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Determinants of Patient Use and Satisfaction With Telemedicine Services

Kumulative Dissertation

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Contents

List of Tables and Figures

List of Abbreviations

COVID-19 – Coronavirus disease 2019

CSQ-I – Client Satisfaction Questionnaire adapted to Internet-based interventions

DEAS – German Ageing Survey [Deutscher Alterssurvey]

SHARE – Survey of Health, Ageing and Retirement in Europe

TAM – Technology Acceptance Model

TSQ – Telemedicine Satisfaction Questionnaire

UTAUT – Unified Theory of Acceptance and Use of Technology

WHO – World Health Organization

List of Publications

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1. Synopsis

This cumulative dissertation aims to identify determinants of patient use of and satisfaction with telemedicine services. The included publications target specific populations that could particularly benefit from telemedicine services, including middle-aged and older adults, as well as mental health patients. Furthermore, a wide range of determinants that hold great potential to enhance future telemedicine use and satisfaction is examined.

To achieve these objectives, five publications were generated as part of this dissertation (chapters 4 to 8). *Publications 1 and 2* (chapters 4 and 5) focus on the determinants of telemedicine use among middle-aged and older adults during the coronavirus disease 2019 (COVID-19) pandemic in Germany. *Publications 3, 4, and 5* (chapters 6, 7, and 8) explore the determinants of use and satisfaction among mental health patients. Specifically, the determinants of patient use of and satisfaction with synchronous telemental health services during the COVID-19 pandemic were systematically reviewed in *Publication 3*. Building on this, *Publications 4 and 5* further investigate determinants of patient use of and satisfaction with telemental health services during and beyond the COVID-19 pandemic in Germany.

This chapter describes the current telemedicine landscape and the potential of telemedicine in selected populations. Further background regarding the rationale and research gaps that motivated this dissertation is provided. Following this, the materials and methods of the individual publications are outlined. Thereafter, the major study findings and their individual discussions are summarized. The final section of this chapter provides a general discussion of the study findings, strengths and limitations, research and practical implications, as well as an overall conclusion.

1.1 Background

1.1.1 The Rise of Telemedicine in Global Health Care

While traditional health consultations require in-person visits, technological advancements have facilitated new ways of providing care via telemedicine. Many definitions of telemedicine exist, reflecting the growing attention to this rapidly evolving and diverse treatment concept (Sood et al., 2007). According to the World Health Organization (WHO), the four key elements of telemedicine are: (1) its purpose is to provide clinical support, (2) it is intended to overcome geographical barriers, connecting users who are not in the same physical location, (3) it involves the use of various types of information and communication technology, and (4) its goal is to improve health outcomes (WHO Global Observatory for eHealth, 2010).

Different types of telemedicine services exist. Bashshur et al. (2011) developed a taxonomy for telemedicine and suggested a three-dimensional model to describe telemedicine services. Accordingly, telemedicine services may differ regarding functionality (i.e., consultation, diagnosis, monitoring, mentoring), applications (i.e., medical specialty, disease entity, site of care, treatment modality), and technology (i.e., synchronicity, network design, connectivity) (Bashshur et al., 2011). An example to illustrate these dimensions could be a remote cognitive behavioral therapy intervention for elderly patients with depression. For this example, the functionality includes consultation as well as ongoing monitoring and diagnosis. The application falls within the field of psychiatry (medical specialty) concerning depression in older adults (disease entity) and is delivered at the patients' home (site of care) via outpatient psychotherapy (treatment modality). Regarding the technology, the intervention may involve synchronous (direct, real-time interactions) video consultations and asynchronous (information is exchanged with a time delay) mood and activity tracking through a mobile app. The network design may include secure teleconferencing platforms with connectivity supported by reliable broadband internet.

Even though the concept of telemedicine had already emerged in 1924, adoption remained at a low level and was limited to certain contexts such as teleradiology, teledermatology, or telemental health (Bakalar, 2022; WHO Global Observatory for eHealth, 2010). Regulatory, cost, reimbursement, clinical, and social barriers often hindered telemedicine implementation worldwide (Bakalar, 2022; Dorsey & Topol, 2016; WHO Global Observatory for eHealth, 2010), including in Germany (Brauns & Loos, 2015). However, this situation changed drastically in 2020. Initially detected in China in December 2019, the novel infectious disease COVID-19 spread rapidly across the world, prompting the WHO to declare the outbreak a pandemic in March 2020 (World Health Organization, 2022a). The pandemic situation forced transformations of global health care systems towards preventing virus transmissions, protecting vulnerable populations (such as chronically ill or elderly individuals), and reducing the burden on the health care system through adaptive measures. Telemedicine represented a key solution to major pandemic challenges. Consequently, global telemedicine implementations increased tremendously across various specialties during the COVID-19 pandemic (Garcia et al., 2024; Omboni et al., 2022). For instance, the proportion of contract physicians and psychotherapists using telemedicine in ambulatory care in Germany increased from 6.1% in 2019 to 24.6% in 2021 (Heuer et al., 2023).

The pandemic circumstances further induced the implementation and expansion of legal frameworks for telemedicine use globally. For instance, this included the relaxation of laws and regulations for telemedicine use, and the introduction of national guidelines

and protocols guiding telemedicine implementations and reimbursement regulations (Omboni et al., 2022). In Germany, the introduction of laws such as the Digital Healthcare Act (Digitale-Versorgung-Gesetz, DVG) in 2019 and the Digital Health Applications Ordinance (Digitale Gesundheitsanwendungen-Verordnung, DiGAV) in 2020 allowed coverage of telemedicine services by the statutory health insurance, the expansion of video consultations, as well as the reimbursement and prescription of digital health applications (Gerke et al., 2020).

Beyond the challenges posed by the COVID-19 pandemic, telemedicine services hold significant potential to enhance future health care. Multiple meta-analyses support the effectiveness of telemedicine services in various contexts (e.g., Eze et al., 2020; Snoswell et al., 2021; Sun et al., 2024). For example, Snoswell et al. (2021) reviewed 38 meta-analyses encompassing 10 medical specialties and found that telemedicine was at least as effective as usual care across all examined specialties. Furthermore, telemedicine can help to increase access to care and health information, bridge geographical barriers and provider shortages, as well as save costs and time (e.g., Hjelm, 2005; Kichloo et al., 2020). Patients and providers were found to be satisfied with the services (e.g., Eze et al., 2020; Saeed et al., 2024). Thus, telemedicine utilization rates remain at a higher level even after the COVID-19 pandemic, and telemedicine services are becoming an integral part of global health care (e.g., Ndwabe et al., 2024). For example, billing data from the Techniker Krankenkasse (2025) in Germany indicate that, although the number of video consultations decreased from 956,000 (2021) to 576,000 (2023) in the post-pandemic period, the figures have recently increased again to 711,000 (2024) and remain substantially higher than pre-pandemic levels (358 video consultations in 2019).

1.1.2 The Potential of Telemedicine in Selected Target Populations

In addition to its more general strengths, telemedicine offers particular advantages to specific health care areas. One of the greatest challenges for future health care systems is the demographic shift towards an aging population. Driven by decreasing birth rates and higher life expectancy, the global population of individuals aged 60 or older will double by 2050 (2.1 billion) (World Health Organization, 2024). Currently, 40 to 60-year-olds represent the largest age group of the German population (27%; Statistisches Bundesamt, 2024), and the number of people at retirement age (67 or older) is expected to grow from 20% (2020) to 24% by 2035 (Statistisches Bundesamt, 2021). The growth of the older population entails particular health care challenges such as the management of chronic and multi-morbid conditions, mental health issues, and disabilities, alongside systematic issues related to access barriers, health inequities, and (long-term) care (Khan

et al., 2024). Additionally, older adults face social risks such as social isolation, ageism, elder abuse, and environmental threats (Khan et al., 2024).

Telemedicine is a valuable tool for addressing health care challenges associated with population aging. Telemedicine services can help to overcome access barriers to health care (e.g., no travelling to in-person appointments needed), enhance the overall quality of care (e.g., improved diagnosis and monitoring of chronic illnesses, support in emergency situations) and life of older adults (e.g., fostering greater independence and active participation among older individuals), and mitigate the burden on caregivers (Magdalena et al., 2015). Facilitated by pandemic-related circumstances, several telemedicine services for older adults were implemented in recent years, which were shown to be feasible, effective, cost-effective, and accepted across multiple health domains (Zhang et al., 2023). However, several systematic reviews highlight that additional studies are necessary to identify effective approaches for tailoring telemedicine services to the specific needs of older adults and addressing individual use barriers (e.g., health impairments or communication difficulties) (Magdalena et al., 2015; Zhang et al., 2023).

Another critical challenge for future health care is related to mental health treatment. Even though mental health needs are high globally, responses are often inadequate or insufficient (World Health Organization, 2022b). The treatment gap for mental disorders, which is represented by the percentage of individuals with a mental health condition who require care but do not receive mental health treatment, ranges from 32.2% (schizophrenia) to 78.1% (alcohol abuse and dependence) in the WHO regions (Kohn et al., 2004). Given the high lifetime prevalence of mental disorders (29.2%; Steel et al., 2014) and their substantial health and economic burden (Arias et al., 2022; GBD 2019 Mental Disorders Collaborators, 2022), there is an urgent need to improve mental health care.

Similar to other countries, one key issue of the German mental health care system is the lack of digitalization (Wiegand et al., 2025). Telemedicine services are especially suited for delivering mental health care (physical examination is not mandatory), and the literature indicates effectiveness of synchronous as well as asynchronous telemental health services (e.g., Chen et al., 2024; Goldberg et al., 2022; Linardon et al., 2024; O'Keefe et al., 2019; Philippe et al., 2022; Shaker et al., 2023). In addition, the services may offer specific advantages in the context of mental health care. The services can support dealing with growing mental health provider shortages (location-independent care) and mental health stigma (e.g., stigmatized mental health facilities do not have to be visited), and may increase convenience, comfort, and access to the services (e.g., reduced waiting time, receiving care from the comfort of own home, no additional

stressors while travelling to in-person appointments) (Di Carlo et al., 2021; McGinty, 2023; Schlief et al., 2022). Despite elevated utilization rates of telemental health services in the post-pandemic period, disparities in acceptance and use of the services persist, driven by factors related to access, socioeconomic characteristics, health, the digital divide, privacy and security concerns, regulatory and legal issues, and clinical limitations (Chandrasekaran, 2023; Ndwabe et al., 2024). Therefore, certain groups may be disadvantaged by telemental health implementation (Schlief et al., 2022), and these groups need to be identified and supported.

1.1.3 Determinants of Patient Use and Satisfaction With Telemedicine Services

Several theories predicting patient acceptance of telemedicine services exist, with the most commonly used models in the literature being the Technology Acceptance Model (TAM; Davis, 1989) and the Unified Theory of Acceptance and Use of Technology (UTAUT; Venkatesh et al., 2003) (Harst et al., 2019). The TAM proposes that the perceived usefulness and perceived ease of use are the primary determinants of the attitude towards technologies, which predicts the behavioral intention and actual use of technology (Davis, 1989). The UTAUT extends the TAM by incorporating additional theories and suggests that, in addition to performance and effort expectancy, social influence and facilitating conditions are key determinants of the behavioral intention and use behavior (Venkatesh et al., 2003). In the context of telemedicine, performance expectancy is the degree to which an individual believes that using telemedicine will be beneficial to them. Effort expectancy refers to the anticipated ease of using telemedicine. Social influence is defined as the degree to which individuals believe that important others think that they should use telemedicine. Facilitating conditions include existing organizational or technical infrastructures that support telemedicine use. Further influential constructs according to the UTAUT are gender, age, experience, and voluntariness of use (Venkatesh et al., 2003).

Some previous studies have examined the association of the dimensions of the UTAUT model and additional determinants with patient use of and satisfaction with telemedicine services. These determinants may have unique associations with patient use and satisfaction within specific populations. For middle-and older-aged populations, existing reviews emphasize the associations of socioeconomic characteristics (e.g., younger age, higher education, area lived in), access factors (e.g., access to technology and internet), health factors (e.g., better health or health behavior, fewer/greater biophysical aging restrictions), psychological factors (e.g., lower anxiety, greater self-efficacy, higher motivation, higher openness to experience), service factors (e.g., temporal and spatial flexibility, convenience), performance expectancy (e.g., perceived gains), effort

expectancy (e.g., greater skills, usability, decreased costs), social influence (e.g., greater social support/influence, training), and facilitating conditions (e.g., experience with electronic devices, accessibility of the services) with the intention to use or actual use of telemedicine (Kampmeijer et al., 2016; Pang et al., 2022; Turcotte et al., 2024; Yang et al., 2025). Nevertheless, a wide range of determinants has been observed across various contexts, underscoring the complexity of the factors involved. Further studies are necessary to verify the initial associations in different settings.

For mental health patients, few reviews highlight the associations of socioeconomic characteristics (e.g., younger age), psychological factors (e.g., less severe psychological symptoms, greater feeling of being in control of one's health, ehealth or computer literacy), service factors (e.g., greater personalization), effort expectancy (e.g., less technical issues), social influence (e.g., greater social connectedness and support), and facilitating conditions (e.g., accessibility of the services) with telemental health service use and satisfaction (Barnett et al., 2021; Borghouts et al., 2021; Li et al., 2022; Sharma & Devan, 2023). However, these reviews were conducted before the COVID-19 pandemic, and only a limited variety of determinants was observed in the previous studies. The increased use of telemental health services during the pandemic facilitated the implementation of new services and generated additional studies on the determinants of patient use and satisfaction, which warrant further evaluation.

1.1.4 Research Gaps and Objectives

The overarching goal of this dissertation is to explore determinants of patient use of and satisfaction with telemedicine services. This knowledge can assist in identifying target groups and patient groups that are currently underserved or not reached by telemedicine services, as well as individual barriers and facilitators of use and satisfaction. This information can support the tailoring and optimization of future services to meet patients' needs, ultimately promoting engagement and adherence, which is essential for enhancing the overall effectiveness of the services (e.g., Gan et al., 2021). Consequently, a greater understanding of the determinants of patient use of and satisfaction with telemedicine services is crucial to facilitate widespread implementation and acceptance of the services, which are vital for the advancement of future health care.

Multiple research gaps exist with respect to the determinants of patient use of and satisfaction with telemedicine. Firstly, studies focusing on target populations of telemedicine services are limited. Middle-aged and older adults, as well as individuals suffering from mental illnesses, may particularly benefit from telemedicine services, and determinants should be further explored among these patient groups. Secondly, the telemedicine landscape expanded tremendously during the COVID-19 pandemic (e.g.,

increased overall implementation across different specialties, a larger variety of services). Consequently, new pandemic research on the determinants of patient use and satisfaction needs to be evaluated. Furthermore, there is a pressing need to investigate the use of and satisfaction with the newly established services. While synchronous telemedicine services were predominantly used during the COVID-19 pandemic (such as video or telephone services), asynchronous services fell behind (e.g., Mehraeen et al., 2023; Witteveen et al., 2022), highlighting the need for additional research to support the use of and satisfaction with asynchronous services. Thirdly, certain categories of determinants, which are potentially modifiable to achieve greater patient use or satisfaction, such as psychosocial determinants (e.g., personality or self-efficacy; Bleidorn et al., 2022; Schwoerer et al., 2005) or provider characteristics, require more attention. Additionally, a better understanding of the determinants of patient use and satisfaction in the post-pandemic period is of major importance, as in-person services have resumed alongside an array of telemedicine services, and the use of telemedicine remains entirely voluntary. Finally, longitudinal studies are needed to test the temporal stability of the associations of the determinants with telemedicine use and satisfaction, as well as to evaluate potential changes over time. The German health care context may be of particular interest for such studies, given the significant legal changes and implementation of new services during the COVID-19 pandemic, as well as the limited existing research regarding determinants of telemedicine use and satisfaction among German samples.

This dissertation aims to bridge existing research gaps and improve the understanding of the determinants of telemedicine use and satisfaction among selected populations, who may derive specific benefits from such services. Five publications were conducted to reach this goal:

Publications 1 and 2 (chapters 4 and 5): Investigated a wide range of socioeconomic, psychosocial, health-related, and COVID-19-related determinants of telemedicine use among middle-aged and older adults during the COVID-19 pandemic in representative samples from Germany. Longitudinal as well as cross-sectional data were considered.

Publication 3 (chapter 6): Systematically reviewed international studies on determinants of patient use of and satisfaction with synchronous telemental health services during the COVID-19 pandemic.

Publications 4 and 5 (chapters 7 and 8): Examined a large variety of socioeconomic, access, health, psychosocial, personality, service, and COVID-19-related determinants as well as provider characteristics and their associations with patient use of and satisfaction with different telemental health services during and after the COVID-19 pandemic in Germany.

1.2 Materials and Methods

1.2.1 Empirical Studies

The empirical studies included in this dissertation focus on different target populations for telemedicine services. For *Publications 1 and 2*, determinants of general telemedicine use in middle-aged and older individuals were observed. *Publications 4 and 5* focused on mental health patients and examined determinants of patient use of and satisfaction with telemental health services. Study samples, materials, and statistical methods are presented in the following sections.

1.2.1.1 Middle-Aged and Older Populations

Sample. *Publication 1* was based on data from the Survey of Health, Ageing and Retirement in Europe (SHARE; Börsch-Supan et al., 2013). The SHARE is the largest social science panel study in Europe and aims to examine the effects of health, social, economic, and environmental policies among European citizens aged 50 years or older (also including their partners). The SHARE panel includes 27 European countries and Israel. The first wave of the SHARE took place in 2004, followed by additional waves conducted on a biennial basis. To date, 9 waves of the SHARE have been executed. For every wave, refreshment samples are drawn to account for attrition in the longitudinal sample. In response to the COVID-19 pandemic, two additional Corona Surveys were carried out to assess the impact of the pandemic on health-related and socioeconomic outcomes.

For *Publication 1*, cross-sectional data of the nationally representative German sample of the SHARE Corona Survey 2 (Börsch-Supan, 2022) were exclusively analyzed, since telemedicine service use was measured for the first time in the SHARE in this wave. Only the German sample of the Corona Survey 2 was examined (n = 2,039) because health care systems, telemedicine use, and telemedicine regulations during the COVID-19 pandemic varied greatly across Europe (e.g., Ndwabe et al., 2024), and comparability could not be assumed. Instead of the usual computer-assisted personal interviews of the SHARE, telephone-administered interviews were conducted for the Corona surveys. Panel households that participated in at least one of the previous SHARE waves (up to wave 8) were eligible to participate in the Corona Survey 1, which in turn made them eligible for participation in the Corona Survey 2 (Bergmann, Wagner, Yilmaz, et al., 2024). The data for the German sample of the Corona Survey 2 were collected between June and August 2021, and the response rate was 91% (Bergmann, Wagner, & Börsch-Supan, 2024), reflecting the overall high response rates and panel stability of the SHARE panel (Bergmann et al., 2022). Verbal informed consent was obtained from all SHARE participants.

Publication 2 included data from the German Ageing Survey (DEAS; Klaus et al., 2017). The DEAS is a nationally representative, population-based panel study that investigates living conditions, diversity, and aging processes as well as related social changes among middle-aged and older adults in Germany. The sample is representative of community-dwelling adults aged 40 to 85 years living in private households in Germany. Starting in 1996 (wave 1), the DEAS data were collected in 2002 (wave 2) and 2008 (wave 3), with subsequent samples gathered triennially (wave 4-8). A cohort-sequential design has been implemented for the DEAS, meaning that, in addition to longitudinal data, new representative, population-based baseline samples are added to the panel every six years. In 2020, no additional baseline data could be collected due to the COVID-19 pandemic. Nevertheless, an additional Compact Survey was implemented in summer 2020 to assess the pandemic impact.

For *Publication 2*, longitudinal data from the Compact Survey (Vogel et al., 2021b) and wave 7 (Vogel et al., 2021a) of the DEAS were considered. Data for the Compact Survey were collected from June to July 2020. Individuals who had participated in the DEAS at least once were eligible and received paper-and-pencil questionnaires by post. From November 2020 until March 2021, wave 7 of the DEAS was conducted. Similar to the SHARE, personal interviews were substituted with telephone-administered interviews and an additional paper-and-pencil questionnaire in wave 7 due to the ongoing pandemic. The response rate for the Compact Survey was 57% (n = 4,823) (Engstler, 2021), and for wave 7 it was 66% (n = 5,402) (Stuth, 2022). Participants were included in *Publication 2* if they had taken part in at least one of the two surveys (n = 5,456 observations corresponding to n = 3,222 individuals). Written informed consent was acquired.

Material. *Publications 1 and 2* both examined telemedicine use during the COVID-19 pandemic as the dependent variable. In both surveys, the frequency of telemedicine service use was assessed (i.e., use frequency of remote medical consultations or consultations with doctors and therapists via online platforms, respectively). The outcome variable was dichotomized for both publications due to small case numbers (0 = no use, 1 = used telemedicine services at least once).

Based on previous research and theoretical considerations, several determinants (independent variables) were considered in both publications. This included socioeconomic, psychosocial, health, and COVID-19-related determinants. Details regarding the included determinants and measuring instruments are summarized in Table A1 (Appendix). For *Publication 2*, multiple validated and well-established scales were used to assess important psychosocial determinants, which showed good or very good psychometric properties.

Statistical Methods. Different methodological approaches were employed to test the associations between the determinants and the dichotomous outcome of telemedicine service use. Missing data were addressed through listwise deletion in both publications, as the number of missing values for the determinants was very small. Model assumptions for the different analytic models were checked in advance (e.g., absence of multicollinearity).

For *Publication 1*, cross-sectional data were analyzed using Firth logistic regressions. The logistic regression model estimates the probability of an individual *i* using telemedicine $P(y_i = 1)$, based on the individual values of the included independent variables (determinants) x_{ik}, their associated coefficients β_k, and the intercept β_0 (e.g., Fahrmeir et al., 2021):

$$P(y_i = 1) = \frac{\exp(\beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \cdots + \beta_k x_{ki})}{1 + \exp(\beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \cdots + \beta_k x_{ki})} \quad (1)$$

Some of the included variables had small case numbers, which can lead to biased estimates when using traditional maximum likelihood logistic regression (Firth, 1993). The Firth method addresses this issue by incorporating a penalty term into the likelihood function (using penalized likelihood estimation instead of conventional maximum likelihood estimation) (Firth, 1993). Thus, the Firth method was employed to produce less biased estimates. Furthermore, psychological symptoms (anxiety, depression, and loneliness) were entered separately into the regression model as they were highly correlated. Additional robustness checks were conducted, which included traditional logistic regression analyses and testing for a non-linear relationship of age group (40-64 years, 65-74 years, ≥75 years) with telemedicine use.

For *Publication 2*, cross-sectional and longitudinal relationships were examined using random effects logistic regression. In contrast to conventional logistic regression, the random effects model accounts for the panel structure of the DEAS data. Under the assumption that unobserved unit-specific heterogeneity u_i is not correlated with the independent variables (determinants), it allows the inclusion of time-varying x_{it} (e.g., psychological symptoms, self-rated health, health behavior) as well as time-constant z_i determinants (e.g., gender, migration background), which is an advantage over fixed effects regression models (Andreß et al., 2013). The selection of the random effects model was further supported by a non-significant Hausman test statistic, which implies that the fixed and random effects models both are consistent, while the random effects model is more efficient (Andreß et al., 2013; Hausman, 1978). The model estimates the probability of telemedicine use $P(y_{it} = 1)$ at time point *t* for unit *i* as a function of the individual values for the included time-varying x_{kit} and time-constant z_{ji} determinants, their associated coefficients β_k and γ_j, and the intercept β_0. Furthermore, the model accounts for

unobserved unit-specific heterogeneity u_i, which may be related to the probability of using telemedicine over time (e.g., Andreß et al., 2013):

$$P(y_{it} = 1) = \frac{\exp(\beta_0(t) + \beta_1 x_{1it} + \cdots + \beta_k x_{kit} + \gamma_1 z_{1i} + \cdots + \gamma_j z_{ji} + u_i)}{1 + \exp(\beta_0(t) + \beta_1 x_{1it} + \cdots + \beta_k x_{kit} + \gamma_1 z_{1i} + \cdots + \gamma_j z_{ji} + u_i)} \quad (2)$$

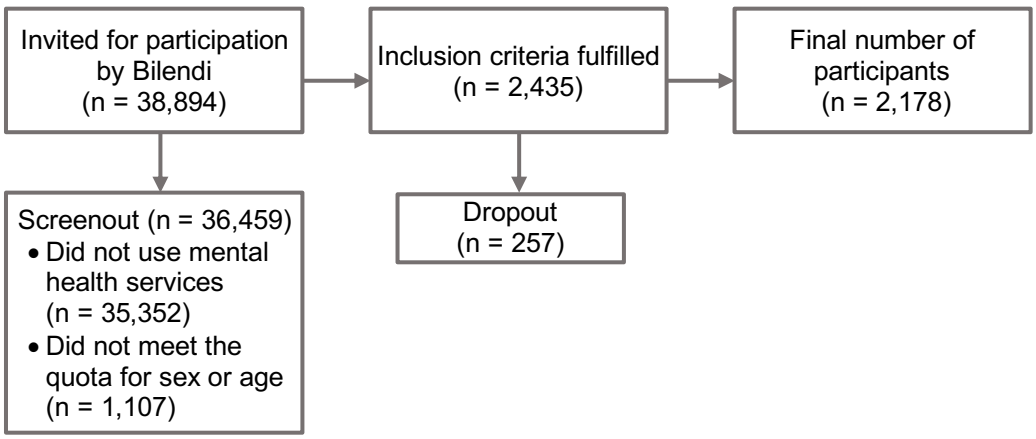
Finally, robustness checks were conducted, including subgroup analyses stratified by gender and age group.

1.2.1.2 Mental Health Patients

Sample. *Publications 4 and 5* focused on a sample of mental health patients. In cooperation with the market research firm Bilendi (ISO 20252:2019-certified online sample provider), a cross-sectional online survey in the general adult population of Germany (18-74 years) was conducted. To improve the clarity and accuracy of the employed questionnaire and prevent bias, a pretest was done in November 2023 (n = 13, 8 female), after which minor changes were applied. Subsequently, the data were collected between December 1 and December 15, 2023. Participants were included if they had been using mental health services since March 2020. To promote the representativeness of the sample, predetermined quotas for gender and age groups were applied, informed by mental health service utilization rates in Germany (Mack et al., 2014; Rommel et al., 2017). Altogether, 2,178 individuals participated in the online survey (see Figure 1 for participant flow).

Figure 1

Participant Flow of the Representative Quota-Based Online Survey



While the sample for *Publication 5* was limited to patients with prior experience of using telemental health services (n = 854), *Publication 4* included the entire sample. Informed consent was acquired from all participants, and the study was approved by the

Local Psychological Ethics Committee of the University Medical Center Hamburg-Eppendorf (LPEK-0683).

Material. The observed dependent variable in *Publication 4* was the use of telemental health services. Telemental health service use, including use of synchronous (video and telephone services) as well as asynchronous services (e.g., email, mobile apps, web-based interventions), was examined using single items that asked whether individuals had used the services since March 2020 and, if so, whether they had also used them in the last four weeks (0 = no use; 1 = used telemental health services at least once since March 2020/in the last four weeks). March 2020 was used as the cut-off point because the COVID-19 pandemic was officially declared by the WHO during that time (World Health Organization, 2022a), resulting in an extensive expansion of telemedicine services in Germany and worldwide.

The dependent variable in *Publication 5* was satisfaction with telemental health services. Satisfaction with synchronous video and telephone services, as well as asynchronous services, was assessed using validated, well-established questionnaires. Satisfaction with synchronous services was measured using the Telemedicine Satisfaction Questionnaire (TSQ; Yip et al., 2003). The TSQ investigates quality of care, similarity to in-person encounters, and the overall perception of the interaction using 14 items (range: 14-70, higher values indicate greater satisfaction). A 5-point Likert scale is used in the questionnaire, ranging from 1 = strongly disagree to 5 = strongly agree. For measuring satisfaction with asynchronous services, the Client Satisfaction Questionnaire adapted to Internet-based interventions was employed (CSQ-I; Boß et al., 2016). The CSQ-I evaluates the patients' general satisfaction with the intervention and the help they received, as well as the likelihood of recommending and reusing the services, using 8 items (range: 8-32, higher values indicate greater satisfaction). A 4-point Likert scale is employed, which ranges from 1 = does not apply to 4 = does totally apply to me. Both instruments exhibit favorable psychometric properties (Boß et al., 2016; Yip et al., 2003). In our sample, Cronbach's alpha and McDonald's omega were 0.93 (TSQ for satisfaction with telephone services), 0.94 (TSQ for satisfaction with video services), and 0.95 (CSQ-I for satisfaction with asynchronous services), respectively.

Based on theoretical considerations, past findings, and research gaps, potential determinants (independent variables) were selected. More specifically, socioeconomic, psychosocial, health, COVID-19-related, access, provider, and service factors were investigated. Further details regarding the included determinants and their measurement are presented in Table A2 (Appendix). In both publications, validated and well-established questionnaires were used to measure psychosocial determinants, which were psychometrically sound.

Statistical Methods. Due to differences in the dependent variables, different analytic methods were used to explore associations of the included determinants with patient use of and satisfaction with telemental health services in *Publications 4 and 5*. Similar to the previous publications, missing data were handled using listwise deletion, as the number of missing values was small. In addition, model assumptions for linear and logistic regression models were checked, respectively (e.g., homoscedasticity or multicollinearity).

For *Publication 4*, cross-sectional data were inspected using multiple logistic regressions (Equation 1). First, associations of the determinants (excluding service factors) with telemental health service use since the onset of the COVID-19 pandemic were analyzed. Additional subgroup analyses were carried out for this outcome to ensure the robustness of our findings. Namely, separate logistic regression models for different types of telemental health services (video, telephone, and asynchronous services) and the two most prevalent groups of psychiatric diagnoses in Germany (anxiety and affective disorders; Jacobi et al., 2014) were calculated. Second, associations with current use of telemental health services (in the last four weeks), also including service factors as determinants, were examined.

For *Publication 5*, cross-sectional data were examined using a multiple linear regression model, which estimates the individual patient satisfaction score y_i as a linear function of the intercept term β_0, the observed independent variables (determinants) $x_{ki,}$ each multiplied by their associated coefficients β_k, and an error term ε_i that captures unobserved heterogeneity (e.g., Fahrmeir et al., 2021):

$$y_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \cdots + \beta_k x_{ki} + \varepsilon_i \quad (3)$$

Robust standard errors were applied to adjust for heteroscedasticity (e.g., Hardin & Hilbe, 2007). For additional robustness checks, full-information maximum likelihood models (FIML) were employed to address the issue of missing data more effectively (Enders, 2001).

1.2.2 Systematic Review

For *Publication 3*, a systematic review of the existing evidence on the determinants of patient use of and satisfaction with synchronous telemental health services during the COVID-19 pandemic was conducted. A review protocol was created and registered in PROSPERO (CRD42022351576), and PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses; Page et al., 2021) guidelines were followed during the review process. Eligibility criteria were specified (see Table 1) to ensure high quality and comparability among the studies.

Table 1

Eligibility Criteria for Systematic Review

Inclusion criteria	Exclusion criteria
• Examination of determinants of patient use and/or satisfaction	• No examination of determinants, outcomes not related to patient use and satisfaction
• Mental health patients	• Patients with physical health conditions
• Focus on synchronous telemedicine services	• Focus on asynchronous telemedicine services
• Data collection during the COVID-19 pandemic	• Data collection before the COVID-19 pandemic
• Peer-reviewed studies with quantitative data analysis	• Non-peer-reviewed studies or studies with qualitative data analysis
• German or English language publication	• Publication not written in the German or English language

PubMed, PsychInfo, and Web of Science databases were searched in August 2022 using a predefined search query. Titles and abstracts of the studies were independently screened by two reviewers, who subsequently conducted an independent screening of the study full-texts. Both reviewers independently rated the risk of bias in the included studies using the assessment tool for observational cohort and cross-sectional studies by the National Heart, Lung, and Blood Institute (2021). Any disagreements in the study selection or risk of bias rating process were resolved through discussion or consultation with a third reviewer if needed. Key characteristics of the included studies were extracted by one reviewer and cross-checked by a second reviewer. Due to great heterogeneity among the studies, a narrative synthesis of the results was carried out, informed by the current reporting guidelines for syntheses without meta-analysis in systematic reviews (Campbell et al., 2020). The study results regarding the determinants of use or satisfaction were summarized in major categories, which were based on the UTAUT (Venkatesh et al., 2003).

