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**Assessment of Electronic Health-Related Activities in
Psychosomatic Outpatients during COVID-19**

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List of Abbreviations

AI	- Artificial intelligence
DF	- Degrees of freedom
EHA	- Electronic health-related activity
eHealth	- Electronic health
EHR	- Electronic health record
EPS	- Electronic prescription service
Med.	- Medical
Med. Infos	- Medical information
Meds	- Medication
mHealth	- Mobile health
PPI	- Physician-patient interaction
SD	- Standard deviation

1 Introduction

The COVID-19 pandemic has led to a surge in research concerning “COVID-19” and “digitalization.” A search of these keywords yields hundreds of papers and publications. This should come as no surprise, considering that the pandemic has indirectly become a catalyst, accelerating an already evolving analog landscape into a fully-fledged digital ecosystem that we are still adapting to today. A lack of human mobility became one of the biggest factors, with the enactment of lockdown measures, social distancing guidelines, and restricted movement forcing many to be introduced to the digital world. (Rahman and Thill, 2022).

The pandemic has affected many sectors, including the medical field. The significant number of COVID-19 cases and the vast toll it has taken on medical workers have consequently led to a demand for change in the current healthcare system (Bao et al., 2020). In particular, the traditional model of physician-patient interaction (PPI), based heavily on in-person interactions, has been thoroughly compromised. To address this challenge, electronic health services have been portrayed as a solution during the pandemic. These services enable social distancing, reduce the need for hospital visits, and minimize direct contact with medical staff, all while maintaining the quality of healthcare (Furlanis et al., 2020).

The following sections discuss key aspects related to PPI and the balance of power between physicians and patients, the development of ePatients, and the digital evolution in relation to COVID-19. These topics show how healthcare has been transformed by adopting various digital technologies to overcome the challenges created by the pandemic.

1.1 ePatient Engagement

"What constitutes a good physician?" It is a question that many patients are confronted with while searching for a healthcare provider worthy of building a trustworthy relationship. While the context may vary, whether it be in clinics, private offices, or during consultations and medical examinations, certain principal qualities are sought after. Although a physician's medical knowledge and expertise in their respective field are vital factors, evidence shows that patients find interpersonal skills paramount when establishing a trustworthy PPI (Berger et al., 2020).

Until recently, patient involvement primarily considered informed consent, with the traditional "paternalistic" role of the physician informing the patient, and the patient then consenting to the recommended therapy, seen in Figure 1 (Chipidza et al., 2015, Kadam, 2017, Masters et al., 2010). Due to the patient's dependency on the physician's medical knowledge, a patient's sole perspective was their perception of the communication (Nutting et al., 2003). This ultimately one-sided relationship leaves the decision-making and power in the hands of the physician and informed consent in the hand of the patient.

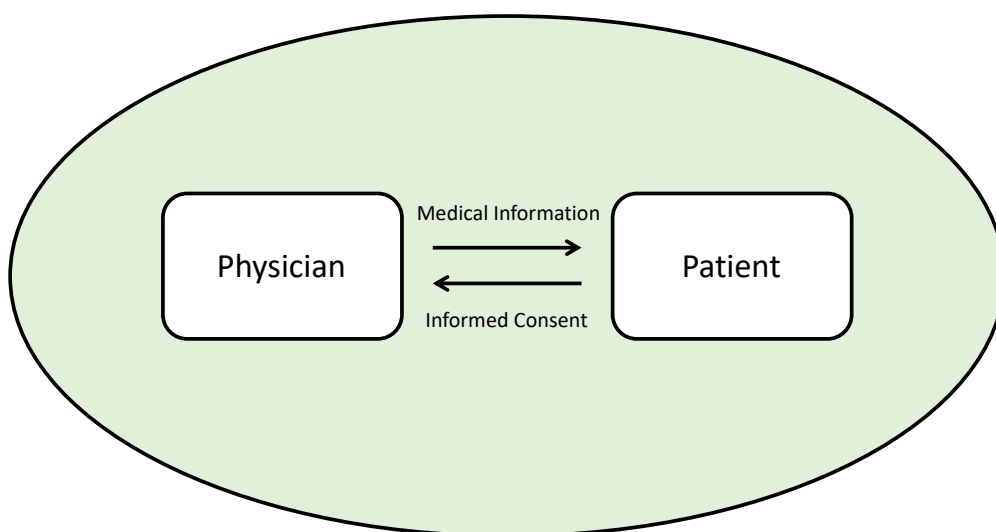


Figure 1: Paternalistic model of physician-patient interaction

Informed consent is an autonomous patient decision based on the risk/benefit analysis of a potential treatment recommended by a physician (De Sutter et al., 2020). One of the biggest challenges behind informed consent is patient incomprehension of the medical information presented, leading to dissatisfaction (Kadam, 2017). Provider dissatisfaction paired with the feeling of receiving insufficient information has led patients to search for information themselves, becoming more knowledgeable about their illnesses (Eysenbach, 2003).

With both patients and physicians using the internet as their main source of medical information, patients could be able to discuss treatment with physicians on an even level (Bhatia et al., 2018, Koller et al., 2001, Melhem et al., 2023, Singh and Banerjee, 2019). This model, known as the shared-decision making model, encourages patients to gather outside information, deliberate with others, and come to a joint decision on treatment form with their physician (Elwyn et al., 2012). As seen in Figure 2, patients who become medically informed through the use of technology and actively engage with their physicians to collectively determine treatment options are known as ePatients (Ferguson and Frydman, 2004).

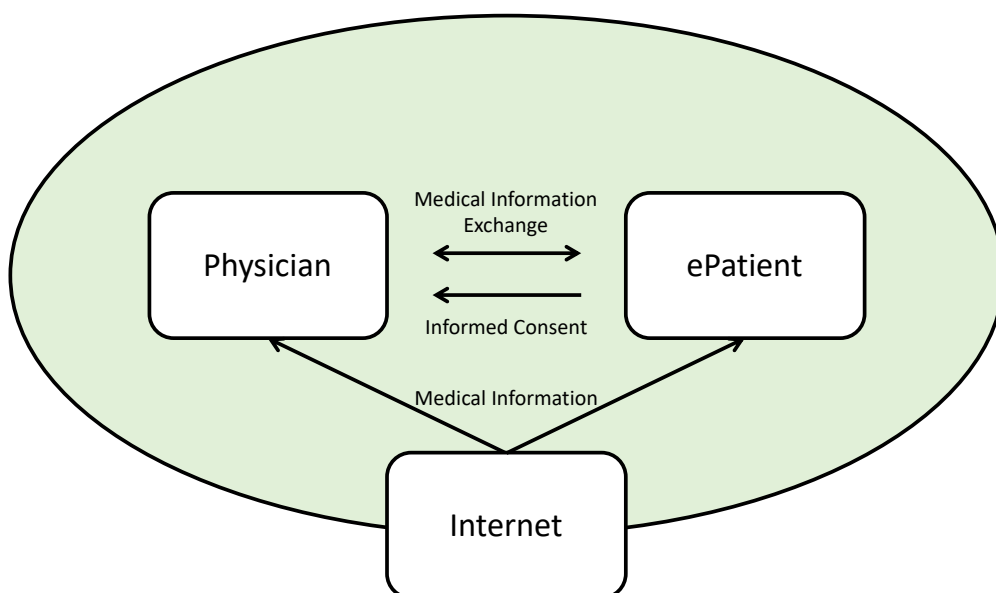


Figure 2: Shared-decision making model of patient-physician interaction

1.1.1 Health Literacy

In an ideal world, ePatients who have properly educated themselves with reputable medical sources are empowered to actively engage in health-related decision-making with their physician. However, for ePatients seeking medical information online, the process becomes far more challenging than a mere Google search.

There are vast amounts of medical information online, much of which is inappropriate or inaccurate (Cuan-Baltazar et al., 2020, Daraz et al., 2019). Additionally, many patients do not have the proper health literacy: the ability to obtain, interpret, and communicate medical information (Hersh et al., 2015, Lu and Zhang, 2021, Perrenoud et al., 2015). Compounding the issue is the fact that the majority of patients cannot distinguish between reliable and unreliable medical information (Diviani et al., 2015, Mota et al., 2018) and health literacy rates are lower among older patients (De Santis et al., 2021, Melhem et al., 2023).

Research has shown that ePatients with limited health literacy, also known as “illiterate”, are more likely to deviate from prescribed medication plans, display an over-concerning health behavior, be mistrusting of their physician, and be less willing to participate in treatment decisions (Chen et al., 2018, Kim and Kim, 2009, Lu and Zhang, 2021, Perrenoud et al., 2015). Increasing health literacy has shown its worth. Well-informed ePatients can strengthen physician-patient relationships, increase medication adherence, and improve the overall quality of healthcare (Lu, 2023, Lu and Zhang, 2021).

Mobile Health (mHealth) apps serve as a valuable source for accessing medical information. Although a large number of mHealth apps have been created in recent years (Bates et al., 2018), many display a suboptimal source of medical information and self-management of healthcare (Gordon et al., 2020, Lee et al., 2018). During the pandemic, mHealth apps have primarily been utilized for contact tracing purposes and require a standardized review for patient safety

(Bates et al., 2018). Rather than dissuading the usage of online medical information and health apps, this has led to health literacy initiatives to improve health literacy and remove variations in knowledge among patient groups (Conard, 2019, Hersh et al., 2015, Melhem et al., 2023).

1.1.2 Communication and Satisfaction

Interactions with ePatients who possess sufficient knowledge about a medical topic may not always result in positive experiences. There have been cases of physicians not welcoming patient input or omitting treatment options (McClung et al., 1998, Schrag and Hanger, 2007), patients not discussing material they have found online (López-Gómez et al., 2012), or “difficult” patients searching for a label to their symptoms (Barry et al., 2000, Chipidza et al., 2015), all leading to mistrust and less satisfaction among patients (Little et al., 2001). However, a more positive physician approach and patients who can communicate openly and effectively with their physicians have shown higher levels of satisfaction and less symptom burden (Little et al., 2001). This has in turn led to higher patient recall, understanding, and compliance (King and Hoppe, 2013).

Although PPI plays an important role in patient satisfaction, effective communication in healthcare extends into other sectors. Support groups, for example, are a valuable resource for patients to connect and interact with others facing similar health challenges. These groups enable the sharing of illness-related information, provide emotional support, and contact between patients (Birkelund and Larsen, 2013, Coulson and Buchanan, 2022). Furthermore, participation in support groups has been linked to an increased sense of belonging, greater self-esteem, increased confidence levels, better disease management, and an overall higher quality of life (Coulson and Buchanan, 2022, Markowitz, 2015, Wenig and Janetzke, 2022).

Both PPI and support groups have displayed interest in a switch to digital systems. Satisfaction levels by patients with either other patients or physicians

were reported as either indifferent or higher (Jiang, 2020, Tates et al., 2017, Walsh and Markus, 2019), and eSupport groups positively reported more flexibility for a first encounter as significant factors (Wenig and Janetzke, 2022). This bodes well for the psychiatric field, as verbal interactions are considered the most effective form of synchronous telemedicine, supporting the idea of transitioning psychosomatic consultations to an online system (Hersh et al., 2006, Locatis and Ackerman, 2013).

The potential of eHealth consultations in healthcare shows great promise, as it has been associated with encouraging patient involvement and positive correlations in terms of clinical efficiency, patient safety, and patient satisfaction (Doyle et al., 2013).

1.2 eHealth

“For the successful progression of our healthcare, the advancement of digitization is the central prerequisite” (Bundesministerium für Gesundheit, 2022a). This quote by Germany’s Federal Ministry of Health highlights the extensive development in the ideology of eHealth since its initial definition by Eysenbach in 2001. eHealth was initially described as the practice of providing healthcare via electronic communication or process, characterized by a digital network that extends past the boundaries of the internet and medicine (Eysenbach, 2001).

The displacement of traditional medical practices of paperwork and in-person physician-patient contact has been shown (Cillessen et al., 2017, Ratwani, 2017) for example with patients and providers in Germany receiving digital identities for online health services and an established EU eHealth contact point in 2023 (Bundesministerium für Gesundheit, 2022b). These changes to the medical system have been motivated by its apparent benefits: safety, efficiency, cost reduction (Mesko and Györffy, 2019), increased medical access, and becoming more interconnected with other health sectors (Hardardottir and Thoroddsen, 2016).

Eysenbach's description of eHealth as a broad network encompassing many different digital tools in the healthcare sector still holds true. In the following sections, key components of eHealth, such as electronic health records, mHealth, and telemedicine, are explored, addressing their potential and impact in transforming modern healthcare.

1.2.1 Electronic Health Records

The electronic health record (EHR) is integral to the foundation of eHealth. EHRs encompass a collection of an individual's medical information, ranging from diagnoses and treatments to vital signs, laboratory data, social and family history, allergies, and medications. The medical data are securely stored in the form of a digital document, allowing for organized management of patient's health records (Ehrenstein, 2019, Nichol et al., 2022, Sarwal and Gupta, 2022, World Health Organization, 2016). EHRs capture small details of patient medical history that can be accessed, tracked over time, and shared with authorized healthcare professionals. This approach allows for a collaborated, inter-organizational system and streamlines patient care across many healthcare sectors (Heart et al., 2017, Janett and Yeracaris, 2020).

The digitalization of EHRs was to primarily enhance the quality of patient care and eliminate handwritten clinical data (Gunter and Terry, 2005). However these modest aims benefits are far more EHR efficiency has been shown in many studies, with its improved communication and seamless information exchange among clinicians and hospitals, quick retrieval of health information, improved admission decisions, accessibility to patient records, and a reduction in double examinations (Ben-Assuli et al., 2015, Bundesministerium für Gesundheit, 2021, El-Kareh et al., 2009, Manca, 2015, Tsai et al., 2020). Patient safety has also been noted, with a significant reduction in documentation mistakes, increased legibility, and fewer medication errors, leading to lower mortality rates (Amarasingham et al., 2009, El-Kareh et al., 2009, Gearing et al., 2006, Manca, 2015, Ratwani, 2017, Rodríguez-Vera et al., 2002, Vaidotas et al., 2019).

The implementation of EHRs has not only brought increased efficiency and safer health practice but has also allowed for cost-reduction strategies in clinics (Heart et al., 2017, Uslu and Stausberg, 2021). Despite the acknowledged challenges linked to EHRs, such as notable issues of privacy breaches, high startup costs, and a large initial learning curve (Dutta and Hwang, 2020, Koczkodaj et al., 2019, Palabindala et al., 2016), their use continues to steadily rise (World Health Organization, 2016).

1.2.2 mHealth

Due to EHR's ease of access through a centralized source, medical practitioners can access patients' records beyond the scope of the workplace. The expansion of mobile technology in the past decades has allowed physicians to become more mobile and flexible in treating patients (Boulos et al., 2011). mHealth is based on the use of mobile devices, such as smartphones, to assist as a portable diagnostic form of healthcare (Bhavnani et al., 2016, Park, 2016, World Health Organization, 2016). These systems provide a wide variety of remote access services, such as detection, surveillance, and monitoring of potential chronic diseases, enabling effective patient communication and access to health professionals outside of the clinic (Bhatt et al., 2022, Hamine et al., 2015). These services have shown increases in medication adherence (Li et al., 2020), a reduction in the need for check-up visits, and effective cost-saving measures (Jiang et al., 2019).

mHealth has also played a major role during the pandemic, using contact tracing as an important alert form to prevent further disease outbreaks and healthcare system overload (Lukas et al., 2020). Furthermore, health monitoring technology has even advanced to the point of "wearing" the technology. These biometric monitoring devices are worn on the body, clothing, or accessories, enabling measurement and analysis of patient data (Dunn et al., 2018, Smuck et al., 2021).

Although initially focused on physical parameters, wearables have since expanded into other fields. This includes tracking molecular biomarkers, mental disorders, and even the detection of COVID-19 showing massive improvement and increase in continuous data collection (Chong et al., 2020, Dunn et al., 2018, Guder et al., 2016, Hilbel et al., 2021, Kang and Chai, 2022, Natarajan et al., 2020). These improvements in the field of wearables allow for improved disease detection, management, and further personalized forms of treatment.

1.2.3 Telemedicine

To fully utilize EHRs and the benefits of mHealth, proper online communication between physicians, other healthcare workers, and patients becomes a necessity. Telemedicine is another prominent component of eHealth and is defined as the use of communication technology to allow the interaction between physicians, patients, and other health professionals and provide healthcare at a distance (Angaran, 1999, Flodgren et al., 2015, World Health Organization, 2016). The benefits of using of telemedicine are evident. The use of remote PPI eliminates the need for potential in-person follow-up appointments and questions about medical information (Crane et al., 2020). Patients could also benefit from reduced travel, waiting time, and additional costs. Moreover, patients could have more control of their health due to flexible meeting locations and times for medical advice.

In addition to the numerous benefits of mHealth, telemedicine has been crucial in sustaining healthcare during the pandemic. By enabling online patient care, telemedicine has overcome the problem of limited patient mobility, ensuring proper medical treatment without putting physician and patient safety in jeopardy, and preventing the further spread of COVID-19. In addition, telemedicine has increased interprofessional communication among physicians and other healthcare sectors, leading to better quality of care (Car and Sheikh, 2004, Casella et al., 2020, Ransdell et al., 2021).

Many patients are familiar with synchronous telemedicine, which involves real-time interaction with healthcare providers (Mechanic et al., 2022, World Health Organization, 2016). Another format of telemedicine is asynchronous, referring to a collection of patient data that is sent to the respective physician for diagnosis and treatment at a later time (Mechanic et al., 2022, World Health Organization, 2016). In this format, email and social media have become the predominant forms of communication between physician and patient, with some parts of the world displaying relatively high usage (Masters et al., 2020a). The convenience factor for quick communication and information sharing is evident (Atherton et al., 2020, Car and Sheikh, 2004) and users report an overall high sense of satisfaction in usage (Pennington et al., 2022, Raj et al., 2022). However, it is important to note that a secure portal for communication is recommended and is not currently recommended to replace face-to-face PPI (Atherton et al., 2020, Schickedanz et al., 2013, Welch et al., 2019).

In addition to the above-mentioned forms of telemedicine, another notable format is the electronic prescription service (EPS), or ePrescribing. EPS acts as a communication system between physicians and pharmacies, (Porterfield et al., 2014), allowing physicians to send prescriptions safely and securely through a patient portal directly to the pharmacy and insurance company (Aldughayfiq and Sampalli, 2021, Porterfield et al., 2014). As with other forms of telemedicine and EHR, a reduction in medication errors, adverse drug reactions, an increase in efficiency, and high satisfaction rates have been reported (Aldughayfiq and Sampalli, 2021, Bundesministerium für Gesundheit, 2023, Nikou and Gallos, 2020, Osmani et al., 2022, Porterfield et al., 2014). Incorporating EPS into telemedicine further improves the convenience, safety, and satisfaction of remote healthcare services.

The necessity of incorporating telemedicine during the pandemic has seen its rapid acceptance and integration into society. With the additional integration of EPS and other telemedicine services into eHealth, the progression of healthcare continues to convert from in-person meetings into a digital system.

1.2.4 Artificial Intelligence

Although not a main research question of this paper due to its emergence after study completion, the discussion of artificial intelligence (AI) should be considered when examining the digital development of eHealth. AI, defined as the use of computer intelligence to perform tasks previously completed with human intelligence, completes tasks including data-driven problem-solving, decision-making, languages, and predictive analysis (Sarker, 2022). AI has been used since the 1950s (Cooper and Leeuwen, 2013), but has lately experienced exponential growth in large part due to the development of big data, deep learning, and neural networks (Graham et al., 2019, Tustumi et al., 2023, Zhu et al., 2022). In the realm of medicine, these systems can store and analyze large amounts of clinical data, make predictions based on the information processed, and can be trained over time to learn from EHRs, optimizing the processes they already analyze (Jiang et al., 2017).

AI has displayed its importance in eHealth and the future physician. AI can analyze medical images, such as X-rays, CTs, and MRIs, performing in studies with expert-level analysis, sometimes superseding radiologists (Goldsmith et al., 2023, Yoon et al., 2023). Other specialties have also reported reliable and reproducible data with the use of AI (Bokhorst et al., 2023, Pradella et al., 2022, Weidlich and Weidlich, 2018). AI can be used for triaging purposes and patient management, due to its use of predictive analytics (Liang et al., 2020). In addition, physicians can be provided with a personalized version of the latest medical journal information, significantly reducing time spent on research (Gellert, 2023). Administrative tasks, such as documentation or patient data entry in a patient's EHR could be automated, dramatically increasing workflow efficiency (Doraiswamy et al., 2020). These advances in technology can be leveraged into the physician's workflow, allowing physicians to have more time with patients and increase the quality and quantity of interactions (Maassen et al., 2021, van der Zander et al., 2022).

AI has also been observed in mental health. With access to EHR, AI can use cognitive profiling, genetics, EEGs, and brain scans to predict patterns and patient outcomes to assist in the detection and eventual treatment of various mental health conditions (Graham et al., 2019, Lee et al., 2021). Algorithms used in surveys have been developed to study psychiatric health measures and well-being traits and have shown potential as beneficial screening instruments and as predictive measures of mental health (Abdul Rahman et al., 2023, Donnelly et al., 2023). Analysis of online activity, such as Google searches and social media usage can also be monitored by AI to display patient tendencies to mental illness (Garg, 2023). AI may soon be able to detect emotions, further strengthening the use of telemedicine in mental health (Mohammad et al., 2022).

Patients also benefit greatly from the implementation of AI in medicine. In the field of mHealth, AI can not only analyze the data from wearables as discussed in 1.2.2, but also compare lifestyle factors, such as physical activity, sleep, and nutrition, to generate personalized recommendations and guidance for patients (Chatterjee et al., 2022). Informed patients can in turn have more informed discussions with their physicians, increasing the quality of patient care (Chatterjee et al., 2022). In addition, the use of virtual assistants in medicine has emerged, most notably with the release of ChatGPT.

ChatGPT, an AI-based language model, is designed to use natural language, to generate sophisticated, yet human-like responses to a wide range of inputs (Dave et al., 2023, Sallam, 2023). Due to its personalized, interactive support, ChatGPT can provide patients with easily comprehensible information about various medical conditions and treatments (Dave et al., 2023). This can enhance patient engagement, increase health literacy, and reinforce the concept of ePatients. The availability of AI programs like ChatGPT provides 24/7 access to personalized healthcare, can lead to a significant alleviation of healthcare burden, and increase patient satisfaction (Sallam, 2023, Tustumi et al., 2023).

1.3 The Role of Psychosomatic Patients

The inclusion of psychosomatic patients is crucial when discussing eHealth. Psychosomatic medicine is a medical specialty with a focus on the connection between the “psycho” – mental and “somatic” – physical aspects of the patient (Sartorius, 1989). This interdisciplinary field delves into the biopsychosocial and behavioral of health and illness, recognizing that these factors can interact to influence the onset, progression, and treatment of medical conditions (Fava and Sonino, 2010, Herrmann-Lingen, 2017).

