them (Table 2.)

7.1 HCPs identified factors influencing efficiency

The HCPs attributes this to a few things but reasons that bare the most weight is all the information presented at once when patients meet the HCP. This information has been more tedious to get before the introduction as the HCP has been forces to ask after all symptoms, medical history, and medications separately if the patient has not presented all this information spontaneously. This is reflected in table 3. The HTIA tool offers the patient the possibility to present their situation so clearly that they can be sent to the right

place of care without further questions on some cases. It could be argued then, that the HTIA tool in some cases can be 100% effective in its intended purpose, to make the chat triage process more efficient, as the HCP in these cases has not needed to ask any further questions at all. When the HTIA tool is used to its maximum, it provides the HCP with information regarding symptoms, and symptoms they do not have, anamnesis, medical history, medications, age, where they are located and how severe their symptoms are. Of all this information mentioned, symptoms presented by the HTIA tool seems to play the most crucial role as it is mentioned by all the participants in the interview and in addition to being mentioned the most. This answers the second research question.

Conversely, what has slowed the triage process down the most seems to be in the user interface (UI) aspect of the tool as it was the only aspect mentioned by all the participants and one of two mentioned the most, that copying text from the HTIA tool involves challenges (Table 4).

7.2 Aligning study results with earlier research

Previous studies where tools resembling the HTIA tool as have been used, has not presented any data about their effectiveness or efficiency. This is mentioned in the use of CDSS as a tool to help in triage. (Harada, T. & Miyagami, T. & Kunitomo, K. & Shimizu, T. 2021:16b). The same study presents HCPs perception of using the tool and mentions possible barriers to its effectiveness, as interrupting workflow, increase cognitive load, reduces the time HCPs have physically with their patients, complex data entry and increases the time required to complete their task. (Harada, T. & Miyagami, T. & Kunitomo, K. & Shimizu, T. 2021:16c). This is not reflected in this study as the data of chat processing time, online questionnaire and interviews indicate the opposite.

A lack of health and digital literacy as show to be a barrier in previous study mentioned above, but it does not directly mention efficiency. (Eldh, AC. & Phil, D. & Sverker, A. Bendtsen, P. & Nilsson, E. 2020). Participants in this study mentioned in the structured interview that they sometimes had difficulties understanding the context of symptoms presented by the patient, that there sometimes was unnecessary information and that the information presented by the HTIA tool, filled out by the patient, and the information

in the open dialogue written by the patient could differ from each other and cause confusion. This could be explained by a lack of health and digital literacy by the patient as mentioned (Eldh, AC. & Phil, D. & Sverker, A. Bendtsen, P. & Nilsson, E. 2020) but other factors contributing to this cannot be excluded.

Online symptom checker as a tool to relieve the triage telephone line was believed to not be efficient in their triage work as concluded by some HCP (Kujala, S. & Hörhammer, I. & Hänninen-Ervarsti, T. & Heponiemi, T. 2020: 966-170). Comments on what aspect about the symptom checker tool could be efficient in doing their work, HCPs commented that the tool was useful in providing information about the patient before they met the HCP and saw that the self-triage tools could provide opportunity to save resources and minimize workload in the future. It is important to note that the mentioned study did not use the same tool as in this. The comments partly reflect the results in this study, that presentation of the patient situation before contact is perceived as most beneficial regarding efficiency in remote triage via chat.

7.3 Associated consequences of HTIA implementation

The result of this study suggests that a HTIA tool provided to HCP when doing remote triage in this setting makes their triage process more efficient and reduces their workload. This study also suggests that the exchange in text when communication with a patient is the factor contributing most to inefficiency, not decision-making regarding triage, communication difficulties or the IT platform. The HCP also improved their chat processing time over the time the study continues which indicates that HCPs will get more efficient given time to use the tool.