1.3 Results and Discussion of the Individual Studies

Individual results and discussion of the publications are summarized in the following chapter. Furthermore, an overview of the key findings from the empirical studies (*Publications 1, 2, 4, and 5*) is displayed in Table 2.

Table 2

Overview of Empirical Study Findings

Determinants	Publications						
	1	2	4		5		
			DV1[a]	DV2[b]	DV1[c]	DV2[d]	DV3[e]
Socioeconomic factors							
Gender	●	●	●	●	●	●	●
Age	●	●	⊖	●	●	●	●
Education	○	⊕[f]	●	●	●	⊖[f]	●
Employment status	●	●	●	⊕[g]	●	⊖[g]	●
Household income	●	●	●	●	●	●	●
Residential form of partnership	●	●	●	●	●	●	⊖[h]
Area lived in	●	●	●	●	●	●	●
Migration background	○	●	●	●	●	●	●
Presence of own (grand)children	○	●	●	●	○	○	○
Psychosocial factors							
Mental illness	○	○	○	○	●	●	●
Depression	⊕	●	●	●	○	○	○
Anxiety	⊕	○	●	●	○	○	○
Loneliness	⊕	⊕	●	●	●	⊕	⊖
Social support	○	○	●	●	○	○	○
Social contacts	●	○	○	○	○	○	○
Life satisfaction	○	⊕	●	●	○	○	○
Self-efficacy	○	○	●	●	⊕	●	●
Personality	○	○	●	⊖[i]	⊕[j]	⊕[k]	●
Self-perception of own aging	○	●	○	○	○	○	○
Attitude towards telemedicine	○	○	⊕	●	⊕	⊕	⊕
Technology commitment	○	○	○	○	⊕	⊖	●
Health factors							
Physical illness	●	○	●	●	●	●	●
Self-rated health	●	⊖	●	●	●	●	●
Health limitations	⊕	○	○	○	○	○	○
Health behavior	●	⊕[l]	○	○	○	○	○
COVID-19-related factors							
Infection status	●	●	○	○	○	○	○
Vaccination status	●	○	●	●	●	●	●
Fear	⊕	⊕	●	●	⊕	⊕	⊕
Preventive measures	●	○	○	○	○	○	○
Control beliefs	○	●	○	○	○	○	○

Determinants	Publications						
	1	2	4		5		
			DV1[a]	DV2[b]	DV1[c]	DV2[d]	DV3[e]
Access factors							
Insurance type	○	○	●	●	●	●	●
Internet connection quality	○	○	●	●	●	⊖[m]	●
Provider characteristics							
Attitude towards telemedicine	○	○	⊕	⊕	⊕	⊕	⊕
Skills in using telemedicine	○	○	⊕	●	⊕	⊕	●
Service factors							
Avoidance of stigmatization	○	○	○	⊕	○	○	○
Higher convenience	○	○	○	⊕	○	○	○

Note. DV = dependent variable; ⊕ = statistically significant positive association; ⊖ = statistically significant negative association; ● = no statistically significant association; ○ = respective determinants were not examined in the study.

[a] Patient use of telemental health services since the onset of the COVID-19 pandemic. [b] Patient use of telemental health services in the last four weeks. [c] Patient satisfaction with video services. [d] Patient satisfaction with telephone services. [e] Patient satisfaction with asynchronous services. [f] For high education. [g] For full-time employment. [h] For partner deceased/widowed. [i] For neuroticism. [j] For extraversion. [k] For conscientiousness and extraversion. [l] For higher frequency of physical activity. [m] For fast, but not stable internet connection.

1.3.1 Middle-Aged and Older Populations

1.3.1.1 Publication 1: Determinants of Telemedicine Service Use Among Middle-Aged and Older Adults in Germany During the COVID-19 Pandemic: Cross-Sectional Survey Study

Results. This study examined determinants of telemedicine use among middle-aged and older individuals in Germany (n = 2,039). Associations of socioeconomic, psychological, social, health, and COVID-19-related determinants with the outcome were observed. Statistically significant positive associations with telemedicine use were found for psychological determinants, including feeling nervous, anxious, or on edge (OR = 1.61, 95% CI [1.04, 2.50], p = .030), feeling sad or depressed (OR = 1.62, 95% CI [1.05, 2.51], p = .030), and feelings of loneliness (OR = 1.66, 95% CI [1.07, 2.58], p = .024). Furthermore, middle-aged or older adults who had forgone medical treatment because of being afraid of being infected by the coronavirus (OR = 1.81, 95% CI [1.10, 2.97], p = .019) or had more severe health limitations (OR = 2.11, 95% CI [1.12, 4.00], p = .021)

were more likely to use telemedicine. The included socioeconomic and social determinants were not significantly associated with the outcome.

Discussion. Considering the impact of population aging, telemedicine services could be especially advantageous for middle-aged and older adults. Nevertheless, research on determinants of telemedicine use is limited, which was addressed in this publication. This study highlights the association of psychological symptoms and telemedicine use, which is supported by previous research (Choi et al., 2022; Hajek & König, 2022; Narcisse et al., 2022; Rauschenberg et al., 2021). This association could be explained by the suitability of telemedicine for mental health care and that it was most commonly used in the mental health care sector during the pandemic (Harju & Neufeld, 2022). However, it may also be explained by generally higher health care utilization rates among patients with mental disorders (e.g., Koopmans et al., 2005). In line with past research (Harju & Neufeld, 2022), the findings additionally suggest that telemedicine services present a valuable treatment option for older patients with severe health limitations. Particularly those with high need for care, restricted mobility, or those seeking to minimize their risk of infection in social environments could benefit (e.g., Magdalena et al., 2015). Likewise, forgoing medical treatment because of being afraid of being infected by the coronavirus was associated with telemedicine use in the SHARE sample. Previous research also identified higher perceived risk of COVID-19 as a key predictor of telemedicine use (Hosseinzadeh et al., 2023). Socioeconomic and social determinants appear less crucial for telemedicine use among middle-aged and older individuals in Germany, indicating that telemedicine use is linked to older individuals' health needs rather than their socioeconomic status or social support. This contrasts not only with existing international research (e.g., Harju & Neufeld, 2022) but also partially with previous studies from Germany (e.g., Hajek et al., 2022; Hannemann et al., 2021; Reitzle et al., 2021; von der Groeben et al., 2023). This could be attributed to differences in study periods and populations; however, the mixed findings highlight the need for further investigation, particularly within the German context.

To summarize, telemedicine use among middle-aged and older adults appears to be primarily associated with psychological and health determinants during the COVID-19 pandemic in Germany. This population appears to be less affected by socioeconomic and social barriers to telemedicine use. Therefore, telemedicine services emerge as a promising treatment option for middle-aged and older individuals, particularly for those with severe health limitations or psychological symptoms, which may constitute a key target group for the services.

1.3.1.2 Publication 2: Determinants of Having Online Health Consultations During the COVID-19 Pandemic Among Middle-Aged and Older Adults in Germany: Representative Longitudinal Survey Study

Results. This study investigated determinants of telemedicine use among middle-aged and older adults in Germany. Two waves of the DEAS were taken into account (n = 5,456). Several determinants were observed, including socioeconomic, health and health behavior, psychosocial, and COVID-19-related determinants. High education (OR = 1.43, 95% CI [1.06, 1.93], p = .019), poor self-rated health (OR = 0.60, 95% CI [0.49, 0.75], p<.001) and higher frequency of physical activity (reference: low frequency; medium frequency: OR = 1.58, [95% CI 1.15, 2.17], p = .005; high frequency: OR = 1.73, 95% CI [1.09, 2.76], p = .019) were associated with telemedicine use. Significant psychosocial determinants included greater levels of loneliness (OR = 1.43, 95% CI [1.06, 1.93], p = .035) and higher life satisfaction (OR = 1.33, 95% CI [1.02, 1.73], p = .035). In addition, older adults who perceived the COVID-19 crisis as a greater personal threat were more likely to use telemedicine (OR = 1.08, 95% CI [1.01, 1.15], p = .017).

Discussion. Only a few studies examining determinants of telemedicine use in older adults exist. Since studies based on longitudinal data are particularly lacking, this study markedly extends the current knowledge. Similar to *Publication 1* and past studies (Harju & Neufeld, 2022), the study findings underscore the relationship between poor health and telemedicine use, further highlighting the potential benefits of telemedicine for older individuals who are chronically ill, mobility-restricted, or homebound. In line with *Publication 1* and previous research (Hosseinzadeh et al., 2023), perceiving the COVID-19 crisis as a greater personal threat was associated with telemedicine use. Telemedicine seems to have emerged as a widely accepted alternative for older patients trying to avoid health risks related to in-person visits during the COVID-19 pandemic. The association of loneliness with telemedicine use during the pandemic was further supported in this study, aligning with the cross-sectional analyses in *Publication 1* and prior research (Robbins et al., 2023). Highly lonely individuals might have used telemedicine to satisfy their unmet social needs during pandemic times. In addition, greater satisfaction with life was linked to telemedicine use. This relationship may be attributed to previously observed associations of life satisfaction with digital health literacy (König et al., 2024) as well as health-promoting behaviors (Grant et al., 2009; Martín-María et al., 2020). Furthermore, a higher frequency of physical activity was associated with telemedicine use. Physically active individuals exhibit higher health awareness (e.g., higher use of preventive health services; Kang & Xiang, 2017), which might facilitate telemedicine use. Corresponding to *Publication 1*, almost all socioeconomic determinants were not associated with telemedicine use. Nevertheless, the significant association of high education with

telemedicine use might be explained by greater levels of digital literacy among highly educated individuals (Estrela et al., 2023). The association of higher education and telemedicine use was also found in other German and international samples (Frydman et al., 2022; Hannemann et al., 2021; Kampmeijer et al., 2016; Reitzle et al., 2021). In contrast to *Publication 1*, depressive symptoms were not associated with telemedicine use. This may be explained by differences in data collection periods, given that the severity of depressive symptoms (Gobbi et al., 2020) and levels of acceptance of telemedicine (von der Groeben et al., 2023) varied throughout the different pandemic periods.

To summarize, higher education, psychosocial, and health determinants were longitudinally associated with telemedicine use among middle-aged and older adults during the COVID-19 pandemic in Germany. Beyond health-related factors, which were identified as key determinants of telemedicine use, the findings stress the need to improve access to telemedicine for older individuals with low education and potentially limited digital literacy, as well as to promote utilization among individuals experiencing low life satisfaction and unhealthy lifestyles.

1.3.2 Mental Health Patients

1.3.2.1 Publication 3: Determinants of Patient Use and Satisfaction With Synchronous Telemental Health Services During the COVID-19 Pandemic: Systematic Review

Results. This study aimed to systematically review the literature on the determinants of patient use of and satisfaction with synchronous telemental health services during the COVID-19 pandemic. Overall, 20 studies passed the full-text screening, of which n = 10 studies investigated patient use, n = 7 studies patient satisfaction, and n = 3 studies examined both outcomes. Substantial heterogeneity was present among the study designs, methods, and results. The quality rating for the included studies was mostly good or fair. Most studies focused on sociodemographic or health determinants, and major research gaps were identified (i.e., UTAUT-based dimensions including psychosocial factors, facilitating conditions, effort, and performance expectancy). Despite the predominance of mixed and non-significant findings, some studies highlight connections that warrant further exploration. This includes associations of female sex, younger age, and lower psychological symptom severity with patient use. Patient satisfaction was mostly high, and the studies revealed either insignificant relationships or limited evidence overall. Notably, only the service delivery format (video compared to telephone services) was significantly associated with higher patient satisfaction across some studies.

Discussion. This is the first systematic review to investigate determinants of patient use of and satisfaction with synchronous telemental health services during the COVID-19 pandemic, thereby contributing significant knowledge to the existing body of literature. The included studies highlight female gender and younger age as determinants of patient use of telemental health services, which overlaps with utilization patterns of in-person mental health services (e.g., Elshaikh et al., 2023; Roberts et al., 2018). Nevertheless, the use of telemental health services by older mental health patients may also be hindered by additional barriers associated with the grey digital divide (Mubarak & Suomi, 2022). Therefore, telephone services could represent a valuable, more accessible alternative for this patient group. Furthermore, the evidence indicates that patients with more severe psychological symptoms are less likely to use telemental health services, suggesting that in-person settings may be more appropriate for individuals with severe mental health conditions. Although the effectiveness of telemental health services was supported by several studies (e.g., Chen et al., 2024), further exploration in severe mental illness populations is needed (Merchant et al., 2020). The high satisfaction ratings and predominant absence of significant determinants of patient satisfaction underscore generally high patient acceptance of telemental health services, which is supported by previous studies (Abuyadek et al., 2024; Saeed et al., 2024). Essential research gaps and implications were derived from this systematic review, including the need to investigate determinants in specific mental health contexts, explore understudied UTAUT dimensions, conduct further longitudinal and qualitative studies, and incorporate established theoretical models and measurement scales in future research.

In summary, this systematic review significantly advances the knowledge on determinants of patient use of and satisfaction with telemental health services. The findings suggest potential target groups for telemental health interventions, such as young women with mild psychological symptoms. Nevertheless, it was also noted that more vulnerable populations, such as older patients with severe symptoms, are harder to reach and require targeted outreach efforts. Important research gaps were identified and need to be addressed in future studies to improve understanding of use disparities, barriers, and individual preferences of mental health patients, ultimately contributing to the improvement and widespread use of telemental health services in the future.

1.3.2.2 Publication 4: Determinants of Patient Use of Telemental Health Services: Representative Cross-Sectional Survey From Germany

Results. This study aimed to identify determinants of patient use of telemental health services. Patient use since the onset of the COVID-19 pandemic (March 2020), as well as current use in the last four weeks (in November/December 2023), served as

outcome measures. Examined determinants included socioeconomic, access, health, COVID-19-related, psychosocial, and service factors, as well as personality and provider characteristics. For patient use since the onset of the pandemic (n = 2,082), associations with younger patient age (OR = 0.97, 95% CI [0.96, 0.98], $p < .001$), a more positive patient attitude towards telemental health services (OR = 1.04, 95% CI [1.02, 1.05], $p < .001$), a more positive provider attitude towards (OR = 1.84, 95% CI [1.62, 2.08], $p < .001$) and higher provider skills for using the services (OR = 1.37, 95% CI [1.20, 1.56], $p < .001$) were found. In the subgroup analyses for service type (video, telephone, and asynchronous services) and psychiatric diagnoses (anxiety and affective disorder), these significant relationships were further supported.

Furthermore, full-time employment (OR = 2.25, 95% CI [1.40, 3.60], $p < .001$), lower neuroticism (OR = 0.94, 95% CI [0.88, 1.00], $p = .046$), and a more positive provider attitude towards the services (OR = 1.43, 95% CI [1.16-1.77], $p < .001$) were associated with patient use in the last four weeks (n = 899). Additional service determinants were considered for this outcome. Use of the services to avoid stigmatization (OR = 1.50, 95% CI [1.26, 1.80], $p < .001$), shorter waiting times and easier scheduling of the first appointment (OR = 4.44, 95% CI [2.67, 7.38], $p < .001$), as well as shorter waiting times (OR = 3.20, 95% CI [2.07, 4.94], $p < .001$) and easier scheduling (OR = 4.51, 95% CI [2.24, 9.06], $p < .001$) individually, were positively associated with telemental health service use in the last four weeks. No significant associations of access, health, and COVID-19-related factors with the outcomes were observed.

Discussion. This study explored a wide range of determinants that have been scarcely investigated in previous research, thereby offering new insights into the use of telemedicine services by mental health patients. The study verified review findings from *Publication 3* and additional recent studies (e.g., Talbot et al., 2024; von der Groeben et al., 2023) regarding the association of younger age and telemental health service use during the COVID-19 pandemic. This finding further spotlights the growing grey digital divide in remote health care (Mubarak & Suomi, 2022) and calls for efforts to facilitate the inclusion of older mental health patients. Nevertheless, when focusing on patient use in the last 4 weeks (post-pandemic context), this relationship did not reach statistical significance. Instead, full-time employment status appeared to be associated with current use, which may mean that full-time employed individuals appreciate the convenience and time savings that remote services offer beyond pandemic circumstances. In addition, full-time employed individuals may interact more frequently with digital devices in their workplace, ultimately leading to higher digital literacy. The patient attitude towards the services, measured using UTAUT dimensions, appears to be associated with patient use, which is in line with previous literature (Harst et al., 2019). Based on the study findings,

this association may be especially relevant for initial use (pandemic context). For current use (post-pandemic context), personality traits such as lower neuroticism may be more influential. Beyond patient characteristics, positive provider attitudes towards and greater skills for using the services were associated with patient use, which underlines the importance of strengthening positive attitudes and skills as well as reducing barriers among providers, who have repeatedly been identified as gatekeepers of telemental health care (e.g., Cowan et al., 2019). Service strengths, such as avoidance of stigmatization (e.g., when visiting mental health facilities) and increased convenience of the service, were associated with patient use, which highlights the services' potential to bridge treatment gaps in mental health care.

In summary, socioeconomic and psychosocial patient characteristics should be considered to facilitate patient use of telemental health services. Determinants may vary depending on use experience (initial versus continuous use) or contextual external factors (involuntary use during the pandemic versus voluntary post-pandemic use). Providers might function as key agents in increasing patient use; thus, provider barriers should be addressed. Finally, the services offer unique advantages for the mental health care context that may facilitate patient use of mental health services and help to address unmet needs in the provision of mental health care.

1.3.2.3 Publication 5: Determinants of Patient Satisfaction With Telemental Health Services: Representative Cross-Sectional Postpandemic Survey Study

Results. This study explored determinants of patient satisfaction with telemental health services. Patient satisfaction with video, telephone, and asynchronous services was examined. Higher self-efficacy (β = 1.05, p = .030), extraversion (β = 0.21, p = .027), fear of COVID-19 (β = 0.20, p < .001), technology commitment (β = 0.12, p < .001), and a more positive patient attitudes towards telemental health services (β = 0.63, p < .001) were positively associated with patient satisfaction with video services (n = 483). In addition, more positive provider attitudes towards the services (β = 1.12, p = .004) and higher provider skills for using the services (β = 1.61, p = .002) were significantly associated with greater patient satisfaction with video services.

High education (β = -3.82, p = .005), full-time employment (β = -2.66, p = .019), an unstable internet connection at home (β = -3.14, p = .018), and higher technology commitment (β = -0.14, p = .008) were negatively associated with patient satisfaction with telephone services (n = 428). Further, higher loneliness (β = 2.26, p = .009), extraversion (β = 0.28, p = .034), agreeableness (β = 0.35, p = .015), and fear of COVID-19 (β = 0.21, p < .001) as well as positive provider attitude towards (β = 2.13, p < .001) and greater

provider skills for using telephone services (β = 1.73, p = .010) were positively associated with greater satisfaction with telephone services.

For asynchronous services (n = 256), significant negative associations of having lost a partner or being widowed (β = -4.02, p = .009) and higher loneliness (β = -1.46, p = .022) with patient satisfaction were identified. Greater fear of COVID-19 (β = 0.15, p < .001) and more positive patient attitudes towards telemental health services (β = 0.22, p < .001), as well as more positive provider attitudes towards telemental health services (β = 1.33, p = .002), were positively associated with higher patient satisfaction with asynchronous services. The FIML models revealed mostly similar relationships.

Discussion. Telemedicine services are especially suited for mental health treatment and have great potential to improve mental health care. Despite the crucial role of patient satisfaction in fostering the widespread and continuous use of telemental health services, determinants of patient satisfaction with the services remain largely underexplored in the current literature. Therefore, this study adds valuable knowledge that considers a large variety of determinants. Differences in associations for various service types were found; however, the study findings generally highlight the association of psychosocial characteristics, individual preferences, and attitudes of mental health patients with patient satisfaction. Particularly, a more positive patient attitude towards the services (measured using UTAUT dimensions) was related to higher satisfaction, supporting previously identified relationships between UTAUT dimensions and patient satisfaction with telemedicine (e.g., for performance expectancy; Amin et al., 2022). Greater technology commitment might indicate preferences for more technologically advanced service options, as satisfaction with telephone services was lower in highly technology-committed individuals. Past research observed a preference for in-person treatment compared to telemedicine among highly extraverted individuals (Cieślik et al., 2023). In contrast, we observed a positive relationship between higher extraversion and satisfaction with synchronous services, which may suggest that highly extraverted individuals prefer the direct social interactions that synchronous services offer. Likewise, more lonely patients seem to be less satisfied with asynchronous services, which offer fewer social interactions. Similar to *Publications 1 and 2* and past studies (Hajek et al., 2022; Lewis et al., 2021), fear of COVID-19 was a meaningful determinant of patient satisfaction. Mental health patients potentially value remote service options to avoid COVID-19-related risk factors (e.g., social contacts while travelling to in-person visits), which could contribute to higher satisfaction levels. Similar to patient use (*Publication 4*), provider attitudes and skills appear as key determinants of patient satisfaction. Consequently, provider training and support should be prioritized to not only support

patient use but also continuous satisfaction and engagement of mental health patients with telemental health services.

To summarize, patient satisfaction with telemental health services is linked to psychosocial patient characteristics as well as provider attributes. Therefore, individual preferences and characteristics of patients should be considered to facilitate consistent satisfaction levels with future telemental health services. The determinants of satisfaction can vary for different service types, which should be considered in practice. Moreover, the crucial role of providers in enhancing patient satisfaction should be acknowledged and supported in the future.

1.4 General Discussion

This cumulative dissertation aimed to identify key determinants of patient use of and satisfaction with telemedicine services. A broad range of determinants was examined to address substantial research gaps related to major patient groups, emerging telemedicine services, the German health care context, and the need for longitudinal and post-pandemic studies. The findings of this dissertation expand current knowledge on several determinants of telemedicine use and satisfaction and stress important implications for future research and practice.

Considering the crucial role of telemedicine in addressing health care challenges associated with population aging (e.g., Magdalena et al., 2015), this dissertation contributes important knowledge on determinants of patient use of telemedicine services among middle-aged and older adults. Beyond greater health needs (e.g., severe limitations because of a health problem) and more positive health behaviors (e.g., frequency of physical activity), psychosocial factors appear to be associated with telemedicine use in middle-aged and older adults. This includes greater symptoms of anxiety, depression, and loneliness (Publication 1) as well as greater life satisfaction (*Publication 2*). Telemedicine may be particularly suited for older individuals experiencing psychological symptoms who are also dealing with health constraints. Surprisingly, almost all examined socioeconomic determinants (e.g., gender, age, household income, area lived in) were not associated with telemedicine use among middle-aged and older adults in Germany (*Publications 1 and 2*). This suggests that, at least during pandemic circumstances, socioeconomic and access barriers did not hinder telemedicine use among this population in Germany. Nevertheless, higher education may be associated with greater digital health literacy (Estrela et al., 2023), which could facilitate use of the services (*Publication 2*). However, in the international context, socioeconomic barriers were frequently identified as a major cause of inequity in telemedicine use (e.g., Yao et al., 2022), which may be attributed to differences in country-specific telemedicine policies

(e.g., cost regulations) or access conditions (e.g., network infrastructure, availability of smartphones or computers, digital divide). Furthermore, COVID-19-related fear was associated with telemedicine use (*Publications 1 and 2*). This may imply that telemedicine functioned as a widely accepted alternative to reduce in-person contacts among the older population during the pandemic. Given its demonstrated utility, the services may remain as a viable treatment option in the post-pandemic period, particularly in contexts where avoiding infections or stressors associated with attending in-person appointments is desirable.

International studies on determinants of patient use of and satisfaction with synchronous telemental health services during the COVID-19 pandemic were systematically reviewed as part of this dissertation (*Publication 3*). Female gender, younger age, and less severe psychological symptoms were identified as important determinants of patient use of the services. For patient satisfaction, mostly non-significant associations were found, reflecting the generally high acceptability of the services (Abuyadek et al., 2024; Saeed et al., 2024). Nevertheless, video services compared to telephone services are potentially related to higher patient satisfaction, demonstrating the individual strengths of the video format for the mental health care context (Chen et al., 2022). Expanding on this and to address the identified research gaps, determinants of patient use of and satisfaction during and after the COVID-19 pandemic in Germany were further explored in *Publications 4 and 5*. In line with the reviewed international studies (*Publication 3*), younger patient age was identified as a determinant of telemental health services use during the COVID-19 pandemic (*Publication 4*). However, education, employment status, psychosocial factors (such as personality, technology commitment, or loneliness), and individual patient attitudes towards the services appear to become more relevant determinants of use and satisfaction in the post-pandemic period. In addition, provider characteristics and service convenience are key determinants of patient use of and satisfaction with telemental health services (*Publications 4 and 5*). This underlines the vital role of providers in facilitating patient use and satisfaction as well as the services' potential in addressing unmet needs in mental health care (e.g., dealing with mental health stigma or long waiting times).

Overall, determinants of telemedicine use and satisfaction were found to vary across different populations, service types, and contextual external circumstances (e.g., different pandemic periods, regional regulations). For instance, in contrast to the older population, health limitations did not appear as key determinants of use and satisfaction among mental health patients. Therefore, unique associations among different populations and treatment contexts should be considered. Nevertheless, this dissertation identified general associations of psychosocial characteristics, individual patient attitudes,

provider characteristics, and service factors with patient use and satisfaction. Socioeconomic and access determinants appear to play a minor role in telemedicine use and satisfaction in Germany, which contrasts with studies from other countries. The results of this dissertation provide new insights into unexplored associations of multiple determinants of patient use of and satisfaction with telemedicine services across different populations and contexts.

1.4.1 Strengths and Limitations

Using different methodological approaches (i.e., systematic review and empirical studies), understudied determinants of patient use of and satisfaction with telemedicine services were investigated. Cross-sectional as well as longitudinal associations were explored. Notably, longitudinal data were rarely examined in the past. Representative samples of the target populations were considered, which supports the generalizability of our findings to the German or comparable health care contexts by accurately reflecting the diversity of the included populations. Generally, a large variety of determinants was explored, which were rarely considered in the previous literature. This dissertation adds important knowledge concerning psychosocial determinants, which have received very little attention in previous research. In addition, major research gaps were addressed regarding determinants of use of and satisfaction with different service types (i.e., synchronous and asynchronous telemedicine services) and different pandemic periods.

Nevertheless, certain limitations regarding the results of this dissertation should be noted. The study findings predominantly rely on cross-sectional data (*Publications 1, 4, and 5),* which limits the ability to infer causal relationships and observe temporal changes. Moreover, limitations regarding data collection partly include broad definitions of telemedicine use (*Publications 1 and 2*) and the use of shorter screening questionnaires to measure the included variables. Furthermore, the possibility remains that the different data collections were affected by selection bias to some degree. Online surveys were partly employed, which may have resulted in overrepresentation of individuals with greater familiarity and competence in using the internet or digital devices. In addition, the SHARE and DEAS panels were both reported to potentially exhibit minor selection bias and small panel attrition (Börsch-Supan et al., 2013; Schiel et al., 2021). Finally, the study findings are limited to specific populations and contexts. Although different populations, telemedicine services, and periods were examined, the findings may not be generalizable to other contexts, such as particular patient groups or countries. It is also important to recognize that telemedicine is a rapidly expanding and evolving field (e.g., Bakalar, 2022; Löchner et al., 2025), and ongoing changes in applications and regulations may impact future patient use of and satisfaction with the services.

1.4.2 Implications for Future Research

This dissertation provides initial findings regarding determinants of patient use of and satisfaction with telemedicine services, thereby paving the way for future research. The conducted systematic review (*Publication 3*) highlights major research gaps, emphasizing the need for more theory-driven, standardized, and inclusive studies investigating underexplored determinants (e.g., effort and performance expectancy, psychosocial factors, or facilitating conditions), diverse populations (e.g., older populations or people with severe mental illness), and longitudinal associations. These gaps were partly addressed in *Publications 1, 2, 4, and 5*. Nonetheless, given the findings and limitations of these publications, additional research is needed.

This includes further longitudinal observations of patient use of and satisfaction with telemedicine services. Identifying determinants of continuous use and satisfaction may be particularly helpful for supporting consistent patient engagement and, thus, enhancing the effectiveness of future telemedicine interventions (e.g., Gan et al., 2021; Khanijahani et al., 2022). Moreover, we found that associations of the determinants with patient use and satisfaction may vary between the pandemic periods. While external circumstances drove telemedicine use during the pandemic, post-pandemic telemedicine use remains voluntary since in-person services have fully resumed. It might be interesting to explore in more detail whether telemedicine is used primarily out of necessity or is motivated by personal preferences. Post-pandemic telemedicine use behavior should be explored more extensively in the future.

Furthermore, additional studies focusing on selected populations, contexts, and application areas are needed. Certain populations may have been underrepresented in the included samples (e.g., patients with severe mental illness, individuals with limited access to or skills for using the services). However, these groups may derive unique benefits from telemedicine (e.g., Lawes-Wickwar et al., 2018) and should be given greater consideration in future studies. Qualitative studies may also help to further clarify individual barriers and facilitators to use and satisfaction among these groups. In addition, previous literature focuses predominantly on synchronous telemedicine services. Asynchronous services and other emerging technologies require further attention, as patient use and satisfaction were found to vary between different service types. Since telemedicine regulations and access to telemedicine differ across different countries (e.g., Ndwabe et al., 2024; Omboni et al., 2022), it is important to explore cross-cultural differences in determinants of patient use and satisfaction.

Additionally, this dissertation underscores the role of providers in facilitating patient use of and satisfaction with the services. Likewise, previous studies have consistently identified providers as gatekeepers to telemedicine implementation (Cowan et al., 2019;

Rangachari et al., 2021), facing barriers linked to infrastructure and technical issues, psychological barriers, and workload-related concerns (Borges do Nascimento et al., 2023). Consequently, there is an urgent need for additional research focusing on overcoming provider-related barriers and finding ways to facilitate telemedicine use among providers, for example, by identifying determinants of provider use of telemedicine services.

1.4.3 Practical Implications

Beyond research implications, the findings from this dissertation also offer important practical implications. Older adults and mental health patients can benefit substantially from telemedicine use, and determinants of telemedicine use and satisfaction can be used to define target groups for the services. Socioeconomic characteristics play a minor role in this, but younger, highly educated, or full-time employed individuals may particularly value the services. Furthermore, more attention should be drawn to health (e.g., mobility restrictions, better health behavior), psychosocial characteristics (e.g., greater psychological symptoms or loneliness, lower neuroticism), and individual attitudes of patients, which favor telemedicine use. These characteristics may inform providers about the suitability of telemedicine treatment in specific populations and treatment contexts, and future services could be aimed at these groups.

However, the study findings may also help to identify patient groups that are currently left out and need additional support in practice, such as older patients with negative attitudes towards the services. Efforts to better reach these groups could cover supporting information regarding the services (e.g., leaflets, video tutorials, or health campaigns), active advertisement and education by providers, or digital literacy training. Moreover, blended care models are highly accepted and may be useful for introducing hesitant patients to telemedicine (e.g., Appleton et al., 2021). Additionally, when designing future telemedicine services, disadvantaged groups should be considered (e.g., patients with visual or hearing impairments, low education, or severe mental illness), and steps must be taken to ensure these services are as inclusive as possible. For instance, this could consist of improvements in functional design (e.g., provision of transcripts, reminders, emotional and cognitive support), interaction logic (e.g., inclusion of tutorials, intuitive navigation, and feedback), visual design (e.g., use of high-contrast colors, font adjustability, visual aids, and simple language), and user experience (e.g., inclusion of gamification, personalization, sociability, simple and functional designs) (He et al., 2025). It could be useful to involve disadvantaged groups in the design process. This information may help providers, policymakers, or stakeholders to facilitate telemedicine use among patients.