In the context of eHealth, the use of digital platforms to deliver online medical care, especially with the fundamentals of psychosomatic medicine, is quite relevant. eHealth systems allow for integrated services via telemedicine, mHealth, and AI to facilitate a multidisciplinary online approach to treatment (Abdul Rahman et al., 2023, Car and Sheikh, 2004, Dunn et al., 2018). Although other medical fields may be capable of approaching eHealth, such as using telemedicine for consultations or follow-up appointments, they expose several significant problems associated with eHealth. Currently, online formats only allow for limited physical examination via video or extensive diagnostic procedures outside the current boundaries of mHealth (Weinstein et al., 2018). In-person visits in most medical fields are still a necessity. However, most psychosomatic approaches involve psychological and functional assessments, and medical history to achieve a holistic view of the patient (Fava and Sonino, 2010). This assessment of the physical and the psychological aspects of psychosomatic medicine have been shown as capable of online medical care (Rajgopal et al., 2021). Furthermore, the confidentiality and convince of online appointments can help patients overcome the social stigma of seeking mental health treatment in-person (Rajgopal et al., 2021, Safer et al., 2016). This could allow for exclusively online appointments.

Participants were chosen from the outpatient psychosomatic clinic to observe the extent of personal preference for future online consultations, due to its high

probability of continued care online and its relevance to further communication with patients during COVID-19 or in the future. Such a survey in other medical fields may be difficult to administer due to the already mentioned limited capabilities of online appointments and a potentially skewed report of the survey. Furthermore, the use of ePatients with medical students has already been approached (Herrmann-Werner et al., 2019) and appears to be a promising fit in the field of psychosomatic medicine.

1.4 Research Significance

Every day, more people are seeking online healthcare than in-person physician consultations. While the traditional approach of in-person consultation is still a legitimate option for patient care, it is impossible to ignore the effect that COVID-19 has had on the medical field. Waiting rooms are no longer full of potentially sick patients, patients are no longer required to commute to and from the healthcare facility, potentially spending hours in transit, and clinics are reaping the benefits of time-saving and cost-cutting measures (Bao et al., 2020, Furlanis et al., 2020, Mesko and Györfy, 2019).

There have been advances in electronic health that cannot be ignored: As seen in Figure 3 below, EHRs allow both physicians and patients to access and update medical information, encouraging shared decision-making (Ben-Assuli et al., 2015, Bundesministerium für Gesundheit, 2021, El-Kareh et al., 2009, Manca, 2015, Tsai et al., 2020), and an interconnection with other health sectors, all able to contribute and receive medical information to and from the EHR (Bhavnani et al., 2016, Park, 2016, World Health Organization, 2016). EPS allows pharmacies access to online medication plans for effective medication management (Porterfield et al., 2014). Furthermore, patients can communicate via synchronous or asynchronous terms with their physicians (Masters et al., 2020a), all from the comfort of one's own home (Birkelund and Larsen, 2013, Coulson and Buchanan, 2022, Mechanic et al., 2022, World Health Organization, 2016).

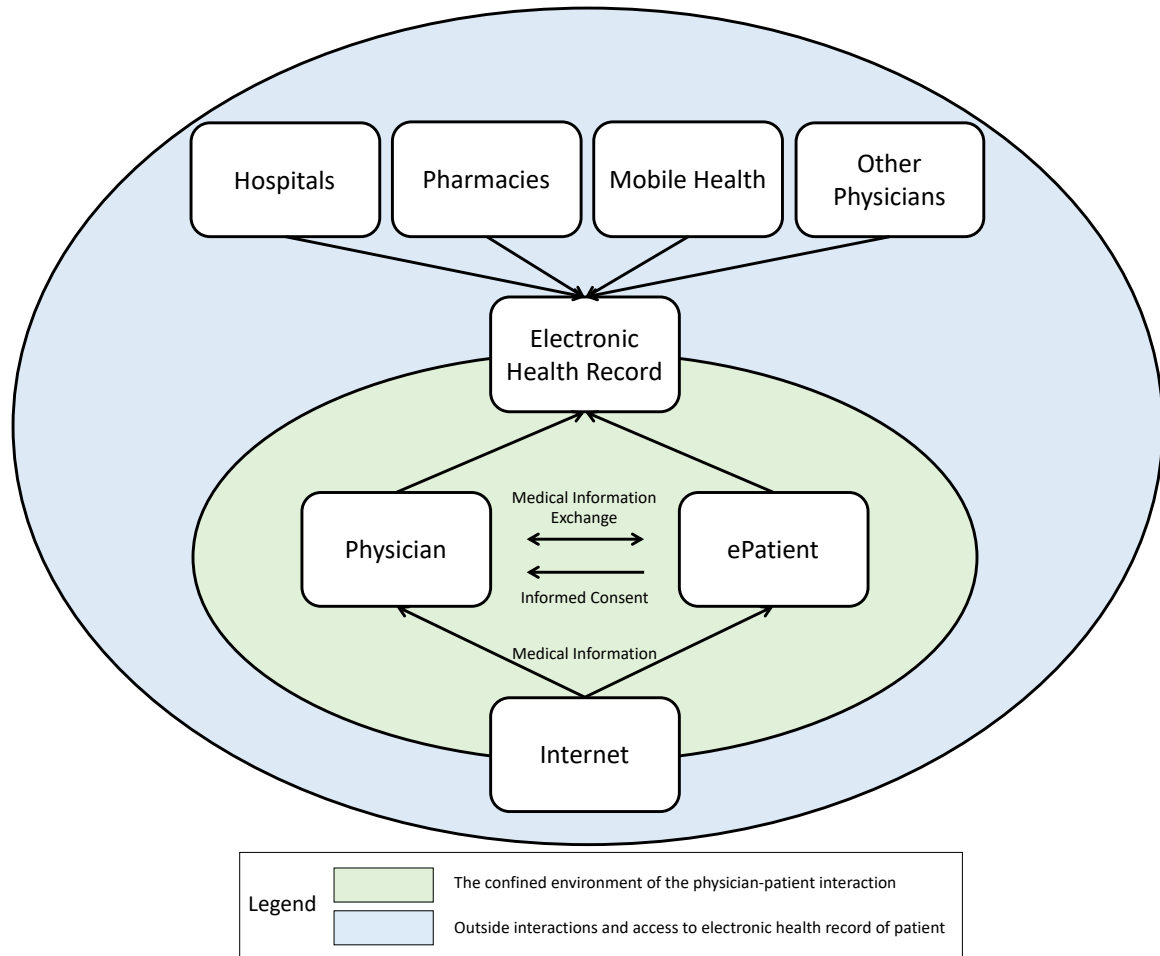


Figure 3: eHealth overview of physician-patient interaction and outside interactions

More focus has been placed on the importance of health literacy. Patients are actively discussing treatment options with their physicians and are taking a stake in their healthcare (Ferguson and Frydman, 2004). AI also has the potential to revolutionize many aspects of eHealth by greatly enhancing the efficiency of physicians, the literacy of patients, and progress in the medical field (Doraiswamy et al., 2020, Maassen et al., 2021, van der Zander et al., 2022). The convenience and efficiency of a digital system have led to higher satisfaction rates across the healthcare landscape (Atherton et al., 2020, Ben-Assuli et al., 2015, Bundesministerium für Gesundheit, 2021, Car and Sheikh, 2004, Doyle et al., 2013, Manca, 2015, Tsai et al., 2020).

Although there are many faults in the current healthcare system (Cuan-Baltazar et al., 2020, Daraz et al., 2019, Dutta and Hwang, 2020, Koczkodaj et al., 2019,

Palabindala et al., 2016), it is rapidly progressing and it is time to adjust appropriately. This applies especially to the field of psychosomatics, where telemedicine has proven to be effective (Hersh et al., 2006, Locatis and Ackerman, 2013).

1.5 Research Questions

The role of this study was to present a description of patient preference and usage of medical information, as well as the preference for digitalized patient-doctor interaction in a psychosomatic clinical setting. This was performed by quantitatively describing psychosomatic patient's usage of telemedicine, ePatient support groups, ePrescription usage, health literacy, its relevant changes due to COVID-19, and how the future ePatient prefers the use of eHealth. This paper aims to provide insight and potential recommendations on future patient-doctor interactions, along with an insight on medical information retrieval, to better tailor the services offered by psychosomatic medicine to patients' experiences and wishes. The knowledge gained in this way may be used to improve diagnostics and therapy.

Questions that arose from the aims were:

1. Have health-related activity levels changed among psychosomatic patients since the start of COVID-19?
2. Can we show that there is a relationship between changes in health-related activity levels and COVID-19?
3. Has COVID-19 played a role in influencing patient wishes for future online or on-site meetings?
4. Can any of these changes be related to gender, age, or specific meeting preference?

2 Materials and Methods

2.1 Study Design

This study presents a cross-sectional design. The study took place in the Department of Psychosomatic Medicine of the University Hospital in Tübingen, Germany. A survey was conducted in 2020 and 2021 to determine if electronic health-related activity (EHA) was influenced by the COVID-19 pandemic. The survey assessed patients' responses to various questions, such as interactions with physicians, interactions with other patients, ordering medication, and obtaining medical information. The topic-related questions asked patients to recall these interactions in relation to before, during, and life after the COVID-19 pandemic to be later analyzed retrospectively. The survey was offered to all patients who were in outpatient treatment.

2.2 Survey Design

The questionnaire design was created using a similar survey to Masters et al. (2020b) and was based on the methodology established by Moick and Terlutter (2012). Following consultation with statistician from Institute for Clinical Epidemiology and Applied Biometry (IKEAB), validating the instrument is out of the scope of this research topic and was not specifically tested. We have therefore adapted a revised version of the survey from Moick and Terlutter and assessed their reliability data for implementation. Their survey used a 7-point scale and yielded Cronbach's Alpha scores of 0.88, 0.79, and 0.71 for their respective 3 factors examined. According to Tavakol and Dennick (2011), this is deemed as an acceptable level of reliability for the study.

A detailed look at the survey reveals 7 questions. Survey questions 1 and 2 refer to the age and gender of the patient, respectively. Given the evolving patients and populations usage and attitudes over time, with names such as digital

nomads and immigrants, or Gen Z used, subdivision of patient groups can become subjective. For example, Masters et al. (2020a) use quartiles and Kim and Kwon (2010) use fixed age groups. To remain as objective as possible, the arithmetic mean of age was chosen to split the patient group. These groups are mentioned as “younger than 37 years old” and “aged 37 and older.”

As seen in many papers, subcategorizing gender involves dividing the broad categories of male and female into more detailed groups that represent the diversity within each gender (Becker et al., 2017, Štrkalj and Pather, 2021). These methods include considering going more in depth beyond biological sex, including gender identity, social norms, and other factors. In our study, we have simplified gender categories to include “male”, “female”, and “unspecified,” to be more inclusive of different gender identities and to potentially include other reasoning beyond gender inclusion.

Survey questions 3 and 4 refer to the location of the appointment when given the survey and the preferred location, respectively. Survey question 5 contains 16 different activities and asks if these activity levels have increased, decreased, or stayed the same since December of 2019. These 16 activities were organized into 4 “main topics” describing physician interactions online (via email, social media, other private electronic systems, and live video), interactions with other online patients, ordering medications online, and obtaining medical information (via online books, videos, medical websites, medical journals, networking sites, institutional bodies, online databases, magazines, wearables, and health apps).

Survey question 6 questioned to what extent the 16 EHA levels from survey question 5 occurred due to COVID-19. The changes in EHA were categorized as “not at all, somewhat, and very.” Survey question 7 asks when the things “return to normal”, where patients preferred four future engagements of physician interaction, other patient interactions, ordering medication, and obtaining medical information. The answers were only in-person, mostly in-person, indifferent, mostly online, or only online. To minimize confusion, survey questions 5 and 6

use the term "EHAs" to refer to electronic health activities, whereas survey question 7 utilizes the term "engagements" reflecting the potential for eventual in-person interactions. In Each question was not required to be answered and had the chance to be left empty. These answers were considered "not specified."

As seen in Figures 13-15 in the Appendix, survey questions 5, 6, and 7 refer to research questions 1, 2, and 3, respectively. Survey questions 1-4 refer to research question 4. To understand and generalize the findings of the 16 different EHAs, the activities were initially presented as total preferences, seen in Figures 5-7. Additionally, the EHAs were further subdivided into four main topics, seen in Figure 16. These four main topics were used to display general tendencies seen in Figures 8 and 10.

The patient data were collected online and on paper, by clinicians of Psychosomatic Medicine and Psychotherapy. The data in each case were from quantitative questionnaire surveys (see Figures 13-15). The data were collected in anonymized form.

2.3 Inclusion Criteria

Included were all patients who completed the survey from the 20th of October 2020 to the 21st of March 2021. This cross-sectional survey, with 176 patients, consisted of patients from the psychosomatic outpatient clinic in Tübingen. All patients were at least 18 years of age and fluent in German.

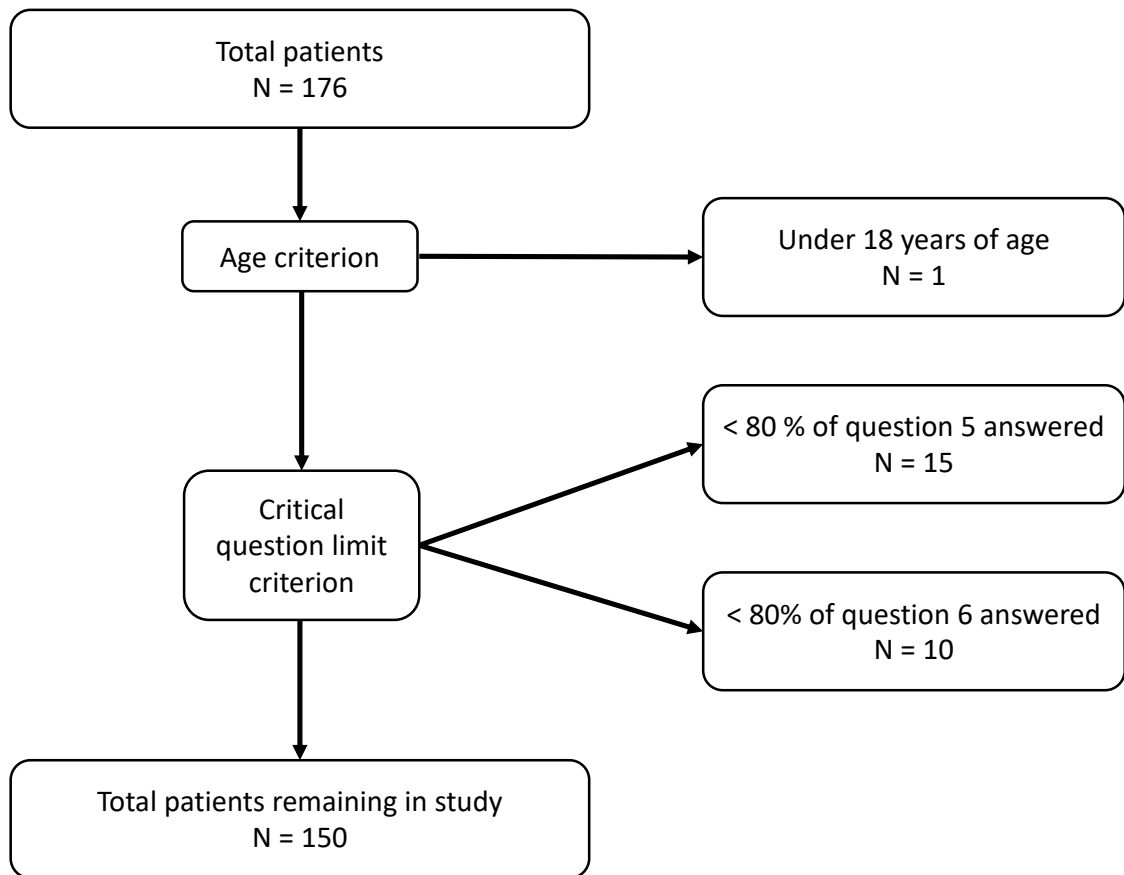


Figure 4. Exclusion process for determining patient eligibility

Patients were excluded from the analysis solely based on two factors. One patient reported being younger than 18 years of age and was subsequently removed from the data. 25 additional patients failed to answer over 80 percent of questions 5 or 6 from the survey (see Figures 13 and 14), each of which had 16 activities. These patients were excluded from the dataset, to conserve data integrity (Fahrmeir, 2012).

2.4 Statistical Analysis

Managing and statistically analyzing the collected data were done with Microsoft® Excel and IBM® SPSS by the author of the dissertation. The statistical analysis of the collected data was performed by the author of the dissertation. During the evaluation, the chi-square test of independence, Cramer V test, mean

values, median values, mode values, and standard errors were calculated. A confidence interval of 95% was considered statistically significant. Chi-square test of independence results with 20% of expected results < 5 and expected values of 0 were reported as not-applicable (Kim, 2017, McHugh, 2013). P-values could only be calculated for research question 4, due to the need for a minimum of two variable groups (Kim, 2017, McHugh, 2013). General tendencies could only be listed as notable, as raw data was averaged to display tendencies, as seen in Figures 8 and 10. Cramer tests, used to show the extent of the effect of the significant value, with values under 0.2 are considered weakly associated, between 0.2 and 0.6 moderately associated, and over 0.6 strongly associated (IBM Corporation, 2023).

2.5 Ethics

This retrospective analysis had been previously approved by the Ethics Committee of the University of Tübingen (Project number 243/2022BO2).

3 Results

Parts of the data from this section are submitted for publication in the Journal of Telemedicine and Telecare:

Mahling, M., McQueeney, A., Festl-Wietek, T., Masters K., Zipfel, S., Herrmann-Werner, A., Rometsch C. (Submitted) 2024. Exploring the preferences and behavioural trends of e-patients in psychosomatics towards telemedicine during and post COVID-19 pandemic: A cross-sectional analysis. *Journal of Telemedicine and Telecare*.

3.1 Patient Distribution

Table 1: Baseline patient demographics

Total	
Patient number	150
Age in years	
Range	18 – 68
Mean, $\pm$ SD	37.1, $\pm$ 12.4
Total above the mean	72 (48.0%)
Total below the mean	78 (52.0%)
Gender	
Male	21 (14.0%)
Female	88 (58.7%)
Unspecified	41 (27.3%)
Meeting Preference	
Online	25 (29.1%)
On-Site	61 (70.9%)

Note. $\pm$ SD, plus or minus standard deviation; The percentage of patients answering each question is provided within parentheses.

The patient demographics are displayed in Table 1. Patient data showed an average age of the 150 patients to be 37.1 years old, with a standard deviation of 12.4 years. The age span of the patients ranged from 18 to 68 years old with a median age of 36 and mode of 40.

The quantitative analysis divided the patients into subgroups based on the following categories: age, gender, and meeting preference. Age was further divided into two categories: below the mean (younger than 37 years of age) and above the mean (age 37 and older). Gender was categorized under male, female, and unspecified gender. Meeting preference was divided into online and on-site groups.

Of this sample, 21 (14.0%) patients reported being male in the survey, whereas 88 (58.7%) and 41 (27.3%) reported being female and unspecified gender, respectively. The average age for males was 42.2, for females 36.5, and for unspecified gender 35.6. 78 (52.0%) of patients were under the age of 37 and 72 (48.0%) of patients were age 37 or older. For a total of $n = 86$ for meeting preference, 25 (29.1%) preferred meetings online, 61 (70.9%) preferred on-site meetings, and 64 patients abstaining from expressing a preference.

3.2 Total Preferences of Patients

Figures 5-7 below depict the total preferences of the patients. These values were derived by averaging the values of the EHAs. Figure 5 showcases the changes in patient usage of EHA since December 2019. Figure 6 refers to the extent to which these change were influenced by COVID-19, while Figure 7 highlights patient preferences for future EHAs.

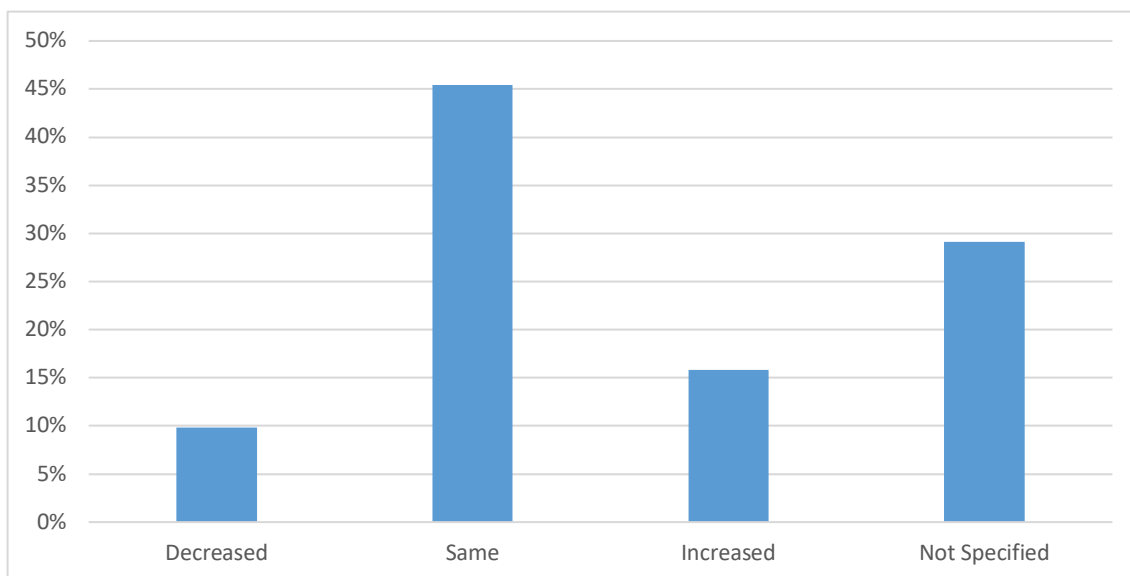


Figure 5: Total averaged patient reported change in electronic health activity usage since 2019

A notable number of patients reported no change in EHA behavior (45.4%), followed by not specified (29.1%). An increase in behavior was reported in 15.7% and a decrease in 9.8% of patients.