Lastly it suggests that it would be beneficial to health care providers that provides remote triage chat as a service to invest in a HTIA tool to improve efficiency. There should be a focus on the UI aspect of the tool to minimize confusion for HCPs and maximize the possibility for patients to provide information about their situation in detail for the triage process to be as efficient as possible.

7.4 Reliability and validity

Reliability in research describes how far testing can be done to produce the same results with the same tool to produce the same results if no other factors have changed. Validity can be described as the closeness of what we believe we are measuring to what we intend to measure (Roberts, P. & Priest, H. 2006)

To ensure utmost efforts in reducing reliability and validity precautions have been implemented throughout the thesis process. Data regarding chat processing time has been documented to be gathered between specific dates and what specific order to facilitate for control. Precautions has been taken not to include HCPs who was newly employed and not familiar with the HTIA tool. In addition, sampling started 4 months after introduction to reduce errors in data due to HCPs not being familiar with the HTIA tool.

When constructing the online questionnaire, consultations regarding questions was done with working life partner and management at the place of study to reduce bias in questions and ensure that the questions was structured in a way to answer the research question as directly as possible. An online questionnaire was chosen to avoid respondent bias and reactivity as most participants was familiar with the author. As the questionnaire is presented in this study it is simple to replicate the study in a similar setting.

Conducting the interview, a model of structured interview was chosen to avoid influence by researcher in addition to an effort to be consistent in what questions was asked regarding to efficiency and based directly on the online questionnaire. The method of in vivo coding was used to ensure the usage of the participant's exact words. Audio recording, coding documents and thematic coding documents are saved to ensure simple control.

The results chapter of this study includes previous research results different to what is shown in this thesis and results are reflected back to other previous research.

The validity of this thesis is enhanced by triangulating results obtained from Ninchat processing logs, the questionnaire, and interviews. These varied sources of data align and corroborate with each other, indicating consistent findings.

There are limitations of this study, firstly in the manner of a small sample size for the online questionnaire of 14 participant and an interview sample of 4 participants. This study took place in an urgent care setting where HCPs focus is guiding patients to emergency or urgent care facilities and other groups of patients not in need of these services are often referred to other places of service. In addition, HCPs in this study works with remote triage with other tools in addition to chat, as telephone and other online software, so their focus is not concentrates to only the online chat tool studied.

The pilot testing of the online questionnaire in this study failed, as no participants included in the pilot study replied to the questionnaire. Questions in the online questionnaire was presented to the participants in the Finnish language and in this thesis in English. In addition, quotations from the transcript are presented in English but are transcribed in Finnish as the interview was done in the Finnish language. The author is proficient in both languages but has used software to translate as Google translate, DeepL translator, Oikofix and OpenAi ChatGPT (GPT-3.5 architecture) to verify translations of all text.

8 Conclusions and implications for further research

It is recommended for future research to study HTIA tools in both the public and private sector spanning over a broader spectrum, to include primary care and occupational healthcare, to name a few. This would give a more extensive insight into what aspects of HTIA tools could be further developed in the future. As AI solutions become increasingly integrated into our healthcare system, the field of remote triage is likely to explore ways to incorporate AI forthcoming. It is advisable to investigate which aspects of this emerging technology can be implemented as the it advances. This ensures that healthcare providers (HCPs) and patients can fully leverage the benefits of this evolving technology in the future.

References

Aarnio, R. & Drakvik, E. & Kalliola, M. & Lehto, P. & Lehtonen, K. & Malkamäki, S. & Piha, T. 2023. Datasta voimaa sote-järjestelmään. Sote-dataa hyödyntämällä parempaa hoitoa ja kustannussäästöjä. <https://www.sitra.fi/app/uploads/2023/05/datasta-voimaa-sote-jarjestelmaan.pdf>. Accessed 5.10.2023.

Bashshur, R. & Howell, J. & Krupinski, E. & Harms, K. & Bashshur, N. & Doarn, C. 2016. The empirical foundations of telemedicine interventions in primary care. *Telemedicine and e-health*, 22 (5), 342-375.