In addition, provider barriers should also be the focus of practical efforts. Since provider attitudes towards and skills for using telemedicine were identified as important determinants of patient use and satisfaction, supporting these characteristics should be prioritized in practice. To promote positive attitudes, awareness of the services' strengths should be increased, and prejudices among providers should be addressed. Training and support to increase provider skills for using the services were identified as facilitators of telemedicine use among providers (Borges do Nascimento et al., 2023; Li et al., 2013). Guidelines and regulatory adaptations to enhance telemedicine implementations and reimbursement, as well as the workflow of providers, may further support telemedicine use among providers (Li et al., 2013).

1.4.4 Conclusion

This cumulative dissertation significantly contributes to identifying crucial determinants of patient use of and satisfaction with telemedicine services. The findings underpin the importance of specific socioeconomic, health-related, and psychosocial patient characteristics to facilitate patient use and satisfaction. Therefore, a personalized approach to telemedicine care, considering individual patient profiles, is essential to optimize engagement and outcomes. Furthermore, provider characteristics and service-related factors appear as key determinants of patient use and satisfaction. Providers should be supported in adopting and effectively using telemedicine, and the transformative potential of telemedicine within health care should be recognized. It was observed that the determinants can vary across populations, service types, and contexts. Therefore, future research is needed to verify these initial findings by exploring different methodological approaches and accounting for unique treatment contexts, while targeted practical actions, informed by the identified determinants, should be developed.

The findings of this dissertation markedly advance the research field and address critical gaps in the literature on determinants of patient use of and satisfaction with telemedicine services in key target populations. Unlike previous research, which mainly focused on socioeconomic and access determinants, as well as limited treatment contexts, the findings suggest additional, more modifiable drivers of telemedicine use and satisfaction across different contexts. This helps to develop a more comprehensive understanding of telemedicine use behavior and satisfaction among middle-aged and older populations, as well as mental health patients. This contribution is pivotal for promoting widespread and consistent telemedicine use and satisfaction among target groups in the future, enabling these services to address major health care challenges effectively.

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3. Appendix

Table A1

Included Determinants and Their Measurement for Publications 1 and 2

Determinants	Publication 1	Publication 2
	Socioeconomic factors	
Sex	Male, female	Male, female
Age	Age in years	Age in years
Education	-	International Standard Classification of Education 97 (United Nations Educational Scientific and Cultural Organization, 2006) (low, medium, high)
Employment status	Employed, retired, unemployed/other	Employed, retired, unemployed/other
Household income	Household's ability to make ends meet regarding their total monthly income (with great difficulty or some difficulty, fairly easily, easily)	Monthly household net income (€)
Residential form of partnership	Living with a partner in the same household (yes, no)	Partner in the same household, partner not in the same household, no partner
Area lived in	Big city, suburbs or outskirts of a big city, large town, small town, rural area or village	Metropolitan districts, urban districts, (partially) densely populated rural districts, sparsely populated rural districts
Migration background	-	Yes, no
Presence of own children	-	Yes, no
	Psychosocial factors	
Depression	Feeling sad or depressed in the last month (yes, no)	10/15-item German version of the Center for Epidemiologic Studies - Depression scale (Andresen et al., 1994; Hautzinger & Bailer, 1993), scores ranging from 0 to 30, higher values indicate more severe depressive symptoms
Anxiety	Feeling nervous, anxious, or on edge in the last month (yes, no)	-
Loneliness	Feeling lonely in the last month (yes, no)	6-item De Jong Gierveld Loneliness Scale (Gierveld & Tilburg, 2006), scores ranging from 1 to 4, higher values indicate higher levels of loneliness
Social contacts	Frequency of social and electronic contacts with people other than relatives (never, less than once a	-

Determinants	Publication 1	Publication 2
	week, about once a week, several times a week, daily)	
Life satisfaction	-	5-item German version of the Satisfaction with Life Scale (Schumacher, 2003), scores ranging from 1 to 5, higher values indicate greater life satisfaction
Self-perception of one's own aging	-	5-item German version of the Attitude Towards Own Aging subscale of the Philadelphia Geriatric Center Morale Scale (Lawton, 1975; Liang & Bollen, 1983), scores ranging from 1 to 4, higher values indicate a more positive perception of own aging
	Health factors	
Physical illness	Number of physical illnesses	-
Self-rated health	Poor, fair, good, very good, excellent	Very bad, bad, average, good, very good
Health limitations	Limitations because of a health problem in usual activities (not limited; limited, but not severely; severely limited)	-
Health behavior	Having trouble sleeping (yes, no)	Frequency of walks/physical activity (low, medium, high)
	COVID-19-related factors	
Infection status	Oneself or anyone close having tested positive for COVID-19 (yes, no)	Oneself or anyone close having tested positive for COVID-19 (yes, no, unknown)
Vaccination status	Yes, no	-
Preventive measures	Taking drugs or medicine as prevention against COVID-19 (yes, no)	-
Fear	Forgoing medical treatment because of being afraid to become infected (yes, no)	Perceiving the Corona crisis as a personal threat (scores ranging from 1 = not at all a threat for me to 10 = extreme threat for me)
Control beliefs	-	Feeling of being able to influence the infection with the Coronavirus (scores ranging from 1 = not at all to 7 = entirely)

Table A2

Included Determinants and Their Measurement for Publications 4 and 5

Determinants	Publication 4	Publication 5
	Socioeconomic factors	
Gender	Male, female, diverse/intersex	Male, female, diverse/intersex
Age	Age in years	Age in years
Education	International Standard Classification of Education 97 (United Nations Educational Scientific and Cultural Organization, 2006) (low, medium, high)	International Standard Classification of Education 97 (United Nations Educational Scientific and Cultural Organization, 2006) (low, medium, high)
Employment status	Full-time employed, part-time employed, unemployed, other	Full-time employed, part-time employed, unemployed, other
Household income	Monthly household net income (low, medium, high)	Monthly household net income (low, medium, high)
Residential form of partnership	Living with a partner in the same household, living with a partner without a common household, widowed/partner deceased, single/divorced	Living with a partner in the same household, living with a partner without a common household, widowed/partner deceased, single/divorced
Area lived in	Urban, mostly urban, rural	Urban, mostly urban, rural
Migration background	Yes, no	Yes, no
Presence of own (grand) children	Yes, no	-
	Psychosocial factors	
Mental illness	-	Number of psychiatric diagnoses received since March 2020 (range: 0-7)
Depression	9-item Patient Health Questionnaire-9 (Kroenke et al., 2001), scores ranging from 0 to 27, higher values indicate more severe depressive symptoms	-
Anxiety	7-item Generalized Anxiety Disorder Scale-7 (Spitzer et al., 2006), scores ranging from 0 to 21, higher values indicate more severe anxiety symptoms	-
Loneliness	6-item De Jong Gierveld Loneliness Scale (Gierveld & Tilburg, 2006), scores ranging from 1 to 4, higher values indicate higher levels of loneliness	6-item De Jong Gierveld Loneliness Scale (Gierveld & Tilburg, 2006), scores ranging from 1 to 4, higher values indicate higher levels of loneliness
Social support	6-item Lubben Social Network Scale (Lubben et al., 2006), scores ranging from 1 to 30, higher values indicate greater perceived social support	-

Determinants	Publication 4	Publication 5
Life satisfaction	5-item German version of the Satisfaction with Life Scale (Schumacher, 2003), scores ranging from 1 to 5, higher values indicate greater life satisfaction	-
Self-efficacy	3-item Short Scale for Measuring General Self-efficacy Beliefs (Beierlein et al., 2013), scores ranging from 1 to 5, higher values indicate greater self-efficacy	3-item Short Scale for Measuring General Self-efficacy Beliefs (Beierlein et al., 2013), scores ranging from 1 to 5, higher values indicate greater self-efficacy
Personality	15-item Big Five Inventory-SOEP (Gerlitz & Schupp, 2005)	15-item Big Five Inventory-SOEP (Gerlitz & Schupp, 2005)
Attitude towards telemedicine	14-item Unified Theory of Acceptance and Use of Technology-Patient version questionnaire (Békés et al., 2022), scores ranging from 17 to 70, higher values indicate more positive attitudes	14-item Unified Theory of Acceptance and Use of Technology-Patient version questionnaire (Békés et al., 2022), scores ranging from 17 to 70, higher values indicate more positive attitudes
Technology Commitment	-	12-item technology commitment short scale (Neyer et al., 2012), scores ranging from 12 to 60, higher values indicate greater technology commitment
	Health factors	
Physical illness	Presence of at least one chronic physical illness (yes, no)	Presence of at least one chronic physical illness (yes, no)
Self-rated health	Very bad, bad, average, good, very good	Very bad, bad, average, good, very good
	COVID-19-related factors	
Infection status	Yes, no	Yes, no
Vaccination status	Yes, no	Yes, no
Fear	7-item Fear of COVID-19 Scale (Ahorsu et al., 2022), scores ranging from 7 to 35, higher values indicate greater fear of COVID-19	7-item Fear of COVID-19 Scale (Ahorsu et al., 2022), scores ranging from 7 to 35, higher values indicate greater fear of COVID-19
	Access factors	
Insurance type	Statutory health insurance, private health insurance	Statutory health insurance, private health insurance
Internet connection quality	Fast and stable; fast, but not stable; stable, but not fast; neither fast nor stable/no internet connection at home	Fast and stable; fast, but not stable; stable, but not fast; neither fast nor stable/no internet connection at home
	Provider characteristics	
Attitude	Mental health provider has a positive and open attitude towards telemental health services, scores ranging from 1 =	Mental health provider has a positive and open attitude towards telemental health services, scores ranging from 1 =

Determinants	Publication 4	Publication 5
	strongly disagree to 5 = strongly agree	strongly disagree to 5 = strongly agree
Skills	Mental health provider has the necessary skills and competencies to use telemental health services without any problems, scores ranging from 1 = strongly disagree to 5 = strongly agree	Mental health provider has the necessary skills and competencies to use telemental health services without any problems, scores ranging from 1 = strongly disagree to 5 = strongly agree
	Service factors	
Avoidance of stigmatization	Using telemental health services to avoid stigmatization (scores ranging from 1 = not true to 5 = completely true)	-
Higher convenience	Yes, shorter waiting times and easier scheduling of first appointment; yes, shorter waiting times; yes, easier scheduling of first appointment; no	-

4. Publication 1: Determinants of Telemedicine Service Use Among Middle-Aged and Older Adults in Germany During the COVID-19 Pandemic: Cross-Sectional Survey Study

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Original Paper

Determinants of Telemedicine Service Use Among Middle-Aged and Older Adults in Germany During the COVID-19 Pandemic: Cross-Sectional Survey Study

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Abstract

Background: The occurrence of the COVID-19 pandemic demanded fast changes in the delivery of health care. As a result, significant growth in the use of telemedicine services occurred. Research, especially from nationally representative German samples, is needed to better understand determinants of telemedicine use.

Objective: The purpose of this study was to identify determinants of telemedicine service use among middle-aged and older adults during the COVID-19 pandemic in Germany.

Methods: Cross-sectional, nationally representative data were taken from the German sample of the Survey of Health, Ageing and Retirement in Europe (SHARE). The German Corona Survey 2 (n=2039), which was conducted between June and August 2021, was used for this study. Reporting experience with remote medical consultations during the COVID-19 pandemic served as the outcome measure. Associations with socioeconomic, psychological, social, health-related, and COVID-19–related determinants were examined using multiple Firth logistic regressions.

Results: Psychological factors including feeling nervous, anxious, or on edge (odds ratio [OR] 1.61, 95% CI 1.04-2.50; *P*=.03), feeling sad or depressed (OR 1.62, 95% CI 1.05-2.51; *P*=.03) and feelings of loneliness (OR 1.66, 95% CI 1.07-2.58; *P*=.02) were positively associated with telemedicine use. Moreover, forgoing medical treatment because of being afraid of being infected by SARS-CoV-2 (OR 1.81, 95% CI 1.10-2.97; *P*=.02) and describing limitations because of a health problem as severe were positively associated with the outcome (OR 2.11, 95% CI 1.12-4.00; *P*=.02). Socioeconomic and social factors were not significantly associated with telemedicine use in our sample.

Conclusions: Middle-aged and older individuals in Germany seem to use telemedicine services according to psychological needs and health limitations. Especially when psychological symptoms are experienced, telemedicine seems to be a promising service option in this age group. Future research is needed to confirm these initial findings in postpandemic circumstances.

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Keywords: telemedicine; telehealth; digital health; service use; COVID-19

Introduction

Telemedicine has been a big part of the digital transformation of the health care sector. Multiple definitions of telemedicine have been introduced in the past [1]. The World Health Organization (WHO) Global Observatory for eHealth [2] identified the four key characteristics of telemedicine: (1) its purpose is to provide clinical support, (2) it is intended to overcome geographical barriers, connecting users who are not in the same physical location, (3) it involves the use of various types of information and communication technology, and (4) its goal is to improve health outcomes. Therefore, telemedicine includes synchronous (eg, videoconferencing,

telephone) as well as asynchronous (eg, mobile apps) health services, which are delivered via electronic devices.

Telemedicine is a presumably promising method to provide health care in the future, as it can improve access to care, save costs, and close treatment gaps [3,4]. For example, it could be a potentially valuable tool when dealing with future shortages of physicians as well as the increased demand for health care services caused by population aging; underserved rural areas can also easily be reached through telemedicine [3,5]. In past research, telemedicine was found to be an effective and cost-effective service delivery model that can be equal to in-patient visits in a variety of specialties [3,6-9]. Additionally, practitioners (eg, physicians and psychotherapists), as well as patients with conditions covered by various specialties, were found to be greatly satisfied with this form of service [8-10]. Despite the clear advantages of telemedicine, it has not yet been widely implemented. Implementations have often been decelerated by limitations regarding reimbursement, as well as clinical, legal, cost, and social issues [11,12]. Telemedicine rates of use were gradually increasing over the previous years but remained at a low level [13].

The occurrence of the COVID-19 pandemic demanded fast changes in the delivery of health care. COVID-19 caused a major public health burden globally and it was essential to reduce in-person contacts to decrease further spreading of the virus [14]. Therefore, many nonessential appointments with physicians were canceled or postponed [15]. In a German population-based sample, this was the case for about one-third of respondents after containment measures were implemented in March 2020 [16]. Moreover, overall use of health care decreased in the first months of the pandemic, a phenomenon that was also observed in Germany [17].

Telemedicine appeared to be a key solution to major pandemic challenges. To facilitate the transformation to telemedicine, changes in infrastructure, reimbursement, and legal conditions were made worldwide. In Germany, legal efforts for the digital transformation of the health care system had already been made in November 2019 with the Digital Healthcare Act (Digitale-Versorgung-Gesetz) [18]. Consequently, it was easier for physicians to prescribe, deliver, and bill for telemedicine, and also for patients to use the services. In response to the pandemic, additional teleconsultation services were developed and regulations concerning video consultations were adapted [19,20]. Thus, telemedicine rates of use increased tremendously [21]. For example, the trend report of the Central Research Institute of Ambulatory Care in Germany reported that the number of video consultations increased from 743 conducted in December 2019 to 302,180 conducted in December 2020 [21]. Especially when there was limited access to in-person medical appointments during the pandemic in Germany, telemedicine services seemed to be a frequently used alternative, and satisfaction with the services was found to be moderately high [22,23]. Even though telephone services were used most frequently in Germany during the pandemic, a sharp increase was observed in the use of video consultations [24,25].

Besides technological, financial, organizational, and legal aspects, patient acceptance seems to be a crucial factor for the successful implementation of telemedicine services [26]. Patient characteristics that have been found to be associated with telemedicine use in past systematic reviews include, for example, age, gender, education, marital status, health status, and prior experience with computers and health technology [27,28]. A preliminary selective review of large-scale studies that were conducted during the pandemic in the United States found that telemedicine rates of use were higher among patients from urban areas, areas with greater broadband availability, and areas with higher prepandemic levels of telehealth use [29]. Moreover, being White; speaking English as first language; having health insurance, higher income, and greater disease burden; and being middle-aged were associated with greater use [29]. Nevertheless, more studies examining the use of telemedicine services and associated patient characteristics during pandemic times are needed.

Studies with samples from Germany, where telemedicine played a major role and was frequently used during the pandemic, are especially scarce. Few studies have looked at different German samples during the pandemic. While some of these studies examined large, nationally representative or quota-based samples [22,23,30], other studies only included convenience or smaller selective samples [31-33]. These studies identified potential socioeconomic (male sex, younger age, higher or lower education, living with a partner in the same household, having children younger than 18 years), psychosocial (increased loneliness, increased life satisfaction, severe psychological distress, frequent social isolation, lack of company), health-related (poor self-rated health), experience-related (higher electronic literacy, past use of telemedicine) and COVID-19–related (higher perceived severity of COVID-19 infection, having had COVID-19 infection, subjective COVID-19–related challenges, COVID-19–related cognitive preoccupation, anxiety, and worries) determinants that were positively associated with actual telemedicine use during the pandemic [22,23,30-33]. However, more studies including large nationally representative samples from Germany are needed to secure these initial findings. Moreover, the different categories of determinants, which were only partly included in single studies (eg, psychosocial or COVID-19–related determinants), should be explored further.

Middle-aged and older individuals represent the largest age group in the German population [34]. Considering population aging, the proportion of middle-aged and older adults will grow even further in the near future in Germany. Due to their increased need for health care (due to, eg, chronic conditions, frailty, and cognitive or functional decline) and potentially limited mobility, these age groups represent a major target group for future telemedicine services. Nevertheless, they seem to use telemedicine less often than other age groups [28]. Although past systematic reviews found that telemedicine is an effective and feasible service delivery model in older adults, it was also stated that further research was required to determine how services could be adapted to the individual needs of older patients

[35-37]. Better understanding the telemedicine use behavior of middle-aged and older individuals could significantly contribute to increased use, as well as widespread acceptance and satisfaction with future telemedicine services. Therefore, this study aimed to explore determinants of patient use of telemedicine services in a nationally representative sample of middle-aged and older individuals during the COVID-19 pandemic in Germany.

Methods

Sample

Cross-sectional data for this study were taken from the Corona Survey 2 [38] of the Survey of Health, Ageing and Retirement in Europe (SHARE) study [39]. SHARE is a multidisciplinary and cross-national panel study that explores health, social, economic, and environmental policies in individuals aged 50 years or older and their partners (regardless of age) from 26 European countries, Switzerland, and Israel. Starting in 2004, SHARE has so far conducted 8 waves. In each wave, new respondents are added to the sample to compensate for attrition. In response to the global COVID-19 pandemic, a special Corona Survey, to examine the health-related and socioeconomic impact of COVID-19, was introduced in June 2020. In the course of this survey, the usual computer-assisted personal interviews were replaced by telephone-administered interviews.

Participation rates for waves 1 to 8 and the Corona Survey 1 have been provided by SHARE [40,41]. According to Bergmann et al [40], these rates increased over time and reflect high overall panel stability. The final rates for the Corona Survey 2 are not available yet; however, an average retention rate of 86% (excluding recovery of respondents) was confirmed by SHARE user support. Due to the fact that SHARE assessed telemedicine service use for the first time in the Corona Survey 2, only data from this survey, which was conducted from June until August 2021, were included in our analyses. Moreover, only the German subsample (n=2039) was considered, which was done to promote comparability among participants due to existing heterogeneity regarding characteristics of health care systems, telemedicine regulations, and telemedicine use across the different countries [20,42,43]. For example, whereas countries such as Denmark, Italy, and Germany are described as advanced in telemedicine use trends, countries like Poland, Portugal, or Slovakia are still developing in the telemedicine field since the pandemic [42].

Ethical Considerations

Verbal informed consent was collected from all individuals that participated in the telephone-administered interviews for the Corona Survey 2. The SHARE project has been repeatedly reviewed and approved by the ethics committee of the University of Mannheim (waves 1-3) and the Ethics Council of the Max Planck Society (waves 4-9; most recently in June 2021 with the ethics approval number 2021_24).

Dependent Variable

In the SHARE Corona Survey 2, telemedicine service use by middle-aged and older adults during the pandemic was assessed with a metric variable: “Since the outbreak of Corona, how many remote medical consultations over the phone, computer, or any other electronic means, did you have, if any, with or without video?” Therefore, this study did not focus on one specific form of telemedicine or patient group and included consultations on online platforms (eg, video calls), as well as telephone appointments. The response format in the original questionnaire was numerical (ie, the number of experienced telemedicine consultations). For the sake of this analysis, this item was dichotomized (1=one or more remote medical consultations since the outbreak of the COVID-19 pandemic; 0=no use) because of small case numbers.

Independent Variables

Independent variables were chosen in line with former research and based on theoretical considerations. Previous systematic reviews identified mostly socioeconomic (eg, sex, age, education, relationship status, area lived in) and health (eg, disease burden, psychological symptoms) determinants of telemedicine use [27-29]. Moreover, we considered the pandemic context, including the pandemic and social consequences, when choosing independent variables. Therefore, socioeconomic, psychological, social, health-related, and COVID-19–related factors were taken into account to explore their potential relationships with telemedicine service use. Socioeconomic factors that were included were sex, age, area lived in (big city, suburbs or outskirts of a big city, large town, small town, rural area or village), living with a partner in the same household (yes or no), employment status (retired, employed or self-employed, unemployed, or other) and the household’s ability to make ends meet regarding their total monthly income (with great difficulty or some difficulty, fairly easily, easily). Included psychological factors were feeling nervous, anxious, or on edge in the last month (yes or no), feeling sad or depressed in the last month (yes or no), and feeling lonely in the last month (yes or no). Furthermore, social factors included social and electronic contact frequency with people other than relatives (never, less than once a week, about once a week, several times a week, daily). Concerning health-related factors, having trouble sleeping recently (yes or no), the number of physical illnesses (including hip fracture; diabetes or high blood sugar; high blood pressure or hypertension; a heart attack, including myocardial infarction or coronary thrombosis; any other heart problem, including congestive heart failure; chronic lung diseases, such as chronic bronchitis or emphysema; and cancer or malignant tumor, including leukemia or lymphoma, but excluding minor skin cancers), limitations because of a health problem in usual activities (not limited; limited, but not severely; severely limited) and self-rated health (excellent, very good, good, fair, poor) were inspected. COVID-19–related factors that were included in the analyses were having received the COVID-19 vaccination (yes or no), oneself or anyone close having tested positive for COVID-19 (yes or

no), forgoing medical treatment because of being afraid to become infected by SARS-CoV-2 (yes or no), and taking drugs or medicine as prevention against COVID-19 (yes or no).

Statistical Analysis

First, sample characteristics were computed. Second, Firth logistic regressions were conducted to identify determinants of telemedicine service use during the pandemic. The Firth method was used to reduce small-sample bias, considering the small case numbers for some of the variables [44]. Due to high correlations, the variables regarding psychological symptoms (including feeling nervous, anxious, or on edge; feeling sad or depressed; and feeling lonely in the last month) were entered separately into the model. For sensitivity analyses, conventional multiple logistic regressions were also performed. Moreover, we computed additional analyses with age as a categorical variable (40-64 years, 65-74 years, ≥75 years) to test for a nonlinear relationship with the outcome. Odds ratios (ORs) are presented with the 95% CI. *P* values were considered statistically significant at an α level of <.05. Since the number of missing values for the independent variables was very small (below 1%), we did not use imputation techniques. Small levels of missing values are usually less likely to significantly bias results [45,46]. Therefore, listwise deletion was applied. Stata (version 16.1; StataCorp) was used for all statistical analyses.

Results

Sample Characteristics

The total sample consisted of 2039 individuals. The sample characteristics for all included variables are presented in Table 1. Overall, 54.2% (1105/2039) of the sample were women. The mean age of the participants was 70.6 (SD 8.7) years. Considering telemedicine service use during the pandemic, 5.7% (115/2031) of the sample reported that they had had remote medical consultations at least once.

Table 1. Sample characteristics (N=2039).

Characteristics	Values
Telemedicine service use, n (%)	
Never	1916 (94.3)
At least once	115 (5.7)
Sex, n (%)	
Male	934 (45.8)
Female	1105 (54.2)
Age (years), mean (SD)	70.6 (8.7)
Age (years), n (%)	
40-64	573 (28.1)
65-74	1083 (53.1)
≥75	383 (18.78)
Area lived in, n (%)	
Big city	289 (14.3)
Suburbs or outskirts of a big city	177 (8.8)
Large town	198 (9.8)
Small town	549 (27.2)
Rural area or village	807 (40)
Living with partner in the same household, n (%)	
Yes	1521 (74.6)
No	518 (25.4)
Employment situation, n (%)	
Retired	1445 (70.9)
Employed or self-employed	457 (22.4)
Other	135 (6.6)
Households' ability to make ends meet, n (%)	
With great or some difficulty	151 (7.4)
Fairly easily	599 (29.6)
Easily	1277 (63)
Nervous, anxious, or on edge in the last month, n (%)	
Yes	524 (25.8)

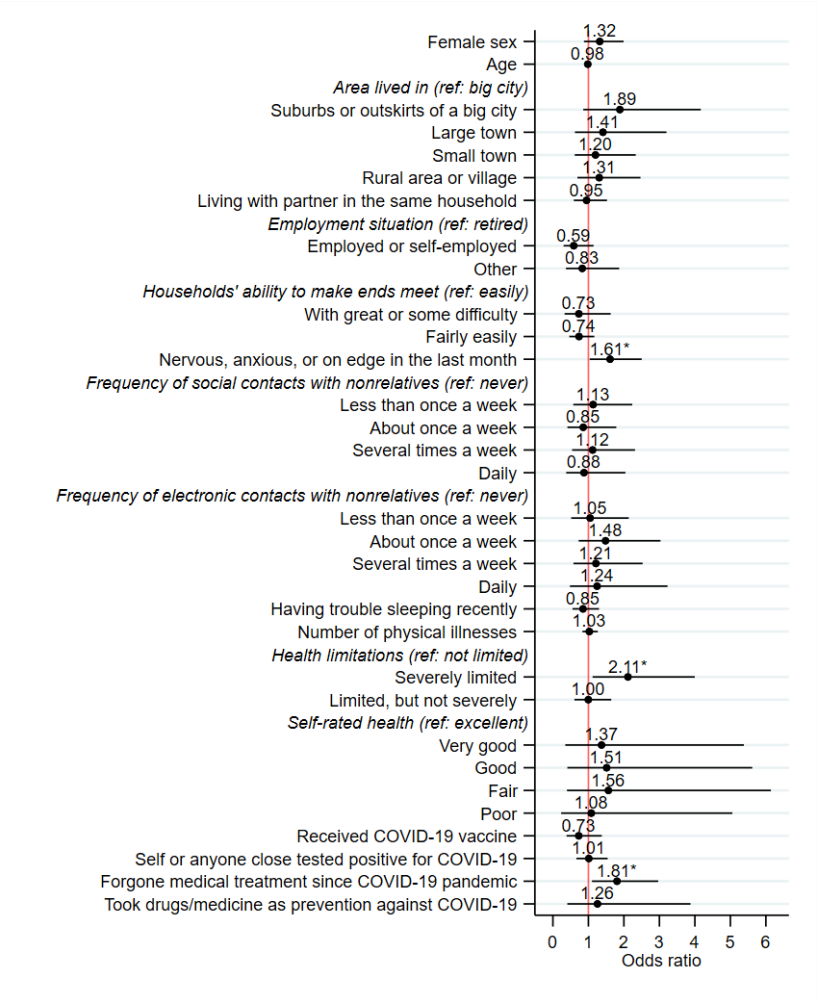
Characteristics	Values
No	1507 (74.2)
Sad or depressed in the last month, n (%)	
Yes	609 (30)
No	1419 (70)
Feelings of loneliness in the last month, n (%)	
Yes	442 (21.8)
No	1583 (78.2)
Frequency of social contacts with nonrelatives, n (%)	
Never	229 (11.3)
Less than once a week	583 (28.7)
About once a week	452 (22.3)
Several times a week	452 (22.3)
Daily	312 (15.4)
Frequency of electronic contacts with nonrelatives, n (%)	
Never	253 (12.5)
Less than once a week	617 (30.4)
About once a week	505 (24.9)
Several times a week	504 (24.8)
Daily	150 (7.4)
Having trouble sleeping recently, n (%)	
Yes	686 (33.8)
No	1344 (66.2)
Number of physical illnesses (range 0-6), mean (SD)	1.1 (1)
Health limitations, n (%)	
Severely limited	310 (15.2)
Limited, but not severely	744 (36.6)
Not limited	981 (48.2)
Self-rated health, n (%)	
Excellent	82 (4)
Very good	320 (15.7)
Good	839 (41.2)
Fair	629 (30.9)
Poor	166 (8.2)
Received COVID-19 vaccine, n (%)	
Yes	189 (9.3)
No	1847 (90.7)
Self or anyone close tested positive for COVID-19, n (%)	
Yes	592 (29.1)
No	1441 (70.9)
Forgone medical treatment since COVID-19 pandemic, n (%)	
Yes	225 (11.1)
No	1810 (88.9)
Took drugs/medicine as prevention against COVID-19, n (%)	
Yes	45 (2.2)
No	1990 (97.8)

Regression Analysis

The analytic sample for the Firth logistic regressions included 1976 individuals. Results for the model, including anxiety symptoms, are presented in Figure 1 (see Multimedia Appendix 1 for detailed results for all models). Most of the included independent variables were not significantly associated with the outcome (P>.05). However, some

associations were observed. Psychological factors, including feeling nervous, anxious, or on edge (OR 1.61, 95% CI 1.04-2.50; *P*=.03), feeling sad or depressed (OR 1.62, 95% CI 1.05-2.51; *P*=.03) and feeling lonely (OR 1.66, 95% CI 1.07-2.58; *P*=.02) in the last month were positively associated with the likelihood of telemedicine service use during the pandemic. Moreover, forgoing medical treatment because of being afraid to become infected by SARS-CoV-2 was positively associated with the outcome (OR 1.81, 95% CI 1.10-2.97; *P*=.02). Describing limitations because of health problems in the last 6 months as severe was also positively associated with the likelihood of telemedicine use during the pandemic (OR 2.11, 95% CI 1.12-4.00; *P*=.02).

Figure 1. Results from Firth logistic regression for determinants of telemedicine service use during the COVID-19 pandemic. The model includes anxiety symptoms. Numbers represent odds ratios, with the 95% CIs shown as bars. More detailed results are provided in Table S1 in Multimedia Appendix 1. ref: reference category. *P<.05.



In a sensitivity analysis in which Firth logistic regressions were replaced by conventional logistic regressions, similar associations were observed (see Tables S1-S3 in Multimedia Appendix 1 for detailed results). When age was included as a categorical variable in the models (see Table S4 in Multimedia Appendix 1 for detailed results), the youngest age group (40-64 years) was significantly more likely to use telemedicine services compared to the older age groups in our sample (65-74 and ≥75 years). Moreover, in these models, being employed or self-employed versus retired achieved statistical significance and was negatively associated with telemedicine use.

Discussion

Key Findings

This study aimed to identify determinants of telemedicine service use in a nationally representative sample of middle-aged and older adults during the COVID-19 pandemic in Germany. Based on data from the German sample of the SHARE Corona Survey 2, some associations of patient characteristics with telemedicine use were identified. This partly included health, psychological, and COVID-19–related factors. Socioeconomic and social determinants were not significantly associated with the outcome in this sample. So far, there has been limited research on determinants of telemedicine use in German samples. Our study findings thus extend our current knowledge

regarding socioeconomic, social, health, psychological, and COVID-19–related determinants.