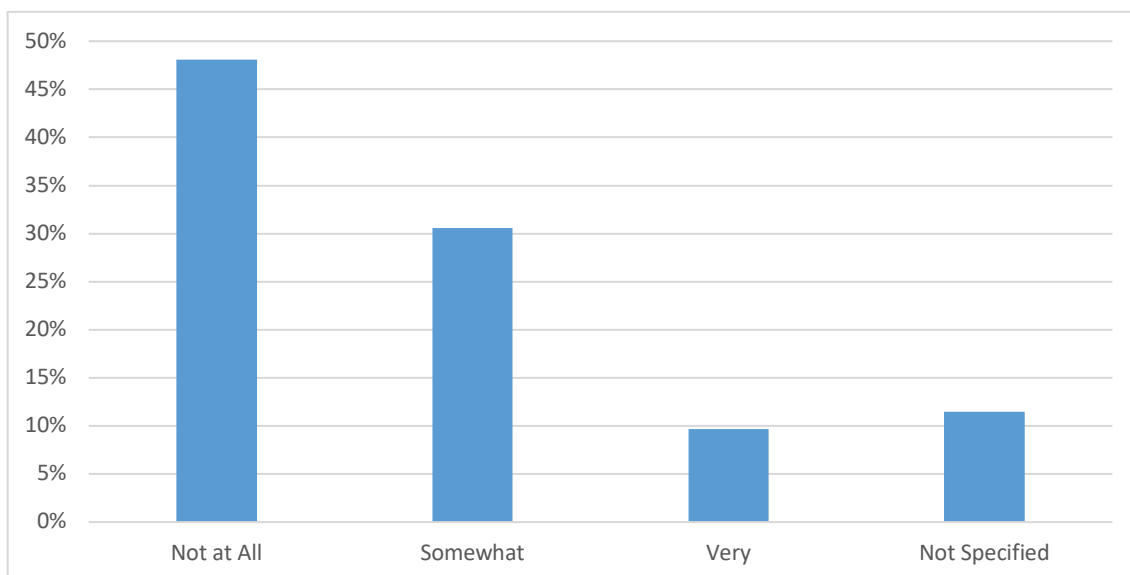


Figure 6: Total averaged patient reported electronic health activity change due to COVID-19

A notable number of patients reported EHA change due to COVID-19 as “not at all” (48.1%). The categories “somewhat” and “very” reported a change of 30.6% and 9.7%, respectively. 11.5% of patients reported answered as “not specified”.

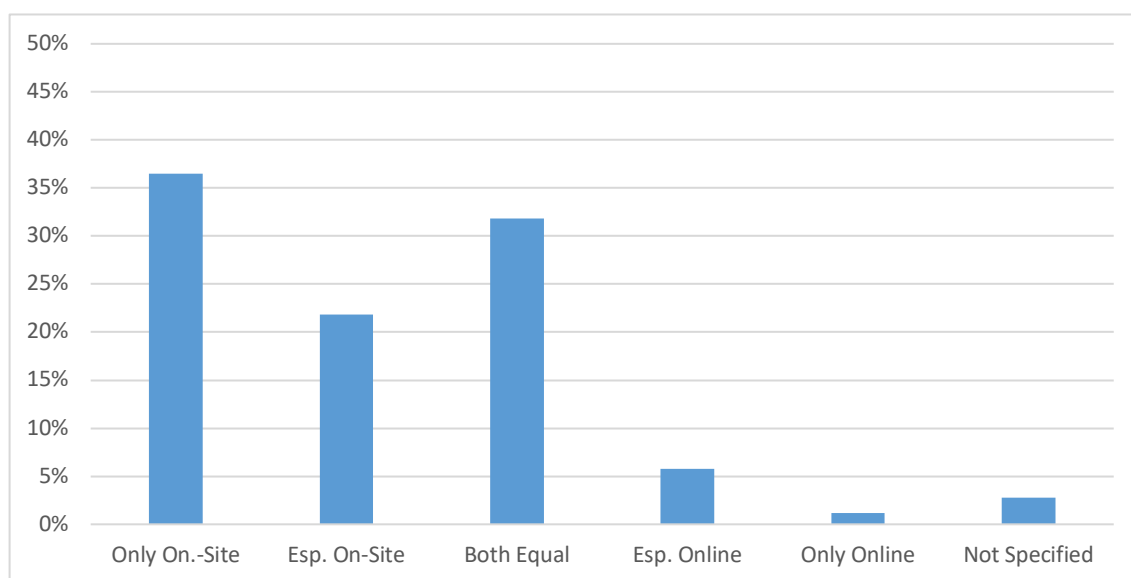


Figure 7: Total averaged patient preferences for future meetings of health activities

A notable number of patients reported future preference of health activities as “only on-site” (36.5%), followed by “both equal” (31.8%) and “especially on-site” (21.8%). Less than 10% of patients reported future preference for health activities in “especially online” (5.8%), “only online” (1.2%), and “not specified” (2.8%).

3.3 Research Question 1: Have health-related activity levels changed among psychosomatic patients since the start of COVID-19?

Figure 8 and 9 illustrate the patients' recollection of changes in usage of EHA since December of 2019. Figure 8 presents the four main topics, whereas Figure 9 goes into detail of all 16 EHAs.

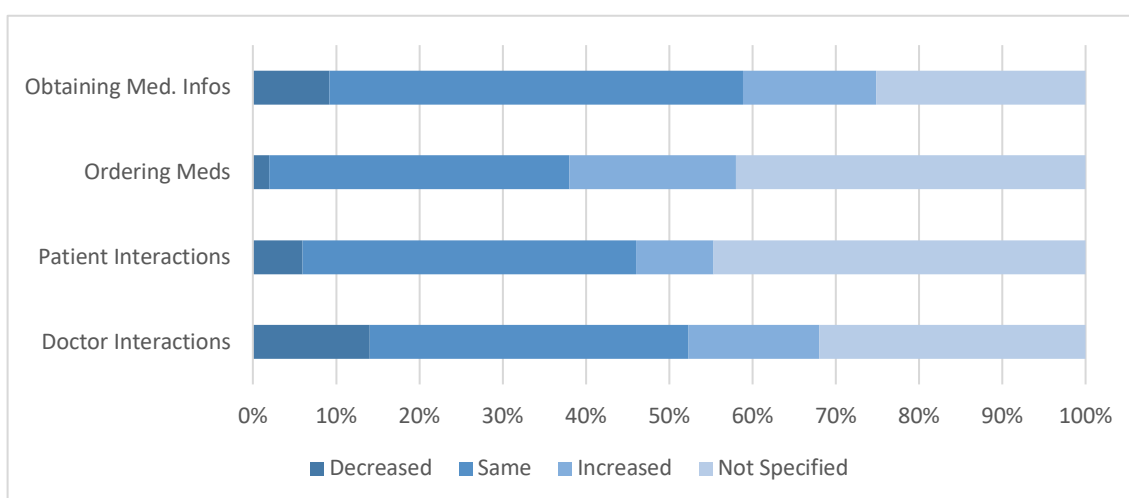


Figure 8: Patient reported change in averaged main topics of electronic health activity usage since 2019

Notable increases in EHA usage since December 2019 include the main topics ordering medication (20.0%) and obtaining medical information (16.0%). Notable decreases include the main topics physician interactions (14.0%) and obtaining medical information (9.2%). 49.7% of patients reported the main topic obtaining medical information as the same usage in EHA. Notable not specified answers include online patient interaction (44.7%) and ordering medication online (42.0%).

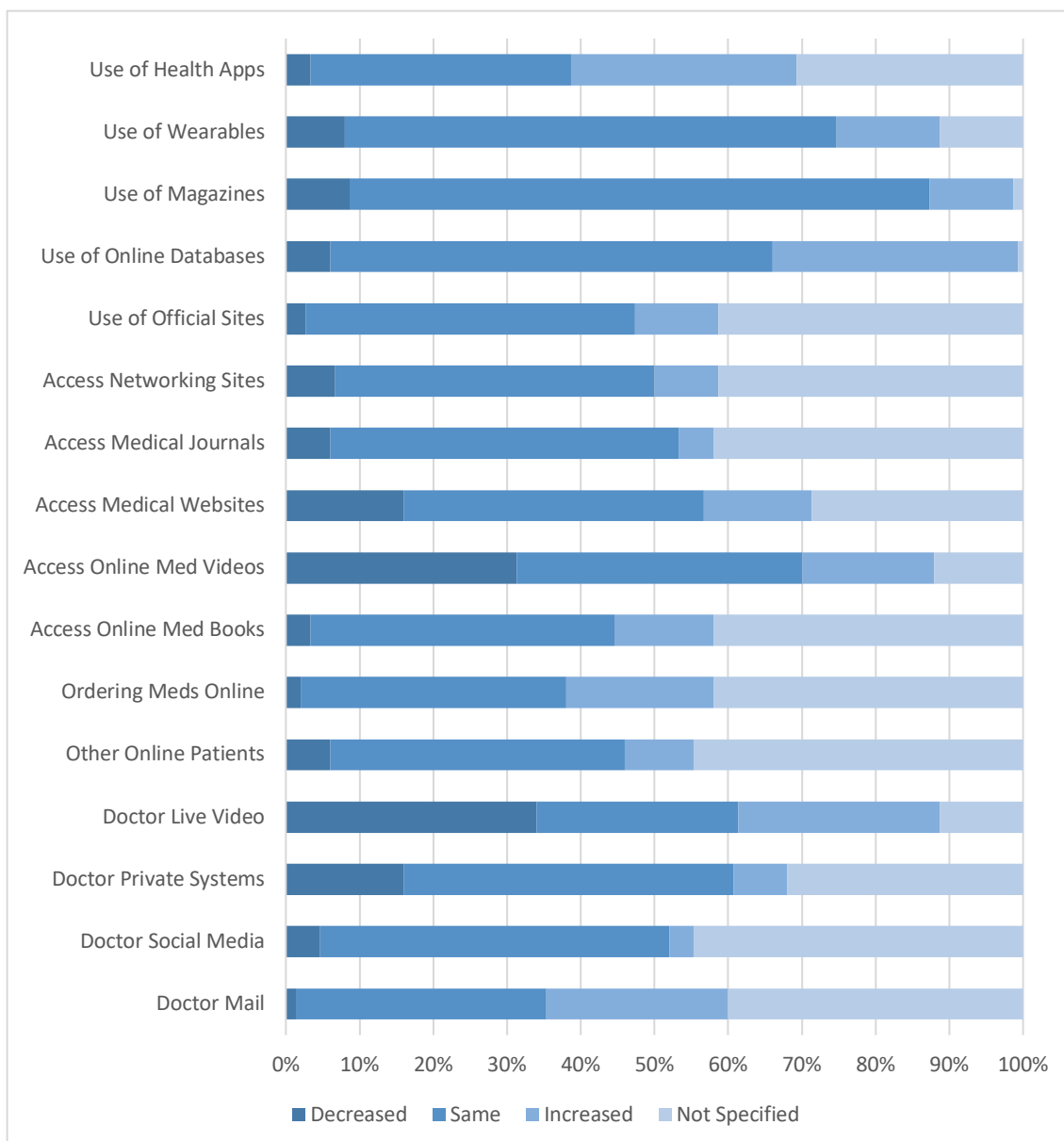


Figure 9: Patient reported change in electronic health activity usage since 2019

Notable decreases in EHA since 2019 include physician interaction via live video (34.0%) and access to online medical videos (31.3%). Notable increases include the use of online databases (33.3%), the use of health apps (30.7%), and physician interaction via live video (27.3%). EHA was reported to have no change on average by 45.4% of all patients. Notable values in this category include the use of magazines (78.7%) and the use of wearables (68.7%). On average, 29.1% of the questions were left as “not specified”.

3.4 Research Question 2: Can we show that there is a relationship between changes in health-related activity levels and COVID-19?

Figure 10 and 11 show patients' recollection of change in usage of EHA due to COVID-19. Figure 10 depicts the four main topics, while Figure 11 delves into specifics of all 16 EHAs.

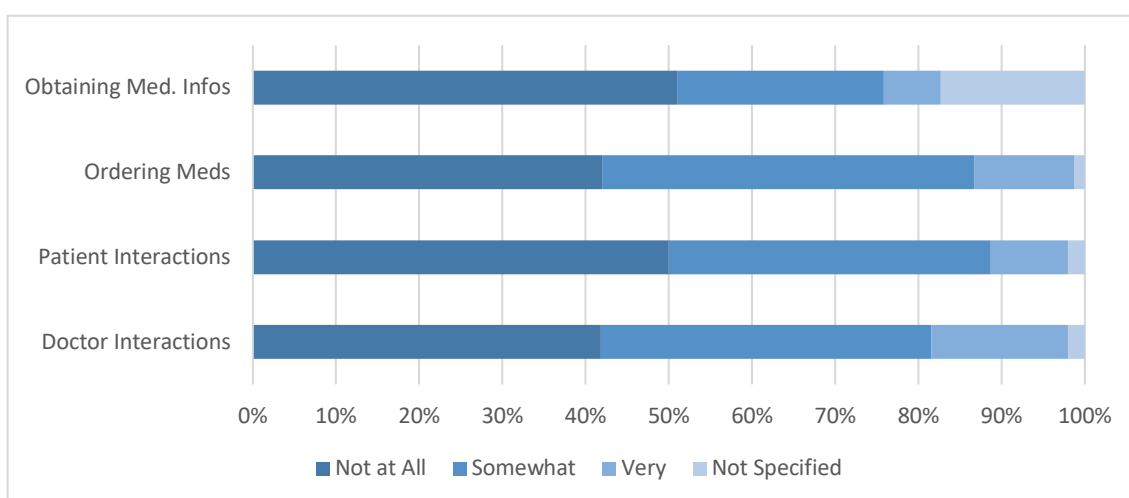


Figure 10: Patient reported electronic health activity change in averaged main topics due to COVID-19

The main topics obtaining medical information (51.1%) and online patient interactions (50.0%) notably reported no change in EHA due to COVID-19. Ordering medication (44.0%) under the category "somewhat" and physician interaction (16.5%) under the category "very" reported notable increases. 17.3% of patients reported obtaining medical information as "not specified".

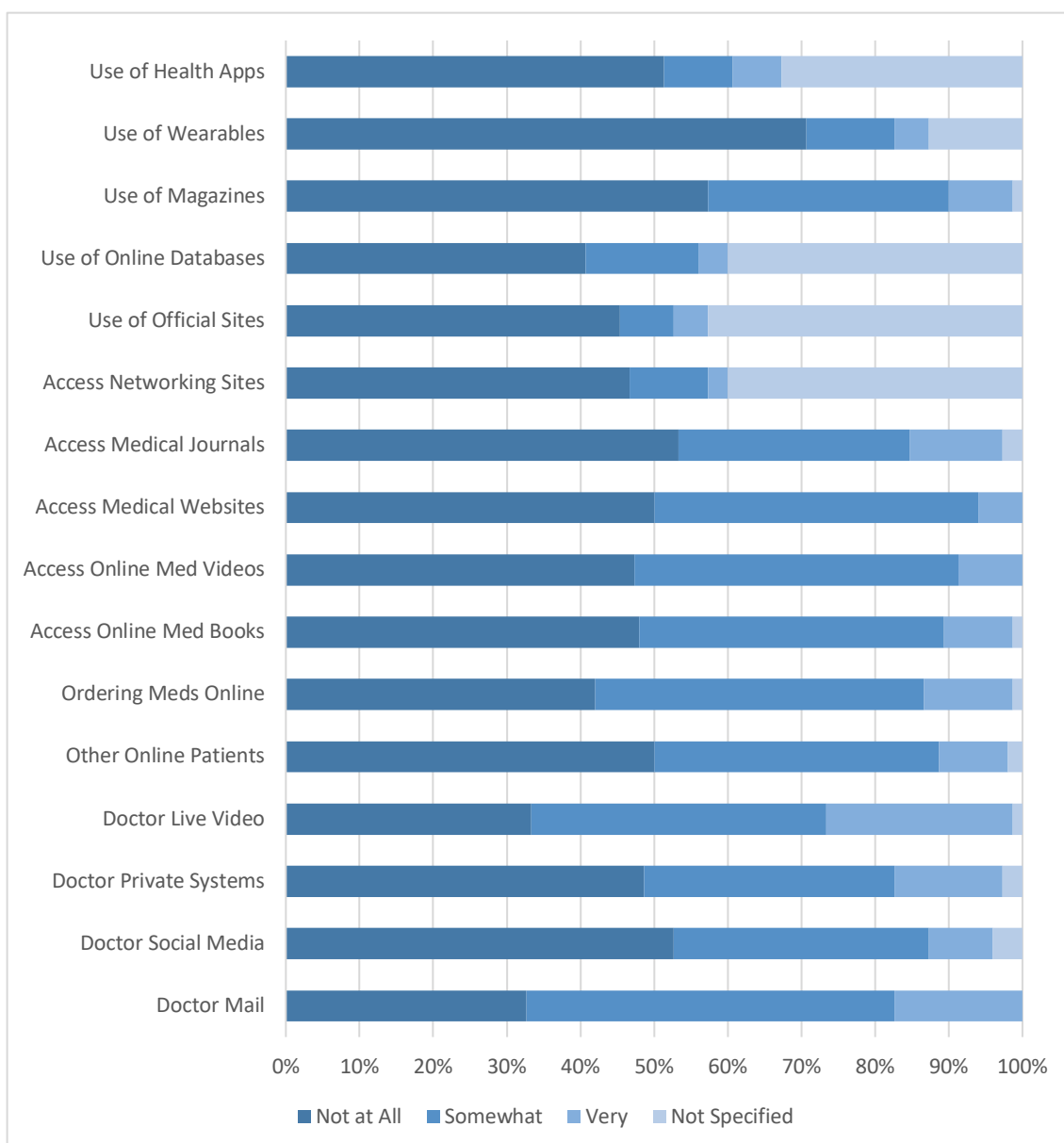


Figure 11: Patient reported electronic health activity change due to COVID-19

Two notable values reporting no change include the use of wearables (70.7%) and the use of magazines (57.3%). Notable differences include “somewhat” changes in physician interaction via mail (50.0%) and use of official sites (7.3%), and “very” changes in physician interaction via live video (25.3%) and accessing network sites (2.7%). Three EHAs (accessing networking sites, use of official sites, and online databases) reported 40% or more of answers as “not specified”.

3.5 Research Question 3: Has COVID-19 played a role in influencing patient wishes for future online or on-site meetings?

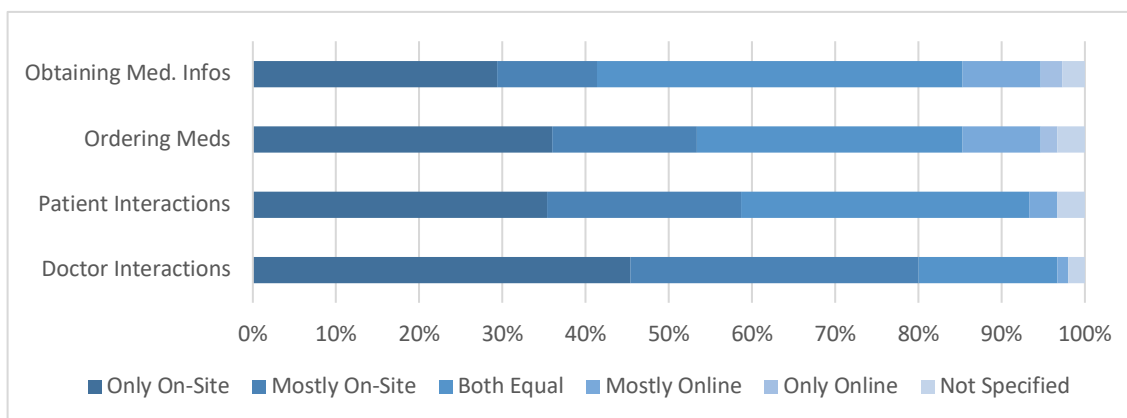


Figure 12: Patient preferences for future engagements

For future preferences, physician interaction “only in person” (45.3%) or “mostly in person” (34.7%) was preferred, followed by patient interaction (35.3%) and (23.3%), and ordering medications (36.0%) and (17.3%), respectively. Obtaining medical information reported a notable number of patients being indifferent to future location (44.0%). A preference for future engagements “mostly online” or “only online” received less than 10% in all subcategories.

3.6 Research Question 4: Relating electronic health-related activity changes to gender, age and meeting preference

Below, Tables 2 – 4 outline changes and preferences concerning EHAs across subcategories of gender, age, and meeting preference. Table 2 shows patients’ recall of change in usage of EHA the four main topics since December of 2019, along with changes due to COVID-19. Table 3 presents all 16 EHAs. Table 4 provides insights into future patient preference of health activities based on specific subcategories.

Table 2: Patients' reported change in electronic health activity across averaged main topics since 2019 and its effect due to COVID-19 in subcategories

Electronic Health Activities	Change in Usage Since 2019				Change Due to COVID-19			
	Decreased	Same	Increased	Not Specified	Not at All	Somewhat	Very	Not Specified
Doctor Interactions								
Men	8.3%	75.0%	16.7%	0.0%	63.1%	16.7%	8.3%	75.0%
Women	9.9%	47.4%	22.7%	19.9%	54.5%	27.6%	9.9%	47.4%
Unspecified	25.6%	0.0%	0.0%	74.4%	3.7%	77.4%	25.6%	0.0%
< 37	10.3%	44.9%	16.7%	28.2%	40.7%	37.8%	10.3%	44.9%
37+	18.1%	31.3%	14.6%	36.1%	43.1%	41.7%	18.1%	31.3%
MP Online	4.0%	54.0%	34.0%	8.0%	53.0%	14.0%	4.0%	54.0%
MP On-Site	7.0%	67.2%	23.0%	2.9%	70.5%	13.1%	7.0%	67.2%
Patient Interactions								
Men	9.5%	71.4%	19.0%	0.0%	71.4%	14.3%	9.5%	71.4%
Women	8.0%	51.1%	11.4%	29.5%	65.9%	23.9%	8.0%	51.1%
Unspecified	0.0%	0.0%	0.0%	100.0%	4.9%	82.9%	0.0%	0.0%
< 37	6.4%	39.7%	12.8%	41.0%	52.6%	33.3%	6.4%	39.7%
37+	5.6%	40.3%	5.6%	48.6%	47.2%	44.4%	5.6%	40.3%
MP Online	4.0%	52.0%	28.0%	16.0%	60.0%	0.0%	4.0%	52.0%
MP On-Site	13.1%	70.5%	11.5%	4.9%	85.2%	11.5%	13.1%	70.5%
Ordering Meds								
Men	0.0%	71.4%	28.6%	0.0%	61.9%	28.6%	0.0%	71.4%
Women	3.4%	44.3%	27.3%	25.0%	52.3%	35.2%	3.4%	44.3%
Unspecified	0.0%	0.0%	0.0%	100.0%	9.8%	73.2%	0.0%	0.0%
< 37	0.0%	34.6%	26.9%	38.5%	41.0%	39.7%	0.0%	34.6%
37+	4.2%	37.5%	12.5%	45.8%	43.1%	50.0%	4.2%	37.5%
MP Online	8.0%	56.0%	28.0%	8.0%	64.0%	20.0%	8.0%	56.0%
MP On-Site	1.6%	62.3%	34.4%	1.6%	62.3%	26.2%	1.6%	62.3%

Electronic Health Activities	Change in Usage Since 2019				Change Due to COVID-19			
	Decreased	Same	Increased	Not Specified	Not at All	Somewhat	Very	Not Specified
Obtaining Med. Infos								
Men	9.5%	73.3%	11.9%	5.2%	75.2%	8.1%	9.5%	73.3%
Women	8.0%	54.9%	19.0%	18.2%	58.2%	23.0%	8.0%	54.9%
Unspecified	13.7%	24.9%	11.2%	50.2%	23.4%	36.8%	13.7%	24.9%
< 37	6.3%	50.9%	19.9%	22.9%	50.1%	25.4%	6.3%	50.9%
37+	12.4%	48.3%	11.8%	27.5%	52.1%	24.2%	12.4%	48.3%
MP Online	7.6%	52.4%	33.2%	6.8%	53.2%	22.0%	7.6%	52.4%
MP On-Site	5.6%	70.5%	14.3%	9.7%	74.1%	14.8%	5.6%	70.5%

Note. Within each main topic, 7 subcategories are delineated. “<37” refers to patients younger than 37 years old and “37+” denotes patients aged 37 and older. “MP Online” signifies a preference online meetings, whereas “MP On-Site” indicates a preference for on-site meetings.