Bunn F, Byrne G, Kendall S. The effects of telephone consultation and triage on healthcare use and patient satisfaction: a systematic review. *Br J Gen Pract*. 2005;55(521):956–961.

Bärninghausen, T & Röttingen, JA. & Rockers, P. & Shemilt, I. Tugwell, P. 2017a Quasi-experimental study design series - paper 1: Introduction: two historical lineages. *J Clin Epidemiol* 89, 4-11.

Bärninghausen, T. at al 2017b Quasi-experimental study design series- paper 4: Uses and value. *J Clin Epidemiol* 89, 9-21.

Cambridge University press. n.d. Efficiency. In Cambridge dictionary. Retrieved 3.11.2023. <https://dictionary.cambridge.org/dictionary/english/efficiency>.

Christensen. MB & Olesen, F. 1998. Out of hours service in Denmark: evaluation five years after reform. *BMJ*, 316 (7143),1502-5.

Christian, M. 2019. Intensive care unit in disaster. *Critical care clinics*, 35 (4), 535-726.

Craig, P. & Katikireddi, SV. & Leyland, A. & Popham, F. 2017 Natural experiments: an overview of methods, approaches, and contributions to public health intervention research. *Annu rev public health* 38, 39-56.

Cui, S & Sedney, CL. & Daffner, SD & Large, MJ. & Davis, SK. & Crossley, L. & France, JC. 2021. Effects of telemedicine triage on efficiency and cost-effectiveness in spinal care. *The Spine Journal*. 21 (5), 779-784.

Eldh, A. & Sverker, A. & Bendtsen, P. & Nilsson, E. 2020. Health Care Professionals' Experience of a Digital Tool for Patient Exchange, Anamnesis, and Triage in Primary Care: Qualitative Study 7 (4), e21698.

Eldh, A.C. & Sverker, A. & Bendtsen, P. & Nilsson, E. 2020. Health Care Professionals' Experience of a Digital Tool for Patient Exchange, Anamnesis, and Triage in Primary Care: Qualitative Study. *JMIR Human Factors*, 7 (4), e21698.

Eminovic, N. & Wyatt, J. & Tarpey, A. & Murray, G. & Grant, I. 2004. First evaluation of the NHS Direct Online Clinical Enquiry Service: A Nurse-led Web Chat Triage Service for the Public. *Journal of medical Internet research* 6 (2), 17.

Eysenback, G. 2001. What is e-health?. *Journal of Medical Internet Research* 3 (2), 20.

Finnish Advisory Board on Research Integrity. Responsible conduct of research and procedures for handling allegations of misconduct in Finland and the RCR guidelines 2012.

Finnish national contact point. 2023. Health care system in Finland. Revised 14.6.2023. <https://www.eu-healthcare.fi/healthcare-in-finland/healthcare-system-in-finland/>. Accessed 3.11.2023.

Harada T, Miyagami T, Kunitomo K, Shimizu T. 2021. Clinical Decision Support Systems for Diagnosis in Primary Care: A Scoping Review. *International Journal of Environmental Research and Public Health*. 18 (16), 8435.

Huibers L, Moth G, Carlsen AH, Christensen MB, Vedsted P. 2016. Telephone triage by GPs in out-of-hours primary care in Denmark: a prospective observational study of efficiency and relevance. *Br J Gen Pract* 66 (650). 667–673.

Huibers L, Smits M, Renaud V, Giesen P, Wensing M. 2011. Safety of telephone triage in out-of-hours care: a systematic review. *Scand J Prim Health Care* 29 (4). 198–209.

Kobeissi, MM. & Ruppert, SD. 2021. Remote patient triage: Shifting toward safer telehealth practice. *Journal of the American Association of Nurse Practitioners*,13;34 (3), 444–51.

Kujala, S. & Hörhammer, I. & Hänninen-Ervarsti, T. & Heponiemi, T. 2020. Health professionals experiences of the benefits and challenges of online symptom checkers. *Study in Health Technology and Informatics. Digital Personalized Health and Medicine - Proceedings of MIE 2020, Studies in Health Technology and Informatics* 270, 966-170.