Relation to Previous Research

Whereas none of the included socioeconomic determinants were associated with telemedicine service use in our sample, some recent studies identified significant relationships. Findings regarding associations of sex and age with telemedicine use were mixed in recent studies conducted during the pandemic in Germany, with some studies observing higher rates of use in male and younger individuals [22,23,30-32]. When observing age groups in our sample, older age groups (65-74 and ≥75 years) were less likely to use telemedicine. While our study did not indicate a significant association, Hajek and König [30] observed that middle-aged and older individuals who reported living with a partner in the same household were more likely to have participated in online consultations with physicians or therapists during the pandemic. These mixed findings could potentially be explained by variations in outcomes (eg, web-based consultations vs mobile app use), samples (eg, all age groups vs only those middle-aged and older), and time frames (2020 vs 2021 vs 2022) of the different studies. This clearly highlights the need for further studies on sociodemographic determinants in German samples. Similar to our results, employment status, financial situation, and area lived in were not significantly associated with telemedicine use in other German samples during the pandemic [23,30]. However, this is in contrast to research from the United States regarding telemedicine use during the pandemic [29,47]. This contrast may be explained by a larger variation in state-specific telehealth policies before and during the pandemic [48], as well as access factors, such as possession of digital devices or availability of high speed internet [49] in the United States compared to the German samples. In contrast to Germany, health care insurance is not obligatory in the United States and additional costs arise for uninsured individuals [50], which could have contributed to telemedicine use disparities caused by socioeconomic factors in the United States [49,51-53]. Further attention should be given to the impact of socioeconomic factors on telemedicine use in future research, especially with respect to postpandemic changes and the increasing availability of in-person visits.

Our study is one of very few that has examined the association of social determinants (ie, electronic and social contact frequency) and telemedicine service use. These determinants were not significantly associated with telemedicine use in our sample. This could mean that middle-aged and older adults used telemedicine services during the pandemic based more on health factors than on reduced social contact. Nevertheless, Rauschenberg et al [33] observed that telemedicine use was higher among young individuals who reported higher perceived social isolation and lack of company during the pandemic in Germany. These contrasting findings may imply that younger individuals have used telemedicine more frequently to deal with reduced social contact during the pandemic.

Furthermore, we found that perceiving one's limitations because of a health problem as severe was associated with telemedicine service use. This suggests that individuals with severe health limitations preferentially used telemedicine services during the pandemic. Likewise, Hajek and König [30] found a significant association of poor self-rated health and telemedicine use during the pandemic in Germany. Additionally, a positive association of disease burden and telemedicine use was observed by Harju and Neufeld [29] in large-scale US samples during the pandemic. Potential reasons for that could include the (urgent) need for treatment, limited mobility, or precautions due to high risk of severe illness from COVID-19. Patients might have used telemedicine because of health needs and lack of in-person services during the pandemic. In contrast, we found that the number of physical illnesses and self-rated health were not associated with telemedicine use during the pandemic in our sample. A potential reason for that could be that these determinants may not reflect the actual need for medicine or telemedicine services. For example, having ever received a diagnosis of physical illnesses such as hip fracture, high blood sugar, or high blood pressure does not indicate that there currently is a higher need for treatment. Other studies that observed German samples during the pandemic also found a nonsignificant association of the presence of chronic conditions and telemedicine use [22,23]. Moreover, necessary treatment for patients with severe diseases (eg, physical examination, cancer treatment) was potentially more likely to be in person and still available during the pandemic. Future telemedicine services might be less suitable for these patient groups. Further research is needed to gain a better understanding of the possible impact of physical illness on telemedicine service use, especially in German samples.

Since few recent studies have examined the association of psychological symptoms with telemedicine use, our findings contribute to existing knowledge concerning psychological determinants during the pandemic in Germany. We observed that symptoms of anxiety, depression, or loneliness increased the likelihood of telemedicine use in middle-aged and older adults. Similar to our results, Hajek and König [30] observed a significant positive association of loneliness and telemedicine use in middle-aged and older adults during the pandemic in Germany. Likewise, Rauschenberg et al [33] found that psychological distress was associated with the current use of mobile health apps in a representative sample of youth aged 16-25 years from the German general population. Other studies with samples from the United States also observed a positive relationship of psychological symptoms with telemedicine use during pandemic times [54,55]. Therefore, it may be the case that findings regarding higher health care use in individuals with mental illness [56-60] can be applied to the field of telemedicine and the pandemic context. These initial findings illustrate the future potential of telemedicine in the field of mental health for middle-aged and older patients, since those who experienced psychological symptoms appeared to preferentially opt for telemedicine services. Moreover, mental health problems, such as anxiety or depression, have been shown to be positively associated with fear of COVID-19 [61]. This fear could also favor

increased telemedicine use due to concerns of being infected with SARS-CoV-2 during in-person health care visits—this association was also found in our sample.

Additionally, other COVID-19–related determinants that were included in our sample (ie, vaccine status, COVID-19 infection history in oneself or close others, and preventive medication), were not significantly associated with telemedicine use. This is in contrast with findings from German samples that looked at younger and adult individuals during the pandemic [23,32,33] and found significant associations of COVID-19–related factors with telemedicine use (ie, higher perceived severity of COVID-19 infection; having had COVID-19 infection; subjective COVID-19–related challenges; and COVID-19–related cognitive preoccupation, anxiety, and worries). However, when looking at a similar sample to our study, which consisted of middle-aged and older adults during the pandemic in Germany, Hajek and König [30] did not find significant associations of COVID-19–related factors with telemedicine service use. This could potentially mean that middle-aged and older individuals' decision to use telemedicine was less influenced by COVID-19–related factors than in the general adult or younger German population.

Strengths and Limitations

This study is one of only a few studies that explore determinants of use of remote medical consultations in German middle-aged and older adults. The nationally representative sample of the widely acknowledged SHARE panel study provides insight into the largest age group of the German population. The data were collected during the COVID-19 pandemic and therefore account for the unique circumstances that individuals were faced with during that time.

However, some limitations should be considered. Telemedicine service use was measured using only one item, which indicated experience with remote medical consultations over the phone, computer, or any other electronic means since the outbreak of the pandemic. Therefore, we did not differentiate between different patient groups, telemedicine modalities, or frequency of use. This should be explored further in future studies. Furthermore, the survey covered a limited selection of socioeconomic, health, and psychosocial aspects. Future studies should include more extensive instruments and variables to make more reliable and comprehensive conclusions. In addition, the majority of our sample did not use telemedicine and case numbers were small for some of the included determinants. This lack of statistical power might explain why some of the tested relationships did not reach statistical significance. Consequently, future studies with very large German samples are needed. Furthermore, this analysis was based on self-reported cross-sectional data, and it is therefore difficult to identify causal relationships. Finally, we only focused on the German context. Future research should also consider cross-cultural differences in use and determinants of telemedicine to better understand potential barriers and facilitators in different cultural contexts and improve worldwide implementations.

Conclusions

To achieve high rates of use and widespread acceptance of telemedicine, it is essential to understand determinants of telemedicine service use in middle-aged and older individuals. Our study findings stress the link between psychological symptoms and telemedicine use in Germany during the COVID-19 pandemic. Middle-aged and older adults seem to have used telemedicine services according to psychological needs and health limitations. One may conclude that, especially when they had psychological symptoms, middle-aged and older individuals accepted telemedicine as a service option. While socioeconomic and social factors were not associated with telemedicine service use, the associations of other health- and COVID-19-related determinants with use behavior remain unclear.

Future (longitudinal) studies are therefore required to confirm these initial findings and clarify whether they also apply to postpandemic circumstances, where widespread in-person visit availability returned. Some patients might have used telemedicine only because they had no other option. However, remote consultations might be especially suited for specific patient groups or forms of treatment and will remain part of postpandemic routine care. Furthermore, use of (remote) blended therapy might increase in the postpandemic context, as it combines the strengths of remote and in-person visits and can be adapted to individual patient preferences. Moreover, potential differences in determinants of telemedicine use between different service types (eg, asynchronous vs synchronous services) or patient groups (eg, mental health vs oncology patients) should be further investigated. Finally, it remains to be explored to what extent determinants of telemedicine use differ from determinants of general health care use, which could help to identify target groups and appropriate fields of application for future telemedicine services. This could be examined in the postpandemic context where both forms of services, in-person and telemedicine visits, are likely to be available to patients.

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Conflicts of Interest

None declared.

Multimedia Appendix 1

Results from logistic regression and Firth logistic regression for determinants of telemedicine service use during the COVID-19 pandemic.
[DOCX File (Microsoft Word File), 39 KB-Multimedia Appendix 1]

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Abbreviations

OR: odds ratio
SHARE: Survey of Health, Ageing and Retirement in Europe
WHO: World Health Organization

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Multimedia Appendix 1

Table S1. Results from logistic regression and Firth logistic regression for determinants of telemedicine service use during the COVID-19 pandemic (with anxiety symptoms).

Independent Variables	Results from Logistic Regression	Results from Firth Logistic Regression
Female sex (ref: male)	1.33 (0.88 - 2.02)	1.32 (0.87 - 1.99)
Age	0.98 (0.95 - 1.01)	0.98 (0.95 - 1.01)
Area lived in (ref: big city)		
Suburbs or outskirts of a big city	1.92 (0.85 - 4.34)	1.89 (0.86 - 4.17)
Large town	1.41 (0.61 - 3.29)	1.41 (0.62 - 3.20)
Small town	1.23 (0.62 - 2.42)	1.20 (0.62 - 2.33)
Rural area or village	1.34 (0.70 - 2.58)	1.31 (0.69 - 2.47)
Living with partner in the same household (ref: no)	0.96 (0.59 - 1.55)	0.95 (0.59 - 1.52)
Employment situation (ref: retired)		
Employed or self-employed	0.57 (0.29 - 1.12)	0.59 (0.30 - 1.15)
Other	0.79 (0.34 - 1.83)	0.83 (0.37 - 1.87)
Households' ability to make ends meet (ref: easily)		
With great or some difficulty	0.69 (0.30 - 1.58)	0.73 (0.33 - 1.63)
Fairly easily	0.72 (0.45 - 1.16)	0.74 (0.46 - 1.17)
Nervous, anxious, or on edge in the last month (ref: no)	1.63* (1.04 - 2.55)	1.61* (1.04 - 2.50)
Frequency of social contacts with nonrelatives (ref: never)		
Less than once a week	1.17 (0.58 - 2.34)	1.13 (0.57 - 2.23)
About once a week	0.87 (0.41 - 1.84)	0.85 (0.41 - 1.79)
Several times a week	1.14 (0.54 - 2.41)	1.12 (0.54 - 2.31)
Daily	0.88 (0.37 - 2.09)	0.88 (0.38 - 2.04)
Frequency of electronic contacts with nonrelatives (ref: never)		
Less than once a week	1.08 (0.52 - 2.24)	1.05 (0.51 - 2.14)
About once a week	1.54 (0.74 - 3.20)	1.48 (0.73 - 3.03)
Several times a week	1.25 (0.59 - 2.65)	1.21 (0.58 - 2.53)
Daily	1.24 (0.46 - 3.32)	1.24 (0.48 - 3.23)
Having trouble sleeping recently (ref: no)	0.84 (0.54 - 1.30)	0.85 (0.55 - 1.30)

Number of physical illnesses (range 0-6)	1.02	1.03
	(0.83 - 1.27)	(0.83 - 1.27)
Health limitations (ref: not limited)		
Severely limited	2.14*	2.11*
	(1.12 - 4.09)	(1.12 - 4.00)
Limited, but not severely	0.99	1.00
	(0.60 - 1.65)	(0.61 - 1.64)
Self-rated health (ref: excellent)		
Very good	1.64	1.37
	(0.36 - 7.45)	(0.35 - 5.38)
Good	1.85	1.51
	(0.43 - 7.95)	(0.41 - 5.62)
Fair	1.91	1.56
	(0.42 - 8.65)	(0.40 - 6.14)
Poor	1.29	1.08
	(0.24 - 6.88)	(0.23 - 5.06)
Received COVID-19 vaccine (ref: no)	0.74	0.73
	(0.38 - 1.43)	(0.38 - 1.38)
Self or anyone close tested positive for COVID-19 (ref: no)	1.00	1.01
	(0.65 - 1.54)	(0.66 - 1.54)
Forgone medical treatment since COVID-19 pandemic (ref: no)	1.81*	1.81*
	(1.09 - 3.01)	(1.10 - 2.97)
Took drugs/medicine as prevention against COVID-19 (ref: no)	1.11	1.26
	(0.33 - 3.75)	(0.41 - 3.88)
Constant	0.08+	0.11
	(0.00 - 1.59)	(0.01 - 2.01)
Observations	1,976	1,976
Pseudo R^2	0.045	0.052
Likelihood ratio chi-square test statistic	38.69	
Wald chi-square test statistic		39.31

Note. Odds Ratios are reported with 95% confidence intervals in parentheses. * $p<0.05$, + $p<0.10$.

Table S2. Results from logistic regression and Firth logistic regression for determinants of telemedicine service use during the COVID-19 pandemic (with depressive symptoms).

Independent Variables	Results from Logistic Regression	Results from Firth Logistic Regression
Female sex (ref: male)	1.33 (0.88 - 2.03)	1.32 (0.88 - 1.99)
Age	0.98 (0.95 - 1.01)	0.98 (0.95 - 1.01)
Area lived in (ref: big city)		
Suburbs or outskirts of a big city	1.92 (0.85 - 4.33)	1.88 (0.85 - 4.15)
Large town	1.43 (0.61 - 3.33)	1.42 (0.63 - 3.24)
Small town	1.24 (0.63 - 2.45)	1.21 (0.62 - 2.35)
Rural area or village	1.35 (0.70 - 2.59)	1.31 (0.69 - 2.48)
Living with partner in the same household (ref: no)	1.00 (0.62 - 1.63)	0.99 (0.62 - 1.60)
Employment situation (ref: retired)		
Employed or self-employed	0.58 (0.29 - 1.13)	0.59 (0.30 - 1.16)
Other	0.80 (0.35 - 1.84)	0.83 (0.37 - 1.87)
Households' ability to make ends meet (ref: easily)		
With great or some difficulty	0.71 (0.31 - 1.63)	0.75 (0.34 - 1.67)
Fairly easily	0.72 (0.45 - 1.15)	0.73 (0.46 - 1.16)
Sad or depressed in the last month (ref: no)	1.64* (1.05 - 2.56)	1.62* (1.05 - 2.51)
Frequency of social contacts with nonrelatives (ref: never)		
Less than once a week	1.19 (0.60 - 2.40)	1.16 (0.59 - 2.29)
About once a week	0.86 (0.41 - 1.84)	0.85 (0.41 - 1.78)
Several times a week	1.14 (0.54 - 2.41)	1.12 (0.54 - 2.32)
Daily	0.88 (0.37 - 2.09)	0.87 (0.38 - 2.04)
Frequency of electronic contacts with nonrelatives (ref: never)		
Less than once a week	1.04 (0.50 - 2.17)	1.02 (0.50 - 2.08)
About once a week	1.50 (0.72 - 3.12)	1.44 (0.71 - 2.95)
Several times a week	1.23 (0.58 - 2.61)	1.20 (0.57 - 2.49)
Daily	1.23 (0.46 - 3.31)	1.24 (0.48 - 3.22)
Having trouble sleeping recently (ref: no)	0.83 (0.54 - 1.29)	0.84 (0.55 - 1.29)
Number of physical illnesses (range 0-6)	1.02 (0.83 - 1.26)	1.02 (0.83 - 1.26)

Health limitations (ref: not limited)		
Severely limited	2.17*	2.14*
	(1.14 - 4.14)	(1.13 - 4.04)
Limited, but not severely	1.00	1.01
	(0.61 - 1.66)	(0.61 - 1.66)
Self-rated health (ref: excellent)		
Very good	1.63	1.36
	(0.36 - 7.38)	(0.35 - 5.33)
Good	1.88	1.54
	(0.44 - 8.09)	(0.41 - 5.71)
Fair	1.92	1.57
	(0.42 - 8.70)	(0.40 - 6.17)
Poor	1.23	1.03
	(0.23 - 6.61)	(0.22 - 4.85)
Received COVID-19 vaccine (ref: no)	0.77	0.76
	(0.40 - 1.49)	(0.40 - 1.43)
Self or anyone close tested positive for COVID-19 (ref: no)	1.00	1.01
	(0.65 - 1.54)	(0.66 - 1.54)
Forgone medical treatment since COVID-19 pandemic (ref: no)	1.86*	1.86*
	(1.12 - 3.10)	(1.13 - 3.05)
Took drugs/medicine as prevention against COVID-19 (ref: no)	1.06	1.21
	(0.31 - 3.63)	(0.39 - 3.76)
Constant	0.07+	0.10
	(0.00 - 1.48)	(0.01 - 1.87)
Observations	1,973	1,973
Pseudo R^2	0.045	0.052
Likelihood ratio chi-square test statistic	39.12	
Wald chi-square test statistic		

Note. Odds Ratios are reported with 95% confidence intervals in parentheses. * $p<0.05$, + $p<0.10$.

Table S3. Results from logistic regression and Firth logistic regression for determinants of telemedicine service use during the COVID-19 pandemic (with feelings of loneliness).

Independent Variables	Results from Logistic Regression	Results from Firth Logistic Regression
Female sex (ref: male)	1.35 (0.89 - 2.05)	1.34 (0.89 - 2.02)
Age	0.98 (0.95 - 1.01)	0.98 (0.95 - 1.01)
Area lived in (ref: big city)		
Suburbs or outskirts of a big city	1.80 (0.80 - 4.07)	1.77 (0.80 - 3.91)
Large town	1.39 (0.60 - 3.23)	1.39 (0.61 - 3.15)
Small town	1.20 (0.61 - 2.37)	1.17 (0.60 - 2.28)
Rural area or village	1.32 (0.69 - 2.54)	1.29 (0.68 - 2.44)
Living with partner in the same household (ref: no)	1.07 (0.65 - 1.75)	1.06 (0.65 - 1.71)
Employment situation (ref: retired)		
Employed or self-employed	0.59 (0.30 - 1.17)	0.61 (0.31 - 1.19)
Other	0.83 (0.36 - 1.92)	0.87 (0.39 - 1.95)
Households' ability to make ends meet (ref: easily)		
With great or some difficulty	0.69 (0.30 - 1.57)	0.72 (0.32 - 1.61)
Fairly easily	0.73 (0.46 - 1.17)	0.74 (0.47 - 1.18)
Feelings of loneliness in the last month (ref: no)	1.68* (1.07 - 2.62)	1.66* (1.07 - 2.58)
Frequency of social contacts with nonrelatives (ref: never)		
Less than once a week	1.19 (0.60 - 2.38)	1.16 (0.59 - 2.27)
About once a week	0.85 (0.40 - 1.81)	0.84 (0.40 - 1.75)
Several times a week	1.15 (0.55 - 2.43)	1.13 (0.55 - 2.32)
Daily	0.89 (0.37 - 2.11)	0.88 (0.38 - 2.06)
Frequency of electronic contacts with nonrelatives (ref: never)		
Less than once a week	1.04 (0.50 - 2.17)	1.02 (0.50 - 2.07)
About once a week	1.54 (0.74 - 3.20)	1.48 (0.73 - 3.02)
Several times a week	1.25 (0.59 - 2.66)	1.22 (0.58 - 2.53)
Daily	1.24 (0.46 - 3.31)	1.24 (0.48 - 3.21)
Having trouble sleeping recently (ref: no)	0.89 (0.58 - 1.36)	0.90 (0.59 - 1.36)
Number of physical illnesses (range 0-6)	1.02 (0.82 - 1.26)	1.02 (0.83 - 1.25)

Health limitations (ref: not limited)		
Severely limited	2.23*	2.20*
	(1.17 - 4.25)	(1.17 - 4.15)
Limited, but not severely	1.00	1.01
	(0.61 - 1.66)	(0.61 - 1.66)
Self-rated health (ref: excellent)		
Very good	1.60	1.34
	(0.35 - 7.25)	(0.34 - 5.24)
Good	1.80	1.47
	(0.42 - 7.75)	(0.40 - 5.48)
Fair	1.94	1.58
	(0.43 - 8.78)	(0.40 - 6.23)
Poor	1.34	1.13
	(0.25 - 7.17)	(0.24 - 5.26)
Received COVID-19 vaccine (ref: no)	0.81	0.80
	(0.42 - 1.58)	(0.42 - 1.52)
Self or anyone close tested positive for COVID-19 (ref: no)	1.01	1.01
	(0.66 - 1.54)	(0.67 - 1.55)
Forgone medical treatment since COVID-19 pandemic (ref: no)	1.86*	1.85*
	(1.12 - 3.09)	(1.13 - 3.04)
Took drugs/medicine as prevention against COVID-19 (ref: no)	1.05	1.19
	(0.31 - 3.58)	(0.38 - 3.70)
Constant	0.06+	0.08+
	(0.00 - 1.24)	(0.00 - 1.58)
Observations	1,973	1,973
Pseudo R^2	0.045	0.052
Likelihood ratio chi-square test statistic	39.18	
Wald chi-square test statistic		39.79

Note. Odds Ratios are reported with 95% confidence intervals in parentheses. * $p<0.05$, + $p<0.10$.

Table S4. Results from Firth logistic regression for all models including age as categorical variable.

Independent Variables	Model with Anxiety Symptoms	Model with Depressive Symptoms	Model with Feelings of Loneliness
Female sex (ref: male)	1.31 (0.87 - 1.98)	1.32 (0.87 - 1.99)	1.34 (0.89 - 2.02)
Age (ref: 40-64 years)			
65-74 years	0.43* (0.22 - 0.86)	0.43* (0.22 - 0.86)	0.46* (0.23 - 0.91)
≥75 years	0.38* (0.17 - 0.86)	0.37* (0.17 - 0.84)	0.40* (0.18 - 0.90)
Area lived in (ref: big city)			
Suburbs or outskirts of a big city	1.92 (0.87 - 4.23)	1.91 (0.86 - 4.21)	1.79 (0.81 - 3.96)
Large town	1.47 (0.65 - 3.35)	1.49 (0.65 - 3.38)	1.43 (0.63 - 3.25)
Small town	1.19 (0.61 - 2.33)	1.20 (0.62 - 2.34)	1.16 (0.60 - 2.26)
Rural area or village	1.30 (0.69 - 2.45)	1.30 (0.69 - 2.46)	1.27 (0.67 - 2.40)
Living with partner in the same household	0.93 (0.58 - 1.50)	0.98 (0.61 - 1.57)	1.04 (0.64 - 1.68)
Employment situation (ref: retired)			
Employed or self-employed	0.36* (0.16 - 0.79)	0.36* (0.17 - 0.79)	0.39* (0.18 - 0.85)
Other	0.52 (0.21 - 1.29)	0.53 (0.21 - 1.29)	0.58 (0.24 - 1.40)
Households' ability to make ends meet (ref: easily)			
With great or some difficulty	0.73 (0.33 - 1.63)	0.75 (0.34 - 1.66)	0.72 (0.32 - 1.61)
Fairly easily	0.73 (0.46 - 1.16)	0.73 (0.46 - 1.15)	0.74 (0.47 - 1.17)
Nervous, anxious, or on edge in the last month (ref: no)	1.64* (1.05 - 2.56)		
Sad or depressed in the last month (ref: no)		1.65* (1.06 - 2.56)	
Feelings of loneliness in the last month (ref: no)			1.64* (1.06 - 2.55)
Frequency of social contacts with nonrelatives (ref: never)			
Less than once a week	1.12 (0.56 - 2.21)	1.13 (0.57 - 2.24)	1.14 (0.58 - 2.24)
About once a week	0.87 (0.41 - 1.82)	0.86 (0.41 - 1.80)	0.85 (0.41 - 1.78)
Several times a week	1.10 (0.53 - 2.28)	1.09 (0.53 - 2.26)	1.10 (0.53 - 2.28)
Daily	0.85 (0.36 - 1.98)	0.84 (0.36 - 1.96)	0.85 (0.36 - 1.98)
Frequency of electronic contacts with nonrelatives (ref: never)			
Less than once a week	1.07 (0.53 - 2.19)	1.04 (0.51 - 2.12)	1.04 (0.51 - 2.11)
About once a week	1.47 (0.72 - 3.01)	1.44 (0.70 - 2.94)	1.46 (0.72 - 2.99)

Several times a week	1.26	1.24	1.26
	(0.60 - 2.63)	(0.60 - 2.60)	(0.60 - 2.62)
Daily	1.25	1.25	1.25
	(0.49 - 3.25)	(0.48 - 3.25)	(0.48 - 3.22)
Having trouble sleeping recently (ref: no)	0.84	0.83	0.89
	(0.54 - 1.28)	(0.54 - 1.28)	(0.58 - 1.35)
Number of physical illnesses (range 0-6)	1.03	1.02	1.02
	(0.83 - 1.27)	(0.83 - 1.26)	(0.83 - 1.25)
Health limitations (ref: not limited)			
Severely limited	2.12*	2.14*	2.21*
	(1.12 - 4.02)	(1.13 - 4.05)	(1.17 - 4.17)
Limited, but not severely	1.01	1.02	1.03
	(0.61 - 1.66)	(0.62 - 1.68)	(0.62 - 1.69)
Self-rated health (ref: excellent)			
Very good	1.41	1.39	1.37
	(0.36 - 5.53)	(0.35 - 5.48)	(0.35 - 5.39)
Good	1.56	1.58	1.51
	(0.42 - 5.78)	(0.42 - 5.88)	(0.41 - 5.63)
Fair	1.57	1.58	1.60
	(0.40 - 6.19)	(0.40 - 6.26)	(0.41 - 6.30)
Poor	1.05	1.00	1.11
	(0.22 - 4.93)	(0.21 - 4.74)	(0.24 - 5.18)
Received COVID-19 vaccine (ref: no)	0.74	0.76	0.80
	(0.39 - 1.39)	(0.40 - 1.44)	(0.42 - 1.52)
Self or anyone close tested positive for COVID-19 (ref: no)	0.99	0.99	1.00
	(0.65 - 1.51)	(0.65 - 1.51)	(0.66 - 1.52)
Forgone medical treatment since COVID-19 pandemic (ref: no)	1.74*	1.79*	1.79*
	(1.06 - 2.86)	(1.09 - 2.94)	(1.09 - 2.94)
Took drugs/medicine as prevention against COVID-19 (ref: no)	1.25	1.19	1.20
	(0.40 - 3.88)	(0.38 - 3.75)	(0.39 - 3.74)
Constant	0.06**	0.06**	0.05**
	(0.01 - 0.40)	(0.01 - 0.37)	(0.01 - 0.33)
Observations	1,976	1,973	1,973
Pseudo R^2	0.058	0.058	0.058
Wald chi-square test statistic	43.81+	44.19+	44.19+

Note. Odds Ratios are reported with 95% confidence intervals in parentheses. ** p<0.01, * p<0.05, + p<0.10.

5. Publication 2: Determinants of Having Online Health Consultations During the COVID-19 Pandemic Among Middle-Aged and Older Adults in Germany: Representative Longitudinal Survey Study

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Original Paper

Determinants of Having Online Health Consultations During the COVID-19 Pandemic Among Middle-Aged and Older Adults in Germany: Representative Longitudinal Survey Study

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Abstract

Background: During the COVID-19 pandemic, telemedicine services represented a widely implemented alternative to in-person doctor and therapist appointments. Consequently, rates of telemedicine use rapidly increased worldwide, also in Germany. Research regarding longitudinal determinants of telemedicine use is needed, particularly from nationally representative German samples, to improve understanding of the use behavior of major target groups such as middle-aged and older adults.

Objective: This study aimed to longitudinally investigate determinants of online health consultation use among middle-aged and older individuals during the COVID-19 pandemic in Germany.

Methods: Nationally representative longitudinal data of German middle-aged and older adults (≥46 years old) were taken from the German Ageing Survey (DEAS). Data from the Compact Survey (conducted between June and July 2020) and wave 7 (conducted between November 2020 and March 2021) of the DEAS were observed (pooled analytic sample N=5456). Having experienced consultations with doctors or therapists on online platforms served as the outcome measure. Associations with socioeconomic, health- and health behavior–related, psychological, and COVID-19–related determinants were tested using random effects logistic regressions.

Results: In our sample, 49% (2673/5456) of participants were female and the mean age of the participants was 67.8 (SD 9.4) years. Past experience with online health consultations was reported by 10.3% (561/5456) of the sample. Online health consultation use was associated with high education (OR 1.43, 95% CI 1.06-1.93; *P*=.02), poor self-rated health (OR 0.60, 95% CI 0.49-0.75; *P*<.001), and higher frequency of physical activity (reference: low frequency; medium frequency: OR 1.58, 95% CI 1.15-2.17; *P*=.005; high frequency: OR 1.73, 95% CI 1.09-2.76; *P*=.02). Moreover, greater levels of loneliness (OR 1.43, 95% CI 1.06-1.93; *P*=.04) and life satisfaction (OR 1.33, 95% CI 1.02-1.73; *P*=.04) as well as perceiving the COVID-19 crisis as a greater personal threat (OR 1.08, 95% CI 1.01-1.15; *P*=.02) were associated with having online health consultations during the COVID-19 pandemic.

Conclusions: Online health consultation use does not seem to be exclusively associated with the health of middle-aged and older patients. Study findings emphasize the longitudinal association of education and psychosocial factors as well as health factors with telemedicine use during the COVID-19 pandemic in Germany. This knowledge may help to improve and adapt services to this patient group, which could contribute to higher utilization rates in the future. Future studies are needed to verify these initial findings under postpandemic circumstances and across different countries.

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Keywords: telemedicine; digital health; remote consultation; health services for the aged; patient acceptance of health care; COVID-19

Introduction

Worldwide, health care systems are facing multiple challenges in the future related to the delivery of services (eg, access and continuity of care), human resources (eg, staff distribution and sufficiency), as well as leadership and governance (eg, strategic policies) [1]. In particular, the increasing prevalence of noncommunicable diseases, disability, and multimorbidity in connection with population aging calls for new solutions in health care (eg, [2]). According to predictions of the World Health Organization (WHO) [3], the number of global deaths due to noncommunicable diseases may increase from 36 million (2008) up to 52 million in 2030.

Promising methods for the delivery of health care in the future include digital solutions such as telemedicine [4]. The WHO Global Observatory for eHealth [5] defines telemedicine as follows: (1) its purpose is to provide clinical support, (2) it is intended to overcome geographical barriers, connecting users who are not in the same physical location, (3) it involves the use of various types of information and communication technology, and (4) its goal is to improve health outcomes. Major strengths of telemedicine include improved access to care and information, time and cost savings, as well as convenience and flexibility [6,7]. Multiple studies evaluated the effectiveness and cost-effectiveness of telemedicine services. The services seem to be effective and can produce at least comparable effects to in-person services [8,9]. Moreover, the current literature suggests that telemedicine can be a cost-effective service delivery method [8-11]. In addition, providers as well as patients seem to be highly satisfied with the services [8,9,12].

Despite its benefits, telemedicine implementations were only limited and remained at a low level up until the occurrence of the COVID-19 pandemic [13-15]. To prevent further spreading of the virus and relieve the health care system, major changes in the delivery of health care services had to be made in response to the pandemic [15]. Telemedicine represented a valuable tool to avoid personal contact during health consultations. Consequently, the global telemedicine utilization increased tremendously [13-16]. For example, Koonin et al [17] reported a 154% increase in telehealth visits in the United States in March 2020 compared with March 2019. Also in Germany, which is the focus of our study, the proportion of contract physicians and psychotherapists who offered and billed for telemedicine services increased from 6.1% (2019) to 24.6% (2021) [18]. Particularly among the psychotherapeutic care sector, utilization rates were high in Germany [18]. Since many nonessential in-person medical appointments were canceled or postponed due to the pandemic in Germany [19,20], remote health consultations represented a valuable alternative format to assure the continuity of care in spite of pandemic circumstances. This digital transformation of the German health care system was facilitated by the introduction of laws including the Digital Health Care Act [21] and the Digital Health Application Ordinance [22], which supported the prescription of health care apps, provision of video consultations, and integration of digital provider networks. In the German health care system, health insurance is compulsory with about 90% of the population having statutory and 10% having private health insurance [23]. The implementation of the new laws enabled the coverage of digital health care by statutory insurances, ensuring that telemedicine users incur no additional costs.