3.6.1 Electronic Health Activity Change in Averaged Main Topics Since 2019 in Subcategories

Men reported in all four main topics over 70% as no change since 2019, while women reported physician interactions at 47.4%, patient interactions at 51.1%, ordering medications at 44.3%, and obtaining medical information at 54.9%. Notably, 25.6% of persons of unspecified gender reported a decrease in physician interactions. Persons of unspecified gender also reported all main topics with more than 40% as not specified and two main topics at 100% not specified (patient interactions and ordering medications). Patients under the age of 37 reported a larger increase in EHA in all main topics compared to

patients aged 37 and older. Pronounced is ordering medication (<37: 26.9% vs. 37+: 12.5%). Patients who preferred on-site meetings reported over 60% of answers as “same”, whereas patients who preferred online meetings reported physician interactions at 54.0%, patient interactions at 52.0%, ordering medications at 56.0%, and obtaining medical information at 52.4%. Additional notable values include an increase in obtaining medical information (online: 33.2% vs. on-site: 14.3%).

3.6.2 Electronic Health Activity Change in Averaged Main Topics due to COVID-19 in Subcategories

30.0% of persons of unspecified gender reported in the main topic obtaining medical information as “not specified”. Persons of unspecified gender also reported other notable values of “somewhat”: patient interactions (77.4%), patient interactions (82.9%), ordering medications (73.2%), and obtaining medical information (36.8%). Men reported all four main topics over 60% as having no change in EHA due to COVID-19, compared to women reporting physician interactions at 54.5%, patient interactions at 65.9%, ordering medications at 52.3%, and obtaining medical information at 58.2%.

Notable differences were reported under the main topic “somewhat” pronounced in online patient interactions (<37: 33.3% vs. 37+: 44.4%) and ordering medications (<37: 39.7% vs. 37+: 50.0%). Patients preferring on-site meetings reported in all four main topics over 60% no change in EHA due to COVID-19, compared to patients preferring online meetings reporting physician interactions at 53.0%, patient interactions at 60.0%, ordering medications at 64.0%, and obtaining medical information at 53.2%. Another notable difference was observed in the main topic “very” with online patient interactions (online: 32.2% vs. on-site: 3.3%).

Table 3: Patients' reported change in electronic health activity since 2019 and its effect due to COVID-19 in subcategories

Electronic Health Activities	Change in Usage Since 2019				Change Due to COVID-19			
	Decreased	Same	Increased	Not Specified	Not at All	Somewhat	Very	Not Specified
Doctor Mail								
Men	4.8%	76.2%	19.0%	0.0%	52.4%	33.3%	14.3%	0.0%
Women	1.1%	39.8%	37.5%	21.6%	40.9%	38.6%	20.5%	0.0%
Unspecified	0.0%	0.0%	0.0%	100.0%	4.9%	82.9%	12.2%	0.0%
< 37	0.0%	41.0%	24.4%	34.6%	29.5%	55.1%	15.4%	0.0%
37+	2.8%	26.4%	25.0%	45.8%	36.1%	44.4%	19.4%	0.0%
MP Online	0.0%	36.0%	64.0%	0.0%	36.0%	36.0%	28.0%	0.0%
MP On-Site	3.3%	65.6%	31.1%	0.0%	54.1%	29.5%	16.4%	0.0%
Doctor Social Media								
Men	14.3%	81.0%	4.8%	0.0%	76.2%	9.5%	4.8%	9.5%
Women	4.5%	61.4%	4.5%	29.5%	70.5%	18.2%	9.1%	2.3%
Unspecified	0.0%	0.0%	0.0%	100.0%	2.4%	82.9%	9.8%	4.9%
< 37	0.0%	59.0%	0.0%	41.0%	55.1%	32.1%	7.7%	5.1%
37+	9.7%	34.7%	6.9%	48.6%	50.0%	37.5%	9.7%	2.8%
MP Online	8.0%	76.0%	0.0%	16.0%	72.0%	0.0%	12.0%	16.0%
MP On-Site	8.2%	78.7%	8.2%	4.9%	86.9%	6.6%	6.6%	0.0%
Doctor Private Systems								
Men	14.3%	85.7%	0.0%	0.0%	71.4%	19.0%	0.0%	9.5%
Women	11.4%	55.7%	12.5%	20.5%	63.6%	21.6%	12.5%	2.3%
Unspecified	26.8%	0.0%	0.0%	73.2%	4.9%	68.3%	26.8%	0.0%
< 37	11.5%	55.1%	6.4%	26.9%	48.7%	26.9%	19.2%	5.1%
37+	20.8%	33.3%	8.3%	37.5%	48.6%	41.7%	9.7%	0.0%
MP Online	8.0%	76.0%	8.0%	8.0%	76.0%	0.0%	16.0%	8.0%
MP On-Site	8.2%	72.1%	14.8%	4.9%	77.0%	9.8%	9.8%	3.3%

Electronic Health Activities	Change in Usage Since 2019				Change Due to COVID-19			
	Decreased	Same	Increased	Not Specified	Not at All	Somewhat	Very	Not Specified
Doctor Live Video								
Men	0.0%	57.1%	42.9%	0.0%	52.4%	4.8%	33.3%	9.5%
Women	22.7%	33.0%	36.4%	8.0%	43.2%	31.8%	25.0%	0.0%
Unspecified	75.6%	0.0%	0.0%	24.4%	2.4%	75.6%	22.0%	0.0%
< 37	29.5%	24.4%	35.9%	10.3%	29.5%	37.2%	30.8%	2.6%
37+	38.9%	30.6%	18.1%	12.5%	37.5%	43.1%	19.4%	0.0%
MP Online	0.0%	28.0%	64.0%	8.0%	28.0%	20.0%	44.0%	8.0%
MP On-Site	8.2%	52.5%	37.7%	1.6%	63.9%	6.6%	29.5%	0.0%
Other Online Patients								
Men	9.5%	71.4%	19.0%	0.0%	71.4%	14.3%	14.3%	0.0%
Women	8.0%	51.1%	11.4%	29.5%	65.9%	23.9%	8.0%	2.3%
Unspecified	0.0%	0.0%	0.0%	100.0%	4.9%	82.9%	9.8%	2.4%
< 37	6.4%	39.7%	12.8%	41.0%	52.6%	33.3%	11.5%	2.6%
37+	5.6%	40.3%	5.6%	48.6%	47.2%	44.4%	6.9%	1.4%
MP Online	4.0%	52.0%	28.0%	16.0%	60.0%	0.0%	32.0%	8.0%
MP On-Site	13.1%	70.5%	11.5%	4.9%	85.2%	11.5%	3.3%	0.0%
Ordering Meds Online								
Men	0.0%	71.4%	28.6%	0.0%	61.9%	28.6%	9.5%	0.0%
Women	3.4%	44.3%	27.3%	25.0%	52.3%	35.2%	10.2%	2.3%
Unspecified	0.0%	0.0%	0.0%	100.0%	9.8%	73.2%	17.1%	0.0%
< 37	0.0%	34.6%	26.9%	38.5%	41.0%	39.7%	16.7%	2.6%
37+	4.2%	37.5%	12.5%	45.8%	43.1%	50.0%	6.9%	0.0%
MP Online	8.0%	56.0%	28.0%	8.0%	64.0%	20.0%	8.0%	8.0%
MP On-Site	1.6%	62.3%	34.4%	1.6%	62.3%	26.2%	11.5%	0.0%

Electronic Health Activities	Change in Usage Since 2019				Change Due to COVID-19			
	Decreased	Same	Increased	Not Specified	Not at All	Somewhat	Very	Not Specified
Access Online Med Books								
Men	4.8%	85.7%	9.5%	0.0%	81.0%	19.0%	0.0%	0.0%
Women	4.5%	50.0%	20.5%	25.0%	60.2%	29.5%	8.0%	2.3%
Unspecified	0.0%	0.0%	0.0%	100.0%	4.9%	78.0%	17.1%	0.0%
< 37	0.0%	42.3%	19.2%	38.5%	44.9%	39.7%	12.8%	2.6%
37+	6.9%	40.3%	6.9%	45.8%	51.4%	43.1%	5.6%	0.0%
MP Online	8.0%	44.0%	40.0%	8.0%	56.0%	16.0%	20.0%	8.0%
MP On-Site	4.9%	77.0%	16.4%	1.6%	82.0%	18.0%	0.0%	0.0%
Access Online Med Videos								
Men	4.8%	81.0%	14.3%	0.0%	81.0%	19.0%	0.0%	0.0%
Women	18.2%	46.6%	27.3%	8.0%	59.1%	34.1%	6.8%	0.0%
Unspecified	73.2%	0.0%	0.0%	26.8%	4.9%	78.0%	17.1%	0.0%
< 37	24.4%	41.0%	24.4%	10.3%	46.2%	42.3%	11.5%	0.0%
37+	38.9%	36.1%	11.1%	13.9%	48.6%	45.8%	5.6%	0.0%
MP Online	8.0%	36.0%	56.0%	0.0%	64.0%	20.0%	16.0%	0.0%
MP On-Site	4.9%	73.8%	21.3%	0.0%	78.7%	21.3%	0.0%	0.0%
Access Medical Websites								
Men	14.3%	71.4%	14.3%	0.0%	81.0%	19.0%	0.0%	0.0%
Women	11.4%	52.3%	21.6%	14.8%	63.6%	31.8%	4.5%	0.0%
Unspecified	26.8%	0.0%	0.0%	73.2%	4.9%	82.9%	12.2%	0.0%
< 37	11.5%	41.0%	23.1%	24.4%	48.7%	46.2%	5.1%	0.0%
37+	20.8%	40.3%	5.6%	33.3%	51.4%	41.7%	6.9%	0.0%
MP Online	8.0%	48.0%	44.0%	0.0%	64.0%	24.0%	12.0%	0.0%
MP On-Site	6.6%	77.0%	14.8%	1.6%	82.0%	18.0%	0.0%	0.0%

Electronic Health Activities	Change in Usage Since 2019				Change Due to COVID-19			
	Decreased	Same	Increased	Not Specified	Not at All	Somewhat	Very	Not Specified
Access Medical Journals								
Men	14.3%	81.0%	4.8%	0.0%	81.0%	0.0%	9.5%	9.5%
Women	6.8%	61.4%	6.8%	25.0%	68.2%	22.7%	6.8%	2.3%
Unspecified	0.0%	0.0%	0.0%	100.0%	7.3%	61.0%	31.7%	0.0%
< 37	2.6%	55.1%	3.8%	38.5%	53.8%	28.2%	12.8%	5.1%
37+	9.7%	38.9%	5.6%	45.8%	52.8%	34.7%	12.5%	0.0%
MP Online	8.0%	64.0%	20.0%	8.0%	56.0%	16.0%	12.0%	16.0%
MP On-Site	11.5%	83.6%	3.3%	1.6%	91.8%	8.2%	0.0%	0.0%
Access Networking Sites								
Men	4.8%	76.2%	19.0%	0.0%	81.0%	9.5%	9.5%	0.0%
Women	10.2%	55.7%	10.2%	23.9%	60.2%	15.9%	2.3%	21.6%
Unspecified	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%
< 37	6.4%	46.2%	12.8%	34.6%	50.0%	12.8%	2.6%	34.6%
37+	6.9%	40.3%	4.2%	48.6%	43.1%	8.3%	2.8%	45.8%
MP Online	20.0%	48.0%	24.0%	8.0%	52.0%	40.0%	8.0%	0.0%
MP On-Site	8.2%	80.3%	11.5%	0.0%	86.9%	9.8%	3.3%	0.0%
Access Official Sites								
Men	4.8%	76.2%	19.0%	0.0%	81.0%	0.0%	9.5%	9.5%
Women	3.4%	58.0%	14.8%	23.9%	58.0%	12.5%	5.7%	23.9%
Unspecified	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%
< 37	2.6%	48.7%	11.5%	37.2%	46.2%	7.7%	6.4%	39.7%
37+	2.8%	40.3%	11.1%	45.8%	44.4%	6.9%	2.8%	45.8%
MP Online	0.0%	56.0%	36.0%	8.0%	48.0%	16.0%	20.0%	16.0%
MP On-Site	6.6%	80.3%	13.1%	0.0%	85.2%	11.5%	3.3%	0.0%

Electronic Health Activities	Change in Usage Since 2019				Change Due to COVID-19			
	Decreased	Same	Increased	Not Specified	Not at All	Somewhat	Very	Not Specified
Use of Online Databases								
Men	4.8%	76.2%	19.0%	0.0%	81.0%	9.5%	9.5%	0.0%
Women	5.7%	64.8%	28.4%	1.1%	50.0%	23.9%	4.5%	21.6%
Unspecified	7.3%	41.5%	51.2%	0.0%	0.0%	0.0%	0.0%	100.0%
< 37	3.8%	60.3%	34.6%	1.3%	41.0%	19.2%	5.1%	34.6%
37+	8.3%	59.7%	31.9%	0.0%	40.3%	11.1%	2.8%	45.8%
MP Online	4.0%	56.0%	40.0%	0.0%	56.0%	28.0%	16.0%	0.0%
MP On-Site	4.9%	77.0%	16.4%	1.6%	73.8%	23.0%	3.3%	0.0%
Use of Magazines								
Men	0.0%	90.5%	9.5%	0.0%	81.0%	0.0%	9.5%	9.5%
Women	10.2%	72.7%	15.9%	1.1%	59.1%	34.1%	6.8%	0.0%
Unspecified	9.8%	85.4%	2.4%	2.4%	41.5%	46.3%	12.2%	0.0%
< 37	5.1%	79.5%	14.1%	1.3%	50.0%	37.2%	10.3%	2.6%
37+	12.5%	77.8%	8.3%	1.4%	65.3%	27.8%	6.9%	0.0%
MP Online	8.0%	56.0%	36.0%	0.0%	48.0%	24.0%	20.0%	8.0%
MP On-Site	4.9%	82.0%	11.5%	1.6%	75.4%	21.3%	3.3%	0.0%
Use of Wearables								
Men	4.8%	85.7%	9.5%	0.0%	76.2%	4.8%	9.5%	9.5%
Women	6.8%	56.8%	17.0%	19.3%	61.4%	14.8%	4.5%	19.3%
Unspecified	12.2%	78.0%	9.8%	0.0%	87.8%	9.8%	2.4%	0.0%
< 37	3.8%	61.5%	20.5%	14.1%	69.2%	11.5%	3.8%	15.4%
37+	12.5%	72.2%	6.9%	8.3%	72.2%	12.5%	5.6%	9.7%
MP Online	12.0%	68.0%	12.0%	8.0%	56.0%	20.0%	8.0%	16.0%
MP On-Site	3.3%	50.8%	21.3%	24.6%	59.0%	13.1%	4.9%	23.0%

Electronic Health Activities	Change in Usage Since 2019				Change Due to COVID-19			
	Decreased	Same	Increased	Not Specified	Not at All	Somewhat	Very	Not Specified
Use of Health Apps								
Men	38.1%	9.5%	0.0%	52.4%	28.6%	0.0%	9.5%	61.9%
Women	2.3%	30.7%	27.3%	39.8%	42.0%	10.2%	6.8%	40.9%
Unspecified	7.3%	43.9%	48.8%	0.0%	82.9%	12.2%	4.9%	0.0%
< 37	2.6%	33.3%	34.6%	29.5%	51.3%	9.0%	7.7%	32.1%
37+	4.2%	37.5%	26.4%	31.9%	51.4%	9.7%	5.6%	33.3%
MP Online	0.0%	48.0%	24.0%	28.0%	32.0%	16.0%	16.0%	36.0%
MP On-Site	0.0%	23.0%	13.1%	63.9%	26.2%	3.3%	6.6%	63.9%

Note. Within each electronic health activity, 7 subcategories are delineated. “<37” refers to patients younger than 37 years old and “37+” denotes patients aged 37 and older. “MP Online” signifies a preference online meetings, whereas “MP On-Site” indicates a preference for on-site meetings.

3.6.3 Electronic Health Activity Change Since 2019 in Subcategories

Significant values for gender ($p < 0.05$) were reported in four EHAs: physician interaction via live video, access to online medical videos and websites, and the use of health apps. Notable significant decreases include physician interactions via live video (men: 0% vs. women: 22.7% vs unspecified gender: 75.6%, $p < 0.001$, Cramér's $V = 0.502$), access to online medical videos (men: 4.8% vs. women: 18.2% vs unspecified gender: 73.2%, $p < 0.001$, Cramér's $V = 0.524$), and use of health apps (men: 38.1% vs. women: 2.3% vs unspecified gender: 7.3%, $p < 0.001$, Cramér's $V = 0.448$). A notable significant increase was found in the use of health apps (men: 0% vs. women: 27.3% vs unspecified gender: 48.8%, $p < 0.001$, Cramér's $V =$

0.448). Discrepancies among access to medical websites were also reported, with both decreases (men: 14.3% vs. women: 11.4% vs unspecified gender: 26.8%, $p < 0.001$, Cramér's $V = 0.509$) and increases (men: 14.3% vs. women: 21.6% vs unspecified gender: 0%, $p < 0.001$, Cramér's $V = 0.509$) Persons of unspecified gender only reported answers to 4 of the 16 EHAs (25.0%) regarding the categories “same” and as “increased”. Persons of unspecified gender answered 100% of the questions in eight categories as not specified. They answered on average 62.5% of all questions as “not specified”

Significant values for age ($p < 0.05$) were reported in three EHAs: access to online medical books, websites, and the use of wearables. Notable significant increases in EHAs for age include access to online medical books (<37: 19.2% vs. 37+: 6.9%, $p = 0.017$, Cramér's $V = 0.260$), access to medical websites (<37: 23.1% vs. 37+: 5.6%, $p = 0.012$, Cramér's $V = 0.270$) and use of wearables (<37: 20.5% vs. 37+: 6.9%, $p = 0.017$, Cramér's $V = 0.260$). Additional, non-significant notable values include physician interaction via social media (same, <37: 59.0% vs. 37+: 34.7%) and physician interaction via private systems (same, <37: 55.1% vs. 37+: 33.3%).

No significant differences for meeting preference ($p < 0.05$) were reported. Notable differences in EHA were noted in the following categories: physician interaction via mail (same, online: 36.0% vs. on-site: 65.6%, increase, online: 64.0% vs. on-site: 31.1%), access to online medical books (same, online: 44.0% vs. on-site: 77.0%, increase, online: 40.0% vs. on-site: 16.0%), and access to online medical videos (same, online: 36.0% vs. on-site: 73.8%, increase, online: 56.0% vs. on-site: 21.3%).

3.6.4 Electronic Health Activity Change due to COVID-19 in Subcategories

All significant values were non-applicable for gender. Persons of unspecified gender notably reported three EHAs for having little effect due to COVID-19: use of magazines (41.5%), use of wearables (87.8%), and use of health apps (82.9%). They also reported ten EHAs with somewhat of an effect: physician interaction via mail – access to medical journals, all over 60%. Physician interaction via live video showed a notable change due to COVID-19 (men: 33.3% vs. women: 25.4% vs. unspecified gender:

22.0%). Persons of unspecified gender answered 100% of the questions in three EHAs as not specified.

The only applicable significant value for age is the EHA physician interaction via private systems ($p = 0.039$, Cramér's $V = 0.237$). Both age groups of patients reported notable discrepancies with values of “somewhat” change (<37: 26.9% vs. 37+: 41.7%) and a “very” change (<37: 19.2% vs. 37+: 9.7%).

All significant values were non-applicable for meeting preference. Notable discrepancies were reported with “not at all” for online preferers (54.3%) vs. on-site preferers (73.2%). 13 of 16 groups of on-site preferers reporting 60% or more compared to five online preferers. Additionally, 13 of 16 groups of online preferers reported 10% or more in the category “very” compared to three on-site preferers with an average of 18.0% for online and 6.4% for on-site. A notable difference in the use of health apps was reported in meeting preference (not specified, online: 28.0% vs. on-site: 63.9%) and (not specified, online: 36.0% vs. on-site: 63.9%).

Table 4: Patients’ preference for future engagements in subcategories

Engagements	Future Meeting Preference					
	Only On-Site	Mostly On-Site	Both Equal	Mostly Online	Only Online	Not Specified
Doctor Interactions						
Men	28.6%	28.6%	38.1%	4.8%	0.0%	0.0%
Women	30.7%	47.7%	17.0%	1.1%	0.0%	3.4%
Unspecified	85.4%	9.8%	4.9%	0.0%	0.0%	0.0%
< 37	41.0%	38.5%	19.2%	1.3%	0.0%	0.0%
37+	50.0%	30.6%	13.9%	1.4%	0.0%	4.2%
MP Online	4.0%	40.0%	40.0%	8.0%	0.0%	8.0%
MP On-Site	26.2%	55.7%	18.0%	0.0%	0.0%	0.0%
Patient Interactions						
Men	19.0%	19.0%	42.9%	9.5%	0.0%	9.5%
Women	23.9%	23.9%	45.5%	3.4%	0.0%	3.4%
Unspecified	68.3%	24.4%	7.3%	0.0%	0.0%	0.0%
< 37	29.5%	25.6%	43.6%	1.3%	0.0%	0.0%
37+	41.7%	20.8%	25.0%	5.6%	0.0%	6.9%
MP Online	4.0%	32.0%	48.0%	8.0%	0.0%	8.0%
MP On-Site	21.3%	18.0%	52.5%	4.9%	0.0%	3.3%

Health Activities	Future Meeting Preference					
	Only On-Site	Mostly On-Site	Both Equal	Mostly Online	Only Online	Not Specified
Ordering Meds						
Men	0.0%	33.3%	38.1%	14.3%	4.8%	9.5%
Women	25.0%	11.4%	45.5%	12.5%	2.3%	3.4%
Unspecified	78.0%	22.0%	0.0%	0.0%	0.0%	0.0%
< 37	33.3%	14.1%	39.7%	10.3%	2.6%	0.0%
37+	38.9%	20.8%	23.6%	8.3%	1.4%	6.9%
MP Online	12.0%	20.0%	36.0%	20.0%	4.0%	8.0%
MP On-Site	8.2%	14.8%	55.7%	14.8%	3.3%	3.3%
Obtaining Med. Infos						
Men	9.5%	9.5%	66.7%	14.3%	0.0%	0.0%
Women	18.2%	6.8%	54.5%	12.5%	4.5%	3.4%
μ	63.4%	24.4%	9.8%	0.0%	0.0%	2.4%
< 37	25.6%	11.5%	52.6%	7.7%	2.6%	0.0%
37+	33.3%	12.5%	34.7%	11.1%	2.8%	5.6%
MP Online	0.0%	4.0%	52.0%	36.0%	0.0%	8.0%
MP On-Site	6.6%	6.6%	72.1%	8.2%	6.6%	0.0%

Note. Within each future engagement, 7 subcategories are delineated. “<37” refers to patients younger than 37 years old and “37+” denotes patients aged 37 and older. “MP Online” signifies a preference online meetings, whereas “MP On-Site” indicates a preference for on-site meetings.