Lewinski. AA, & Rushton, S. & Van Voorhees, E. & Boggan, JC. & Whited, JD. & Shoup, JP & Tabriz, AA & Adam, S. & Fulton, J. & Gordon, AM. & Ear, B. & Williams, JW. & Goldstein, KM. & Van Noord, MG & Gierisch, JM.2021. Implementing remote triage in large health systems: A qualitative evidence synthesis. *Research in Nursing and Health*. 44 (1).138-154.

Mohr, D. & Benzer, J. & Young, G. 2013. Provider workload and quality of care settings: Moderating role of rational climate. *Medical Care* 51 (1), 108-114.

Monaghan R, Clifford C, McDonald P. 2003. Seeking advice from NHS direct on common childhood complaints: does it matter who answers the phone? *Journal of advanced nursing* 42 (2). 209–216.

Murthy, S.N. & Bhojanna, U. 2009. *Business research methods*. 2 Edition. E-Book. New Delhi: Excel books.

Osheroff, J. & Teich, J. & Levick, D. & Saldana, L. & Velasco, F. Sittig, D. & Rogers, K. & Jenders, R. 2012. *Improving Outcomes with Clinical Decision Support. An Implementer's Guide, Second Edition*. Boca Raton: Taylor and Francis group. 13.

Pettersen, N. & Durivage, A. 2008. The structured interview. Enhancing staff collection. Quebec: Bibliothèque et Archives Canada.

Pires, IM. & Marques, G. & Garcia, NM. & Flórez-Revuelta, F. & Ponciano, V. & Oniani, S. 2020. A Research on the Classification and Applicability of the Mobile Health Applications. *Journal of Personalized Medicine*, 10 (1),11.

Prince, M., & Wu, F. & Guo, Y. & Gutierrez Robledo, L. & O'Donnell, M. & Sullivan, R. & Yusuf, S. 2015. The Burden of disease on older people and implications for health policy and practice. *Lancet* 385 (9967), 549-62.

Responsible conduct of research and procedures for handling allegations of misconduct in Finland 2012. Finnish advisory board on research integrity. <<https://tenk.fi/en/advice-and-materials/RCR-Guidelines-2012>> Accessed 17 February 2023.

Roberts, P. & Priest, H. 2006. Reliability and validity in research. *Nursing Standard*. 20(44): 41.

Rowley, J. 2014. Designing and using research questionnaires. Online document. Manchester Metropolitan University. 4-7. Accessed 9.11.2023.

Semigran, HL. & Linder, JA. & Gidengil, C. & Mehrotra, A. 2015. Evaluation of symptom checkers for self-diagnosis and triage: audit study. *BMJ*. 351 (6), 3480.

Shadish, WR. & Cook, TD. & Campbell, DT. 2002 Quantitative research designs: Experimental, quasi-experimental, and descriptive 6, 157-170.

Stoffers, J. 2018. The promise of eHealth for primary care: opportunities for service delivery, patient-doctor communication, self-management, shared decision making and research. *The European Journal of General Practice* 24 (1), 146-148.

Illustration of Online questionnaire used

What aspects of HTIA have been effective in reducing chat processing time?

Strongly agree= 5 Strongly disagree= 1	1	2	3	4	5
In my opinion, HTIA helps me make triage decisions quicker					
The presentation of patient history at the start of the interaction helps to reduce chat processing time					
Patients writes less text overall in the open chat dialogue when HTIA is in use					
I need to ask fewer questions overall when HTIA is in use					
In my opinion, open dialogue without the HTIA tool is quicker					
In my opinion, HTIA makes the triage process more ineffective					
Reading and understanding the information presented by HTIA takes more time than asking for the information in the open dialogue					
I have the impression that HTIA consumes more of my time than it contributes when in use					
Other opinion, Please specify:					