Considering population aging, telemedicine is particularly relevant for the older patient groups. Telemedicine was found to be effective in older adults [24-26]. For instance, van den Berg et al [25] reviewed 68 interventional telemedical studies with a controlled design examining older adults and found that none of the included studies reported better outcomes for the control group (eg, randomized or matched control groups that received usual in-person care). Moreover, older adults seem to accept and are satisfied with the services [24,27]. Taking older adults' higher need for health care and probable mobility restrictions into account, older adults can particularly benefit from the remote format. Nevertheless, older patients use telemedicine services less often than younger age groups and report multiple barriers to using the services (eg, [28-32]). For example, Wilson et al [30] identified factors such as physical difficulties (eg, visual or hearing impairments), privacy concerns, lack of experience, training, or support as barriers to the use of eHealth by older adults.

In Germany, older patients also used telemedicine services less frequently than younger patients did during the pandemic [18,33-36]. However, increasing telemedicine use in older age groups can be helpful for the future delivery of health care services in Germany to deal with problems such as physician shortages or increased demand for (long-term) care caused by demographic change [37]. Therefore, it is important to examine factors that are associated with telemedicine use in older adults to increase utilization in Germany. Previous international reviews highlighted older patients' characteristics associated with higher telemedicine use [38-40]. This included younger age, higher education, higher self-efficacy, greater experience or skills in using electronic devices, access to technology and internet, greater social support or influence, higher (health-related) motivation, and greater openness to experience as well as fewer privacy concerns and less severe health impairments.

So far, only limited evidence from Germany regarding the determinants of telemedicine use during the pandemic exists. The previous studies stressed the association of socioeconomic (male or female sex, younger age, high or low education, social status, living in an urban area, and

having children under 18 years), psychosocial (loneliness, digital literacy), health (mental or physical health problems), and COVID-19–related factors (higher perceived severity of COVID-19 infection, having had COVID-19 infection, subjective COVID-19–related challenges, COVID-19–related cognitive preoccupation, anxiety, and worries) with telemedicine use [18,34-36,41-43]. Very few studies exclusively looked at middle-aged and older adults in Germany during the pandemic. These studies highlighted the positive association of telemedicine use with education, living with a partner in the same household, mental (ie, anxiety and depression) or physical health problems, loneliness, life satisfaction as well as forgoing medical treatment due to the fear of being infected by the coronavirus [44,45]. A large variety of determinants was observed in the existing studies and more research is needed to further explore and verify the findings.

In addition to the small number of studies that observe determinants of telemedicine use in middle-aged and older adults during the pandemic in Germany, hardly any studies examined the determinants longitudinally. Solely, von der Groeben et al [35] used a quasi-longitudinal design (ie, they observed cross-sectional data from 3 different time points) to detect determinants of patient use and attitude toward using video and telephone conferences in a population-representative sample of adults (18-69 y) affected by depression during 3 different pandemic time points in Germany. Since telemedicine use and acceptance varied over the course of the pandemic (eg, [31,35,46]), it may be beneficial to consider more than just one time point when observing telemedicine use behavior during the pandemic. Moreover, the longitudinal approach gives further insight into the directionality of the relationships. Therefore, our study aimed to longitudinally investigate determinants of online health consultation use in a large representative sample of middle-aged and older individuals during the COVID-19 pandemic in Germany.

Expanding the knowledge regarding determinants of online health consultation use in middle-aged and older adults could help to identify target groups for telemedicine services, as well as groups that would benefit from additional support for using the services. Furthermore, this knowledge may help to adapt telemedicine services to the needs and preferences of middle-aged and older adults. Consequently, important practical and theoretical implications may be derived from our findings, which could foster greater use of telemedicine services among middle-aged and older individuals, ultimately helping to deal with future health care challenges posed by population aging.

Methods

Sample

Nationally representative cross-sectional and longitudinal data were taken from the German Ageing Survey (DEAS [47]). The DEAS focuses on the German middle-aged and older population (starting at 40 y) and aims to describe living conditions and diversity among this population as well as aging and social change processes that are related to this life stage [47]. The first wave of the DEAS was conducted in 1996, followed by further waves in 2002, 2008, 2011, 2014, 2017, 2020/2021. The survey has a cohort-sequential design in which new baseline samples were added in 2002, 2008, and 2014. The baseline samples of the DEAS were disproportionally stratified into age groups, gender, and region [47]. In response to the COVID-19 pandemic, an additional Compact Survey to measure the pandemic impact on middle- and older adults' lives in Germany was implemented in 2020.

For the purpose of our study, data from the Compact Survey [48] and wave 7 [49] of the DEAS were observed. The Compact Survey was conducted from June until July 2020 and consisted of paper-and-pencil questionnaires that were sent to individuals who had taken part in the DEAS at least once in the past. The response rate for the Compact Survey was 57% (4823/8533) [50]. Due to the ongoing pandemic during wave 7, the usual computer-assisted personal interviews were replaced by telephone-administered interviews as well as an additional paper-and-pencil questionnaire. The data collection for wave 7 took place from November 2020 until March 2021 and the response rate was 66% (5402/8207) [51]. Overall, 4103 individuals participated in both surveys [51]. Since the last DEAS baseline sample was added in 2014, participants of the Compact Survey and wave 7 of the DEAS were at least 46 years old.

The DEAS is funded by the German Federal Ministry for Family Affairs, Senior Citizens, Women, and Youth and was conducted and developed by the German Centre of Gerontology. The fieldwork was carried out by the INFAS Institute for Applied Social Sciences.

Ethical Considerations

Written informed consent was obtained from all individuals who participated in the DEAS, and opting out of the survey was possible at all times [47]. DEAS participants received an incentive (eg, €10 in DEAS wave 7; conversion rate US $1=€0.951 in 2022 [51]). Due to data protection guidelines, a data distribution contract needs to be signed prior to using the anonymized DEAS data [47]. The DEAS study complies with the Declaration of Helsinki and did not require further ethical examination since the criteria for the need of ethical approval were not met for this survey (eg, missing information regarding the study or aim of the study, examination of vulnerable groups or patients, high risk or burden for participants due to participation).

Dependent Variable

For the sake of our study, we exclusively included DEAS participants, who indicated having access to the internet (Compact survey: 3858/4676, 83%; wave 7: 3676/4276, 86%). In both DEAS waves, participants were asked "How often do you use the Internet for the following purposes?." Among the listed items was "Consultations with doctors and therapists via an online platform" in the Compact survey and "Providing consultations with doctors or therapists on online platforms" in wave 7 of the DEAS. The response format consisted of a 6-point Likert scale indicating use frequency as "never," "less often or seldom," "1 to 3 times a month," "once

a week," "several times a week," or "daily." Since only a small number of participants had multiple consultations with doctors or therapists on online platforms, the outcome was dichotomized for our analysis (0="never"; 1="less often or seldom," "1 to 3 times a month," "once a week," "several times a week," or "daily").

Independent Variables

Based on theoretical considerations and previous research [38-40,44,45], different groups of determinants were considered. This included socioeconomic, health- and health behavior–related, psychological, and COVID-19–related determinants. Regarding socioeconomic characteristics, we examined sex, age, educational level (International Standard Classification of Education 97 [52]: low, medium, or high education), employment status (used, retired, and other or unemployed), household income, migration background (no, yes), area lived in (metropolitan districts, urban districts, [partially] densely populated rural districts, sparsely populated rural districts), residential form of partnership (no partner, partner in the same household, and partner not in the same household), and presence of children (no, yes).

Health-related factors included self-rated health (ranging from 0=very bad to 4=very good) as well as the frequency of physical activity and walks (ranging from 0=never to 5=daily) as measures of health-related behavior. For the sake of our analysis, the values for the frequency of physical activity and walks were divided into tertiles and were included as categorical variables (low, medium, and high frequency).

Psychological determinants that were considered were depressive symptoms, loneliness, attitude toward own aging, and life satisfaction. Depressive symptoms were measured using a 10-item German short form of the Center for Epidemiologic Studies - Depression scale [53] (CES-D; scores ranging from 0 to 30, higher values indicate more severe depressive symptoms) in the Compact survey. In wave 7 of the DEAS, depressive symptoms were measured using the German version of the 15-item CES-D [54] (scores ranging from 0 to 45, higher values indicate more severe depressive symptoms). The values for both scales were standardized to assure comparability between both surveys in our analysis. Both of these well-established instruments were evaluated in the past and have good psychometric properties [53,55,56]. Cronbach α values for both scales were 0.83 (Compact survey) and 0.84 (wave 7) and McDonald Omega was 0.85 (Compact survey) and 0.86 (wave 7) in our sample. In addition, loneliness was measured with the 6-item De Jong Gierveld Loneliness Scale [57] (scores ranging from 1 to 4, higher values indicate higher levels of loneliness). The scale has favorable psychometric properties [57] (Compact survey: Cronbach α=0.78, McDonald's Omega =0.79; wave 7: Cronbach α=0.80, McDonald Omega =0.81). The self-perception of one's own aging was examined using the German version of the 5-item Attitude Toward Own Aging subscale of the Philadelphia Geriatric Center Morale Scale [58,59] (scores ranging from 1 to 4, higher values indicate a more positive perception of own aging). This widely used scale was evaluated in different age groups in the past (eg, [60]). In our sample, Cronbach α was 0.77 (Compact Survey and wave 7) and McDonald Omega was 0.77 (Compact Survey and wave 7). Life satisfaction was measured with the German version of the Satisfaction with Life Scale [61,62] (scores ranging from 1 to 5, higher values indicate greater life satisfaction). The German version of the scale was evaluated in the past and showed good psychometric properties [63]. For this scale, the Cronbach α was 0.86 (Compact survey) and 0.84 (wave 7) and the McDonald Omega was 0.87 (Compact survey) and 0.86 (wave 7) in our sample.

Finally, we controlled for COVID-19–related determinants, which included perceiving the Corona crisis as a personal threat (scores ranging from 1=not at all a threat for me to 10=extreme threat for me), past infection with the Coronavirus by oneself (no, yes, and unknown), or by people from one's personal environment (no, yes, and unknown) as well as the feeling of being able to influence the infection with the Coronavirus (scores ranging from 1=not at all to 7=entirely).

Statistical Analysis

In the first step, sample characteristics of our pooled analytic sample were computed. The analytic sample consisted of individuals who participated in at least one of the 2 surveys (5456 observations corresponding to 3222 individuals). Second, random effects logistic regressions were calculated to test the associations of the determinants with online health consultation use. The random effects regression model considers the panel structure of the data and allows the inclusion of not only time-varying but also time-constant predictors in our model, under the assumption that unobserved unit-specific heterogeneity is not correlated with the independent variables [64]. When this independence assumption is fulfilled, the random effects model may be more efficient than the fixed effects model as it considers both between and within variation [64]. Our choice was supported by the Hausman test. The null hypothesis of the Hausman test states that both models (fixed and random effects model) are consistent while the random effects model is more efficient [64,65]. Therefore, the random effects model is preferred when the null hypothesis cannot be rejected. Since the Hausman test statistic was nonsignificant for our sample (P=.72), we used random effects models for our analysis. Stata (version 16.0, StataCorp) was used for the statistical analyses and the random effects logistic regression was calculated using the "xtlogit" command with the "re" option. The sample was stratified by sex and age groups (≤64 and ≥65 years) in additional analyses. Statistical significance was defined as an alpha level of P<.05. Missing data were handled using listwise deletion.

Results

Sample Characteristics

The pooled analytic sample characteristics for all included variables are presented in Table 1. In the pooled sample of the Compact survey and wave 7 of the DEAS, 49% (2673/5456)

were female and the mean age of the participants was 67.8 (SD 9.4) years. When examining past consultations with doctors or therapists on online platforms, 10.3% (561/5456) reported past experience with online consultations.

Table 1. Analytic pooled sample characteristics (N=5456).

Characteristics[a]	Values
Consultations with doctors or therapists on online platforms, n (%)	
No	4895 (89.7)
Yes	561 (10.3)
Sex, n (%)	
Male	2783 (51)
Female	2673 (49)
Age (years), mean (SD)	67.8 (9.4)
Educational level, n (%)	
Low (ISCED[b] 0-2) or medium (ISCED 3-4)	2455 (45)
High (ISCED 5-6)	3001 (55.0)
Employment status, n (%)	
Employed	1745 (32.0)
Retired	3475 (63.7)
Other or unemployed	236 (4.3)
Monthly household income (€), mean (SD)[c]	4051.2 (11,806.1)
Migration background, n (%)	
No	5223 (95.7)
Yes	233 (4.3)
Area lived in, n (%)	
Metropolitan districts	1524 (27.9)
Urban districts	2014 (36.9)
(Partially) densely populated rural districts	1135 (20.8)
Sparsely populated rural districts	783 (14.4)
Residential form of partnership, n (%)	
No partner	1069 (19.6)
Partner in the same household	4152 (76.1)
Partner not in the same household	235 (4.3)
Having children, n (%)	
None	602 (11)
One or more	4854 (89)
Self-rated health, mean (SD)[d]	2.6 (0.8)
Frequency of physical activity, n (%)	
Low frequency	1589 (29.1)
Medium frequency	3234 (59.3)
High frequency	633 (11.6)
Frequency of walks, n (%)	
Low frequency	2135 (39.1)
Medium frequency	2147 (39.4)
High frequency	1174 (21.5)
Depressive symptoms, mean (SD)[e]	–0.1 (0.9)
Loneliness, mean (SD)[f]	1.8 (0.5)
Life satisfaction, mean (SD)[g]	3.9 (0.7)
Attitude toward own aging, mean (SD)[h]	3.0 (0.5)
Perceiving the Corona crisis as a personal threat, mean (SD)[i]	4.3 (2.1)

Characteristics[a]	Values
Oneself infected with the Coronavirus, n (%)	
No	5244 (96.1)
Yes	57 (1)
Unknown	155 (2.8)
People from personal environment infected with the Coronavirus, n (%)	
No	4517 (82.8)
Yes	853 (15.6)
Unknown	86 (1.6)
Feeling that one can influence the infection with the Coronavirus, mean (SD)[j]	4.7 (1.4)

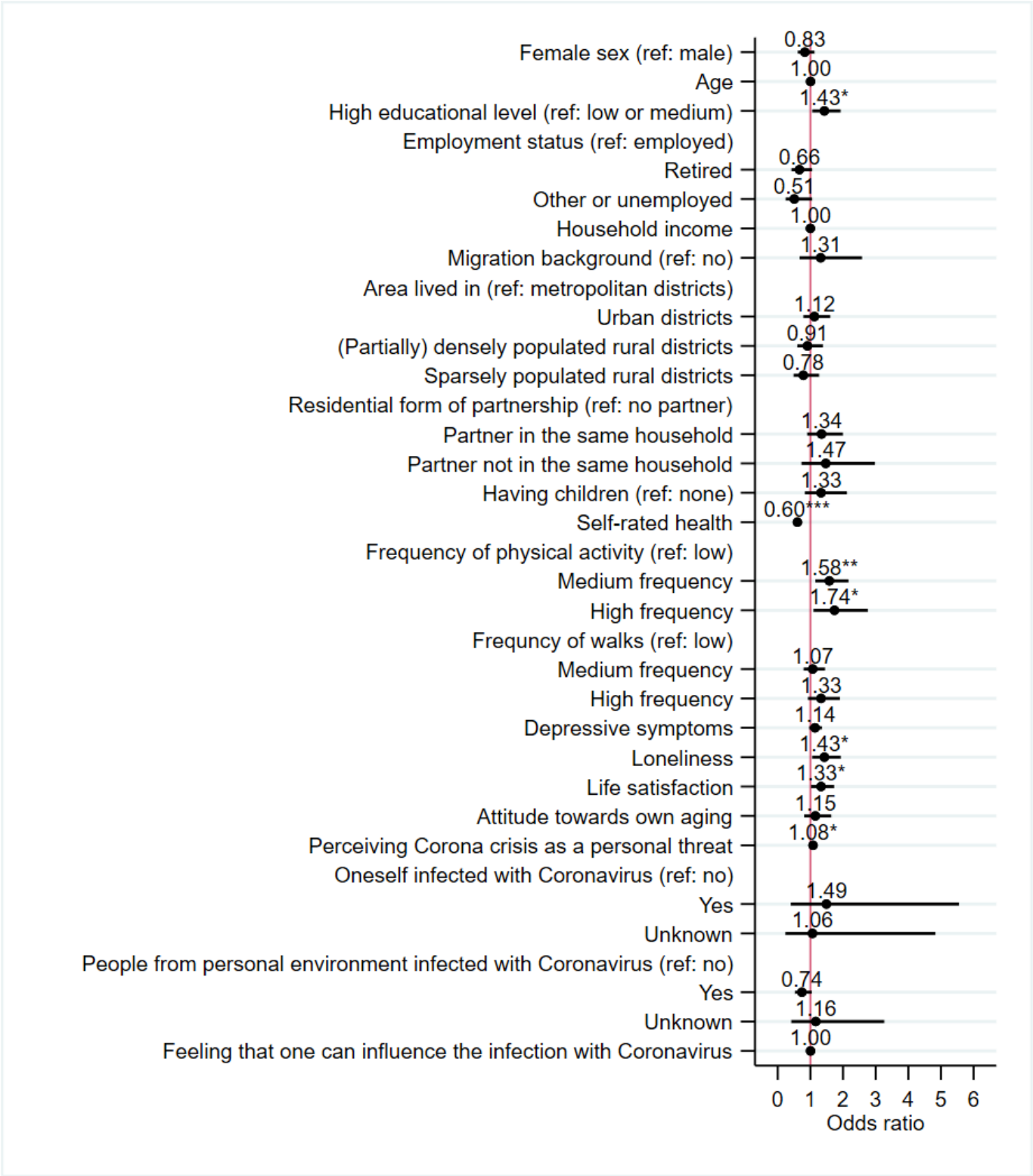
[a]Due to differences in measurement tools, values for depressive symptoms had to be standardized. The standardized values should be interpreted as number of SDs by which the original values lay above or below their mean. For example, a value of 1 or -1 indicates that the reported overall score in the CES-D lays one SD above/below the mean CES-D score.
[b]ISCED: International Standard Classification of Education.
[c] Range (0-500,000); the conversion rate of USD to Euro was US $1=€0.846 in 2021 and US $1=€0.951 in 2022.
[d]Range 0-4. Higher values indicate better self-rated health.
[e]Range for standardized values –1.8 to 5.9. Higher values indicate more depressive symptoms.
[f]Range 1-4. Higher values indicate higher loneliness levels.
[g]Range 1-5. Higher values indicate greater life satisfaction.
[h]Range 1-4. Higher values indicate a more positive perception of own aging.
[i]Range 1=not at all a threat for me to 10=extreme threat for me.
[j]Range 1=not at all to 7=entirely.

Regression Analysis

The results of the random effects logistic regression are presented in Figure 1 (Table S1 in Multimedia Appendix 1). The majority of the determinants were not significantly associated with online health consultation use during the COVID-19 pandemic. Nevertheless, we found a significant longitudinal association of the outcome with high education (OR 1.43, 95% CI 1.06-1.93; *P*=.02), poor self-rated health (OR 0.60, 95% CI 0.49-0.75; *P*<.001), higher frequency of physical activity (medium frequency: OR 1.58, 95% CI 1.15-2.17; *P*=.005; high frequency: OR 1.73, 95% CI 1.09-2.76; *P*=.02), higher loneliness (OR 1.43, 95% CI 1.06-1.93; *P*=.04), greater life satisfaction (OR 1.33, 95% CI 1.02-1.73; *P*=.04), and perceiving the Corona crisis as a greater personal threat (OR 1.08, 95% CI 1.01-1.15; *P*=.02).

In additional analyses, we stratified the sample by sex and age group (Tables S2 and S3 in Multimedia Appendix 1 for more details). While online health consultation use in female participants was only associated with poor self-rated health (OR 0.62, 95% CI 0.45-0.85; *P*=.004), in male individuals the outcome was associated with poor self-rated health (OR 0.59, 95% CI 0.44-0.79; *P*<.001) as well as high education (OR 1.70, 95% CI 1.12-2.56; *P*=.01), living with a partner in the same household (OR 2.27, 95% CI 1.13-4.59; *P*=.02), living with a partner not in the same household (OR 2.86, 95% CI 1.04-7.87; *P*=.04), higher loneliness (OR 1.94, 95% CI 1.25-2.99; *P*=.003), higher frequency of physical activity (medium frequency: OR 1.88, 95% CI 1.22-2.90; *P*=.004; high frequency: OR 2.17, 95% CI 1.17-4.03; *P*=.01) and walks (high frequency: OR 1.99, 95% CI 1.24-3.20; *P*=.004). In participants aged ≤64 years, online health consultation use was associated with poor self-rated health (OR 0.59, 95% CI 0.42-0.83; *P*=.003) and higher frequency of physical activity (medium frequency: OR 1.91, 95% CI 1.14-3.21; *P*=.01). In older participants (≥65 years), poor self-rated health (OR 0.61, 95% CI 0.46-0.81; *P*=.001) as well as older age (OR 1.03, 95% CI 1.00-1.07; *P*=.05), high education (OR 1.58, 95% CI 1.06-2.37; *P*=.026), and higher loneliness (OR 1.52, 95% CI 1.01-2.29; *P*=.04) were associated with online health consultation use.

Figure 1. Results of random effects logistic regression for determinants of online health consultation use during the COVID-19 pandemic (N=5456). Odds ratios with 95% CI are reported. Unless stated otherwise, the reference category is always zero or absence of the characteristic. ref: reference category; *** *P*<.001; ** *P*<.01; * *P*<.05.



Discussion

Principal Findings

Nationally representative longitudinal data from Germany were used to observe the longitudinal association of various determinants with the use of online consultations with doctors or therapists during the COVID-19 pandemic in a large sample of middle-aged and older individuals with access to the internet. Random effects logistic regressions revealed associations of education, health, and psychosocial factors with online health consultation use during the pandemic. In additional analyses stratified by sex and age, self-rated health was negatively associated with the outcome

in all groups. Additional relationships with age, education, relationship status, and loneliness were only observed among the male and older (≥65 years) subgroups. Considering the limited evidence regarding determinants of telemedicine use (particularly based on longitudinal data), our longitudinal study considerably extend current knowledge on socioeconomic, health- and health behavior–related, psychological, and COVID-19-related determinants.

Relation to Previous Research

In contrast to findings from other German samples [18,33,35,36,41,42,66], most of the socioeconomic determinants, such as sex or age, were not associated with online health consultation use in our sample. Nevertheless, a study that exclusively observed an older German sample also found no associations with socioeconomic characteristics [45]. This could imply that socioeconomic characteristics are less relevant for telemedicine use in middle-aged and older patients in Germany. However, the individual's educational level was positively associated with the outcome in our analysis. This is in line with findings from other large German [33,34,36,42] and international samples [38,40,67,68] and could suggest that high education is linked to higher digital literacy as well as access to necessary technical equipment for using telemedicine. A systematic review by Estrela et al [69] examined 36 international articles on digital health literacy and highlighted its positive relationship with education. Correspondingly, in a large US sample of old-aged Medicare beneficiaries (≥65 years), Choi et al [70] found associations of younger age and higher income with telemedicine use during the COVID-19 pandemic, which disappeared when controling for technology-enabling factors (eg, information and communication technology device ownership or use experience). Consequently, technology-enabling factors could be particularly considered when trying to enhance telemedicine use among older patients. For instance, implementing supporting material (eg, leaflets or video instructions), technical support (eg, via telephone) or hybrid care combinations in clinical practice may be helpful to strengthen competence and digital health literacy in older patients.

Health and health behavior were associated with online health consultation use in our sample. Individuals who reported a poorer health status were more likely to use online health consultations during the pandemic. Likewise, severe health limitations or poor health were associated with telemedicine use in the German Survey of Health, Ageing and Retirement in Europe (SHARE) sample of middle-aged and older adults [45] and in international samples [68,71]. This association could have been caused by greater health needs in unhealthy individuals or may be connected to precautions due to the COVID-19 pandemic. Likewise, perceiving the Corona crisis as a greater personal threat was associated with online health consultation use. Telemedicine might have presented a treatment option for patients who were scared of becoming infected with the Coronavirus and wanted to avoid personal contact (eg, [72]). Fear of the Coronavirus and pandemic-related challenges were also associated with telemedicine use in other German samples during the pandemic [36,41,42,45]. Other COVID-19–related factors such as the infection of oneself or close others with the virus were not associated with the outcome in our sample. A reason for that could be that only a small proportion of our pooled sample was infected with the virus (1%) or knew someone in their close personal environment who was infected (15.6%). Furthermore, the frequency of physical activity was positively associated with online consultation use. Physical activity is an important determinant of health and was associated with higher utilization of preventive or office-based health services and lower use of inpatient or emergency care among adults in previous international research (eg, [73,74]). Therefore, physically active individuals seem to show greater levels of health awareness, which might have been connected to the higher telemedicine use in this group.

Some psychological factors were associated with the outcome in our sample. Whereas depressive symptoms and the attitude towards one's own aging did not show an association, psychosocial factors including loneliness and life satisfaction had a significant relationship with online health consultation use. In the German SHARE sample, a positive association of depressive symptoms as well as loneliness with telemedicine use in middle-aged and older individuals was observed [45]. The mixed evidence concerning the relationship of depressive symptoms with telemedicine utilization might be explained by the different pandemic periods that were considered in the studies (Summer and Winter 2020 vs Summer 2021). In fact, depressive symptoms [75] and telemedicine acceptance [35] were found to have increased over the course of the pandemic. Regarding loneliness, Robbins et al [76] also observed higher loneliness rates among telemedicine users (telephone contacts), while in-person visits were associated with fewer feelings of loneliness among older adults (≥65 years) residing in the United States during the pandemic. It might be the case that older adults who indicated higher levels of loneliness were more open to using telemedicine services to satisfy their unmet social needs during pandemic times. Telemedicine services may be more accessible for older individuals (eg, no traveling for mobility-restricted individuals needed), which might encourage lonely individuals to take the initiative to foster social interaction through telemedicine appointments. Regarding life satisfaction, König et al [77] recently observed a positive correlation between life satisfaction and digital health literacy in a nationally representative survey of the population in Germany, which could explain the observed relationship between higher life satisfaction and online health consultation use in our sample. In addition, higher life satisfaction was associated with health-promoting behaviors in previous studies [78-80], which could have contributed to higher online health consultation use.

Additional analyses stratified by sex and age further highlighted the relationships with the determinants, especially in male and older participants. While online consultation use in females was only associated with health needs, male individual's use behavior was additionally associated with psychosocial factors (ie, relationship status and loneliness), education, and health behavior (ie, frequency of walks and

physical activity). The decision of male patients to use telemedicine services seems to be connected to additional factors and therefore more complex compared with female patients. Male patients may be facing additional barriers to telemedicine utilization. Therefore, future research is needed to explore gender-specific determinants and barriers to the use of telemedicine. Furthermore, particularly among individuals aged 65 years and older, loneliness, education, and age were associated with online health consultation use. Consequently, compared with individuals aged 40 to 64 years, older patients might be especially affected by disparities in education or loneliness.

When considering the international context, multiple reviews mainly based on quantitative cross-sectional, randomized controlled or qualitative studies observed determinants of telemedicine use in older age groups and found positive associations with educational level, health needs, and health-related motivation to use the services [38-40], which is in line with our findings. Moreover, they observed additional relationships (eg, with age, sex, and social support or influence), which we did not find in our analysis. Age or sex were not associated with overall telemedicine use in our sample. The reviews [38-40] mostly included studies from the United States or Europe. Telemedicine regulations differ substantially between Germany and the United States, but also in the European context. Whereas Germany has implemented national telemedicine coverage rules during the pandemic, large state-specific variation in insurance coverage and regulations exist in the United States [71,81], which may have caused additional barriers for older telemedicine users. Nevertheless, our stratified analyses indicated differences in determinants of use in the different sex and age groups. Furthermore, we observed a positive relationship of loneliness with telemedicine use, which is in contrast to the observed negative relationship of social isolation or lack of social support with telemedicine use in international studies [39]. Raja et al [82] reviewed studies of older adults in European countries and found that social support and lack of social support were both associated with using new technologies, including telemedicine. Social support may be crucial when older adults are faced with problems when learning new technologies, which was also observed in US samples [68]. Nevertheless, lack of social support or loneliness might also motivate older adults to try out new technologies to address their social needs, which we observed in our sample. Moreover, the discrepancies might also be explained by differences in regulations or access to telemedicine care (eg, variations in out-of-pocket payments, supply, or complexity of use). For instance, the requirement for additional out-of-pocket payments or high barriers to use may lower the probability of using telemedicine services for the primary purpose of social interaction. Future research concerning differences in psychosocial determinants across different countries is needed.

Strengths and Limitations

The nationally representative, large DEAS sample of middle-aged and older individuals in Germany represents a key strength of our study. Middle-aged and older adults are a major target group for future telemedicine services in Germany, thus it is of particular importance to explore the telemedicine use behavior of this age group. In addition, longitudinal data were exploited, which enabled us to consider two different pandemic stages and account for the exceptional circumstances during that time. Since only few studies observed determinants of online health consultation use in German middle-aged and older adults in the past, our study adds valuable knowledge to the existing literature.

Nevertheless, some limitations should be noted. Telemedicine use was represented by having online consultations with doctors or therapists in our study. We neither examined specific patient groups nor focused on a certain telemedicine format (eg, video conferences or mobile apps). Therefore, we observed a potentially heterogeneous user group. Since telemedicine acceptance during the pandemic was found to vary across medical specialties and telemedicine formats [31], future research that tests for differences in use among patient groups or different telemedicine formats is needed to tailor future services to major user groups. However, our study provides initial insights into telemedicine use in middle and old age. In addition, the DEAS panel holds a slight selection bias. Young, highly educated, healthier, and female individuals were somewhat more likely to participate in the DEAS [83]. However, selection bias in the DEAS sample was found to be small and the distribution of major sociodemographic characteristics closely mirrors the distribution within the overall population of Germany [47]. Moreover, only individuals with access to the internet were included in our study. Therefore, generalization of the results might be slightly limited for some groups of the German middle-aged and older population.

Conclusion

Telemedicine services represent a valuable tool to deal with the increasing demand for health care caused by population aging. Knowledge about telemedicine use and its determinants, particularly in middle-aged and older individuals, is essential to promote widespread implementations in the future. Our study highlights the relationship of education, psychosocial, and health factors with telemedicine use of community-dwelling middle-aged and older individuals in Germany during the COVID-19 pandemic. Therefore, telemedicine use does not only depend on health needs of middle-aged and older patients. The finding that particularly highly educated individuals used online health consultations may point toward social inequality among telemedicine users. Consequently, efforts should be made to enable access to telemedicine for all patient groups and individual support should be provided (eg, for patients with low [digital] health literacy) to remove barriers to telemedicine use. Moreover, special attention should be paid to individuals with low life satisfaction and an unhealthy lifestyle since they seem harder to reach through telemedicine services. Finally, future research is needed to test the relevance of the observed relationships in the postpandemic context and identify potential reasons for use or nonuse of telemedicine

services in middle-aged and older adults in Germany (eg, based on qualitative data). Moreover, cross-country comparisons regarding the determinants of telemedicine use remain to be explored.

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Conflicts of Interest

None declared.