In Table 4, all significant values were non-applicable. No engagement under all three subcategories reported over 10%. Notable differences were reported in persons of unspecified gender, preferring over 60% in all future engagements only in person. Notable values were reported in physician interactions (mostly on-site: men: 28.6% vs. women: 47.7% vs. unspecified gender: 9.8%) and (both equal: men: 38.1% vs. women: 17.0% vs. unspecified gender: 4.9%). Additional notable values include ordering medications (only on-site: men: 0% vs. women: 25.0% vs. unspecified gender: 78.0%) and (mostly on-site: men: 33.3% vs. women: 11.4% vs. unspecified gender: 22.0%).

For the subcategory age, notable values include other patient interactions (only on-site: <37: 29.5% vs. 37+: 41.7%) and (both equal: <37: 43.6% vs. 37+: 25.0%) as well as obtaining medical information (only on-site: <37: 25.6% vs. 37+: 33.3%) and (both

equal: <37: 52.6% vs. 37+: 34.7%). Notably, no patients under the age of 37 answered questions as “not specified.”

For the subcategory meeting preference, notable values were reported in physician interactions (only on-site, online: 4.0% vs. on-site: 26.2%), (mostly on-site, online: 40.0% vs. on-site: 55.7%), and (both equal, online: 40.0% vs. on-site: 18.0%). Patients who preferred on-site meetings reported patient interactions, ordering medications, and obtaining medical information under the category “both equal” over 50%. Additional notable values include obtaining medical information (mostly online, online: 36.0% vs. on-site: 8.2%).

4 Discussion

4.1 Results

This retrospective survey provides additional evidence on the extent to which patients express their preference for specific treatment options. The primary objective of this study was to describe patient preferences in relation to EHA, with the aim of potentially transforming the digitalization process in the field of psychosomatics and improving therapy outcomes. The findings presented in this study reveal important discrepancies between patient observances and outlooks across different subcategories of gender, age, and meeting preference, discussed in the following sections. Detailed analysis of psychosomatic patients will be discussed in 4.2.

The survey, encompassing a range of 16 EHAs, initially focused on total preferences and subsequently categorized into four main topics: online physician interactions, online patient interactions, ordering medications online, and obtaining medical information. Each of these EHAs were individually analyzed for changes since December of 2019 and their association with COVID-19-induced changes, as explored in research question 1 and 2, respectively. Additionally, future meeting preferences were examined in research question 3. Moreover, these inquiries were further subcategorized by gender, age, and meeting preference in research question 4.

4.1.1 Research Question 1: Have health-related activity levels changed among psychosomatic patients since the start of COVID-19?

Analysis of the data showed since 2019, on average, close to half of the patients reported no change in EHA usage and almost one third of the patients reported answers as not specified. This is surprising, considering the evolution of technology and its further digitalization (Bates et al., 2018, Edgerly et al., 2017, Gunter and Terry, 2005). When observing main topics, obtaining medical information reported the smallest change in EHA. On the other hand, ordering medication online reported the largest increase. Physician interaction displayed a noteworthy combination of both

increases and decreases. In contrast, patient interactions online did not display any notable increases or decreases.

Upon further examination of the categories of online physician interaction and obtaining medical information, several points emerged. Two notable EHAs, namely the use of magazines and wearables, displayed the highest proportion of reported answers showing no change. This finding is interesting, considering the usage of wearables is expected to annually increase by 14% until 2030 (Grand View Research, 2021, Precedence Research, 2022). However, an anticipated rise in usage was not shown in our data. A potential explanation for no change in magazine consumption could be due to the digitalization of news (Edgerly et al., 2017), allowing for a relatively seamless transition from paper to online.

Since the start of the COVID-19 pandemic, notable decreases have been observed in two EHAs: physician interaction via live video and access to online medical videos. Conversely, notable increases include physician interaction via live video and mail, as well as the use of online databases and health apps. The increase in usage of telemedicine usage since the start of COVID-19 has been shown in many reports (Gentry et al., 2021, Guder et al., 2016, Mann et al., 2020, Saiyed et al., 2021) and is reflected in the rise in physician interaction via video and mail. The absence of studies describing a decrease in telemedicine further questions the legitimacy of a proposed decrease observed in our study. Moreover, an increase in medical video usage and its association with COVID-19 reflects the recommendations of improving health literacy by using online platforms to share readily accessible medical information (Conard, 2019, Hersh et al., 2015). Additionally, the increase popularity of health apps has been reflected in other studies, highlighting the increase in smartphone usage and the popularity of health apps (Paradis et al., 2022, Yang et al., 2023). A dramatic rise in COVID-19 publications and in information research has been shown, potentially explaining the increase in online journal usage (Lemenager et al., 2020, Raynaud et al., 2021).

4.1.2 Research Question 2: Can we show that there is a relationship between changes in health-related activity levels and COVID-19?

Analysis of the data showed, on average, nearly half of the patients reported no change in EHA usage as a result of COVID-19. Upon further examination of the main topics, it was found that online physician interactions and ordering medications online reported the largest changes due to the COVID-19 pandemic. On the contrary, obtaining medical information online and online patient interactions reported the least change. Further elaboration of general tendencies of research questions 1-3 is examined in 4.1.4.

As already discussed in 4.1.1, the use of magazines and wearables was the most likely to display no change in EHA usage since 2019. These same two EHAs also reported the least amount of change due to COVID-19. The no change in magazine usage and its relevance to COVID-19 may show that usage of magazines has become digitalized even before the start of COVID-19. Magazines can portray news even on social media, continuing news consumption (Dvir-Gvirsman, 2022). Although wearables could be used to potentially detect a COVID-19 infection, the widespread use of specific COVID-19 wearables has not been established and continues to be an area of ongoing research (Channa et al., 2021, Guder et al., 2016, Natarajan et al., 2020). This could be a plausible explanation for the low relevance to the COVID-19 pandemic observed in our study.

Other noteworthy EHAs, such as physician interaction via live video and mail, reported the largest change due to COVID-19, followed by access to online medical videos. These changes are not surprising, considering the rapid increase of usage of online physician consultation discussed in 4.1.1. In contrast, the use of online databases and health apps displayed little correlation due to COVID-19. The trivial lack of correlation of increase in online journal usage due to COVID-19 may be attributed to other search categories, such as other major diseases and conditions. Although a large number of apps were developed specifically relating to different areas of COVID-19 (Almalki and Giannicchi, 2021), a correlation between health app usage and COVID-19 was not reflected in our data. This lack of correlation may be due to the kinds of apps generated.

Many popular health apps created in recent years are not COVID-19 related (Paradis et al., 2022, Yang et al., 2023), and may therefore attribute to the lack of relevance to COVID-19.

Generalized statements to research questions 1 and 2 could imply that obtaining medical information and online patient interactions have experienced the least amount of change and relation to the COVID-19 pandemic. Conversely, ordering medication online and online physician interaction have demonstrated notable changes in usage and its relation to COVID-19. Among the patient group, the usage of magazines and wearables was least likely to change in usage and be influenced by COVID-19. Physician interactions via live video and mail have increased the most in usage and, along with access to online medical videos, were the most influenced by COVID-19. It's worth noting that while the use of online databases and health apps may have had notable increases, they were not COVID-19 related.

4.1.3 Research Question 3: Has COVID-19 played a role in influencing patient wishes for future online or on-site meetings?

Patients' preferences for future engagements showed noticeable differences. The majority of patients' answers skewed towards preferring in-person meetings for future engagements. This was reflected in physician and patient interactions and ordering medication, whose majority preferred future engagements in person. Of these three categories, physician interaction reported the greatest preference for meetings only or mostly in-person. However, approximately one-third of patients provided neutral answers regarding future location preferences. This was particularly notable with the engagement obtaining medical information, where the majority of patients did not express a preference in location for accessing medical information. The minority of patients displayed a preference for future online meetings. Further elaboration of patient preference is found in 4.1.4 and 4.1.5.

4.1.4 Elaboration of Research Questions 1-3

A clearer understanding of patients' EHA usage and future preferences emerge once fully discussing research questions 1-3. In terms of total preferences, patients reported

the highest amount of questions as not having changed since December of 2019, noted no impact due to COVID-19, and expressing a preference for future physician interaction in-person. Among main topics, obtaining medical information online reported the least change, was the least influenced by COVID-19, and was the largest reported category to being indifferent to the location of future meetings. One can infer that obtaining medical information has shown little tendential change since the start of the pandemic and patients do not necessarily need face to face interactions to access information. As discussed in 1.2.4, patients have been shown to prefer chatbot responses to physicians, opening the opportunity for medical information to be obtained online (Ayers et al., 2023). Other findings, such as low engagement in society, high required health literacy rates, and an overall lack of understanding on the use of medical programs appear to explain the seeming disinterest (Ernsting et al., 2017, Hermes-DeSantis et al., 2021, Kondo, 2021).

Online patient interactions reported a low change since December of 2019 and extent due to COVID-19, however, reported a higher preference for future patient interactions to be in-person. Studies have shown that while showing online patient-patient interactions are generally beneficial (Birkelund and Larsen, 2013), equally effective patient-patient interactions were preferred in-person, in part due to concerns of increasing technological burdens and damage to other patient relationships (Mirzaei and Kashian, 2020, Walker et al., 2019).

This cannot be said of online physician interactions and ordering medication. Both had notable changes in usage, were the most influenced due to COVID-19, and had the highest preference of future interactions to be only in-person. This could potentially be explained through physical touch. Although verbally connected through the Internet, patients may feel disconnected by the lack of nonverbal communication and physical examination (Car and Sheikh, 2004, Sirintrapun and Lopez, 2018). A physical examination and a physician's touch have been shown to be beneficial to physician-patient interaction, improving communication and comfort (Artandi and Stewart, 2018, Bush, 2001, Connelly, 2004). Technological hurdles and privacy concerns also raise concerns (Tashkandi et al., 2020). This may partially explain why patients still prefer physician interactions in-person and consequently ordering medication in-person, as

seen in other studies (Mirzaei and Kashian, 2020, Wehrle et al., 2021). These preferences are presented in Table 5 below.

Table 5: Overview of general tendencies from the total data

Interaction Method	Change in Usage since 2019	Relation to COVID-19	Future Preference
Doctor Interactions	High	High	In-Person
Patient Interactions	Low	Low	In-Person
Ordering Medications	High	High	In-Person
Obtaining Medical Information	Low	Low	Indifferent

4.1.5 Research Question 4: Can any of these changes be related to gender, age, or specific meeting preference?

4.1.5.1 Tendencies

When comparing gender, the subcategory unspecified gender must be discussed. Participants that checked “no answer” for the category gender could have ample reason for doing so. This may be due to laziness, personal preference, being of diverse gender, or other reasons. The data does not discern which reason the participants may have chosen, meaning assumptions of unspecified gender must be carefully considered. Further discussion of unspecified gender will be discussed in 4.1.6.

Persons of unspecified gender were most likely to report EHA changes since 2019 as not specified, attributed the highest amount of change due to COVID-19, and were most likely to prefer all future engagements in-person. It is plausible that many opted not to specify their answers on grounds of laziness or personal preference. One could also assume that persons of diverse gender prefer in-person meetings for reasons similar as based above: lack of nonverbal communication, the comfort of in-person meetings, and eventually more privacy. Literature seems to show the opposite: although a low usage of telemedicine exists, especially among persons of diverse

gender, many prefer online meetings, have a higher satisfaction rate, and have a positive change towards telemedicine after initial usage (Hertling et al., 2021, Radix et al., 2022). However, persons of diverse gender face many obstacles receiving treatment specific to their needs (Ng et al., 2021, Radix et al., 2022, Safer et al., 2016), which may strengthen the reasoning behind the comfort of in-person meetings.

Men and women differed only slightly from each other in most EHA categories, but men were most likely to report no change to EHA since 2019 and were most likely to not attribute EHA changes to COVID-19. Women preferred physician interactions and ordering medications more in-person than men. This agrees with other studies, showing women have a higher usage of telemedicine (Lucas and Villarroel, 2022), but lower satisfaction levels with virtual meetings (Ramaswamy et al., 2020). Men were more indifferent to the location of future preference for physician interaction and obtaining medical information than women.

When comparing age, patients younger than 37 years old reported a larger increase in EHA since December 2019 compared to patients aged 37 and older, although the change due to COVID-19 did not show notable differences. This is not surprising, considering younger patients' greater access to technology (Carroll et al., 2017, Heron et al., 2019, Talmon, 2019), and older patients' lower health literacy (Diviani et al., 2015, Melhem et al., 2023). Patients aged 37 and older were more likely to prefer future physician engagements in-person, whereas patients younger than 37 years old were more likely to be indifferent to future meeting locations. This was also reflected in other studies as well, citing technological issues, privacy, and self-efficacy to be the main factors (Reed et al., 2020, van Houwelingen et al., 2018).

When comparing meeting preferences, patients who preferred on-site meetings were more likely to report no change in EHA, however, patients who preferred online meetings were more likely to attribute changes due to COVID-19. Both patient groups preferred future engagements on-site the most for physician interactions. In addition, and more so than other groups, both were indifferent to location for patient interactions, ordering medications, and obtaining medical information, reflecting the reasoning discussed in 4.1.4. Patients who preferred online meetings also reported a

notable percentage preferring obtaining medical information mostly online, but only a small percentage preferred only online.

The reasons behind patient's preference for in-person meetings despite initially expressing a preference for online meetings is unclear. Survey question 4 asks patients where their meeting on that day would have been preferred, while survey question 7 addresses future meetings. It is plausible that patients desired for that specific meeting to have been online, but future meetings to be in-person. Factors such as complex medical issues, future diagnostic procedures, and the trust and confidence in their physician could play a role in future meeting preference. However, these parameters were not evaluated in the study.

These preferences describe tendencies shown throughout research questions 1-4: telemedicine is preferred rather than in-person interactions, and obtaining medical information is flexible with the location of services.

4.1.5.2 Significant values vs notable changes

All significant values in research question 4 were compared to notable changes found in research questions 1-3. Following the guidelines highlighted in 2.4, all significant values pertaining to meeting preference for future health activities, and the subcategory meeting preference were considered not applicable.

The subcategory gender revealed many comparisons between significant values and notable changes. Persons of unspecified gender were least likely to have used physician interaction via live video, whereas men were more likely to be indifferent and reported a significant increase in usage. Women, on the other hand, reported a significant increase and decrease in physician interaction via live video. This ambiguity of answers could potentially be explained by significant patient barriers experienced (Ftouni et al., 2022), but does not reflect the overall increase in telemedicine usage (Gentry et al., 2021, Guder et al., 2016, Mann et al., 2020, Saiyed et al., 2021). Furthermore, persons of unspecified gender reported a significant decrease in access to online medical videos. Men were more likely to report a decrease in health app usage compared to women and unspecified gender, who reported a significant

increase. This is supported by other studies, highlighting male's lower usage of health apps (Carroll et al., 2017, Dahmen et al., 2021, Escoffery, 2018).

There was only one subcategory on age that correlated to the criteria above. Patients younger than 37 years old displayed a significant increase in the use of wearables compared to patients aged 37 and older, which has also been supported in other studies (Chandrasekaran et al., 2020). These findings suggest a technological divide that could affect EHA usage between individuals from different age groups.

4.1.6 Not Specified Data

Not specified data, or questions that were not answered in the survey, may have potential implications that warrant consideration. Patients may have intentionally left questions unanswered, for personal reasons, or may have had a lack of information to be able to answer the question. Assuming patients attempted to answer every question to the best of their abilities, not specified answers would entail that the questions were non-applicable. In this study, two notable sources of not specified answers emerged: persons of unspecified gender and the subcategory of health apps.

Within the subcategory gender mentioned earlier, persons of unspecified gender reported the highest percentage of "not specified" responses in survey questions 5-7. For persons of diverse gender, this may be attributed to a large number of social obstacles, lack of providers and specific care, and a current low health literacy rate as discussed in 4.1.5.1. Persons of diverse gender also may have perceived the questioning framework did not apply to their unique needs, potentially leading to feelings of neglect or reluctance to disclose their preference to the specific categories. However, it is important to note that other reasoning beyond diverse gender, such as laziness or personal preference may have contributed to these answers. The reasoning behind this patient group reporting EHA changes as "not specified," while attributing the highest change due to COVID-19 and expressing a preference for future in-person engagements remains unclear.

After discussing the substantial role of persons of unspecified gender and excluding them for further evaluation of not specified data, the question pertaining to the use of

health apps was the most unanswered among the other subcategories. There could be several interpretations of this data. The use of health apps may not be deemed necessary by a number of the patients, or they have not had any experience with them. There may also be a discrepancy as to what a health app entails, therefore making the question unclear to answer. A last reason could be that patients were unwilling to disclose the fact that they use health apps. Questions and concerns of reliability, validity, and privacy were also voiced in other studies (Vo et al., 2019).

Not specified answers do not answer the specific questions of the aim of the study, nor as to why they were reported as not specified. However, understanding the reasoning behind these missing answers could provide important information. They could provide vital insights into specific population groups that may have influenced their decision-making, which may in turn raise new questions for future research.

4.2 Representation of Psychosomatic Patients

Although we had no preconceived hypothesis, we anticipated that psychosomatic patients would express an openness to telemedicine, supporting an alternative to the in-person meeting dilemma raised by the pandemic. These patients often require more frequent medical appointments compared to other specialties, due to ongoing monitoring and treatment of physical and psychological symptoms (Schmidt et al., 2023, Tschopp et al., 2023, Wortman et al., 2019). Despite the attractiveness of online psychotherapy encouraged by the COVID-19 pandemic, psychosomatic patients continue to express an interest in in-person physician appointments in the future. Although there may be underlying reasons for wanting appointments online, such as certain medical conditions and appointment type, the general consensus for wanting in-person meetings has been shown. It's possible that while patients are generally open to online communication, they do not consider it as a replacement to the benefits of in-person consultations.

Understanding why psychosomatic patients reported answers in the survey as such offers insights and contributes to our comprehension of mental health and its impact on health care – even beyond the field of psychosomatics. Studies show that for example up to 30% of patients in general practices have non-specific functional

somatoform symptoms (Fink et al., 2004, Sauer and Eich, 2007, Schaefert et al., 2012). Further examples of conditions in society include migraines, diabetes, and other somatic disorders that exhibit a high level of psychological comorbidity (Campayo et al., 2011, Guidetti et al., 2019, Henning et al., 2020). A study from Pieh et al. (2011) even suggests the prevalence of psychosomatic comorbidities are comparable in other medical fields. Studies in other medical departments, such as Bangalore et al. (2011) and Nicolucci et al. (2019) reported findings of their patient groups and have formed conclusions with representation in the general population. It is therefore important to note that the scope of this survey extends beyond psychosomatic patients alone. Further implications are discussed in 4.5.

4.3 Strengths and Limitations

There are some key strengths to this study. To the best of our knowledge, this is the first study to show an overview of ePatients describing their usage of medical information and telemedicine in relation to COVID-19. The design of the survey used 16 specific questions pertaining to EHA and the subdivision of the patient group into three categories to display significant changes. These significant changes show not only differences in usage and extent due to COVID-19, but also its relation to gender, age, or meeting preference. These results along with future patient preferences can potentially be used to determine further eHealth applications in the future.

The study performed had several limitations. An initial limitation relates to survey question 6 referring to the extent of the reported changes being related to COVID-19, Figure 14. If patients answered survey question 5 in Figure 13 relating to change since COVID-19 as “same” or “not specified”, they should not have been allowed to answer the following question. A second limitation relates to the sample size. Although 150 patients were surveyed, subdividing patients into subcategories led to small sample sizes and subsequent low significant values. A low response latency was reported in some areas, which could also be due to a lack of motivation. Potential errors in data transmission and a large number of unanswered questions could be avoided by moving the survey exclusively to an online platform. This would also allow for the study to reach additional clinics for an increased sample size. An additional limitation relates to validity, or lack thereof. As explained in the statistical analysis, the validity was not

assessed for this survey. That could mean that the survey's intended questions, while adapted from a reliable survey, may not accurately capture the intended concepts.

4.4 Future Questions

Many additional questions have emerged since these findings. Further investigation into the reasoning behind the “not specified” answers of the patients with long-answer explanations to each not specified answer is strongly recommended. Additional work needs to be done to establish whether persons of unspecified gender can associate with the questions asked, or if other parameters are needed.

With digitalization becoming intertwined in our daily life, more research is needed to determine the need/want of future patients with wearables. Certain questions, such as physician interaction via live video, achieved such a discrepancy in increase and decrease among gender, that further research is recommended to be undertaken in those areas. It would also be interesting to discern what kind of physician interaction desires an in-person meeting compared to online, and only in-person versus mostly in-person meetings. Additional factors, such as ethnicity, income, education level, and previous usage of telemedicine may play a role and should be examined as well (Carroll et al., 2017, Chae, 2018, Ernsting et al., 2017, Hertling et al., 2021, Lucas and Villarroel, 2022, Ramaswamy et al., 2020).

An interesting observation by Walsh and Markus is that a large number of patients preferred follow-up meetings online after an initial consultation (Walsh and Markus, 2019). About one-third of the psychosomatic patients in this survey reported wanting meetings only “mostly in person”, implying the idea of online follow-up meetings is plausible. Additional questions pertaining to previous usage of telemedicine and the impact on future meetings should be considered.

This study was conducted before the release of ChatGPT and could not address its potential implications. It would be interesting to discern to what extent AI has changed the way patients interact with EHA with respect to the four research questions stated in this study. A study questioning patients' preference for AI or physicians could be considered. One study suggests patients have even been shown to prefer chatbot

responses compared to physician responses and reported a high amount of quality answers given (Ayers et al., 2023). Another study suggests patients were more inclined to disclose personal information with a computer than a physician (Lucas et al., 2014). This raises the question to what extent can natural language programs replace physicians in the future, as already warned by numerous papers (Doraiswamy et al., 2020, Fiske et al., 2019).

Concerns regarding ChatGPT's use of clinical data in ethical, and liability issues have been voiced, and reports of bias, incorrect citations, and security hacks have been shown (Derton et al., 2023). Guidelines, AI transparency, and legal framework considering informed consent of patients with the use of AI in the medical field will be needed (Masters, 2019, Tolsgaard et al., 2023). The need for human oversight has also been suggested, due to AI's incapability of critical decision-making (Brault and Saxena, 2021). Despite the concerns, AI will continue its integration into the field of medicine. Its undoubted potential to enhance the efficiency of healthcare will increase its usage in the coming years.