Multimedia Appendix 1

Results of random effects logistic regression for determinants of online health consultation use during the COVID-19 pandemic and additional analyses stratified by sex and age.
[DOCX File (Microsoft Word File), 34 KB-Multimedia Appendix 1]

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Abbreviations

CES-D: Center of Epidemiologic Studies - Depression scale
DEAS: Deutsches Alterssurvey (German Ageing Survey)
ISCED: International Standard Classification of Education
OR: odds ratio
SHARE: Survey of Health, Ageing and Retirement in Europe
WHO: World Health Organization

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Multimedia Appendix 1

Table S1. Results of random effects logistic regression for determinants of online health consultation use during the COVID-19 pandemic.

Independent Variables	Results of random effects logistic regression
Female sex	0.83 (0.61 - 1.13)
Age	1.00 (0.98 - 1.03)
High educational level	1.43* (1.06 - 1.93)
Employment status (ref: employed)	
Retired	0.66+ (0.42 - 1.06)
Other/unemployed	0.51+ (0.24 - 1.05)
Household income	1.00 (1.00 - 1.00)
Migration background	1.31 (0.67 - 2.58)
Area lived in (ref: metropolitan districts)	
Urban districts	1.12 (0.79 - 1.61)
(Partially) densely populated rural districts	0.91 (0.60 - 1.38)
Sparsely populated rural districts	0.78 (0.49 - 1.27)
Residential form of partnership (ref: no partner)	
Partner in the same household	1.34 (0.90 - 2.00)
Partner not in the same household	1.47 (0.73 - 2.98)
Having children	1.33 (0.83 - 2.12)
Self-rated health	0.60*** (0.49 - 0.75)
Frequency of physical activity (ref: low frequency)	
Medium frequency	1.58** (1.15 - 2.17)
High frequency	1.74* (1.09 - 2.76)
Frequency of walks (ref: low frequency)	
Medium frequency	1.07 (0.79 - 1.45)
High frequency	1.33 (0.92 - 1.90)
Depressive symptoms	1.14 (0.96 - 1.35)
Loneliness	1.43* (1.06 - 1.93)
Life satisfaction	1.33* (1.02 - 1.73)
Attitute towards own aging	1.15 (0.81 - 1.64)

Perceiving Corona crisis as a personal threat	1.08*
	(1.01 - 1.15)
Oneself infected with Coronavirus (ref: no)	
Yes	1.49
	(0.40 - 5.55)
Unknown	1.06
	(0.23 - 4.83)
People from personal environment infected with Coronavirus (ref: no)	
Yes	0.74+
	(0.53 - 1.04)
Unknown	1.16
	(0.41 - 3.26)
Feeling that one can influence the infection with Coronavirus	1.00
	(0.92 - 1.10)
Constant	0.00***
	(0.00 - 0.04)
Observations	5,456
Individuals	3,222

Note. Odds Ratios are reported with 95% confidence intervals in parentheses. Unless stated otherwise, the reference category is always zero/absence of the characteristic. ref = reference category. *** p<.001, ** p<.01,* p<.05, + p<.10.

Table S2. Results of random effects logistic regression for determinants of online health consultation use during the COVID-19 pandemic stratified by sex.

Independent Variables	Male	Female
Age	1.00	1.01
	(0.97 - 1.03)	(0.97 - 1.04)
High educational level	1.70*	1.21
	(1.12 - 2.56)	(0.77 - 1.91)
Employment status (ref: employed)		
Retired	0.86	0.53+
	(0.45 - 1.62)	(0.26 - 1.06)
Other/unemployed	0.28+	0.66
	(0.07 - 1.07)	(0.26 - 1.67)
Household income	1.00	1.00
	(1.00 - 1.00)	(1.00 - 1.00)
Migration background	0.94	1.90
	(0.37 - 2.38)	(0.69 - 5.24)
Area lived in (ref: metropolitan districts)		
Urban districts	1.14	1.11
	(0.71 - 1.84)	(0.64 - 1.93)
(Partially) densely populated rural districts	0.93	0.90
	(0.53 - 1.65)	(0.48 - 1.71)
Sparsely populated rural districts	0.64	0.97
	(0.33 - 1.22)	(0.47 - 2.03)
Residential form of partnership (ref. no partner)		
Partner in the same household	2.27*	0.96
	(1.13 - 4.59)	(0.57 - 1.62)
Partner not in the same household	2.86*	0.81
	(1.04 - 7.87)	(0.27 - 2.47)
Having children	1.38	1.11
	(0.71 - 2.69)	(0.56 - 2.21)
Self-rated health	0.59***	0.62**
	(0.44 - 0.79)	(0.45 - 0.85)
Frequency of physical activity (ref: low frequency)		
Medium frequency	1.88**	1.22
	(1.22 - 2.90)	(0.75 - 1.96)
High frequency	2.17*	1.32
	(1.17 - 4.03)	(0.65 - 2.70)
Frequency of walks (ref: low frequency)		
Medium frequency	1.02	1.13
	(0.68 - 1.53)	(0.72 - 1.79)
High frequency	1.99**	0.81
	(1.24 - 3.20)	(0.45 - 1.44)
Depressive symptoms	1.12	1.16
	(0.88 - 1.42)	(0.91 - 1.49)
Loneliness	1.94**	1.05
	(1.25 - 2.99)	(0.68 - 1.62)
Life satisfaction	1.30	1.44+
	(0.91 - 1.85)	(0.97 - 2.15)
Attitute towards own aging	1.48	0.81
	(0.92 - 2.36)	(0.46 - 1.40)
Perceiving Corona crisis as a personal	1.08+	1.09+

threat		
	(0.99 - 1.18)	(0.99 - 1.20)
Oneself infected with Coronavirus (ref: no)		
Yes	1.39	1.49
	(0.25 - 7.74)	(0.19 - 11.71)
Unknown	1.19	0.76
	(0.17 - 8.26)	(0.07 - 8.80)
People from personal environment infected with Coronavirus (ref: no)		
Yes	0.68	0.78
	(0.42 - 1.09)	(0.47 - 1.28)
Unknown	0.99	1.90
	(0.27 - 3.61)	(0.34 - 10.80)
Feeling that one can influence the infection with Coronavirus	0.98	1.02
	(0.87 - 1.11)	(0.89 - 1.18)
Constant	0.00***	0.01*
	(0.00 - 0.02)	(0.00 - 0.69)
Observations	2,783	2,673
Individuals	1,636	1,586

Note. Odds Ratios are reported with 95% confidence intervals in parentheses. Unless stated otherwise, the reference category is always zero/absence of the characteristic. ref = reference category. *** p<.001, ** p<.01,* p<.05, + p<.10.

Table S3. Results of random effects logistic regression for determinants of online health consultation use during the COVID-19 pandemic stratified by age groups.

Characteristics	≤64 Years	≥65 Years
Female sex	0.87	0.86
	(0.55 - 1.38)	(0.57 - 1.30)
Age	0.98	1.03*
	(0.93 - 1.03)	(1.00 - 1.07)
High educational level	1.26	1.58*
	(0.79 - 2.01)	(1.06 - 2.37)
Employment status (ref: employed)		
Retired	1.21	0.64
	(0.59 - 2.46)	(0.21 - 1.92)
Other/unemployed	0.65	0.36
	(0.29 - 1.49)	(0.06 - 2.20)
Household income	1.00	1.00
	(1.00 - 1.00)	(1.00 - 1.00)
Migration background	1.52	1.28
	(0.56 - 4.10)	(0.49 - 3.32)
Area lived in (ref: metropolitan districts)		
Urban districts	1.26	1.06
	(0.72 - 2.23)	(0.66 - 1.70)
(Partially) densely populated rural districts	1.03	0.85
	(0.53 - 2.00)	(0.49 - 1.48)
Sparsely populated rural districts	0.86	0.73
	(0.40 - 1.84)	(0.38 - 1.37)
Residential form of partnership (ref. no partner)		
Partner in the same household	1.01	1.66+
	(0.53 - 1.94)	(0.98 - 2.82)
Partner not in the same household	0.92	1.99
	(0.31 - 2.68)	(0.76 - 5.23)
Having children	1.10	1.76
	(0.58 - 2.10)	(0.86 - 3.61)
Self-rated health	0.59**	0.61***
	(0.42 - 0.83)	(0.46 - 0.81)
Frequency of physical activity (ref: low frequency)		
Medium frequency	1.91*	1.52*
	(1.14 - 3.21)	(1.00 - 2.29)
High frequency	2.13+	1.60
	(0.95 - 4.81)	(0.90 - 2.86)
Frequency of walks (ref: low frequency)		
Medium frequency	1.19	1.01
	(0.75 - 1.88)	(0.67 - 1.52)
High frequency	0.95	1.57+
	(0.52 - 1.74)	(0.97 - 2.52)
Depressive symptoms	1.13	1.11
	(0.87 - 1.47)	(0.88 - 1.41)
Loneliness	1.45	1.52*
	(0.91 - 2.32)	(1.01 - 2.29)
Life satisfaction	1.44+	1.29
	(0.93 - 2.22)	(0.91 - 1.82)
Attitute towards own aging	1.09	1.26
	(0.62 - 1.92)	(0.79 - 2.00)
Perceiving Corona crisis as a personal threat	1.10+	1.07
	(1.00 - 1.21)	(0.98 - 1.17)
Oneself infected with Coronavirus (ref: no)		

Yes	1.08	3.19
	(0.22 - 5.22)	(0.23 - 43.82)
Unknown	0.44	3.85
	(0.06 - 3.18)	(0.23 - 63.87)
People from personal environment infected with Coronavirus (ref: no)		
Yes	0.70	0.81
	(0.44 - 1.11)	(0.48 - 1.36)
Unknown	0.57	2.63
	(0.12 - 2.74)	(0.62 - 11.09)
Feeling that one can influence the infection with Coronavirus	0.98	1.02
	(0.84 - 1.13)	(0.90 - 1.15)
Constant	0.02+	0.00***
	(0.00 - 1.41)	(0.00 - 0.01)
Observations	2,031	3,425
Individuals	1,226	2,074

Note. Odds Ratios are reported with 95% confidence intervals in parentheses. Unless stated otherwise, the reference category is always zero/absence of the characteristic. ref = reference category. *** p<.001, ** p<.01,* p<.05, + p<.10.

6. Publication 3: Determinants of Patient Use and Satisfaction With Synchronous Telemental Health Services During the COVID-19 Pandemic: Systematic Review

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Review

Determinants of Patient Use and Satisfaction With Synchronous Telemental Health Services During the COVID-19 Pandemic: Systematic Review

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Abstract

Background: Several recent studies examined patient use and satisfaction with synchronous telemental health services in response to the widespread implementation during the COVID-19 pandemic. However, a systematic review of recent literature on the determinants of these outcomes is missing.

Objective: The aim of this systematic review was to give an extensive overview of the literature on and highlight the influential determinants of patient use and satisfaction with synchronous telemental health services during the COVID-19 pandemic.

Methods: This review satisfied the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines and was registered in PROSPERO. Peer-reviewed, quantitative studies that observed the determinants of patient use or satisfaction with synchronous telemental health services during the COVID-19 pandemic were included. PubMed, PsycInfo, and Web of Science database searches were conducted in August 2022 for English and German language studies published from 2020 onward. Key steps were performed by 2 reviewers. Determinants were synthesized into major categories informed by the dimensions of the widely used and established Unified Theory of Acceptance and Use of Technology.

Results: Of the 20 included studies, 10 studies examined determinants of patient use, 7 examined determinants of patient satisfaction, and 3 observed both outcomes. The quality of the studies was mainly good or fair. There was substantial heterogeneity in the study designs, methods, and findings. Sociodemographic characteristics and health-related determinants were mostly considered. Some of the major dimensions of the Unified Theory of Acceptance and Use of Technology were neglected in recent studies. Although most findings were mixed or nonsignificant, some indications for potential relationships were found (eg, for sex, age, and symptom severity).

Conclusions: The findings revealed potential target groups (eg, female and young patients with mild symptoms) for future postpandemic telemental health interventions. However, they also identified patient groups that were harder to reach (eg, older patients with severe symptoms); efforts may be beneficial to address such groups. Future quantitative and qualitative research is needed to secure and expand on recent findings, which could help improve services.

Trial Registration: PROSPERO CRD42022351576; https://tinyurl.com/yr6zrva5

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KEYWORDS

telemedicine; digital health; teletherapy; mental health; use; satisfaction

Introduction

Background

Over the past 3 decades, health care services were usually delivered in person. Telemedicine is a promising, alternative service delivery model. The World Health Organization [1] summarized the four core characteristics of telemedicine as follows: (1) its purpose is to provide clinical support; (2) it is intended to overcome geographic barriers, connecting users who are not in the same physical location; (3) it involves the use of various types of information and communication technology; and (4) its goal is to improve health outcomes. Telemedicine benefits have been evaluated in the past and include, for example, reduced costs and improved access to services and information [2,3]. Evidence also suggests that telemedicine, in general, is a clinically and cost-effective tool with high satisfaction in patients and health care professionals [4]. However, the implementation of telemedicine has often been hindered by multiple barriers regarding reimbursement and clinical, legal, sustainability, and social issues [5,6].

In the wake of the COVID-19 pandemic, rapid changes in the delivery of health care services had to be made to prevent further spread of the virus, to protect people at higher risk of severe illness from COVID-19 (eg, patients with cancer, cardiovascular disease, or chronic respiratory disease), and to relieve the strain on the health care system. Consequently, telemedicine has been used worldwide across multiple specialties [7-9]. For instance, a large cohort study by Weiner et al [10] reported an increase in telemedicine use from 0.3% of ambulatory contacts between March and June 2019 to 23.6% between March and June 2020 among privately insured working-age individuals in the United States. Most telemedicine services were delivered via synchronous video or telephone calls during those periods [8].

The outbreak of the COVID-19 pandemic was also linked to stressors such as restrictions in everyday life, lifestyle changes, social isolation, and uncertainty and worries regarding health, finances, and work, which caused psychological burden [11]. Consequently, multiple studies have observed an increase in public mental health problems [12,13]. Liu et al [12] included 71 papers in their meta-analysis and detected an increased prevalence of anxiety (32.60%, 95% CI 29.10%-36.30%), depression (27.60%, 95% CI 24.00%-31.60%), insomnia (30.30%, 95% CI 24.60%-36.60%), and posttraumatic stress disorder (16.70%, 95% CI 8.90%-29.20%) during the pandemic. Moreover, preexisting mental health conditions were found to aggravate owing to the pandemic [14]. Therefore, patients with mental health conditions represented an especially vulnerable group during that time.

Telemental health services played an essential role in managing the increased public mental health burden and preventing the worsening of psychological symptoms. Mental health services are well suited for the remote format, as they do not require physical examination and can be delivered in multiple ways (eg, via telephone and video calls or mobile apps) [15]. In fact, telemental health services were found to be part of the medical specialty with the highest use rate during the pandemic [9]. The National Institute of Mental Health defined telemental health services as the use of telecommunications or videoconferencing technology to provide mental health services [16]. This can include synchronous (eg, videoconference and telephone) and asynchronous (eg, mobile apps and email) services. Regarding the effectiveness of telemental health services, an umbrella review of 19 systematic reviews on telemental health services before the pandemic suggested that remote mental health services produced at least moderate reductions in symptom severity and could be as effective as in-person formats [17]. They also found that user acceptance and satisfaction of telemental health services were comparable with those of in-person interventions. Recent reviews have also reported the effectiveness of and high patient and provider satisfaction with telemental health services during the pandemic [18,19]. Therefore, telemental health services seem to be a valuable addition to the treatment of mental illnesses of which implementation should be supported in the postpandemic future [20,21].

A crucial factor in the successful implementation of telemental health services is patient acceptance. In previous research, no universal definition of technology or telemedicine acceptance was identified. However, past definitions can be sorted into four main categories, which refer to (1) the effectiveness or efficiency of the services, (2) the use or adoption of the services, (3) the intention or willingness to use the services, and (4) consumer or provider satisfaction with the services [22-26]. To set a more precise focus, this systematic review concentrates only on patient use and satisfaction. In the course of this systematic review, patient use includes different measures of use behavior, such as the adoption of a new service, frequency of use, or attendance. Multiple definitions of patient satisfaction were introduced in the past and include various perspectives. For example, the expectancy-disconfirmation model defines consumer satisfaction as a function of expectation and expectancy disconfirmation, which can influence attitude change and purchase intention [27]. Although this definition is widely used, there is a lack of consensus regarding the definition of satisfaction [28]. The systematic review by Giese and Joseph [28] summarized three essential components of consumer satisfaction: (1) a summary affective response, which varies in intensity; (2) satisfaction, which focuses on product choice, purchase, and consumption; and (3) time of determination, which varies by situation but is generally limited in duration.

Different theories have been introduced to explain why patients accept telemedicine services. The Unified Theory of Acceptance and Use of Technology (UTAUT) [23] was thereby one of the most frequently used theories to predict patient acceptance of telemedicine [29]. In this theory, the key determinants of behavioral intention and technology use behavior are performance expectancy, effort expectancy, social influence, and facilitating conditions. In the context of telemedicine, performance expectancy is the degree to which an individual believes that using telemedicine could be helpful. Effort expectancy refers to the perceived ease of using the service, which also includes the effect of factors such as computer anxiety and computer self-efficacy. Furthermore, social influence means the degree to which an individual believes that others think that they should use telemedicine. Facilitating

conditions include perceived organizational and technical infrastructure to support the use of telemedicine. Additional influential constructs in this theory include gender, age, experience, and voluntariness of use. User satisfaction was also found to be associated with major UTAUT constructs and to potentially contribute to the service reuse intentions [30,31].

Objective

In addition to theoretical models, only few systematic reviews have summarized the determinants of patient use or satisfaction with telemental health services from prepandemic studies [32,33]. Potential determinants that were observed in these reviews were sex, age, education, socioeconomic status, living arrangement, cognitive function, experience with telehealth technology, comfort with using the internet, satisfaction with the health care provider, experience with the clinic, and cultural background [32,33]. Nevertheless, these reviews also highlighted the need for further research on this topic. The rapid, extensive implementation of synchronous telemental health services during the COVID-19 pandemic sparked international interest in the topic. Several studies examined the determinants of patient use and satisfaction with telemental health services since the pandemic. However, a systematic review of recent literature is missing.

Conducting such a systematic review may be helpful in identifying target groups, as well as groups that need further attention and support in relation to telemental health services. This could be of major importance to successfully implement postpandemic telemental health interventions and benefit from the remote format in the future, where it can be a valuable tool to deal with challenges, such as population aging (ie, shortage of health care professionals and increased demand for long-term care), stigma attached to visiting mental health facilities and undersupply in rural areas [34,35]. Moreover, it could be useful to identify gaps in the literature and guide future research. Therefore, the objective of this systematic review was to give an extensive overview of the literature on and highlight the influential determinants of patient use and satisfaction with synchronous telemental health services during the COVID-19 pandemic. In other words, this systematic review examined the following research question: what are the determinants of patient use of and satisfaction with synchronous telemental health services in studies conducted during the COVID-19 pandemic?

Methods

Overview

The systematic review protocol is available in PROSPERO (registration number: CRD42022351576). This manuscript was written in accordance with the most recent version of the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines [36].

Eligibility Criteria

For this systematic review, peer-reviewed quantitative studies in German or English that observed determinants of patient use or satisfaction with synchronous telemental health services during the COVID-19 pandemic were included. Only peer-reviewed quantitative studies were considered to assure high quality of the included studies. As most of the telemedicine services were delivered via synchronous services during the pandemic [8] and to assure comparability among the studies, only synchronous telemental health services were included. Mental health patients of all age groups (ie, children, adolescents, and middle- and older-aged adults) were considered to obtain as much information as possible from recent studies. Therefore, studies were excluded if they referred to (1) asynchronous services or eHealth interventions, (2) exclusively individuals with physical illnesses (to assure comparability among the samples), (3) data that were collected before the COVID-19 pandemic, (4) qualitative data, (5) outcomes that were not related to the use or satisfaction with telemental health services, or (6) studies that did not examine determinants of use or satisfaction with the services.

Search Strategy

We searched the PubMed, PsycInfo, and Web of Science databases for studies published from 2020 onward. The PubMed and Web of Science databases are well established and frequently used in medical and related research fields. Moreover, they have also been recommended for searching telemedicine-related studies [37]. In addition, the PsycInfo database was included to account for the mental health context. A predefined search query was used to filter the databases (see Table 1 for the PubMed search query). Moreover, reference lists of eligible studies were screened for additional relevant articles. A pretest including 100 titles and abstracts was conducted before the screening process started.

Table 1. Search strategy (PubMed).

Serial number	Search term	Limits (filter, limits, and refine)
1	*telepsychiatry OR online therap* OR telepsychology OR teleconferenc* OR teleconsult* OR online consult* OR videoconferenc* OR video consult* OR phone consultation* OR telephone OR telemental* OR teletherapy OR video call OR televideo OR telehealth OR telemedicine*	• Text word
2	*satisfaction OR utilization OR engagement OR usage OR adherence OR patient satisfaction OR patient engagement*	• All fields
3	*predict* OR determin* OR associat* OR correlat**	• All fields
4	#1 *AND* #2 *AND* #3	• Publication years: 2020-2022 • Language: English and German • Species: humans

Selection Process

In August 2022, all the results from the different databases were imported to EndNote (Clarivate), where duplicates were removed. For the next step, 2 reviewers (AN and JB) independently screened the titles and abstracts of the studies, followed by a full-text screening (Cohen κ=0.61). The Rayyan web application was used to support the double-screening process [38]. Disagreements (15/144, 10.4% of studies) were resolved via discussion and consultation with a third reviewer (AH) when needed.

Data Collection Process

Relevant data from articles that passed the full-text screening were extracted by 1 reviewer (JB) and crosschecked by a second reviewer (AN) using an Excel spreadsheet (Microsoft Corp). The information that was extracted included study characteristics (author, year, study design, country, study period, and data source), population characteristics (sample size, sex, and age), setting (psychiatric care setting and telemental health service type), outcome definition, determinants, analytic approach, and key findings. For missing information or for reasons of clarification, the corresponding authors of the studies were contacted.

Quality Assessment

The risk of bias was assessed by 2 reviewers independently (AN and JB) using the assessment tool for observational cohort and cross-sectional studies by the National Heart, Lung and Blood Institute [39]. Disagreements were resolved via discussion and consultation with a third reviewer (AH) when needed.

Synthesis Methods

A formal narrative synthesis of the study results was conducted following the current reporting guidelines for syntheses without meta-analysis in systematic reviews [40]. General study characteristics were summarized in a tabular format. Key findings concerning the determinants of patient use and satisfaction were grouped into categories based on the UTAUT constructs. The UTAUT constructs were adapted and extended depending on the focus of the different studies and the pandemic context. The final categories included performance expectancy, effort expectancy, facilitating conditions, and experience. Age and gender were included into a larger category that contained sociodemographic determinants. The social influence category was adapted to include psychosocial influence to account for the special pandemic situation. Owing to the pandemic circumstances, voluntariness of use was excluded as a category because there was often no option to choose between in-person and telemental health visits. In addition, health- and service-related factors were added as categories to account for potential satisfaction-specific determinants. A meta-analysis of the results was not conducted because of the high heterogeneity across the study designs, outcomes, and effect measures. However, regression coefficients, correlations, and odds ratios were reported when available. In addition, if available, related CIs were specified to assess the certainty of the findings.

Results

Quality Assessment

The ratings for study quality are summarized in Tables 2 and 3. Most studies were rated as being of either good (n=12) or fair (n=6) quality. The quality criteria that were most commonly not met in the different studies were the reporting of participation rates (20% fulfilled) and sample size justification, power description or variance, and effect estimates (10% fulfilled).

Table 2. Quality assessment for the included studies (studies [41-50]).

Criteria	Studies									
	Ainslie et al [41]	Ceniti et al [42]	Chakawa et al [43]	Connolly et al [44]	Guinart et al [45]	Haxhihamza et al [46]	Hutchison et al [47]	Lewis et al [48]	Lohmiller et al [49]	Lynch et al [50]
1. Was the research question or objective in this paper clearly stated?	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No
2. Was the study population clearly specified and defined?	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
3. Was the participation rate of eligible persons at least 50%?	N/A[a]	NR[b]	NR	N/A	No	CD[c]	No	Yes	NR	No
4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	No
5. Was a sample size justification, power description, or variance and effect estimates provided?	No	No	No	Yes	No	No	No	No	No	No
6. For the analyses in this paper, were the exposures of interest measured prior to the outcomes being measured?	N/A	N/A	N/A	N/A	N/A	N/A	Yes	N/A	N/A	N/A
7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?	N/A	N/A	N/A	N/A	N/A	N/A	Yes	N/A	N/A	N/A
8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (eg, categories of exposure or exposure measured as continuous variable)?	Yes	Yes	Yes	Yes	Yes	CD	Yes	Yes	Yes	Yes
9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	Yes	Yes	Yes	No (patients vs providers)	Yes	No	Yes	Yes	Yes	Yes
10. Was the exposures assessed more than once over time?	Yes (2 waves)	No	Yes (2 waves)	Yes (2 waves)	No	No	Yes (before and after)	No	No	Yes (3 waves)
11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
12. Were the outcome assessors blinded to the exposure status of participants?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
13. Was loss to follow-up after baseline 20% or less?	Yes/	N/A	Yes	Yes	N/A	N/A	Yes	N/A	N/A	Yes
14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposures and outcomes?	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes
Quality rating	Good	Good	Fair	Good	Fair	Poor	Fair	Good	Good	Fair

[a]N/A: not applicable.

[b]NR: not reported.

[c]CD: cannot determine.

Table 3. Quality assessment for the included studies (studies [51-60]).

Criteria	Studies									
	Meininger et al [51]	Michaels et al [52]	Miu et al [53]	Morgan et al [54]	Nesset et al [55]	Severe et al [56]	Sizer et al [57]	Ter Heide et al [58]	Tobin et al [59]	Vakil et al [60]
1. Was the research question or objective in this paper clearly stated?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Was the study population clearly specified and defined?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3. Was the participation rate of eligible persons at least 50%?	Yes	No	N/A[a]	NR[b]	No	No	Yes	Yes	N/A	N/A
4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5. Was a sample size justification, power description, or variance and effect estimates provided?	No	No	No	Yes	No	No	No	No	No	No
6. For the analyses in this paper, were the exposures of interest measured prior to the outcomes being measured?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (eg, categories of exposure or exposure measured as continuous variable)?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
10. Was the exposures assessed more than once over time?	No	No	No	No	No	No	No	No	Yes (3 waves)	Yes (2 waves)
11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
12. Were the outcome assessors blinded to the exposure status of participants?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
13. Was loss to follow-up after baseline 20% or less?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes	Yes
14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposures and outcomes?	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Quality rating	Good	Fair	Good	Good	Poor	Fair	Good	Good	Good	Good

[a]N/A: not applicable.

[b]NR: not reported.

Overview of Included Studies

After the study selection process, 20 studies remained for the final synthesis (Figure 1; see Multimedia Appendix 1 [41-60] for the citations of all included studies). The main characteristics of these studies are summarized in Tables 4 and 5.

The study samples were predominantly from North America (n=14, with 12 from the United States and 2 from Canada). Furthermore, 5 study samples were from Europe (2 from Germany, 1 from the Netherlands, 1 from Norway, and 1 from North Macedonia), and 1 study sample was from Asia (Israel). Data sources consisted of electronic medical records in 7 studies as well as samples recruited from mental health clinics and community centers in 12 studies. One study used data from a sample that was recruited through targeted emails to mental health organizations nationwide, provincial psychiatric and family physician associations, hospital newsletters, existing participant networks within Canadian Biomarker Integration Network in Depression, and social media. A total of 4 studies were published in 2020, 6 in 2021, 8 in 2022, and 2 in 2023. Although most of the data were collected during the first months of the pandemic, starting from March 2020, some studies also included data from later periods until December 2021.

Figure 1. Flow diagram of the study selection process.

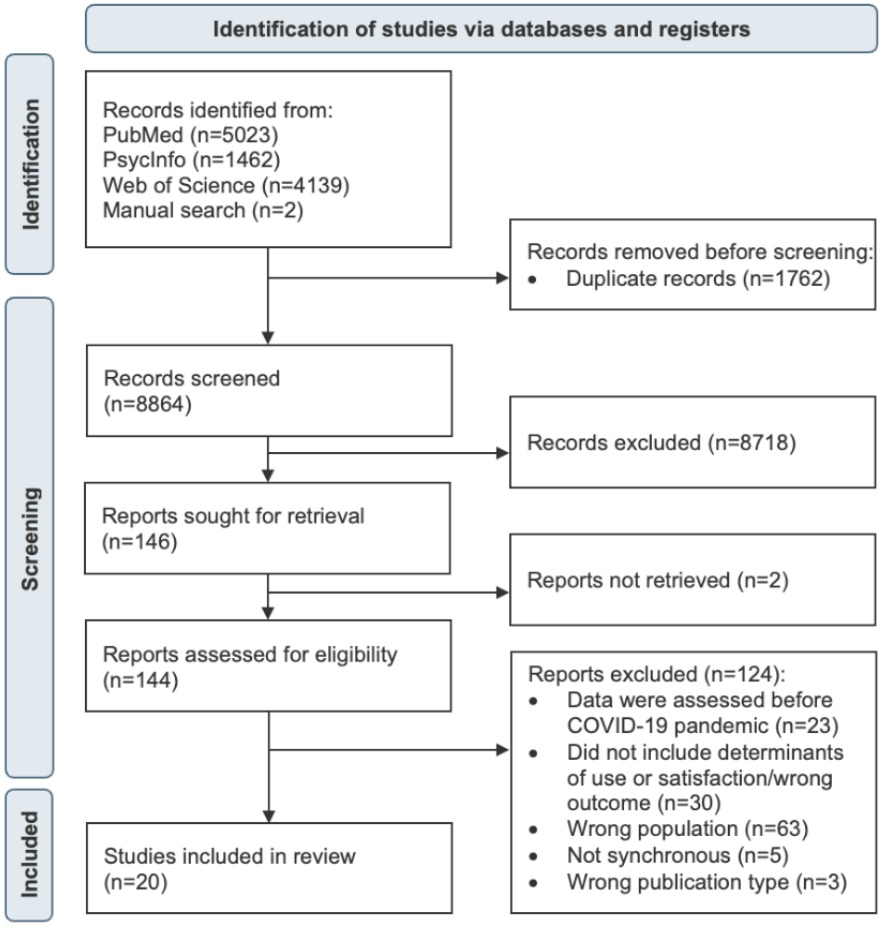

Table 4. Main characteristics of the included studies.

Study, year	Characteristics				
	Study design	Country	Study period	Data source	Population characteristics (sample size; sex: female; age [years], mean [SD])	Psychiatric care setting
Ainslie et al [41], 2022	Observational retrospective study	United States	• Study base period: December 1, 2019, to February 29, 2020 • Study retention period: April 1 to June 30, 2020 • Time trends comparison with study base period: December 1, 2018, to February 28, 2019 • Time trends comparison with study retention period: April 1 to June 30, 2019	Electronic medical record data	• Medicaid beneficiaries with SMIs[a], N=15,471 in 2020 • Sex: n=6792 (54.7%) • Age: mean age not reported	Community mental health centers
Ceniti et al [42], 2022	Cross-sectional, mixed methods study	Canada	• October 8, 2020, to February 4, 2021	Recruitment through targeted emails to mental health organizations nationwide, provincial psychiatric and family physician associations, hospital newsletters, existing participant networks within CAN-BIND[b], and social media	• Mental health care users N=332 • Sex: n=238 (71.7%) • Age: mean age not reported	General remote care experience
Chakawa et al [43], 2021	Comparative study	United States	• Before COVID-19: April to October 2019 • During COVID-19: April to October 2020	Recruited from clinic	• Children aged 1-19 years, N=226 (n=106 for in-person cases before COVID-19, n=120 for telehealth visits cases during COVID-19) • Sex: n=83 (36.7%) (before COVID-19 38.7%, during COVID-19 35%) • Age: 8.04 (4.30); before COVID-19 mean 7.0, during COVID-19 mean 8.0	Large, inner-city pediatric primary care clinic within a large regional children's hospital
Connolly et al [44], 2021	Cross-sectional study	United States	• Pre-COVID: October 1, 2017, to March 10, 2020 • COVID: March 11 to July 10, 2020	Electronic medical record	• US veterans with ≥1 mental health outpatient appointment N=2,480,119 before COVID-19; N=1,054,670 during COVID-19; N=954,704 cases from COVID-19 included in pre-COVID cases • Sex: before COVID-19 n=325,225 (13.5%), during COVID-19 n=163,186 (15.8%) • Age: mean age not reported	Department of Veterans Affairs
Guinart et al [45], 2020	Cross-sectional study	United States	• April to June 2020	Recruited from clinics and community centers	• Patients using telepsychiatry N=3052 • Sex: not reported • Age: mean age not reported	18 hospitals and community centers located in rural, suburban, small urban, and large urban areas

Study, year	Characteristics					
	Study design	Country	Study period	Data source	Population characteristics (sample size; sex: female; age [years], mean [SD])	Psychiatric care setting
Haxhihamza et al [46], 2021	Cross-sectional study	North Macedonia	• Not reported	Recruited from clinic	• Patients from the ward N=28 • Sex: n=11 (37.9%) • Age: mean 40.25 (19)	Daily hospital as a part of the University Clinic in Skopje
Hutchison et al [47], 2022	Cross-sectional study	United States	• October 2020 to June 2021	Recruited from clinic	• Adolescents aged 12-17 years, N=56 • Sex: n=37 (66.1%) • Age: 14.5 (1.6)	Community mental health clinic
Lewis et al [48], 2021	Cross-sectional study	Israel	• Mid-April to mid-May 2020	Recruited from clinic	• Eating disorder patients N=63 • Sex: n=57 (90.5%) • Age: 27.25 (11.47)	Hadarim Eating Disorders Treatment Center (part of the Shavata Mental Health Center)
Lohmiller et al [49], 2021	Cross-sectional study	Germany	• July 2020 to February 2021	Recruited from clinic	• Patients from the psychosomatic outpatient clinic N=278 • Sex: n=182 (83%) • Age: 31.5 (range 18-80)	Psychosomatic outpatient clinic at the University Hospital in Tübingen
Lynch et al [50], 2021	Cross-sectional, mixed methods study	United States	• February 2 to June 12, 2020 • Before COVID-19 (t1): February 2 to March 18, 2020 • After COVID-19 1 (t2): March 19 to April 30, 2020 • After COVID-19 2 (t3): May 1 to June 12, 2020	Recruited from clinic	• Adults with SMI (N=72; t1, n=60; t2, n=64; and t3, n=62) • Sex: t1 n=23 (38.3%), t2 n=20 (31.3%), and t3 n=21 (33.9%) • Age: t1 28.1 (10), t2 28.22 (10.7), and t3 28.45 (11.14)	Private university-affiliated outpatient psychiatric treatment center
Meininger et al [51], 2022	Cross-sectional study	Germany	• July 27 to October 22, 2020	Recruited from clinic	• Parents or caregivers answering for or with their children receiving teletherapy N=168 • Sex: n=61 (36.3%) • Age: 12.29 (4.01)	University Hospital Cologne—School for Child and Adolescent Cognitive Behavior Therapy
Michaels et al [52], 2022	Cross-sectional study	United States	• Not reported	Recruited from clinic	• College students in a postacute outpatient program who recently required psychiatric hospitalization N=101 • Sex: n=72 (74.5%) • Age: 22.5 (2.8)	Outpatient mental health clinic at a local psychiatric hospital that provides specialized postacute services to college students
Miu et al [53], 2021	Cross-sectional study	United States	• January 16 to April 30, 2020	Electronic medical record	• SMI and non-SMI patients N=1444 • Sex: n=970 (67.2%) • Age: mean age not reported	Outpatient psychiatry clinic of an urban, academic medical center
Morgan et al [54], 2021	Cross-sectional study	United States	• March 20 to June 10, 2020	Electronic medical record	• Clients in marriage and family training clinics (telehealth sample) N=142 • Sex: n=79 (55.6%) • Age: 32.56 (16.58)	A total of 2 marriage and family training clinics
		Norway				

Study, year	Characteristics					
	Study design	Country	Study period	Data source	Population characteristics (sample size; sex: female; age [years], mean [SD])	Psychiatric care setting
Nesset et al [55], 2023	Cross-sectional study		• October-December 2021	Recruited from clinic	• Patients from outpatient clinic who attended therapy for aggressive and violent behavior against their partners and children N=28 • Sex: n=7 (25%) • Age: mean age not reported	Outpatient clinic at St Olav's University Hospital, Center for Research and Education in Security, Prisons, and Forensic Psychiatry
Severe et al [56], 2020	Cross-sectional study	United States	• June-August 2020	Recruited from clinic	• Patients who had an in-person appointment date that fell in the first few weeks following the Michigan governor's stay-at-home edict, necessitating conversion to web-based visits or deferment of in-person care N=244 • Sex: n=167 (68.4%) • Age: mean age not reported	Outpatient Psychiatry Clinics at the University of Michigan
Sizer et al [57], 2022	Cross-sectional study	United States	• April 1, 2020, to March 31, 2021	Electronic medical record	• Patients from rural outpatient clinics N=1115 • Sex: n=623 (55.9%) • Age: not reported	A total of 6 Northeast Delta Human Services Authority outpatient behavioral health clinics
Ter Heide et al [58], 2021	Cross-sectional study	Netherlands	• June 3 to July 31, 2020	Recruited from clinic	• Patients with complex psychotrauma complaints N=318 • Sex: n=130 (40.9%) • Age: 52 (11.9)	ARQ Centrum '45 (National institute for diagnostics and treatment of complex psychotrauma complaints)
Tobin et al [59], 2022	Retrospective cohort study	United States	• January 1 to December 31, 2020 • Before COVID-19: January 1 to March 18, 2020 • Telehealth only: March 19 to May 31, 2020, December 1 to December 31, 2020 • Choice between telehealth and in-person services: June 1 to November 30, 2020	Electronic medical record	• Patients seen by integrated psychology team in general internal medicine N=1075 encounters • Sex: n=759 (70.6%) • Age: 49.73 (15.89)	Integrated psychology team within the general internal medicine primary care clinic at a large urban health system
Vakil et al [60], 2022	Retrospective cohort study	Canada	• Comparison sample: March 19, 2019, to March 18, 2020 • COVID-19 sample: March 19, 2020, to April 7, 2021	Electronic medical record	• Patients in need of urgent mental health assessment and treatment without referral N=3573 visits • Sex: n=1981 (55.4%) • Age: 33.9 (13.4)	Crisis Response Center

[a]SMI: serious mental illness.

[b]CAN-BIND: Canadian Biomarker Integration Network in Depression.

Table 5. Characteristics of the included studies.

Study, year	Characteristics				
	Telemental health service type (telephone vs video)	Outcome (use vs satisfaction and assessment)	Determinants	Analytic approach	Quality rating
Ainslie et al [41], 2022	All forms of telemental health services	Use: use from pandemic identified by service claim codes; categorized based on percentage of total treatment services during the retention period (low: <25%; medium: 25%-75%; high: >75%)	Sex, age group, diagnosis, and zip code (rural vs urban)	Chi-square test and logistic regression	Good
Ceniti et al [42], 2022	All forms of telemental health services	Use: number of remote visits Satisfaction: 7-point Likert scale (from total dissatisfied to total satisfied) for overall satisfaction with remote care, security, user-friendliness, speed of access and provision of care, continuity of care, convenience, maintenance of therapeutic rapport	Age, type of provider (psychiatrist or family physician vs other mental health care providers), level of connectedness with loved ones, living with others, province or territory, high-risk status for COVID-19, frequency of internet use, and number of people living at home	Chi-square test and Spearman correlation	Good
Chakawa et al [43], 2021	Video (or telephone or audio-only when there were technical problems)	Use: differences in service delivery modality use (in-person visit before COVID-19 vs telehealth use during COVID-19)	Sex, age, referral concern, health insurance type, race or ethnicity, language, controlling for primary care provider, visit control variable (assigned or familiar or not), and appointment type (first or follow-up visit)	Binominal logistic regression	Fair
Connolly et al [44], 2021	Telephone vs video vs in-person services	Use: having had any video experience (before COVID-19 vs during COVID-19); having had ≥50% of visits via phone vs video vs in person	Sex, age, socio economic status, race or ethnicity, rurality, marital status, ≥50% Department of Veterans Affairs disability rating, diagnosis, and history of mental health hospitalization	Binominal and multinomial logistic regression	Good
Guinart et al [45], 2020	Telephone vs video services	Satisfaction: overall experience (telephone or video), perceived helpfulness of remote sessions, challenges and advantages	Age and duration of care	Chi-square test	Fair
Haxhihamza et al [46], 2021	Not specified	Satisfaction: Patient Satisfaction Questionnaire (18 items with 7 dimensions of satisfaction with medical care measured by the Patient Satisfaction Questionnaire-III: general satisfaction, technical quality, interpersonal manner, communication, financial aspects, time spent with doctor, accessibility and convenience)	Age, gender, and place of living	Not specified	Poor
Hutchison et al [47], 2022	Video services	Use: attendance across sessions Satisfaction: Treatment Perception Questionnaire (10 items; general satisfaction and acceptability of mental health services); Internet Evaluation and Utility Questionnaire (15 items; ease of use, convenience, engagement, privacy, satisfaction and acceptability of an internet intervention)	Risk status for adverse mental and behavioral outcomes, and symptom severity	Bivariate correlation and *t* test	Fair

Study, year	Characteristics				
	Telemental health service type (telephone vs video)	Outcome (use vs satisfaction and assessment)	Determinants	Analytic approach	Quality rating
Lewis et al [48], 2021	Web-based platforms, not specified	Satisfaction: Telemedicine Satisfaction Questionnaire (15 items, 5-point Likert scale, 3 factors: quality of care, similarity of remote meetings to face-to-face meetings, perception of the interaction); perspective toward the transition to web-based treatment (6 self-developed statements, 1-5 Likert scale, perception of care, preference of web-based treatment to face-to-face treatment, promotion of this mode of therapy toward others)	Age, gender, education, BMI, duration of treatment in days, past eating disorder, hospitalization, Eating Disorder Examination Questionnaire, Depression, Anxiety and Stress Scales-21, Working Alliance Inventory-S, fear of COVID-19 scale-19S	*t* test and Pearson correlation	Good
Lohmiller et al [49], 2021	Telephone vs video vs in-person services	Satisfaction: self-developed questionnaire with 4 subject areas: patient characterization (10 items), assessment of therapeutic contact (12 items), therapeutic relationship (11 items), hurdles (5 items), 5 additional free-text items	Age, gender, and type of contact	Chi-square test, ANOVA, and hierarchical regression	Good
Lynch et al [50], 2021	Video services	Use: no show or cancellation frequency	Age, gender, race or ethnicity, primary diagnosis, and time period	Model building approach using generalized linear modeling with a Poisson log link (multilevel approach because of nested data structure was used)	Fair
Meininger et al [51], 2022	Video services	Satisfaction: self-developed questionnaire, 11 items: stable internet connection, overall satisfaction, intention to use teletherapy after pandemic=mean satisfaction score; changes in treatment satisfaction and changes in the therapeutic relationship=mean satisfaction change score	Corona Child Stress Scale, psychosocial functioning (Children's Global Assessment Scale, Child Behavior Checklist [6-18 R] and Youth Self Report [11-18 R]), Checklist for Screening Behavioral and Emotional Problems, and number of teletherapy sessions	Pearson correlation	Good
Michaels et al [52], 2022	Telephone vs video vs in-person services	Satisfaction: preferred telehealth method, overall experience (telephone or video), future telehealth use, perceived helpfulness of remote sessions	Sex, gender, race, and teletherapy format	Chi-square test, Mann-Whitney *U* test, and Kruskal-Wallis test	Fair
Miu et al [53], 2021	Video or telephone vs in-person services	Use: conversion rate to teletherapy for SMI[a] patients vs non-SMI patients, number of teletherapy sessions between SMI and non-SMI group, differences in new patients starting therapy via telehealth between SMI and non-SMI groups	Age, sex, ethnicity, previous engagement, and SMI vs non-SMI groups	Chi-square test and *t* test	Good
Morgan et al [54], 2021	Video and telephone services	Use: conversion to teletherapy (attendance of at least 1 teletherapy session vs opting out), engagement in teletherapy (number of teletherapy sessions)	Age, gender, race, ethnicity, relationship status, income, education, number of sessions before teletherapy, and case constellation (individual vs relational therapy)	*t* test, logistic regression, and multiple linear regression	Good
Nesset et al [55], 2023	Video services	Satisfaction: Client Satisfaction Questionnaire-8 (8 items measure respondents' perception of treatment quality)	Gender	*t* test	Poor
Severe et al [56], 2020	Video and telephone services	Use: visit type	Age, sex, race, health insurance type, and number of previous clinic visits	Multiple logistic regression	Fair

Study, year	Characteristics				
	Telemental health service type (telephone vs video)	Outcome (use vs satisfaction and assessment)	Determinants	Analytic approach	Quality rating
Sizer et al [57], 2022	Video and telephone services	Use: number of visits	Age, gender, education (number of school years), race, referral source, monthly income, discharge, chronic condition, number of diagnoses, primary diagnosis type	Negative binomial regression	Good
Ter Heide et al [58], 2021	Video services	Use: 1 item: how did you stay in touch with your therapist during the past 2 mo? (Multiple answers could be given: face-to-face, via videoconferencing, via telephone, through email or chat, not at all) Satisfaction: one item: how satisfied were you with this form of contact, rated on a scale from 0 (not at all satisfied) to 10 (as satisfied as can be)?	Age, gender, level of education, refugee status, Brief Symptom Inventory, Cantril Ladder (life satisfaction), COVID-19 stress level	Pearson product-moment correlation, MANCOVA[b], ANCOVA[c], chi-square test, binary logistic regression, and *t* test (2-tailed)	Good
Tobin et al [59], 2023	Telephone vs video vs in-person services	Use: visit type	Age, sex, race, and health insurance type	Logistic regression	Good
Vakil et al [60], 2022	Video or telephone vs in-person services	Use: visit type	Age, sex, distance to crisis response center, household income, prior visit to the center within 1 year, suicidal behavior, diagnosis, visit characteristics (day of the week, time of day, and period of pandemic)	Binary logistic regression	Good

[a]SMI: serious mental illness.

[b]MANCOVA: multivariate analysis of covariance.

[c]ANCOVA: analysis of covariance.

Patient use was examined in 10 studies [41,43,44,50,53,54,56,57,59,60], patient satisfaction in 7 studies [45,46,48,49,51,52,55], and both outcomes were observed in 3 studies [42,47,58]. Patient use was mostly defined as having at least 1 telemental health visit during the pandemic [43,44,53,54,56,58-60]. However, others have also considered the number of telemental health visits [42,53,54,57] and the percentage of telemental health services in overall mental health service use during the pandemic [41,44] or attendance [47,50]. For patient satisfaction, 6 studies used self-developed items and scales [42,45,49,51,52,58], whereas 4 studies used established instruments (ie, Telemedicine Satisfaction Questionnaire [61], Client Satisfaction Questionnaire [62], Patient Satisfaction Questionnaire [63], Treatment Perception Questionnaire [64], and Internet Evaluation and Utility Questionnaire [65]) [46-48,55]. The satisfaction questionnaires mainly focused on the overall satisfaction with the services. Nevertheless, specific satisfaction areas such as satisfaction with the therapeutic relationship and interaction, quality of care, technical aspects, or utility were also addressed.

Most samples included adult populations [42,44,46,49,50,52,55,57,58]. However, children or adolescents were also considered in other studies [41,45,48,53,54,56]. Moreover, some studies exclusively used data collected from children and adolescents [43,47,51]. The sample sizes ranged from 28 to 1,054,670 individuals, with 5 studies including less than 100 individuals, 8 including more than 100 individuals, and 7 including more than 1000 individuals. The proportion of female participants ranged from 15.8% (Department of Veterans Affairs [44]) to 90.5% (patients with an eating disorder [48]). The mean percentage of female participants in the included studies was approximately 55%.

Although none of the included studies used a theoretical model as a background for their analysis, the following sections are based on the UTAUT dimensions to allow for some theoretical context. This may guide future research in this area.

Patient Use

Overview

Key findings for the determinants of patient use of telemental health services are summarized in Table 6 (if reported, adjusted results are presented).

Table 6. Key findings of the included studies for determinants[a] of patient use.

Study, year	Sociodemographic factors (eg, sex, age, race, education, and area lived in)	Health factors (eg, diagnosis, symptoms, and symptom severity)	Service factors (eg, video or telephone and duration of treatment)	Experience (with mental health services)	Facilitating conditions (eg, electronic devices, internet connection, and insurance)
Ainslie et al [41], 2022	• Female sex was negatively associated with going from low to either moderate or high telemedicine use (OR[b] 0.87, 95% CI 0.86-0.92). • Compared with patients aged ≥55 y, patients aged 0-12 y (OR 1.18, 95% CI 1.09-1.27) and 13-17 y (OR 1.16, 95% CI 1.09-1.25) had greater odds; patients aged 18-34 y (OR 0.74, 95% CI 0.70-0.79) and 35-54 y (OR 0.79, 95% CI 0.74-0.84) had lower odds of progressing from low to either moderate or high telemedicine use. • Living in an urban or rural area did not significantly change the probability for telemedicine use (*P*=.009).	• Except for bipolar disorder (OR 0.93, 95% CI 0.84-1.02), patients with diagnoses other than schizophrenia (reference) were negatively associated with progressing from low to either moderate or high use (major depression, OR 0.73, 95% CI 0.68-0.78; PTSD[c], OR 0.77, 95% CI 0.72-0.83; and anxiety or other disorders, OR 0.69, 95% CI 0.65-0.74).	_[d]	—	—
Ceniti et al [42], 2022	• There were no significant age differences (≥50 vs <50 y) regarding video vs telephone service use (detailed results, including numbers, were not reported).	—	—	—	—

Study, year	Sociodemographic factors (eg, sex, age, race, education, and area lived in)	Health factors (eg, diagnosis, symptoms, and symptom severity)	Service factors (eg, video or telephone and duration of treatment)	Experience (with mental health services)	Facilitating conditions (eg, electronic devices, internet connection, and insurance)
Chakawa et al [43], 2021	• Black children were less likely to have telemental health visits than White children compared with in-person visits (OR 0.35, 95% CI 0.16-0.76, *P*=.008). Hispanic (reference White: OR 0.45, 95% CI 0.17-1.19, *P*=.11) or other race or ethnicity (reference White: OR 0.57, 95% CI 0.21-1.53, *P*=.26) were not significantly associated with telemental health service use compared with in-person visits. • Telemental health service use was not significantly associated with sex (OR 0.64, 95% CI 0.33-1.23, *P*=.18), age (OR 1.22, 95% CI 0.62-2.51, *P*=.54), and language (OR 0.69, 95% CI 0.25-1.89, *P*=.47) compared with in-person visits.	• Children with internalizing problems were more likely to have telemental health visits than children with externalizing problems compared with in-person visits (OR 2.78, 95% CI 1.19-6.45, *P*=.02). Other primary referral concerns were not significantly associated with telemental health service use compared with in-person visits (reference; externalizing: OR 1.24, 95% CI 0.57-2.71, *P*=.59).	—	—	• Telemental health service use was not significantly associated with health insurance type compared with in-person visits (OR 1.68, 95% CI 0.74-3.82, *P*=.22).
Connolly et al [44], 2022			—	—	—

Study, year	Sociodemographic factors (eg, sex, age, race, education, and area lived in)	Health factors (eg, diagnosis, symptoms, and symptom severity)	Service factors (eg, video or telephone and duration of treatment)	Experience (with mental health services)	Facilitating conditions (eg, electronic devices, internet connection, and insurance)
	• Female sex was associated with having at least 1 video visit (OR 1.46, 95% CI 1.44-1.48, *P*<.01), having ≥50% of visits via video vs in-person (OR 1.64, 95% CI 1.60-1.68, *P*<.01), having ≥50% of visits via phone vs in-person (OR 1.17, 95% CI 1.15-1.19, *P*<.01), and having ≥50% of visits via video vs phone (OR 1.41, 95% CI 1.38-1.43, *P*<.01). • Age was negatively associated with having at least 1 video visit (ORs ranged from 0.27 to 0.92, *P*<.01), having ≥50% of visits via video vs in-person (ORs ranged from 0.23 to 0.91, *P*<.01), having ≥50% of visits via phone vs in-person (ORs ranged from 0.69 to 1.04, *P*<.01), and having ≥50% of visits via video vs phones (ORs ranged from 0.33 to 0.94, *P*<.01). • Race and ethnicity was associated with having at least 1 video visit (reference White and non-Hispanic: Black and non-Hispanic OR 0.97, 95% CI 0.96-0.98, *P*<.01; other race and non-Hispanic OR 1.21, 95% CI 1.18-1.25, *P*<.01; Hispanic OR 1.16, 95% CI 1.14-1.18, *P*<.01), having ≥50% of visits via video vs in-person (reference White and non-Hispanic: Black and non-Hispanic OR 0.86, 95% CI 0.84-0.88, *P*<.01; other race and non-Hispanic OR 1.18, 95% CI 1.13-1.23, *P*<.01; Hispanic OR 1.09, 95% CI 1.06-1.12, *P*<.01), having ≥50% of visits via phone vs in-person (reference White and non-Hispanic: Black and non-Hispanic, OR	• Schizophrenia diagnosis was negatively associated with having at least 1 video visit (OR 0.69, 95% CI 0.67-0.71, *P*<.01), having ≥50% of visits via video vs in-person (OR 0.36, 95% CI 0.34-0.37, *P*<.01), having ≥50% of visits via phone vs in-person (OR 0.64, 95% CI 0.62-0.65, *P*<.01), and having ≥50% of visits via video vs phone (OR 0.56, 95% CI 0.54-0.59, *P*<.01). • Depression diagnosis was associated with having at least 1 video visit (OR 1.06, 95% CI 1.05-1.07, *P*<.01), having ≥50% of visits via video vs in-person (OR 1.10, 95% CI 1.08-1.12, *P*<.01), and having ≥50% of visits via phone vs in-person (OR 1.10, 95% CI 1.09-1.12, *P*<.01). It was not significantly associated with having ≥50% of visits via video vs phone (OR 1.00, 95% CI 0.99-1.02, *P*>.05). • Anxiety disorder diagnosis was associated with having at least 1 video visit (OR 1.03, 95% CI 1.02-1.04, *P*<.01), having ≥50% of visits via video vs in-person (OR 1.03, 95% CI 1.02-1.05, *P*<.01), and having ≥50% of visits via phone vs in-person (OR 1.04, 95% CI 1.03-1.06, *P*<.01). It was not significantly associated with having ≥50% of visits via video vs phone (OR 1.00, 95% CI 0.98-1.01, *P*>.05). • Bipolar disorder diagnosis was negatively associated with having ≥50% of visits via video vs in-person (OR 0.89, 95% CI 0.86-0.91, *P*<.01) and having ≥50% of visits via video vs phone (OR 0.89, 95% CI 0.86-0.91, *P*<.01). It was not significantly associated with having at least 1 video			

Study, year	Sociodemographic factors (eg, sex, age, race, education, and area lived in)	Health factors (eg, diagnosis, symptoms, and symptom severity)	Service factors (eg, video or telephone and duration of treatment)	Experience (with mental health services)	Facilitating conditions (eg, electronic devices, internet connection, and insurance)
	0.88, 95% CI 0.87-0.89, *P*<.01; other race and non-Hispanic, OR 0.93, 95% CI 0.90-0.96, *P*<.01; Hispanic, OR 0.95, 95% CI 0.93-0.97, *P*<.01), and having ≥50% of visits via video vs phone (reference White and non-Hispanic: Black and non-Hispanic, OR 0.97, 95% CI 0.96-0.99, *P*<.01; other race and non-Hispanic, OR 1.27, 95% CI 1.23-1.31, *P*<.01; Hispanic, OR 1.15, 95% CI 1.13-1.18, *P*<.01). • A low socioeconomic status (most disadvantaged tercile) was negatively associated with having at least 1 video visit (OR 0.68, 95% CI 0.67-0.69, *P*<.01), having ≥50% of visits via video vs in-person (OR 0.62, 95% CI 0.60-0.63, *P*<.01), having ≥50% of visits via phone vs in-person (OR 0.96, 95% CI 0.94-0.97, *P*<.01), and having ≥50% of visits via video vs phone (OR 0.64, 95% CI 0.63-0.65, *P*<.01).	visit (OR 1.00, 95% CI 0.98-1.02, *P*>.05) and having ≥50% of visits via phone vs in-person (OR 1.00, 95% CI 0.98-1.02, *P*>.05). • PTSD diagnosis was associated with having ≥50% of visits via video vs in-person (OR 1.11, 95% CI 1.09-1.13, *P*<.01), having ≥50% of visits via phone vs in-person (OR 1.16, 95% CI 1.15-1.18, *P*<.01), and negatively with having ≥50% of visits via video vs phone (OR 0.96, 95% CI 0.94-0.97, *P*<.01). It was not significantly associated with having at least 1 video visit (OR 1.01, 95% CI 0.98-1.01, *P*>.05). • Substance use disorder diagnosis was negatively associated with having ≥50% of visits via video vs in-person (OR 0.75, 95% CI 0.73-0.76, *P*<.01), having ≥50% of visits via phone vs in-person (OR 0.87, 95% CI 0.86-0.89, *P*<.01), and having ≥50% of visits via video vs phone (OR 0.86, 95% CI 0.84-0.87, *P*<.01). It was not significantly associated with having at least 1 video visit (OR 1.00, 95% CI 0.98-1.01, *P*>.05).			

Study, year	Sociodemographic factors (eg, sex, age, race, education, and area lived in)	Health factors (eg, diagnosis, symptoms, and symptom severity)	Service factors (eg, video or telephone and duration of treatment)	Experience (with mental health services)	Facilitating conditions (eg, electronic devices, internet connection, and insurance)
	• Rurality was partly associated with having at least 1 video visit (reference urban: rural OR 1.14, 95% CI 1.12-1.16, *P*<.01; highly rural OR 1.22, 95% CI 1.14-1.31, *P*<.01), having ≥50% of visits via video vs in-person (reference urban: rural, OR 1.00, 95% CI 0.98-1.02, *P*>.05; highly rural, OR 1.24, 95% CI 1.13-1.36, *P*<.01), having ≥50% of visits via phone vs in-person (reference urban: rural, OR 1.14, 95% CI 1.12-1.16, *P*<.01; highly rural, OR 1.22, 95% CI 1.14-1.31, *P*<.01), and having ≥50% of visits via video vs phone (reference urban: rural, OR 0.88, 95% CI 0.86-0.89, *P*<.01; highly rural, OR 1.01, 95% CI 0.94-1.09, *P*>.05). • Not being married and being divorced, separated, or widowed compared with being married was negatively associated with having at least 1 video visit (ORs ranged from 0.92 to 0.93, *P*<.01), having ≥50% of visits via video vs in-person (ORs ranged from 0.82 to 0.83, *P*<.01), having ≥50% of visits via phone vs in-person (ORs ranged from 0.91 to 0.93, *P*<.01), and having ≥50% of visits via video vs phones (ORs ranged from 0.89 to 0.90, *P*<.01).	• Past mental health hospitalization was associated with having at least one video visit (OR 1.09, 95% CI 1.07-1.12, *P*<.01) and negatively associated with having ≥50% of visits via video vs in-person (OR 0.56, 95% CI 0.54-0.58, *P*<.01), having ≥50% of visits via phone vs in-person (OR 0.62, 95% CI 0.61-0.64, *P*<.01) and having ≥50% of visits via video vs phone (OR 0.88, 95% CI 0.86-0.91, *P*<.01). A disability rating of ≥50% was associated with having at least 1 video visit (OR 1.05, 95% CI 1.03-1.06, *P*<.01), having ≥50% of visits via video vs in-person (OR 1.07, 95% CI 1.05-1.10, *P*<.01), having ≥50% of visits via phone vs in-person (OR 1.02, 95% CI 1.00-1.04, *P*<.01), and having ≥50% of visits via video vs phone (OR 1.05, 95% CI 1.03-1.07, *P*<.01).			
Hutchison et al [47], 2022	—		—	—	—

Study, year	Sociodemographic factors (eg, sex, age, race, education, and area lived in)	Health factors (eg, diagnosis, symptoms, and symptom severity)	Service factors (eg, video or telephone and duration of treatment)	Experience (with mental health services)	Facilitating conditions (eg, electronic devices, internet connection, and insurance)
		• Increased baseline depression symptomology (r=–0.34, *P*<.05) and baseline anxiety symptomology (r=–0.32, *P*<.05) were associated with lower internet intervention use. Baseline somatic symptoms were not significantly correlated with internet intervention use (r=–0.26, *P*>.05). • No significant differences in attendance or retention rate were found for the moderate-risk and high-risk group (t=1.22, *P*=.23; t=0.20, *P*=.84).			
Lynch et al [50], 2021	• No significant associations with number of missed or cancelled sessions for age, gender, and race or ethnicity were found (detailed results, including numbers, were not reported).	• Having had at least 1 psychotic episode was associated with fewer missed or cancelled sessions (B=–0.49, *P*<.05).	—	• The mean no show or cancellation rate was 37% less during time 3 (post 2, week 13-18) compared with no show or cancellations while sessions were held in person (B=–0.47, *P*<.05).	—
Miu et al [53], 2021	• Older age was significantly associated with a smaller likelihood for conversion to teletherapy (B=–0.010, *P*=.01, OR 0.99, 95% CI 0.98-0.99). The SMI[e] status × age interaction was nonsignificant (B=0.021, *P*=.13, OR 1.02), meaning that the conversion for SMI and non-SMI groups did not depend on age. Nonsignificant predictors for conversion to teletherapy were sex (B=0.229, *P*=.13, OR 1.26, 95% CI 0.94-1.69) and ethnicity (reference non-Hispanic or Latino: Hispanic or Latino, B=–0.170, *P*=.44, OR 0.84, 95% CI 0.55-1.30; other, B=0.150, *P*=.56, OR 1.16, 95% CI 0.70-1.93).	• SMI status did not significantly predict conversion to telehealth (B=0.095, *P*=.63, OR 1.10, 95% CI 0.75-1.62). • The proportion of new patients starting teletherapy did not significantly differ by SMI status (χ21=1.2, *P*=.27). Patients with SMI had significantly higher numbers of telehealth visits compared with the non-SMI group (SMI: mean 1.47, SD 2.01; non-SMI: mean 1.04, SD 1.42; t251,154=–3.027, *P*=.003).	—	• Patients' previous engagement was not significantly associated with conversion to teletherapy (B=0.003, *P*=.41, OR 1.00, 95% CI 0.99-1.01). The SMI status × previous engagement interaction was nonsignificant (B=0.007, *P*=.43, OR 1.00), meaning that conversion for SMI and non-SMI groups did not depend on patients' previous engagement.	—