4.5 Implications

The current approach to treatment in the psychosomatic department in Tübingen, Germany predominantly relies on in-person meetings. However, the findings from this survey, along with other papers, propose the possibility of change in the current system of psychosomatic medicine to adjust to the specific needs of patients. According to patient preference, the future use of obtaining medical information in an online setting appears to be a reasonable application for future psychosomatic treatment. Supporting research, including our results, propose that physician interactions and medication orders can be applied in an online platform, however after establishing a proper physician-patient relationship through previous in-person meetings. Support groups have the potential to expand into the online field, but are currently not preferred by a majority of patients. It is critical to consider specific factors such as gender, age, and previous preferences when implementing these suggestions, as they may vary among different patient populations. Furthermore, these findings may not be applicable to all clinical settings and additional research may be required.

5 Summary

5.1 English Version

Since the corona pandemic, the debate to what extent patient treatment can be expanded to an online platform has reached new heights. Our retrospective analysis of outpatient psychosomatic patients surveyed four groups of questions relating to online activities: i) interaction with physicians, ii) patient interaction, iii) ordering medication, and iv) obtaining medical information. The study set out to assess patients' usage of EHA in relation to the start of COVID-19, its change in extent to COVID-19, and future EHA preferences. Our results show physician interaction and ordering medication online have notably increased in usage since the start of COVID-19, shown a high relation due to COVID-19, and future engagements were primarily preferred in-person. On the other hand, obtaining medical information and other patient interactions have shown little increase online since the start of COVID-19, little change due to COVID-19, and future engagements were primarily preferred in-person for patient interactions, whereas obtaining medical information was flexible to online or in-person meetings. Further examination of the data revealed the use of magazines and wearables were least likely to change in usage and be influenced by COVID-19, while physician interaction via live video and mail has increased the most in usage and extent due to COVID-19. Although the use of online databases and health apps also portrayed a notable increase in usage, the rise was not COVID-19 related.

Specific handling for people of different genders, age groups, and meeting preference should be taken into consideration. People of unspecified gender were more likely to consider the questions asked as being non-applicable and tended to prefer future forms of physician interaction in-person. Women were most likely to obtain medical information and interact with physicians via email. Men's answers did not differ noticeably from women, however, were least likely to use health apps. Women were more likely to contribute EHA changes due to COVID-19 than men. Men and women both tended towards being indifferent to meeting locations. Younger patients were more likely to use electronic health forms and displayed more flexibility in future

physician interaction compared to older patients, who preferred in-person interactions. Age was not a factor in EHA changes due to COVID-19. Patients originally displaying a preference towards online and in-person meetings displayed a preference for future physician engagements in-person and an indifference towards further EHA. The original preference towards on-site meetings reported less change in EHA since 2019, but the preference towards online meetings attributed more changes due to COVID-19.

The amount of digital possibilities in regard to medicine is rapidly increasing. This applies especially to health-related activities such as searching for information on the Internet, video consultations with physicians, or the use of wearables. Even beyond the pandemic situation, these changes will continue. These changes include the emergence of artificial intelligence, which has the potential to revolutionize the way we do medicine tomorrow. As seen in the data, obtaining medical information has shown to be indifferent to the location of services. With the help of AI, receiving medical information in a praxis could become obsolete. Although the presence of the physician is still desired, questions about the extent of AI integration in the medical field have risen. To be at the forefront of technological advances and to what degree patients desire these changes is essential: providing satisfactory communication, preventing the spread of misinformation, and continue optimizing healthcare.

5.2 Deutsche Version

Seit der Corona-Pandemie hat die Debatte darüber, inwieweit die Behandlung von Patienten auf eine Online-Plattform ausgeweitet werden kann, neue Dimensionen erreicht. In unserer retrospektiven Analyse ambulanter psychosomatischer Patienten wurden vier Gruppen von Fragen zu Online-Aktivitäten gestellt: i) Interaktion mit Ärzten, ii) Interaktion mit Patienten, iii) Bestellung von Medikamenten und iv) Einholung von medizinischen Informationen. Ziel der Studie war es, die Nutzung von EHA durch die Patienten in Bezug auf den Beginn von COVID-19, die Veränderung des Umfangs von COVID-19 und die künftigen EHA-Präferenzen zu bewerten. Unsere Ergebnisse zeigen, dass die Interaktion mit dem Arzt und die Online-Bestellung von Medikamenten seit dem Start von COVID-19 deutlich zugenommen haben, dass ein hoher Zusammenhang mit COVID-19 besteht und dass künftige Interaktionen in erster Linie persönlich bevorzugt werden. Andererseits haben die Einholung medizinischer Informationen und andere Interaktionen mit Patienten seit dem Start von COVID-19 kaum zugenommen, es gab kaum Veränderungen aufgrund von COVID-19, und künftige Interaktionen mit Patienten wurden in erster Linie persönlich bevorzugt, während die Einholung medizinischer Informationen flexibel für Online- oder persönliche Treffen war. Eine weitere Untersuchung der Daten ergab, dass sich die Nutzung von Zeitschriften und Wearables am wenigsten verändert und durch COVID-19 beeinflusst wird, während die Interaktion mit dem Arzt per Live-Video und E-Mail durch COVID-19 am stärksten zunimmt. Obwohl die Nutzung von Online-Datenbanken und Gesundheits-Apps ebenfalls einen bemerkenswerten Anstieg der Nutzung verzeichnete, war dieser Anstieg nicht auf COVID-19 zurückzuführen.

Die spezifische Handhabung für Menschen unterschiedlichen Geschlechts, Alters und mit unterschiedlichen Sitzungspräferenzen muss berücksichtigt werden. Personen ohne Angabe des Geschlechts hielten die gestellten Fragen eher für nicht zutreffend und bevorzugten künftige Formen der Interaktion mit dem Arzt in Person. Frauen informierten sich am ehesten per E-Mail über medizinische Themen und interagierten mit Ärzten. Die Antworten der Männer unterschieden sich nicht nennenswert von denen der Frauen, allerdings nutzten sie am seltensten Gesundheits-App. Frauen trugen mit größerer Wahrscheinlichkeit zu den EHA-Veränderungen aufgrund von

COVID-19 bei als Männer. Sowohl Männer als auch Frauen waren tendenziell gleichgültig, was die Treffpunkte anging. Jüngere Patienten nutzten eher elektronische Gesundheitsformulare und zeigten mehr Flexibilität bei der künftigen Interaktion mit dem Arzt als ältere Patienten, die persönliche Gespräche bevorzugten. Das Alter spielte bei den Änderungen der EHA durch COVID-19 keine Rolle. Patienten, die ursprünglich eine Vorliebe für Online- und persönliche Besprechungen zeigten, bevorzugten in Zukunft persönliche Arztkontakte und zeigten sich gegenüber weiteren EHA gleichgültig. Die ursprüngliche Präferenz für Vor-Ort-Besprechungen meldete weniger Veränderungen in der EHA seit 2019, während die Präferenz für Online-Besprechungen mehr Veränderungen auf COVID-19 zurückführte.

Die Zahl der digitalen Möglichkeiten im Bereich der Medizin nimmt rapide zu. Dies gilt insbesondere für gesundheitsbezogene Aktivitäten wie die Suche nach Informationen im Internet, Videosprechstunden mit Ärzten oder die Nutzung von Wearables. Auch über die Pandemiesituation hinaus werden sich diese Veränderungen fortsetzen. Zu diesen Veränderungen gehört auch das Aufkommen der künstlichen Intelligenz, die das Potenzial hat, die Art und Weise, wie wir morgen Medizin betreiben, zu revolutionieren. Wie aus den Daten hervorgeht, hat sich gezeigt, dass die Beschaffung medizinischer Informationen nicht vom Standort der Dienste abhängt. Mit Hilfe der KI könnte die Entgegennahme medizinischer Informationen in einer Praxis überflüssig werden. Obwohl die Anwesenheit des Arztes nach wie vor erwünscht ist, stellt sich die Frage nach dem Ausmaß der Integration von KI in den medizinischen Bereich. Um an der Spitze des technologischen Fortschritts zu stehen und inwieweit die Patienten diese Veränderungen wünschen, ist es wichtig, eine zufriedenstellende Kommunikation zu gewährleisten, die Verbreitung von Fehlinformationen zu verhindern und die Gesundheitsversorgung weiter zu optimieren.

6 Bibliography

- ABDUL RAHMAN, H., KWICKLIS, M., OTTOM, M., AMORNSRIWATANAKUL, A., K, H. A.-M., ROSENBERG, M. & DINOVI, I. D. 2023. Machine Learning-Based Prediction of Mental Well-Being Using Health Behavior Data from University Students. *Bioengineering (Basel)*, 10.
- ALDUGHAYFIQ, B. & SAMPALLI, S. 2021. Digital Health in Physicians' and Pharmacists' Office: A Comparative Study of e-Prescription Systems' Architecture and Digital Security in Eight Countries. *Omics*, 25, 102-122.
- ALMALKI, M. & GIANNICCHI, A. 2021. Health Apps for Combating COVID-19: Descriptive Review and Taxonomy. *JMIR Mhealth Uhealth*, 9, e24322.
- AMARASINGHAM, R., PLANTINGA, L., DIENER-WEST, M., GASKIN, D. J. & POWE, N. R. 2009. Clinical information technologies and inpatient outcomes: a multiple hospital study. *Arch Intern Med*, 169, 108-14.
- ANGARAN, D. M. 1999. Telemedicine and telepharmacy: current status and future implications. *Am J Health Syst Pharm*, 56, 1405-26.
- ARTANDI, M. K. & STEWART, R. W. 2018. The Outpatient Physical Examination. *Med Clin North Am*, 102, 465-473.
- ATHERTON, H., BOYLAN, A. M., ECCLES, A., FLEMING, J., GOYDER, C. R. & MORRIS, R. L. 2020. Email Consultations Between Patients and Doctors in Primary Care: Content Analysis. *J Med Internet Res*, 22, e18218.
- AYERS, J. W., POLIAK, A., DREDZE, M., LEAS, E. C., ZHU, Z., KELLEY, J. B., FAIX, D. J., GOODMAN, A. M., LONGHURST, C. A., HOGARTH, M. & SMITH, D. M. 2023. Comparing Physician and Artificial Intelligence Chatbot Responses to Patient Questions Posted to a Public Social Media Forum. *JAMA Intern Med*, 183, 589-596.
- BANGALORE, S., KUMAR, S., WETTERSLEV, J. & MESSERLI, F. H. 2011. Angiotensin receptor blockers and risk of myocardial infarction: meta-analyses and trial sequential analyses of 147 020 patients from randomised trials. *Bmj*, 342, d2234.
- BAO, Y., SUN, Y., MENG, S., SHI, J. & LU, L. 2020. 2019-nCoV epidemic: address mental health care to empower society. *Lancet*, 395, e37-e38.
- BARRY, C. A., BRADLEY, C. P., BRITTEN, N., STEVENSON, F. A. & BARBER, N. 2000. Patients' unvoiced agendas in general practice consultations: qualitative study. *Bmj*, 320, 1246-50.
- BATES, D. W., LANDMAN, A. & LEVINE, D. M. 2018. Health Apps and Health Policy: What Is Needed? *JAMA*, 320, 1975-1976.
- BECKER, I., RAVENS-SIEBERER, U., OTTOVÁ-JORDAN, V. & SCHULTE-MARKWORT, M. 2017. Prevalence of Adolescent Gender Experiences and Gender Expression in Germany. *J Adolesc Health*, 61, 83-90.
- BEN-ASSULI, O., SHABTAI, I. & LESHNO, M. 2015. Using electronic health record systems to optimize admission decisions: the Creatinine case study. *Health Informatics J*, 21, 73-88.
- BERGER, R., BULMASH, B., DRORI, N., BEN-ASSULI, O. & HERSTEIN, R. 2020. The patient-physician relationship: an account of the physician's perspective. *Isr J Health Policy Res*, 9, 33.

- BHATIA, S., PATNAIK, L., PATTANAIK, S. & SAHU, T. 2018. Internet use for patient care and health research: A cross-sectional study among physicians in a teaching hospital of Eastern India. *J Family Med Prim Care*, 7, 993-997.
- BHATT, P., LIU, J., GONG, Y., WANG, J. & GUO, Y. 2022. Emerging Artificial Intelligence-Empowered mHealth: Scoping Review. *JMIR Mhealth Uhealth*, 10, e35053.
- BHAVNANI, S. P., NARULA, J. & SENGUPTA, P. P. 2016. Mobile technology and the digitization of healthcare. *Eur Heart J*, 37, 1428-38.
- BIRKELUND, R. & LARSEN, L. S. 2013. Patient-patient interaction--caring and sharing. *Scand J Caring Sci*, 27, 608-15.
- BOKHORST, J. M., NAGTEGAAL, I. D., FRAGGETTA, F., VATRANO, S., MESKER, W., VIETH, M., VAN DER LAAK, J. & CIOMPI, F. 2023. Deep learning for multi-class semantic segmentation enables colorectal cancer detection and classification in digital pathology images. *Sci Rep*, 13, 8398.
- BOULOS, M. N., WHEELER, S., TAVARES, C. & JONES, R. 2011. How smartphones are changing the face of mobile and participatory healthcare: an overview, with example from eCAALYX. *Biomed Eng Online*, 10, 24.
- BRAULT, N. & SAXENA, M. 2021. For a critical appraisal of artificial intelligence in healthcare: The problem of bias in mHealth. *J Eval Clin Pract*, 27, 513-519.
- BUNDESMINISTERIUM FÜR GESUNDHEIT. 2021. *Die elektronische Patientenakte (ePA)* [Online]. Bundesministerium für Gesundheit. Available: <https://www.bundesgesundheitsministerium.de/elektronische-patientenakte.html> [Accessed 14.01.2023].
- BUNDESMINISTERIUM FÜR GESUNDHEIT. 2022a. *Digitalisierung im Gesundheitswesen* [Online]. Bundesministerium für Gesundheit. Available: <https://www.bundesgesundheitsministerium.de/themen/digitalisierung/digitalisierung-im-gesundheitswesen.html> [Accessed 14.01.2023].
- BUNDESMINISTERIUM FÜR GESUNDHEIT. 2022b. *E-Health* [Online]. Bundesministerium für Gesundheit. Available: <https://www.bundesgesundheitsministerium.de/service/begriffe-von-a-z/e-e-health.html> [Accessed 14.01.2023].
- BUNDESMINISTERIUM FÜR GESUNDHEIT. 2023. *Das E-Rezept startet!* [Online]. Bundesministerium für Gesundheit. Available: <https://www.bundesgesundheitsministerium.de/e-rezept.html> [Accessed 14.01.2023].
- BUSH, E. 2001. The use of human touch to improve the well-being of older adults. A holistic nursing intervention. *J Holist Nurs*, 19, 256-70.
- CAMPAYO, A., GÓMEZ-BIEL, C. H. & LOBO, A. 2011. Diabetes and depression. *Curr Psychiatry Rep*, 13, 26-30.
- CAR, J. & SHEIKH, A. 2004. Email consultations in health care: 1--scope and effectiveness. *Bmj*, 329, 435-8.
- CARROLL, J. K., MOORHEAD, A., BOND, R., LEBLANC, W. G., PETRELLA, R. J. & FISCELLA, K. 2017. Who Uses Mobile Phone Health Apps and Does Use Matter? A Secondary Data Analytics Approach. *J Med Internet Res*, 19, e125.
- CASELLA, G., INGRAVALLE, F., INGRAVALLE, A., MONTI, C., BONETTI, F. & LIMONTA, A. 2020. COVID emergency: an opportunity to increase the interaction between hepatologist and primary care physician. *Minerva Gastroenterol Dietol*, 66, 328-330.
- CHAE, J. 2018. A Comprehensive Profile of Those Who Have Health-Related Apps. *Health Educ Behav*, 45, 591-598.

- CHANDRASEKARAN, R., KATTHULA, V. & MOUSTAKAS, E. 2020. Patterns of Use and Key Predictors for the Use of Wearable Health Care Devices by US Adults: Insights from a National Survey. *J Med Internet Res*, 22, e22443.
- CHANNA, A., POPESCU, N., SKIBINSKA, J. & BURGET, R. 2021. The Rise of Wearable Devices during the COVID-19 Pandemic: A Systematic Review. *Sensors (Basel)*, 21.
- CHATTERJEE, A., PAHARI, N., PRINZ, A. & RIEGLER, M. 2022. Machine learning and ontology in eCoaching for personalized activity level monitoring and recommendation generation. *Sci Rep*, 12, 19825.
- CHEN, X., HAY, J. L., WATERS, E. A., KIVINIEMI, M. T., BIDDLE, C., SCHOFIELD, E., LI, Y., KAPHINGST, K. & OROM, H. 2018. Health Literacy and Use and Trust in Health Information. *J Health Commun*, 23, 724-734.
- CHIPIDZA, F. E., WALLWORK, R. S. & STERN, T. A. 2015. Impact of the Doctor-Patient Relationship. *Prim Care Companion CNS Disord*, 17.
- CHONG, K. P. L., GUO, J. Z., DENG, X. & WOO, B. K. P. 2020. Consumer Perceptions of Wearable Technology Devices: Retrospective Review and Analysis. *JMIR Mhealth Uhealth*, 8, e17544.
- CILLESSEN, F., DE VRIES ROBBÉ, P. F. & BIERMANS, M. C. J. 2017. A hospital-wide transition from paper to digital problem-oriented clinical notes. A descriptive history and cross-sectional survey of use, usability, and satisfaction. *Appl Clin Inform*, 8, 502-514.
- CONARD, S. 2019. Best practices in digital health literacy. *Int J Cardiol*, 292, 277-279.
- CONNELLY, J. E. 2004. The power of touch in clinical medicine. *Pharos Alpha Omega Alpha Honor Med Soc*, 67, 11-3.
- COOPER, S. B. & LEEUWEN, J. V. 2013. Computing Machinery and Intelligence. In: COOPER, S. B. & LEEUWEN, J. V. (eds.) *Alan Turing: His Work and Impact*. Boston: Elsevier.
- COULSON, N. S. & BUCHANAN, H. 2022. The Role of Online Support Groups in Helping Individuals Affected by HIV and AIDS: Scoping Review of the Literature. *J Med Internet Res*, 24, e27648.
- CRANE, S. J., GANESH, R., POST, J. A. & JACOBSON, N. A. 2020. Telemedicine Consultations and Follow-up of Patients With COVID-19. *Mayo Clin Proc*, 95, S33-s34.
- CUAN-BALTAZAR, J. Y., MUNOZ-PEREZ, M. J., ROBLEDO-VEGA, C., PEREZ-ZEPEDA, M. F. & SOTO-VEGA, E. 2020. Misinformation of COVID-19 on the Internet: Infodemiology Study. *JMIR Public Health Surveill*, 6, e18444.
- DAHMEN, A., KELLER, F. M., DERKSEN, C., KÖTTING, L. & LIPPKE, S. 2021. [Which Digital Services do Psychosomatic Rehabilitation Patients Use During the Corona Pandemic and do Interrelations with Anxiety and Depressive Symptoms Exist?]. *Psychother Psychosom Med Psychol*, 71, 508-514.
- DARAZ, L., MORROW, A. S., PONCE, O. J., BEUSCHEL, B., FARAH, M. H., KATABI, A., ALSAWAS, M., MAJZOUB, A. M., BENKHADRA, R., SEISA, M. O., DING, J. F., PROKOP, L. & MURAD, M. H. 2019. Can Patients Trust Online Health Information? A Meta-narrative Systematic Review Addressing the Quality of Health Information on the Internet. *J Gen Intern Med*, 34, 1884-1891.
- DAVE, T., ATHALURI, S. A. & SINGH, S. 2023. ChatGPT in medicine: an overview of its applications, advantages, limitations, future prospects, and ethical considerations. *Front Artif Intell*, 6, 1169595.

- DE SANTIS, K. K., JAHNEL, T., SINA, E., WIENERT, J. & ZEEB, H. 2021. Digitization and Health in Germany: Cross-sectional Nationwide Survey. *JMIR Public Health Surveill*, 7, e32951.
- DE SUTTER, E., ZAÇE, D., BOCCIA, S., DI PIETRO, M. L., GEERTS, D., BORRY, P. & HUYS, I. 2020. Implementation of Electronic Informed Consent in Biomedical Research and Stakeholders' Perspectives: Systematic Review. *J Med Internet Res*, 22, e19129.
- DERTON, A., GUEVARA, M., CHEN, S., MONINGI, S., KOZONO, D. E., LIU, D., MILLER, T. A., SAVOVA, G. K., MAK, R. H. & BITTERMAN, D. S. 2023. Natural Language Processing Methods to Empirically Explore Social Contexts and Needs in Cancer Patient Notes. *JCO Clin Cancer Inform*, 7, e2200196.
- DIVIANI, N., VAN DEN PUTTE, B., GIANI, S. & VAN WEERT, J. C. 2015. Low health literacy and evaluation of online health information: a systematic review of the literature. *J Med Internet Res*, 17, e112.
- DONNELLY, N., CUNNINGHAM, A., SALAS, S. M., BRACHER-SMITH, M., CHAWNER, S., STOCHL, J., FORD, T., RAYMOND, F. L., ESCOTT-PRICE, V. & VAN DEN BREE, M. B. M. 2023. Identifying the neurodevelopmental and psychiatric signatures of genomic disorders associated with intellectual disability: a machine learning approach. *Mol Autism*, 14, 19.
- DORAISWAMY, P. M., BLEASE, C. & BODNER, K. 2020. Artificial intelligence and the future of psychiatry: Insights from a global physician survey. *Artif Intell Med*, 102, 101753.
- DOYLE, C., LENNOX, L. & BELL, D. 2013. A systematic review of evidence on the links between patient experience and clinical safety and effectiveness. *BMJ Open*, 3.
- DUNN, J., RUNGE, R. & SNYDER, M. 2018. Wearables and the medical revolution. *Per Med*, 15, 429-448.
- DUTTA, B. & HWANG, H. G. 2020. The adoption of electronic medical record by physicians: A PRISMA-compliant systematic review. *Medicine (Baltimore)*, 99, e19290.
- DVIR-GVIRSMAN, S. 2022. Understanding news engagement on social media: A media repertoire approach. *New Media Soc*, 24, 1791-1812.
- EDGERLY, S., VRAGA, E. K., BODE, L., THORSON, K. & THORSON, E. 2017. New Media, New Relationship to Participation? A Closer Look at Youth News Repertoires and Political Participation. *Journalism & Mass Communication Quarterly*, 95, 192-212.
- EHRENSTEIN, V. K., K.; LEHMANN, H.; TAYLOR, C. 2019. Obtaining Data From Electronic Health Records. In: GLIKLICH, R. E., LEAVY, M. B. & DREYER, N. A. (eds.) *Tools and Technologies for Registry Interoperability, Registries for Evaluating Patient Outcomes: A User's Guide, 3rd Edition, Addendum 2*. Rockville (MD).
- EL-KAREH, R., GANDHI, T. K., POON, E. G., NEWMARK, L. P., UNGAR, J., LIPSITZ, S. & SEQUIST, T. D. 2009. Trends in primary care clinician perceptions of a new electronic health record. *J Gen Intern Med*, 24, 464-8.
- ELWYN, G., FROSCH, D., THOMSON, R., JOSEPH-WILLIAMS, N., LLOYD, A., KINNERSLEY, P., CORDING, E., TOMSON, D., DODD, C., ROLLNICK, S., EDWARDS, A. & BARRY, M. 2012. Shared decision making: a model for clinical practice. *J Gen Intern Med*, 27, 1361-7.
- ERNSTING, C., DOMBROWSKI, S. U., OEDEKOVEN, M., JL, O. S., KANZLER, M., KUHLMAY, A. & GELLERT, P. 2017. Using Smartphones and Health Apps to

- Change and Manage Health Behaviors: A Population-Based Survey. *J Med Internet Res*, 19, e101.
- ESCOFFERY, C. 2018. Gender Similarities and Differences for e-Health Behaviors Among U.S. Adults. *Telemed J E Health*, 24, 335-343.
- EYSENBACH, G. 2001. What is e-health? *J Med Internet Res*, 3, E20.
- EYSENBACH, G. 2003. The impact of the Internet on cancer outcomes. *CA Cancer J Clin*, 53, 356-71.
- FAHRMEIR, L. 2012. *Statistik: Der Weg zur Datenanalyse*, Springer.
- FAVA, G. A. & SONINO, N. 2010. Psychosomatic medicine. *Int J Clin Pract*, 64, 1155-61.
- FERGUSON, T. & FRYDMAN, G. 2004. The first generation of e-patients. *Bmj*, 328, 1148-9.
- FINK, P., HANSEN, M. S. & OXHØJ, M. L. 2004. The prevalence of somatoform disorders among internal medical inpatients. *J Psychosom Res*, 56, 413-8.
- FISKE, A., HENNINGSEN, P. & BUYX, A. 2019. Your Robot Therapist Will See You Now: Ethical Implications of Embodied Artificial Intelligence in Psychiatry, Psychology, and Psychotherapy. *J Med Internet Res*, 21, e13216.
- FLODGREN, G., RACHAS, A., FARMER, A. J., INZITARI, M. & SHEPPERD, S. 2015. Interactive telemedicine: effects on professional practice and health care outcomes. *Cochrane Database Syst Rev*, 2015, Cd002098.
- FTOUNI, R., ALJARDALI, B., HAMDANIEH, M., FTOUNI, L. & SALEM, N. 2022. Challenges of Telemedicine during the COVID-19 pandemic: a systematic review. *BMC Medical Informatics and Decision Making*, 22, 207.
- FURLANIS, G., AJCEVIC, M., NACCARATO, M., CARUSO, P., SCALI, I., LUGNAN, C., BUOITE STELLA, A. & MANGANOTTI, P. 2020. e-Health vs COVID-19: home patient telemonitoring to maintain TIA continuum of care. *Neurol Sci*, 41, 2023-2024.
- GARG, M. 2023. Mental Health Analysis in Social Media Posts: A Survey. *Arch Comput Methods Eng*, 30, 1819-1842.
- GEARING, P., OLNEY, C. M., DAVIS, K., LOZANO, D., SMITH, L. B. & FRIEDMAN, B. 2006. Enhancing patient safety through electronic medical record documentation of vital signs. *J Healthc Inf Manag*, 20, 40-5.
- GELLERT, G. A. 2023. Medical Scribes: Symptom or Cause of Impeded Evolution of a Transformative Artificial Intelligence in the Electronic Health Record? *Perspect Health Inf Manag*, 20, 1d.
- GENTRY, M. T., PUSPITASARI, A. J., MCKEAN, A. J., WILLIAMS, M. D., BREITINGER, S., GESKE, J. R., CLARK, M. M., MOORE, K. M., FRYE, M. A. & HILTY, D. M. 2021. Clinician Satisfaction with Rapid Adoption and Implementation of Telehealth Services During the COVID-19 Pandemic. *Telemed J E Health*, 27, 1385-1392.
- GOLDSMITH, A. J., JIN, M., LUCASSEN, R., DUGGAN, N. M., HARRISON, N. E., WELLS, W., EHRMAN, R. R., FERRE, R., GARGANI, L., NOBLE, V., LEVY, P., LANE, K., LI, X., COLLINS, S., KAPUR, T., PANG, P. & RUSSELL, F. M. 2023. Comparison of Pulmonary Congestion severity using AI-assisted scoring vs. clinical experts: A Secondary Analysis of BLUSHED-AHF. *Eur J Heart Fail*.
- GORDON, W. J., LANDMAN, A., ZHANG, H. & BATES, D. W. 2020. Beyond validation: getting health apps into clinical practice. *NPJ Digit Med*, 3, 14.
- GRAHAM, S., DEPP, C., LEE, E. E., NEBEKER, C., TU, X., KIM, H. C. & JESTE, D. V. 2019. Artificial Intelligence for Mental Health and Mental Illnesses: an Overview. *Curr Psychiatry Rep*, 21, 116.

- GRAND VIEW RESEARCH. 2021. *Wearable Technology Market Share & Trends Analysis Report, 2023-2030* [Online]. Available: <https://www.grandviewresearch.com/industry-analysis/wearable-technology-market> [Accessed 17.01.2023].
- GUDER, F., AINLA, A., REDSTON, J., MOSADEGH, B., GLAVAN, A., MARTIN, T. J. & WHITESIDES, G. M. 2016. Paper-Based Electrical Respiration Sensor. *Angew Chem Int Ed Engl*, 55, 5727-32.
- GUIDETTI, V., CERUTTI, R., FAEDDA, N. & NATALUCCI, G. 2019. Migraine in childhood: an organic, biobehavioral, or psychosomatic disorder? *Neurol Sci*, 40, 93-98.
- GUNTER, T. D. & TERRY, N. P. 2005. The emergence of national electronic health record architectures in the United States and Australia: models, costs, and questions. *J Med Internet Res*, 7, e3.
- HAMINE, S., GERTH-GUYETTE, E., FAULX, D., GREEN, B. B. & GINSBURG, A. S. 2015. Impact of mHealth chronic disease management on treatment adherence and patient outcomes: a systematic review. *J Med Internet Res*, 17, e52.
- HARDARDOTTIR, G. A. & THORODDSEN, A. 2016. National eHealth Implementation: Country Experience. *Stud Health Technol Inform*, 225, 168-72.
- HEART, T., BEN-ASSULI, O. & SHABTAI, I. 2017. A review of PHR, EMR and EHR integration: A more personalized healthcare and public health policy. *Health Policy and Technology*, 6, 20-25.
- HENNING, M., SUBIC-WRANA, C., WILTINK, J. & BEUTEL, M. 2020. Anxiety Disorders in Patients With Somatic Diseases. *Psychosom Med*, 82, 287-295.
- HERMES-DESANTIS, E. R., HUNTER, R. T., WELCH, J., BHAVSAR, R., BOULOS, D. & NOUE, M. A. 2021. Preferences for Accessing Medical Information in the Digital Age: Health Care Professional Survey. *J Med Internet Res*, 23, e25868.
- HERON, K. E., ROMANO, K. A. & BRAITMAN, A. L. 2019. Mobile technology use and mHealth text message preferences: an examination of gender, racial, and ethnic differences among emerging adult college students. *Mhealth*, 5, 2.
- HERRMANN-LINGEN, C. 2017. The American Psychosomatic Society - integrating mind, brain, body and social context in medicine since 1942. *Biopsychosoc Med*, 11, 11.
- HERRMANN-WERNER, A., WEBER, H., LODA, T., KEIFENHEIM, K. E., ERSCHENS, R., MÖLBERT, S. C., NIKENDEI, C., ZIPFEL, S. & MASTERS, K. 2019. "But Dr Google said..." - Training medical students how to communicate with E-patients. *Med Teach*, 41, 1434-1440.
- HERSH, L., SALZMAN, B. & SNYDERMAN, D. 2015. Health Literacy in Primary Care Practice. *Am Fam Physician*, 92, 118-24.
- HERSH, W. R., HICKAM, D. H., SEVERANCE, S. M., DANA, T. L., PYLE KRAGES, K. & HELFAND, M. 2006. Diagnosis, access and outcomes: Update of a systematic review of telemedicine services. *J Telemed Telecare*, 12 Suppl 2, S3-31.
- HERTLING, S., HERTLING, D., MARTIN, D. & GRAUL, I. 2021. Acceptance, Use, and Barriers of Telemedicine in Transgender Health Care in Times of SARS-CoV-2: Nationwide Cross-sectional Survey. *JMIR Public Health Surveill*, 7, e30278.
- HILBEL, T., ALHERSH, T., STEIN, W., DOMAN, L. & SCHULTZ, J. H. 2021. Analysis and postprocessing of ECG or heart rate data from wearable devices beyond

- the proprietary cloud and app infrastructure of the vendors. *Cardiovasc Digit Health J*, 2, 323-330.
- IBM CORPORATION. 2023. *Cognos Analytics: Cramér's V* [Online]. IBM Corporation. Available: <https://www.ibm.com/docs/en/cognos-analytics/11.1.0?topic=terms-cramrs-v> [Accessed 19.12.2022].
- JANETT, R. S. & YERACARIS, P. P. 2020. Electronic Medical Records in the American Health System: challenges and lessons learned. *Cien Saude Colet*, 25, 1293-1304.
- JIANG, F., JIANG, Y., ZHI, H., DONG, Y., LI, H., MA, S., WANG, Y., DONG, Q., SHEN, H. & WANG, Y. 2017. Artificial intelligence in healthcare: past, present and future. *Stroke Vasc Neurol*, 2, 230-243.
- JIANG, S. 2020. The Relationship between Face-to-Face and Online Patient-Provider Communication: Examining the Moderating Roles of Patient Trust and Patient Satisfaction. *Health Commun*, 35, 341-349.
- JIANG, X., MING, W. K. & YOU, J. H. 2019. The Cost-Effectiveness of Digital Health Interventions on the Management of Cardiovascular Diseases: Systematic Review. *J Med Internet Res*, 21, e13166.
- KADAM, R. A. 2017. Informed consent process: A step further towards making it meaningful! *Perspect Clin Res*, 8, 107-112.
- KANG, M. & CHAI, K. 2022. Wearable Sensing Systems for Monitoring Mental Health. *Sensors (Basel)*, 22.
- KIM, H. Y. 2017. Statistical notes for clinical researchers: Chi-squared test and Fisher's exact test. *Restor Dent Endod*, 42, 152-155.
- KIM, J. & KIM, S. 2009. Physicians' perception of the effects of Internet health information on the doctor-patient relationship. *Inform Health Soc Care*, 34, 136-48.
- KIM, K. & KWON, N. 2010. Profile of e-Patients: Analysis of Their Cancer Information-Seeking From a National Survey. *Journal of Health Communication*, 15, 712-733.
- KING, A. & HOPPE, R. B. 2013. "Best practice" for patient-centered communication: a narrative review. *J Grad Med Educ*, 5, 385-93.
- KOCZKODAJ, W. W., MASIAK, J., MAZUREK, M., STRZAŁKA, D. & ZABRODSKII, P. F. 2019. Massive Health Record Breaches Evidenced by the Office for Civil Rights Data. *Iran J Public Health*, 48, 278-288.
- KOLLER, M., GRÜTTER, R., PELTENBURG, M., FISCHER, J. E. & STEURER, J. 2001. Use of the Internet by medical doctors in Switzerland. *Swiss Med Wkly*, 131, 251-4.
- KONDO, Y. 2021. [Patients' Informational Needs for Pharmacotherapy and Health Literacy]. *Yakugaku Zasshi*, 141, 387-391.
- LEE, E. E., TOROUS, J., DE CHOUDHURY, M., DEPP, C. A., GRAHAM, S. A., KIM, H. C., PAULUS, M. P., KRYSTAL, J. H. & JESTE, D. V. 2021. Artificial Intelligence for Mental Health Care: Clinical Applications, Barriers, Facilitators, and Artificial Wisdom. *Biol Psychiatry Cogn Neurosci Neuroimaging*, 6, 856-864.
- LEE, Y. L., CUI, Y. Y., TU, M. H., CHEN, Y. C. & CHANG, P. 2018. Mobile Health to Maintain Continuity of Patient-Centered Care for Chronic Kidney Disease: Content Analysis of Apps. *JMIR Mhealth Uhealth*, 6, e10173.
- LEMENAGER, T., NEISSNER, M., KOOPMANN, A., REINHARD, I., GEORGIADOU, E., MÜLLER, A., KIEFER, F. & HILLEMACHER, T. 2020. COVID-19 Lockdown

- Restrictions and Online Media Consumption in Germany. *Int J Environ Res Public Health*, 18.
- LI, R., LIANG, N., BU, F. & HESKETH, T. 2020. The Effectiveness of Self-Management of Hypertension in Adults Using Mobile Health: Systematic Review and Meta-Analysis. *JMIR Mhealth Uhealth*, 8, e17776.
- LIANG, W., YAO, J., CHEN, A., LV, Q., ZANIN, M., LIU, J., WONG, S., LI, Y., LU, J., LIANG, H., CHEN, G., GUO, H., GUO, J., ZHOU, R., OU, L., ZHOU, N., CHEN, H., YANG, F., HAN, X., HUAN, W., TANG, W., GUAN, W., CHEN, Z., ZHAO, Y., SANG, L., XU, Y., WANG, W., LI, S., LU, L., ZHANG, N., ZHONG, N., HUANG, J. & HE, J. 2020. Early triage of critically ill COVID-19 patients using deep learning. *Nat Commun*, 11, 3543.
- LITTLE, P., EVERITT, H., WILLIAMSON, I., WARNER, G., MOORE, M., GOULD, C., FERRIER, K. & PAYNE, S. 2001. Observational study of effect of patient centredness and positive approach on outcomes of general practice consultations. *Bmj*, 323, 908-11.
- LOCATIS, C. & ACKERMAN, M. 2013. Three principles for determining the relevancy of store-and-forward and live interactive telemedicine: reinterpreting two telemedicine research reviews and other research. *Telemed J E Health*, 19, 19-23.
- LÓPEZ-GÓMEZ, M., ORTEGA, C., SUÁREZ, I., SERRALTA, G., MADERO, R., GÓMEZ-RAPOSO, C., SERENO, M., CASADO, E., ESPINOSA, E., LOBO, F. & FELIU, J. 2012. Internet use by cancer patients: should oncologists 'prescribe' accurate web sites in combination with chemotherapy? A survey in a Spanish cohort. *Ann Oncol*, 23, 1579-85.
- LU, X. 2023. The Effects of Patient Health Information Seeking in Online Health Communities on Patient Compliance in China: Social Perspective. *J Med Internet Res*, 25, e38848.
- LU, X. & ZHANG, R. 2021. Association Between eHealth Literacy in Online Health Communities and Patient Adherence: Cross-sectional Questionnaire Study. *J Med Internet Res*, 23, e14908.
- LUCAS, G. M., GRATCH, J., KING, A. & MORENCY, L.-P. 2014. It's only a computer: Virtual humans increase willingness to disclose. *Computers in Human Behavior*, 37, 94-100.
- LUCAS, J. W. & VILLARROEL, M. A. 2022. Telemedicine Use Among Adults: United States, 2021. *NCHS Data Brief*, 1-8.
- LUKAS, H., XU, C., YU, Y. & GAO, W. 2020. Emerging Telemedicine Tools for Remote COVID-19 Diagnosis, Monitoring, and Management. *ACS Nano*, 14, 16180-16193.
- MAASSEN, O., FRITSCH, S., PALM, J., DEFFGE, S., KUNZE, J., MARX, G., RIEDEL, M., SCHUPPERT, A. & BICKENBACH, J. 2021. Future Medical Artificial Intelligence Application Requirements and Expectations of Physicians in German University Hospitals: Web-Based Survey. *J Med Internet Res*, 23, e26646.
- MANCA, D. P. 2015. Do electronic medical records improve quality of care? Yes. *Can Fam Physician*, 61, 846-7, 850-1.
- MANN, D. M., CHEN, J., CHUNARA, R., TESTA, P. A. & NOV, O. 2020. COVID-19 transforms health care through telemedicine: Evidence from the field. *J Am Med Inform Assoc*, 27, 1132-1135.
- MARKOWITZ, F. E. 2015. Involvement in mental health self-help groups and recovery. *Health Sociol Rev*, 24, 199-212.

- MASTERS, K. 2019. Artificial intelligence in medical education. *Medical Teacher*, 41, 976-980.
- MASTERS, K., LODA, T., AL-ABRI, R., JOHANNINK, J. & HERRMANN-WERNER, A. 2020a. Surgical patients' use of, and attitudes towards, the internet for e-patient activities in Germany and Oman. *Ann Med Surg (Lond)*, 55, 287-293.
- MASTERS, K., LODA, T., JOHANNINK, J., AL-ABRI, R. & HERRMANN-WERNER, A. 2020b. Surgeons' Interactions With and Attitudes Toward E-Patients: Questionnaire Study in Germany and Oman. *J Med Internet Res*, 22, e14646.
- MASTERS, K., NG'AMBI, D. & TODD, G. 2010. "I Found it on the Internet": Preparing for the e-patient in Oman. *Sultan Qaboos Univ Med J*, 10, 169-79.
- MCCLUNG, H. J., MURRAY, R. D. & HEITLINGER, L. A. 1998. The Internet as a source for current patient information. *Pediatrics*, 101, E2.
- MCHUGH, M. L. 2013. The chi-square test of independence. *Biochem Med (Zagreb)*, 23, 143-9.
- MECHANIC, O. J., PERSAUD, Y. & KIMBALL, A. B. 2022. Telehealth Systems. *StatPearls*. Treasure Island (FL): StatPearls Publishing
Copyright © 2022, StatPearls Publishing LLC.
- MELHEM, S. J., NABHANI-GEBARA, S. & KAYYALI, R. 2023. Digital Trends, Digital Literacy, and E-Health Engagement Predictors of Breast and Colorectal Cancer Survivors: A Population-Based Cross-Sectional Survey. *Int J Environ Res Public Health*, 20.
- MESKO, B. & GYÖRFFY, Z. 2019. The Rise of the Empowered Physician in the Digital Health Era: Viewpoint. *J Med Internet Res*, 21, e12490.
- MIRZAEI, T. & KASHIAN, N. 2020. Revisiting Effective Communication Between Patients and Physicians: Cross-Sectional Questionnaire Study Comparing Text-Based Electronic Versus Face-to-Face Communication. *J Med Internet Res*, 22, e16965.
- MOHAMMAD, G. B., POTLURI, S., KUMAR, A., A, R. K., P, D., TIWARI, R., SHRIVASTAVA, R., KUMAR, S., SRIHARI, K. & DEKEBA, K. 2022. An Artificial Intelligence-Based Reactive Health Care System for Emotion Detections. *Comput Intell Neurosci*, 2022, 8787023.
- MOICK, M. & TERLUTTER, R. 2012. Physicians' motives for professional internet use and differences in attitudes toward the internet-informed patient, physician-patient communication, and prescribing behavior. *Med 2 0*, 1, e2.
- MOTA, L., FERREIRA, C. C. G., COSTA NETO, H., FALBO, A. R. & LORENA, S. B. 2018. Is doctor-patient relationship influenced by health online information? *Rev Assoc Med Bras (1992)*, 64, 692-699.
- NATARAJAN, A., SU, H.-W. & HENEGHAN, C. 2020. Assessment of physiological signs associated with COVID-19 measured using wearable devices. *npj Digital Medicine*, 3, 156.
- NG, H., ZIMMERMAN, L., FERGUSON, B., DIMMOCK, E., HARLAN, R., HEKMAN, J. & OBEID, H. 2021. Delivering Holistic Transgender and Nonbinary Care in the Age of Telemedicine and COVID-19: Reflections and Implications for Best Practices. *Prim Care*, 48, 213-226.
- NICHOL, J. R., SUNDJAJA, J. H. & NELSON, G. 2022. Medical History. *StatPearls*. Treasure Island (FL).
- NICOLUCCI, A., CANDIDO, R., CUCINOTTA, D., GRAZIANO, G., ROCCA, A., ROSSI, M. C., TUCCINARDI, F. & MANICARDI, V. 2019. Generalizability of Cardiovascular Safety Trials on SGLT2 Inhibitors to the Real World: Implications for Clinical Practice. *Adv Ther*, 36, 2895-2909.

- NIKOU, G. & GALLOS, P. 2020. Physicians' and Pharmacists' Opinions Regarding the e-Prescription Systems. *Stud Health Technol Inform*, 270, 1351-1352.
- NUTTING, P. A., GOODWIN, M. A., FLOCKE, S. A., ZYZANSKI, S. J. & STANGE, K. C. 2003. Continuity of primary care: to whom does it matter and when? *Ann Fam Med*, 1, 149-55.
- OSMANI, F., ARAB-ZOZANI, M., SHAHALI, Z. & LOTFI, F. 2022. Evaluation of the effectiveness of electronic prescription in reducing medical and medical errors (systematic review study). *Ann Pharm Fr*.
- PALABINDALA, V., PAMARTHY, A. & JONNALAGADDA, N. R. 2016. Adoption of electronic health records and barriers. *J Community Hosp Intern Med Perspect*, 6, 32643.
- PARADIS, S., ROUSSEL, J., BOSSON, J. L. & KERN, J. B. 2022. Use of Smartphone Health Apps Among Patients Aged 18 to 69 Years in Primary Care: Population-Based Cross-sectional Survey. *JMIR Form Res*, 6, e34882.
- PARK, Y. T. 2016. Emerging New Era of Mobile Health Technologies. *Healthc Inform Res*, 22, 253-254.
- PENNINGTON, Z., MICHALOPOULOS, G. D., BIEDERMANN, A. J., ZIEGLER, J. R., DURST, S. L., SPINNER, R. J., MEYER, F. B., DANIELS, D. J. & BYDON, M. 2022. Positive impact of the pandemic: the effect of post-COVID-19 virtual visit implementation on departmental efficiency and patient satisfaction in a quaternary care center. *Neurosurg Focus*, 52, E10.
- PERRENOUD, B., VELONAKI, V. S., BODENMANN, P. & RAMELET, A. S. 2015. The effectiveness of health literacy interventions on the informed consent process of health care users: a systematic review protocol. *JBI Database System Rev Implement Rep*, 13, 82-94.
- PIEH, C., LAHMANN, C., HEYMANN, F. V., TRITT, K., LOEW, T., BUSCH, V. & PROBST, T. 2011. [Prevalence and comorbidity of somatoform disorder in psychosomatic inpatients: a multicentre study]. *Z Psychosom Med Psychother*, 57, 244-50.
- PORTERFIELD, A., ENGELBERT, K. & COUSTASSE, A. 2014. Electronic prescribing: improving the efficiency and accuracy of prescribing in the ambulatory care setting. *Perspect Health Inf Manag*, 11, 1g.
- PRADELLA, M., ACHERMANN, R., SPERL, J. I., KÄRGEL, R., RAPAKA, S., CYRIAC, J., YANG, S., SOMMER, G., STIELTJES, B., BREMERICH, J., BRANTNER, P. & SAUTER, A. W. 2022. Performance of a deep learning tool to detect missed aortic dilatation in a large chest CT cohort. *Front Cardiovasc Med*, 9, 972512.
- PRECEDENCE RESEARCH. 2022. *Wearable Technology Market* [Online]. Precedence Research. Available: <https://www.precedenceresearch.com/wearable-technology-market> [Accessed 17.01.2023].
- RADIX, A. E., BOND, K., CARNEIRO, P. B. & RESTAR, A. 2022. Transgender Individuals and Digital Health. *Curr HIV/AIDS Rep*, 19, 592-599.
- RAHMAN, M. M. & THILL, J. C. 2022. Associations between COVID-19 Pandemic, Lockdown Measures and Human Mobility: Longitudinal Evidence from 86 Countries. *Int J Environ Res Public Health*, 19.
- RAJ, M., RAI, P., G, V. L. N., ONKAR, A., ANGRAL, S. & VARSHNEY, S. 2022. Feasibility and Acceptability of Teleconsultation During COVID-19: A Cross-Sectional Study. *Cureus*, 14, e30937.

- RAJGOPAL, A., LI, C. R., SHAH, S. & SUNDAR BUDHATHOKI, S. 2021. The use of telehealth to overcome barriers to mental health services faced by young people from Afro-Caribbean backgrounds in England during the COVID-19 pandemic. *J Glob Health*, 11, 03040.
- RAMASWAMY, A., YU, M., DRANGSHOLT, S., NG, E., CULLIGAN, P. J., SCHLEGEL, P. N. & HU, J. C. 2020. Patient Satisfaction With Telemedicine During the COVID-19 Pandemic: Retrospective Cohort Study. *J Med Internet Res*, 22, e20786.
- RANDELL, L. B., GREENBERG, M. E., ISAKI, E., LEE, A., BETTGER, J. P., HUNG, G., GELATT, A., LINDSTROM-METTE, A. & CASON, J. 2021. Best Practices for Building Interprofessional Telehealth: Report of a Conference. *Int J Telerehabil*, 13, e6434.
- RATWANI, R. 2017. Electronic Health Records and Improved Patient Care: Opportunities for Applied Psychology. *Curr Dir Psychol Sci*, 26, 359-365.
- RAYNAUD, M., GOUTAUDIER, V., LOUIS, K., AL-AWADHI, S., DUBOURG, Q., TRUCHOT, A., BROUSSE, R., SALEH, N., GIARRAPUTO, A., DEBIAIS, C., DEMIR, Z., CERTAIN, A., TACAFRED, F., CORTES-GARCIA, E., YANES, S., DAGOBERT, J., NASER, S., ROBIN, B., BAILLY, É., JOUVEN, X., REESE, P. P. & LOUPY, A. 2021. Impact of the COVID-19 pandemic on publication dynamics and non-COVID-19 research production. *BMC Med Res Methodol*, 21, 255.
- REED, M. E., HUANG, J., GRAETZ, I., LEE, C., MUELLY, E., KENNEDY, C. & KIM, E. 2020. Patient Characteristics Associated With Choosing a Telemedicine Visit vs Office Visit With the Same Primary Care Clinicians. *JAMA Netw Open*, 3, e205873.
- RODRÍGUEZ-VERA, F. J., MARÍN, Y., SÁNCHEZ, A., BORRACHERO, C. & PUJOL, E. 2002. Illegible handwriting in medical records. *J R Soc Med*, 95, 545-6.
- SAFER, J. D., COLEMAN, E., FELDMAN, J., GAROFALO, R., HEMBREE, W., RADIX, A. & SEVELIUS, J. 2016. Barriers to healthcare for transgender individuals. *Curr Opin Endocrinol Diabetes Obes*, 23, 168-71.
- SAIYED, S., NGUYEN, A. & SINGH, R. 2021. Physician Perspective and Key Satisfaction Indicators with Rapid Telehealth Adoption During the Coronavirus Disease 2019 Pandemic. *Telemed J E Health*, 27, 1225-1234.
- SALLAM, M. 2023. ChatGPT Utility in Healthcare Education, Research, and Practice: Systematic Review on the Promising Perspectives and Valid Concerns. *Healthcare (Basel)*, 11.
- SARKER, I. H. 2022. AI-Based Modeling: Techniques, Applications and Research Issues Towards Automation, Intelligent and Smart Systems. *SN Comput Sci*, 3, 158.
- SARTORIUS, N. 1989. Psychosomatic medicine and primary health care (PHC). *Psychother Psychosom*, 52, 5-9.
- SARWAL, D. & GUPTA, V. 2022. Personal Health Record. *StatPearls*. Treasure Island (FL).
- SAUER, N. & EICH, W. 2007. Somatoforme Störungen und Funktionsstörungen. *Dtsch Arztebl Int*, 104, 45-54.
- SCHAEFERT, R., HAUSTEINER-WIEHLE, C., HÄUSER, W., RONEL, J., HERRMANN, M. & HENNINGSEN, P. 2012. Non-specific, functional, and somatoform bodily complaints. *Dtsch Arztebl Int*, 109, 803-13.
- SCHICKEDANZ, A., HUANG, D., LOPEZ, A., CHEUNG, E., LYLES, C. R., BODENHEIMER, T. & SARKAR, U. 2013. Access, interest, and attitudes

- toward electronic communication for health care among patients in the medical safety net. *J Gen Intern Med*, 28, 914-20.
- SCHMIDT, K., BARAC-DAMMEYER, D., KOWALSKI, A., TEIGELACK, P., PFEIFFER, C., ROBITZSCH, A., DÖRRIE, N., SKODA, E. M., BÄUERLE, A., FINK, M. & TEUFEL, M. 2023. Implementing biofeedback treatment in a psychosomatic-psychotherapeutic inpatient unit: a mixed methods evaluation of acceptance, satisfaction, and feasibility. *Front Psychiatry*, 14, 1140880.
- SCHRAG, D. & HANGER, M. 2007. Medical oncologists' views on communicating with patients about chemotherapy costs: a pilot survey. *J Clin Oncol*, 25, 233-7.
- SINGH, S. & BANERJEE, A. 2019. Internet and doctor-patient relationship: Cross-sectional study of patients' perceptions and practices. *Indian J Public Health*, 63, 215-219.
- SIRINTRAPUN, S. J. & LOPEZ, A. M. 2018. Telemedicine in Cancer Care. *Am Soc Clin Oncol Educ Book*, 38, 540-545.
- SMUCK, M., ODONKOR, C. A., WILT, J. K., SCHMIDT, N. & SWIERNIK, M. A. 2021. The emerging clinical role of wearables: factors for successful implementation in healthcare. *NPJ Digit Med*, 4, 45.
- ŠTRKALJ, G. & PATHER, N. 2021. Beyond the Sex Binary: Toward the Inclusive Anatomical Sciences Education. *Anat Sci Educ*, 14, 513-518.
- TALMON, G. A. 2019. Generation Z: What's Next? *Med Sci Educ*, 29, 9-11.
- TASHKANDI, E., ZEENELDIN, A., ALABDULWAHAB, A., ELEMAM, O., ELSAMANY, S., JASTANIAH, W., ABDULLAH, S., ALFAYEZ, M., JAZIEH, A. R. & AL-SHAMSI, H. O. 2020. Virtual Management of Patients With Cancer During the COVID-19 Pandemic: Web-Based Questionnaire Study. *J Med Internet Res*, 22, e19691.
- TATES, K., ANTHEUNIS, M. L., KANTERS, S., NIEBOER, T. E. & GERRITSE, M. B. 2017. The Effect of Screen-to-Screen Versus Face-to-Face Consultation on Doctor-Patient Communication: An Experimental Study with Simulated Patients. *J Med Internet Res*, 19, e421.
- TAVAKOL, M. & DENNICK, R. 2011. Making sense of Cronbach's alpha. *Int J Med Educ*, 2, 53-55.
- TOLSGAARD, M. G., PUSIC, M. V., SEBOK-SYER, S. S., GIN, B., SVENDSEN, M. B., SYER, M. D., BRYDGES, R., CUDDY, M. M. & BOSCARDIN, C. K. 2023. The fundamentals of Artificial Intelligence in medical education research: AMEE Guide No. 156. *Med Teach*, 45, 565-573.
- TSAI, C. H., EGH DAM, A., DAVOODY, N., WRIGHT, G., FLOWERDAY, S. & KOCH, S. 2020. Effects of Electronic Health Record Implementation and Barriers to Adoption and Use: A Scoping Review and Qualitative Analysis of the Content. *Life (Basel)*, 10.
- TSCHOPP, R., KÖNIG, R. S., REJMER, P. & PARIS, D. H. 2023. Health system support among patients with ME/CFS in Switzerland. *J Taibah Univ Med Sci*, 18, 876-885.
- TUSTUMI, F., ANDREOLLO, N. A. & AGUILAR-NASCIMENTO, J. E. 2023. FUTURE OF THE LANGUAGE MODELS IN HEALTHCARE: THE ROLE OF CHATGPT. *Arq Bras Cir Dig*, 36, e1727.
- USLU, A. & STAUSBERG, J. 2021. Value of the Electronic Medical Record for Hospital Care: Update From the Literature. *J Med Internet Res*, 23, e26323.
- VAIDOTAS, M., YOKOTA, P. K. O., NEGRINI, N. M. M., LEIDERMAN, D. B. D., SOUZA, V. P., SANTOS, O. & WOLOSKE, N. 2019. Medication errors in

- emergency departments: is electronic medical record an effective barrier? *Einstein (Sao Paulo)*, 17, eGS4282.
- VAN DER ZANDER, Q. E. W., VAN DER ENDE-VAN LOON, M. C. M., JANSSEN, J. M. M., WINKENS, B., VAN DER SOMMEN, F., MASCLÉE, A. A. M. & SCHOON, E. J. 2022. Artificial intelligence in (gastrointestinal) healthcare: patients' and physicians' perspectives. *Sci Rep*, 12, 16779.
- VAN HOUWELINGEN, C. T., ETTEMA, R. G., ANTONIETTI, M. G. & KORT, H. S. 2018. Understanding Older People's Readiness for Receiving Telehealth: Mixed-Method Study. *J Med Internet Res*, 20, e123.
- VO, V., AUROY, L. & SARRADON-ECK, A. 2019. Patients' Perceptions of mHealth Apps: Meta-Ethnographic Review of Qualitative Studies. *JMIR Mhealth Uhealth*, 7, e13817.
- WALKER, R. C., TONG, A., HOWARD, K. & PALMER, S. C. 2019. Patient expectations and experiences of remote monitoring for chronic diseases: Systematic review and thematic synthesis of qualitative studies. *Int J Med Inform*, 124, 78-85.
- WALSH, J. & MARKUS, H. S. 2019. Telemedicine for Follow-Up of Rare Neurological Disease. *Stroke*, 50, 750-753.
- WEHRLE, C. J., LEE, S. W., DEVARAKONDA, A. K. & ARORA, T. K. 2021. Patient and Physician Attitudes Toward Telemedicine in Cancer Clinics Following the COVID-19 Pandemic. *JCO Clin Cancer Inform*, 5, 394-400.
- WEIDLICH, V. & WEIDLICH, G. A. 2018. Artificial Intelligence in Medicine and Radiation Oncology. *Cureus*, 10, e2475.
- WEINSTEIN, R. S., KRUPINSKI, E. A. & DOARN, C. R. 2018. Clinical Examination Component of Telemedicine, Telehealth, mHealth, and Connected Health Medical Practices. *Med Clin North Am*, 102, 533-544.
- WELCH, W. C., MATHEW, M. S., WELCH, R. L. & MCSHANE, B. J. 2019. Email as an Encumbrance to Physician-patient Communication. *Cureus*, 11, e3816.
- WENIG, V. & JANETZKE, H. 2022. "That You Just Know You're Not Alone and Other People Have Gone through It Too." Eating Disorder Recovery Accounts on Instagram as a Chance for Self-Help? A Qualitative Interview Study among People Affected and Self-Help Experts. *Int J Environ Res Public Health*, 19.
- WORLD HEALTH ORGANIZATION 2016. Global diffusion of eHealth: making universal health coverage achievable. Report of the third global survey on eHealth. Geneva: World Health Organization.
- WORTMAN, M. S. H., VAN DER Wouden, J. C., GRUTTERS, J. P. C., VISSER, B., ASSENDELFT, W. J. J., VAN DER HORST, H. E. & OLDE HARTMAN, T. C. 2019. Psychosomatic therapy for patients frequently attending primary care with medically unexplained symptoms, the CORPUS trial: study protocol for a randomised controlled trial. *Trials*, 20, 697.
- YANG, L., WU, J., MO, X., CHEN, Y., HUANG, S., ZHOU, L., DAI, J., XIE, L., CHEN, S., SHANG, H., RAO, B., WENG, B., ABULIMITI, A., WU, S. & XIE, X. 2023. Changes in Mobile Health Apps Usage Before and After the COVID-19 Outbreak in China: Semilongitudinal Survey. *JMIR Public Health Surveill*, 9, e40552.
- YOON, J. H., STRAND, F., BALTZER, P. A. T., CONANT, E. F., GILBERT, F. J., LEHMAN, C. D., MORRIS, E. A., MULLEN, L. A., NISHIKAWA, R. M., SHARMA, N., VEJBORG, I., MOY, L. & MANN, R. M. 2023. Standalone AI for Breast Cancer Detection at Screening Digital Mammography and Digital Breast Tomosynthesis: A Systematic Review and Meta-Analysis. *Radiology*, 222639.

ZHU, Y., WANG, M., YIN, X., ZHANG, J., MEIJERING, E. & HU, J. 2022. Deep Learning in Diverse Intelligent Sensor Based Systems. *Sensors (Basel)*, 23.

7 Declaration of Own Contribution

I hereby declare the following in relation to my doctoral application:

1. I confirm that the thesis submitted has not been previously presented in any doctoral procedure, either within Germany or abroad and have not applied for a doctoral or equivalent examination procedure at another university.
2. The statistical analysis was conducted with guidance from the Institute of Biometrics by myself.
3. I affirm that the dissertation submitted is my original work, and have not utilized any sources or aids other than those stated. Any verbatim or content-based excerpts from external sources are appropriately cited.
4. I am not subject to any pending criminal proceedings related to scientific misconduct.
5. I acknowledge that providing false or incomplete information may lead to the faculty initiating proceedings to revoke any academic title awarded to me.
6. I affirm that I have not utilized commercial services to aid my involvement in the doctoral process. This encompasses refraining from employing organizations that provide dissertation supervision for a fee or take on any part of my examination duties. I acknowledge the legal repercussions, including potential exclusion from candidacy, termination of the doctoral process, and revocation of degrees, should I engage in such practices or provide false information, as outlined in § 18.
7. I disclose any science-related criminal convictions, disciplinary measures, and pending disciplinary proceedings, in accordance with applicable laws, unless exempted by § 53 of the Federal Central Register Act.
8. If I have any science-related criminal convictions, I will provide a police clearance certificate not older than six months.

Tübingen, 12.04.2024

Alexander McQueeney

8 List of Publications

Parts of the data from this section are submitted for publication in the Journal of Telemedicine and Telecare:

Mahling, M., McQueeney, A., Festl-Wietek, T., Masters K., Zipfel, S., Herrmann-Werner, A., Rometsch C. (Submitted) 2024. Exploring the preferences and behavioural trends of e-patients in psychosomatics towards telemedicine during and post COVID-19 pandemic: A cross-sectional analysis. *Journal of Telemedicine and Telecare*.

9 Appendix



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Umfrage zu gesundheitsbezogenen elektronischen Aktivitäten



Bitte beziehen Sie sich auf Ihre medizinisch bezogenen Aktivitäten während der letzten 12 Monate.

1. Mein Alter ist _____
2. Mein Geschlecht ist: ☐ weiblich ☐ männlich
☐ keine Angaben
3. Ich hatte folgenden Termin in der Ambulanz:
☐ Direkt vor Ort ☐ Online
4. Was hätten Sie bevorzugt:
☐ Direkt vor Ort-Termin ☐ Online-Termin
5. Bitte kreuzen (x) Sie an, ob Ihre gesundheitsbezogenen elektronischen Aktivitäten in den folgenden Bereichen seit Dezember 2019 abgenommen (Abgen.), gleich geblieben (Gleich) oder zugenommen (Zugen.) haben.

Aktivität	Abgen.	Gleich	Zugen.
Interaktion mit meinen Ärzten per E-Mail			
Interaktion mit meinen Ärzten über soziale Medien (z. B. Facebook)			
Interaktion mit meinen Ärzten über andere private elektronische Systeme (z.B. WhatsApp)			
Interaktion mit meinen Ärzten über Live-Video			
Interaktion mit anderen Online-Patienten			
Medikamente online bestellen			
Zugriff auf medizinische Online-Bücher			
Zugriff auf medizinische Online-Videos			
Zugriff auf allgemeine medizinische Referenzseiten im Internet (z. B. Medscape, WebMD)			
Zugriff auf medizinische Fachzeitschriften (z.B. BMJ, Lancet, NEMJ)			
Zugang zu Networking-Seiten (z. B. EbM-Network, Facebook-Gruppen)			
Zugang offizielle / institutionelle Stellen (z.B. Ärztliches Zentrum für Qualität in der Medizin)			
Online-Datenbanken (z.B. PubMed, Google Scholar, MediSuch)			
Zeitschriften (z.B. Apothekenumschau, Focus Gesundheit, Men's Health)			
Nutzung von Wearables (z.B. Fitbit, AppleWatch) zur Erfassung biologischer Parameter (z.B. Herzfrequenz, Schrittzahl)			
Nutzung von Apps mit gesundheitsbezogenem Inhalt			

Figure 13: Part 1 of 3 of the questionnaire



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Umfrage zu gesundheitsbezogenen elektronischen Aktivitäten



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6. Bei den oben genannten Änderungen, inwieweit ist diese Änderung aufgrund der durch COVID-19 ausgelösten Ereignisse eingetreten? Bitte kreuzen Sie an.

Aktivität	Gar nicht	Etwas	Sehr
Interaktion mit meinen Ärzten per E-Mail			
Interaktion mit meinen Ärzten über soziale Medien (z. B. Facebook)			
Interaktion mit meinen Ärzten über andere private elektronische Systeme (z.B. WhatsApp)			
Interaktion mit meinen Ärzten über Live-Video			
Interaktion mit anderen Online-Patienten			
Medikamente online bestellen			
Zugriff auf medizinische Online-Bücher			
Zugriff auf medizinische Online-Videos			
Zugriff auf allgemeine medizinische Referenzseiten im Internet (z. B. Medscape, WebMD)			
Zugriff auf medizinische Fachzeitschriften (z.B. BMJ, Lancet, NEMJ)			
Zugang zu Networking-Seiten (z. B. EbM-Network, Facebook-Gruppen)			
Zugang offizielle / institutionelle Stellen (z.B. Ärztliches Zentrum für Qualität in der Medizin)			
Online-Datenbanken (z.B. PubMed, Google Scholar, MediSuch)			
Zeitschriften (z.B. Apothekenumschau, Focus Gesundheit, Men's Health)			
Nutzung von Wearables (z.B. Fitbit, AppleWatch) zur Erfassung biologischer Parameter (z.B. Herzfrequenz, Schrittzahl)			
Nutzung von Apps mit gesundheitsbezogenem Inhalt			
Andere:			

Figure 14: Part 2 of 3 of the questionnaire



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Umfrage zu gesundheitsbezogenen elektronischen Aktivitäten



7. Nachdem sich die Dinge wieder „normalisiert“ haben, welchen Aktivitäten würden Sie in welcher Form nachgehen? Bitte kreuzen Sie an:

Aktivität	Nur direkt vor Ort	Vor allem direkt vor Ort	Beide gleicher- maßen	Vor allem Online	Nur Online
Interaktionen mit Ärzten					
Interaktionen mit anderen Patienten					
Medikamente bestellen					
Beschaffung medizinischer Informationen					
Andere:					

8. Haben Sie noch weitere Themen?

Vielen Dank für Ihre Unterstützung!

Figure 15: Part 3 of 3 of the questionnaire



Umfrage zu gesundheitsbezogenen elektronischen Aktivitäten



5. Bitte kreuzen (x) Sie an, ob Ihre gesundheitsbezogenen elektronischen Aktivitäten in den folgenden Bereichen seit Dezember 2019 abgenommen (Abgen.), gleich geblieben (Gleich) oder zugenommen (Zugen.) haben.

Aktivität	Abgen.	Gleich	Zugen.
Interaktion mit meinen Ärzten per E-Mail			
Interaktion mit meinen Ärzten über soziale Medien (z. B. Facebook)			
Interaktion mit meinen Ärzten über andere private elektronische Systeme (z.B. WhatsApp)			
Interaktion mit meinen Ärzten über Live-Video			
Interaktion mit anderen Online-Patienten			
Medikamente online bestellen			
Zugriff auf medizinische Online-Bücher			
Zugriff auf medizinische Online-Videos			
Zugriff auf allgemeine medizinische Referenzseiten im Internet (z. B. Medscape, WebMD)			
Zugriff auf medizinische Fachzeitschriften (z.B. BMJ, Lancet, NEMJ)			
Zugang zu Networking-Seiten (z. B. EbM-Network, Facebook-Gruppen)			
Zugang offizielle / institutionelle Stellen (z.B. Ärztliches Zentrum für Qualität in der Medizin)			
Online-Datenbanken (z.B. PubMed, Google Scholar, MediSuch)			
Zeitschriften (z.B. Apothekenumschau, Focus Gesundheit, Men's Health)			
Nutzung von Wearables (z.B. Fitbit, AppleWatch) zur Erfassung biologischer Parameter (z.B. Herzfrequenz, Schrittzahl)			
Nutzung von Apps mit gesundheitsbezogenem Inhalt			
Andere:			

Online Physician Interactions

Aktivität	Abgen.	Gleich	Zugen.
Interaktion mit meinen Ärzten per E-Mail			
Interaktion mit meinen Ärzten über soziale Medien (z. B. Facebook)			
Interaktion mit meinen Ärzten über andere private elektronische Systeme (z.B. WhatsApp)			
Interaktion mit meinen Ärzten über Live-Video			

Online Patient Interactions

Interaktion mit anderen Online-Patienten			
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Ordering Medications Online

Medikamente online bestellen			
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Obtaining Medical Information

Zugriff auf medizinische Online-Bücher			
Zugriff auf medizinische Online-Videos			
Zugriff auf allgemeine medizinische Referenzseiten im Internet (z. B. Medscape, WebMD)			
Zugriff auf medizinische Fachzeitschriften (z.B. BMJ, Lancet, NEMJ)			
Zugang zu Networking-Seiten (z. B. EbM-Network, Facebook-Gruppen)			
Zugang offizielle / institutionelle Stellen (z.B. Ärztliches Zentrum für Qualität in der Medizin)			
Online-Datenbanken (z.B. PubMed, Google Scholar, MediSuch)			
Zeitschriften (z.B. Apothekenumschau, Focus Gesundheit, Men's Health)			
Nutzung von Wearables (z.B. Fitbit, AppleWatch) zur Erfassung biologischer Parameter (z.B. Herzfrequenz, Schrittzahl)			
Nutzung von Apps mit gesundheitsbezogenem Inhalt			
Andere:			

Figure 16: Subdivision of the electronic health activities into four main topics

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