Study, year	Sociodemographic factors (eg, sex, age, race, education, and area lived in)	Health factors (eg, diagnosis, symptoms, and symptom severity)	Service factors (eg, video or telephone and duration of treatment)	Experience (with mental health services)	Facilitating conditions (eg, electronic devices, internet connection, and insurance)
Morgan et al [54], 2021	• Conversion to teletherapy was significantly associated with Hispanic ethnicity (χ21=6.7, *P*=.01, also in logistic regression model: B=2.425, *P*<.05, OR 11.30). • The association between conversion to teletherapy and the following demographic characteristics were not significant: age (t165=−1.474, *P*=.74), gender (χ21=2.1, *P*=.15), being a person of color (χ21=3.2, *P*=.07), poverty (χ21=3.0, *P*=.09), low educational attainment (χ21=0.1, *P*=.80), and household poverty status (χ21=1.2, *P*=.27). • Engagement in teletherapy was not significantly associated with ethnicity (B=1.15, β=.125, *P*>.05).	—	• Clients in individual therapy (individual vs relational case constellations) were more likely to convert to teletherapy (χ21=4.2, *P*=.04), also in logistic regression model (B=−1.38, *P*<.05, OR 0.25). • Engagement in teletherapy was associated with individual therapy (B=−2.34, *P*<.001, β=−.289).	• The number of sessions attended before the conversion to teletherapy was not significantly associated with the conversion to teletherapy (B=0.01, *P*>.05, OR 1.01) and engagement in teletherapy (B=0.02, *P*<.05, β=.179).	—
Severe et al [56], 2020	• Patient age was associated with the initial choice in visit type (*P*<.001). Patients aged ≥44 y were more likely than patients aged <44 y to choose telephone visits (RRR[f]=1.2; 95% CI 1.06-1.35). Sex (*P*=.99) and race (*P*=.06) were not significantly associated with the initial choice in visit type (delineating new and preexisting patients).	—	—	• The number of previous clinic visits was not significantly associated with the initial choice in visit type (delineating new and preexisting patients; *P*=.63).	• Health insurance type was not significantly associated with the initial choice in visit type (delineating new and preexisting patients; *P*=.08).
Sizer et al [57], 2022			• Discharge from clinic was negatively associated with the number of telehealth visits (IRR=0.55, *P*<.01). • No significant associations were found for referral source (self vs external source) and the number of telehealth visits (IRR=1.00, *P*>.10).	—	—

Study, year	Sociodemographic factors (eg, sex, age, race, education, and area lived in)	Health factors (eg, diagnosis, symptoms, and symptom severity)	Service factors (eg, video or telephone and duration of treatment)	Experience (with mental health services)	Facilitating conditions (eg, electronic devices, internet connection, and insurance)
	• Female sex was associated with an increased number of telehealth visits (reference male: IRR[g]=1.11, *P*<.05). • Age was negatively associated with the number of telehealth visits (reference>60 years: 18-30 y IRR=1.16, *P*<.10; 31-45 y IRR=1.22, *P*<.01; 46-60 y IRR=1.22, *P*<.01). • The number of school years was positively associated with the number of telehealth visits (IRR=1.01, *P*<.05). • No significant associations were found for race (IRR ranged from 0.74 to 0.99, *P*>.10) and monthly income (IRR=1.03, *P*>.10).	• The number of telehealth visits among patients with schizophrenia spectrum and other psychotic disorders decreased by 15% compared with patients with depressive disorders (IRR=0.85, *P*<.01). No significant results were found for other primary diagnosis types (IRR ranged from 0.903 to 0.959, *P*>.10). • The number of diagnosed mental illnesses was positively associated with the number of telehealth visits (IRR=1.07, *P*<.01). • The presence of other chronic health conditions was positively associated with the number of telehealth visits (IRR=1.10, *P*<.05).			
Ter Heide et al [58], 2021	• Refugee status was negatively associated with VCT[h] use (B=1.35, *P*<.01, OR 3.86, 95% CI 1.80-8.28).	• General psychopathology was negatively associated with VCT use (B=–0.58, *P*<.01, OR 0.56, 95% CI 0.39-0.56).	—	—	—
Tobin et al [59], 2023	• Older (OR 1.04, *P*<.001) and Black patients compared with White patients (OR 3.85, *P*<.05) were more likely to complete audio-only visits compared with video visits when only telehealth visits were offered (n=359). Gender was not significantly associated with telehealth visit type during that period (OR 1.04, *P*=.90). • No significant associations with demographic predictors were found (age, gender, and race; ORs ranged from 0.49 to 1.60, *P* value ranged from .07 to .25) when in-person and telehealth visits were offered (n=222).	—	—	—	• Patients with Medicare (OR 3.46, *P*<.001) and Medicaid (OR 3.43, *P*<.001) health insurance compared with private payers were more likely to complete audio-only visits than video visits when only telehealth visits were offered (n=359). • Health insurance type was not significantly associated with use of telehealth visits when in-person and telehealth visits were offered (n=222; reference private payer: Medicare, OR 2.01, *P*=.10; Medicaid, OR 1.07, *P*=.83).
					—

Study, year	Sociodemographic factors (eg, sex, age, race, education, and area lived in)	Health factors (eg, diagnosis, symptoms, and symptom severity)	Service factors (eg, video or telephone and duration of treatment)	Experience (with mental health services)	Facilitating conditions (eg, electronic devices, internet connection, and insurance)
Vakil et al [60], 2022	• Male sex was negatively associated with telehealth visit use (reference female: male, OR 0.76, 95% CI 0.64-0.91, *P*=.002; other, OR 0.43, 95% CI 0.13-1.45, *P*=.18). • Older age was positively associated with telehealth visit use (OR 1.01, 95% CI 1.00-1.01, *P*=.03). • Patients with income Q2[i] were more likely to use telehealth visits compared with the lowest income group Q1 (reference Q1: Q2, OR 1.32, 95% CI 1.01-1.74, *P*=.046). Other Qs did not significantly differ from the lowest income group Q1 concerning telehealth visit use (ORs ranged from 0.94 to 1.29, *P* values ranged from .10 to .69). • The distance between the individual's residence and the clinic was positively associated with telehealth visit use (OR 1.04, 95% CI 1.02-1.07, *P*=.001).	• Absence of suicidal behavior (reference none: ideation, OR 0.74, 95% CI 0.61-0.90, *P*=.003; planning, OR 0.55, 95% CI 0.38-0.79, *P*=.001; self-harm or attempt, OR 0.62, 95% CI 0.48-0.81, *P*<.001), substance use (reference none: OR 0.60, 95% CI 0.50-0.72, *P*<.001), psychotic symptoms (reference absent: OR 0.41, 95% CI 0.30-0.56, *P*<.001) and cognitive impairment (reference absent: OR 0.53, 95% CI 0.34-0.84, *P*=.007) were associated with telehealth visit use • Presence of personality problems (OR 1.13, 95% CI 0.92-1.40, *P*=.26), depressive or anxiety problems (OR 1.26, 95% CI 0.98-1.63, *P*=.07), bipolar spectrum disorders (OR 0.94, 95% CI 0.65-1.34, *P*=.30), and other mental illnesses (OR 0.82, 95% CI 0.57-1.19, *P*=.30) were not significantly associated with telehealth visit use.	• Each pandemic period after the first lockdown (reference lockdown 1: in-between period, OR 0.37, 95% CI 0.23-0.49, *P*<.001; lockdown 2, OR 0.39, 95% CI 0.30-0.52, *P*<.001; after lockdown 2, OR 0.35, 95% CI 0.26-0.49, *P*<.001), overnight visits (reference daytime visits: OR 0.48, 95% CI 0.34-0.67, *P*<.001), and weekend visits (reference weekday visits: OR 0.75, 95% CI 0.61-0.91, *P*=.004) were negatively associated with telehealth visit use.	• Patients with a prior visit in the last year were less likely to use telehealth visits (OR 0.75, 95% CI 0.61-0.91, *P*=.004).	

[a]Psychosocial influence, effort, and performance expectancy were not included as categories in this table because none of the included studies observed the relationship of these determinants with patient use.

[b]OR: odds ratio.

[c]PTSD: posttraumatic stress disorder.

[d]No information present in the study regarding this category of determinants.

[e]SMI: serious mental illness.

[f]RRR: relative risk reduction.

[g]IRR: incidence rate ratio.

[h]VCT: clinical videoconferencing.

[i]Q: income quintile (Q1: lowest and Q5: highest).

Sociodemographic Factors

In total, 11 studies examined the relationship between sex and patient use of telemental health services. Approximately half of these studies (n=6) did not find significant sex differences in use [43,50,53,54,56,59]. Nevertheless, 4 studies reported higher use rates in female participants [44,57,58,60]. In contrast, 1 study reported lower odds for female participants to go from low use rates (before the pandemic) to moderate or high use rates during the pandemic [41].

A total of 13 studies examined the relationship between age and patient use of telemental health services. Nearly half of these studies (n=6) found a nonsignificant association of age with patient use [42,43,50,54,58,59]. In contrast, 1 study found that older age was positively associated with telemental health service use [60] and 3 studies found that older patients were more likely to use audio-only formats (eg, telephone services) compared with video formats [44,56,59]. Nevertheless, 3 studies observed a negative association of age with telemental health service use [44,53,57]. Ainslie et al [41] reported mixed findings. In their sample, participants aged 0 to 17 years were more likely than those aged ≥55 years to go from having <25%

of mental health services in a remote format (low use) to having 25% to 75% (moderate use) or >75% (high use) of use. However, participants aged 18 to 54 years were less likely than those aged ≥55 years to go from low to moderate or high use.

In total, 8 studies examined the relationship between race or ethnicity and patient use of telemental health services. Of these, 5 studies did not find a significant association [50,53,56,57,59]. However, Tobin et al [59] reported that Black individuals were more likely to use audio-only services, which was also found in the study by Connolly et al [44]. In addition, 2 studies found that Black patients were less likely to use telemental health services and used them less frequently compared with White patients [43,44]. Connolly et al [44] found that other than Black races and Hispanic ethnicity compared with the White race, non-Hispanic race or ethnicity is positively associated with telemental health service use and frequency of video service use (but negatively associated with frequency of phone service use). Although being a person of color was a nonsignificant determinant for the conversion to teletherapy, a relationship between Hispanic ethnicity and the conversion was found in the sample of Morgan et al [54]. However, when examining engagement with teletherapy, no significant association with ethnicity was observed in their sample.

A total of 3 studies examined the relationship of area lived in and patient use of telemental health services. Findings suggested a positive association with rurality: 1 study found that individuals from (highly) rural areas were more likely to use telemental health services [44] and 1 study stated that telehealth users lived further away from the clinic [60]; however, 1 study found no significant association [41].

Other sociodemographic determinants of patient use were considered in very few studies. A low socioeconomic and financial status was associated with lower use in 2 studies [44,60] but failed to significantly predict telemental health service use in 2 other studies [54,57]. Years of schooling were positively associated with the number of visits in the sample by Sizer et al [57]; however, Morgan et al [54] did not find a significant association between educational attainment and opting out of teletherapy after clinical conversion from in-person therapy to teletherapy. In addition, being married was positively associated with telemental health service use and use frequency in 1 study [44]. Language was not significantly associated with use, and refugee status was associated with lower odds of telemental health use in single studies [43,58].

Health Factors

A total of 9 studies examined the relationship of psychological symptom severity or diagnosis and patient use of telemental health services. Most of these studies (n=5) found that individuals with higher symptom severity (eg, patients with schizophrenia) had lower use rates [44,47,57,58,60]. However, the number of diagnoses, depression, anxiety or posttraumatic stress disorder diagnosis, past psychotic episodes, and serious mental illness status were each associated with a higher use frequency or fewer missed sessions in single studies [44,50,53,57]. Similarly, Ainslie et al [41] reported that individuals with schizophrenia were more likely to go from low to moderate or high use than individuals with other diagnoses. Nevertheless, the risk status for adverse mental and behavioral outcomes and serious mental illness status were not significantly associated with use and visit intensity in single studies [47,53]. In addition, Chakawa et al [43] found that children with internalizing problems were more likely to have a telemental health visit than children with externalizing problems.

Furthermore, the presence of chronic health conditions was associated with a higher number of visits in the sample studied by Sizer et al [57]. A disability rating of ≥50% in US veterans was positively associated with telemental health service use and frequency of use in 1 study [44].

Service Factors

A total of 3 studies examined the relationship between service factors and patient use of telemental health services. Morgan et al [54] found that patients undergoing individual therapy were more likely to convert to telemental health services. Referral source (self vs external sources) was not significantly associated with use rates [57]. Regarding service times, Vakil et al [60] stated that telehealth visits were significantly less likely during each pandemic period after the first lockdown, for nighttime visits (compared with daytime visits) and weekend visits (compared with weekday visits).

Experience

A total of 5 studies examined the relationship between experience with telemental health services and patient use of telemental health services. Previous engagement in mental health services was found to be negatively associated with telehealth visit use in the sample studied by Vakil et al [60] but failed to predict use in 2 other studies [53,56]. Although the number of sessions attended before teletherapy was not significantly associated with conversion to teletherapy in the analysis by Morgan et al [54], it was found to significantly predict the number of telemental health visits in this sample. Moreover, Lynch et al [50] reported that longer duration of participation in telemental health services was associated with fewer missed sessions.

Facilitating Conditions

A total of 3 studies examined the relationship between facilitating conditions and patient use of telemental health services. Health insurance type was not significantly associated with patient use in these studies [43,56,59]. Nevertheless, Tobin et al [59] reported that Medicare- or Medicaid-insured individuals used audio-only formats more often than private payers.

Psychosocial Influence, Effort and Performance Expectancy

None of the included studies examined the relationship between psychosocial factors, effort or performance expectancy and patient use of telemental health services.

Patient Satisfaction

Overview

Key findings for the determinants of patient satisfaction with telemental health services are summarized in Table 7 (if reported, adjusted results are presented).

Table 7. Key findings of the included studies for determinants[a] of patient satisfaction.

Study, year	Sociodemographic factors (eg, sex, age, race, education, and area lived in)	Health factors (eg, diagnosis, symptoms, and symptom severity)	Service factors (eg, video or telephone and duration of treatment)	Experience (with mental health services)	Psychosocial influence (what do families and peers think about program or psychosocial impact)	Facilitating conditions (eg, electronic devices, internet connection, and insurance)
Ceniti et al [42], 2022	• Satisfaction was not significantly associated with age (≥50 y vs <50 y) and number of people living in the household (detailed results, including numbers, were not reported). • Living with others was significantly associated with satisfaction (χ21=5.8, *P*=.02). • Satisfaction was greater in users from Ontario compared with those from other Canadian provinces (χ21=3.9, *P*=.047).	• Satisfaction was not significantly associated with high-risk status for COVID-19 (detailed results, including numbers, were not reported).	• Video services (compared with telephone) were associated with greater satisfaction (User-MD[b] χ21=6.1, *P*=.01; User-HCP[c] χ21=6.6, *P*=.01). • No significant differences between user-groups (psychiatrists or family physicians vs other mental health care providers) in overall satisfaction were found (detailed results, including numbers, were not reported).	—[d]	• Level of connectedness with loved ones was positively correlated with overall remote care satisfaction (*r*=.197, *P*=.007) and satisfaction with therapeutic rapport (*r*=.155, *P*=.03).	• Satisfaction was not significantly associated with frequency of internet use (detailed results, including numbers, were not reported).
Guinart et al [45], 2020	• Significant age differences for telephone services were found (χ24=46.3, *P*=.004). A lower proportion of patients aged 55-64 y described their experience as excellent compared with other age groups (χ24=12.8, *P*=.01). A higher proportion of patients aged 45-54 y rated their experience as poor compared with other age groups (χ24=10.5, *P*=.03).	—	—	• Patients under care for <1 y endorsed missing the clinic and feeling connected to it less frequently than other groups (χ^2_6=21.5, *P*=.002).	—	—
Haxhihamza et al [46], 2021	• Satisfaction was not significantly associated with gender, age, and place of living (detailed results, including numbers, were not reported).	—	—	—	—	—

Study, year	Sociodemographic factors (eg, sex, age, race, education, and area lived in)	Health factors (eg, diagnosis, symptoms, and symptom severity)	Service factors (eg, video or telephone and duration of treatment)	Experience (with mental health services)	Psychosocial influence (what do families and peers think about program or psychosocial impact)	Facilitating conditions (eg, electronic devices, internet connection, and insurance)
Hutchison et al [47], 2022	—	• None of the baseline psychological symptoms were correlated with treatment satisfaction (r values ranged between –0.13 and 0.01, *P*>.05). • Adolescents in the moderate-risk group reported significantly higher satisfaction with the intervention than those in the high-risk group (t=2.03, *P*<.05, Cohen d=0.60).	—	—	—	—
Lewis et al [48], 2021	• No significant correlations with the views toward the transition to web-based therapy for age (r=.036, *P*=.78), gender (r=.006, *P*=.96), and education (r=.092, *P*=.47) were found. • No significant correlations with the TSQ[e] for age (similarity scale: r=.182, *P*=.15; quality scale: r=–.047, *P*=.72), gender (similarity scale: r=.067, *P*=.60; quality scale: r=.146, *P*=.25), and education (similarity scale: r=.093, *P*=.47; quality scale: r=–.017, *P*=.89) were found.		—	• Treatment duration correlated with positive views toward the transition to online therapy (r=0.291, *P*=.02). • Treatment duration was not significantly correlated with the TSQ (similarity scale: r=0.124, *P*=.34; quality scale: r=–0.144, *P*=.26).	• The fear of COVID-19 scale-19S score correlated with positive views toward the transition to web-based therapy for (r=0.276, *P*=.03). The fear of COVID-19 scale-19S score was not significantly associated with the TSQ (similarity scale: r=–0.193, *P*=.13; quality scale: r=–0.143, *P*=.26).	—

Study, year	Sociodemographic factors (eg, sex, age, race, education, and area lived in)	Health factors (eg, diagnosis, symptoms, and symptom severity)	Service factors (eg, video or telephone and duration of treatment)	Experience (with mental health services)	Psychosocial influence (what do families and peers think about program or psychosocial impact)	Facilitating conditions (eg, electronic devices, internet connection, and insurance)
		• No significant correlations with the views toward the transition to web-based therapy for past eating disorder hospitalization (t=0.152, *P*=.24), EDE-Q[f] scales (r values ranged from –0.168 to –0.094, *P* values ranged from .19 to .47) and Depression, Anxiety and Stress Scales-21 scales (r values ranged from –0.162 to –0.080, *P* values ranged from .21 to .53) were observed. • No significant associations of the TSQ with past eating disorder hospitalization (similarity scale: t=0.149, *P*=.24; quality scale: t=0.061, *P*=.63), EDE-Q scales (r values ranged from –0.100 to 0.101, *P* values ranged from .43 to .77) and Depression, Anxiety and Stress Scales-21 scales (r values ranged from –0.121 to 0.094, *P* values ranged from .34 to .84) were found. TSQ scores did not significantly differ between eating disorder diagnoses (detailed results, including numbers, were not reported). • No significant correlation of the views toward the transition to web-based therapy with BMI (r=0.226, *P*=.08) were found. BMI was not significantly correlated with the TSQ (similarity scale: r=0.221, *P*=.09; quality scale: r=–0.011, *P*=.93).				

Study, year	Sociodemographic factors (eg, sex, age, race, education, and area lived in)	Health factors (eg, diagnosis, symptoms, and symptom severity)	Service factors (eg, video or telephone and duration of treatment)	Experience (with mental health services)	Psychosocial influence (what do families and peers think about program or psychosocial impact)	Facilitating conditions (eg, electronic devices, internet connection, and insurance)
Lohmiller et al [49], 2021	• No significant associations of age (F1,277=0.18, *P*=.67) and gender (detailed results, including numbers, were not reported) with the overall "assessment of therapeutic contact" were found. • However, a significant association of age with the item "assessment of therapeutic contact as personal" was found (F1,277=4.50, *P*=.04) indicating that older individuals perceived the video format as partly more impersonal. • When looking at "hurdles" age was significantly associated with single items: "The necessary technology/framework conditions overwhelmed me" (F1,277=7.85, *P*=.005) indicating that older individuals perceived the video format as more challenging and "I was able to fully concentrate on the content of the conversation" (F1,277=14.85, *P*<.001) indicating that older individuals perceived the video format to be more impersonal and depersonalized.	—	• Significant differences were found in the items: global judgment conversation contact (F2,275=3.39, *P*=.04), pleasantness (F2,275=3.35, *P*=.04), friendliness (F2,275=5.55, *P*=.004), and feeling comfortable (F2, 275=8.49, *P*<.001), all favoring video consultations compared with phone and office consultation. The other items of the "assessment of therapeutic contact" showed no significant differences (P≥.05). • The assessment of the "therapeutic relationship" did not significantly differ between groups, except for the item "I have recently started to feel better" (F2,275=4.97, *P*=.008), favoring phone and video contacts.	—	—	—
Meininger et al [51], 2022	—	• There were no significant correlations between parent-rated treatment satisfaction and the severity of patients' symptoms, stress, and psychosocial functioning (detailed results, including numbers, were not reported).	—	• Treatment duration correlated positively with parent-rated treatment satisfaction (mean satisfaction score: r=.20, *P*<.02).	—	—

Study, year	Sociodemographic factors (eg, sex, age, race, education, and area lived in)	Health factors (eg, diagnosis, symptoms, and symptom severity)	Service factors (eg, video or telephone and duration of treatment)	Experience (with mental health services)	Psychosocial influence (what do families and peers think about program or psychosocial impact)	Facilitating conditions (eg, electronic devices, internet connection, and insurance)
Michaels et al [52], 2022	• No sex-based differences in the preferred telehealth method (P=.67), experiences using telephone (P=.92) or video (P=.58), whether patients would use telehealth in the future (P=.11) and was perceived as helpful as in-person treatment (P=.38) were found. • No gender-based differences in the preferred telehealth method (P=.64), experiences using telephone (P=.63) or video (P=.53), whether patients would use telehealth in the future (P=.52) and was perceived as helpful as in-person treatment (P=.13) were found. • No race-based differences in the preferred telehealth method (P=.21), experiences using telephone (P=.29) or video (P=.99) and whether patients would use telehealth in the future (P=.15) were found.	—	• No between-group differences in preferences for telehealth methods were found (H_1=0.46, P=.49). Most of the college therapy and medication group (63/78, 81%) and college medication–only group (20/23, 87%) reported a strong preference for the video format.	—	—	—
Nesset et al [55], 2023	• No significant sex differences were found for Client Satisfaction Questionnaire-8 scores (P values ranged from .10 to .57 for the different items), except that female participants were more content with the length of the therapy (item 5: mean 3.86, SD 0.378 vs male, mean 2.90, SD 1.01, P=.03).	—	—	—	—	—
Ter Heide et al [58], 2021				—		—

Study, year	Sociodemographic factors (eg, sex, age, race, education, and area lived in)	Health factors (eg, diagnosis, symptoms, and symptom severity)	Service factors (eg, video or telephone and duration of treatment)	Experience (with mental health services)	Psychosocial influence (what do families and peers think about program or psychosocial impact)	Facilitating conditions (eg, electronic devices, internet connection, and insurance)
	• There was a significant main effect of gender, with female participants reporting significantly higher VCT[g] satisfaction than male participants (F1,196=10.60, *P*<.01). • No significant associations with VCT satisfaction were found for age, refugee status and level of education (detailed results, including numbers, were not reported).	• There was a significant main effect of general psychopathology, with general psychopathology being negatively associated with VCT satisfaction (F1,196=6.61, *P*<.05). Among those who reported using VCT, a small, negative correlation between VCT satisfaction and general psychopathology was found (r=–0.18, *P*<.01, n=221).	• There was no significant difference in treatment satisfaction between the VCT group and the non-VCT group (t276=–0.237, *P*=.81, n=278).		• Among those who reported using VCT, a small, negative correlation between satisfaction and coronavirus stress level was found (r=–0.21, *P*<.01, n=228). A small, positive correlation between VCT satisfaction and life satisfaction was found (r=0.27, *P*<.001, n=228).	

[a]Effort and performance expectancy were not included as categories in this table because none of the included studies observed a relationship between these determinants and patient satisfaction.

[b]User-MD: mental health care users who saw an MD provider (psychiatrist or family physician).

[c]User-HCP: mental health care users who saw another mental health care provider (eg, psychotherapist).

[d]No information present in the study regarding this category of determinants.

[e]TSQ: telemedicine satisfaction questionnaire.

[f]EDE-Q: Eating Disorder Examination Questionnaire.

[g]VCT: clinical videoconferencing.

Sociodemographic Factors

A total of 5 studies examined the relationship between sex and patient satisfaction with telemental health services, and all of them did not find a significant association of sex with the satisfaction scores [46,48,49,52,55].

A total of 6 studies examined the relationship between age and patient satisfaction with telemental health services. Most studies (n=4) did not find a significant association between age and satisfaction [42,46,48,58]. Lohmiller et al [49] also did not find a significant association between age and the overall satisfaction with therapeutic contact. However, older age was associated with lower satisfaction for some items, meaning that older individuals perceived the video intervention as less personal and more challenging and found it harder to fully concentrate on the content of the conversation. Guinart et al [45] found lower satisfaction ratings for telephone services among older patients.

One study observed a nonsignificant relationship between race and patient satisfaction with telemental health services [52].

In total, 2 studies examined the relationship between area lived in and patient satisfaction with telemental health services. While Haxhihamza et al [46] did not find a significant association, Ceniti et al [42] reported greater satisfaction ratings in users from Ontario compared with those in other Canadian provinces.

Other sociodemographic determinants of patient satisfaction were considered in some studies. Educational level was observed in 2 studies and was not significantly associated with satisfaction in these samples [48,58]. In addition, Ter Heide et al [58] reported that refugee status is not significantly associated with satisfaction. Moreover, Ceniti et al [42] included living situation of participants as a potential determinant. While the number of people living in the household was not significantly associated with remote care satisfaction, living with others showed a significant association with this outcome.

Health Factors

A total of 4 studies examined the relationship between psychological symptom severity and patient satisfaction with telemental health services. Only 1 study found a significant association between symptom severity and satisfaction. In the sample studied by Hutchison et al [47], patients at moderate risk were more satisfied than patients who were at high risk for adverse mental and behavioral outcomes. However, the other 3 studies did not observe significant relationships [42,48,51].

A total of 2 studies examined the relationship between physical health and patient satisfaction with telemental health services. Nonsignificant relationships were found between BMI and high-risk status for COVID-19, with satisfaction in single studies [42,48].

Service Factors

A total of 7 studies examined the relationship between service factors and patient satisfaction with telemental health services. Of these, 3 studies reported that telemental health services delivered via video services were associated with higher patient satisfaction than those delivered via telephone services [42,49,52]. However, Ter Heide et al [58] could not find this relationship. Furthermore, the therapeutic alliance bond was associated with higher satisfaction ratings in 1 study [48]. The provider type (psychiatrists or family physicians vs other mental health care providers) was not significantly associated with patient satisfaction in the study by Ceniti et al [42].

Experience

A total of 3 studies examined the relationship between experience with telemental health services and patient satisfaction with telemental health services. In the study by Lewis et al [48], longer treatment duration was associated with higher satisfaction, while Guinart et al [45] observed that patients who were under care for less than a year perceived the transition to telemental health services as less negative (missed the clinic less and did not feel less connected). Moreover, the number of telemental health sessions was associated with higher satisfaction ratings in 1 study [51].

Psychosocial Influence

A total of 3 studies examined the relationship between psychosocial factors and patient satisfaction with telemental health services. Level of connectedness with loved ones and life satisfaction were associated with greater patient satisfaction [42,58]. Moreover, COVID-19–related aspects were considered in single studies. The COVID-19 stress level had a small negative correlation with satisfaction [58], and fear of COVID-19 was associated with positive views toward the transition to teletherapy but was not significantly associated with overall satisfaction scores [48].

Facilitating Conditions

One study examined the relationship between facilitating conditions and patient satisfaction with telemental health services. Ceniti et al [42] reported that the frequency of internet use was not significantly associated with patient satisfaction.

Effort and Performance Expectancy

None of the included studies examined the relationship between effort or performance expectancy and patient satisfaction with telemental health services.

Discussion

Principal Findings

Overview

This systematic review aimed to provide an extensive overview of the literature on and highlight the influential determinants of patient use and satisfaction with synchronous telemental health services during the COVID-19 pandemic. Various determinants of patient use and satisfaction were considered. Sociodemographic characteristics were most frequently examined. Nevertheless, health- and service-related determinants also received considerable attention. Major dimensions of the UTAUT, such as effort and performance expectancy, were neglected in recent studies. Although most associations were mixed or nonsignificant, some indications for potential relationships were found (eg, for sex, age, and symptom severity). This systematic review is the first to examine the determinants of patient use and satisfaction with synchronous telemental health services during the pandemic, thus markedly extending our current knowledge.

Sociodemographic Factors

Regarding sociodemographic factors, a variety of determinants were observed in the included studies. Most studies found that sex was not significantly associated with patient use and satisfaction. However, some studies with large samples found that female participants were more likely to use telemental health services. This suggests that previous findings regarding greater use of mental health services among female participants may also apply to the field of telemental health [66-69]. Moreover, this could explain the finding that women were less likely to go from low to either moderate or high telemedicine use [41], as they already had higher use rates before the occurrence of the pandemic.

When looking at patient age, mostly nonsignificant associations with the outcomes were found. Nevertheless, some large-sample studies found that older age was negatively associated with the outcomes and that older patients were more likely to use audio-only services compared with video services. This could be not only because of the lower likelihood of older adults using mental health care services [70] but also because of the digital divide in mobile health [71]. However, audio-only formats seem to be a promising alternative to video consultations for older adults, which was also found in other telemedicine areas during the pandemic (eg, academic medical center outpatient visits and oncological care) [72-74].

Race, ethnicity, area lived in (ie, rurality and province lived in), education, and other determinants (eg, refugee status, financial status, and living situation) were observed in only few studies and led to mainly nonsignificant or mixed associations with the outcomes. More research regarding these sociodemographic determinants is needed in the future. In summary, sociodemographic factors tend to play a role in patient use of telemental health services. In particular, sex and age appear to be potential determinants that were frequently observed. For patient satisfaction, mainly nonsignificant or mixed findings were reported.

Health Factors

Regarding health factors, symptom severity was observed in some studies and was mostly associated with lower use rates in patients with mental health conditions. This is in contrast to in-person mental health services research, where symptom severity was associated with an increased likelihood of seeking treatment [69]. A potential reason for this could be that patients with very severe symptoms were preferably kept in an in-person setting despite the pandemic to assure appropriate treatment. However, findings on engagement or attendance were mixed, with some studies suggesting that more severe symptoms were

associated with an increased frequency of telemental health visits. This could mean that individuals with more severe symptoms were less likely to start teletherapy, but once they were participating in telemental health services, they used it more frequently than patients with less severe symptoms. For satisfaction, most of the associations were nonsignificant. In conclusion, the associations with determinants were mostly observed for patient use. Although psychological symptom severity seemed to be negatively associated with the likelihood of telemental health service use, some indications for a positive association with use frequency were observed.

Service Factors

With regard to service factors, various determinants were observed in different studies. For patient use, there was great heterogeneity in the observed aspects. Therefore, it is challenging to compare the results of these studies. More research in this field is clearly needed. Nevertheless, services that were delivered in video format seemed to be associated with higher patient satisfaction than services delivered via telephone. A qualitative study in primary care highlighted potential reasons for the preference of video services, including nonverbal cues and reassurance, lower risk of miscommunication, more personal experience, and increased focus [75]. A recent systematic review on using telephone and video services for mental health treatment also emphasized the strengths of the video format [76]. However, they also stated that the telephone format can be superior to the video format in some cases (eg, fewer technological challenges [76]).

Experience

With regard to the experience with telemental health services, previous engagement in mental health services was not significantly associated with patient use. This could potentially mean that telemental health use rather depends on need factors than on experience. Regarding patient satisfaction, findings for the treatment duration were mixed. However, the number of telehealth sessions attended seemed to be associated with fewer missed sessions and higher satisfaction ratings. Therefore, patients might have got used to the new situation over time and had adapted to the remote format.

Psychosocial Influence

With regard to psychosocial factors, no determinants of patient use were observed. For patient satisfaction, significant determinants were only observed in single studies. Further research, including on psychosocial determinants, is urgently required. Especially factors such as personality (eg, neuroticism or conscientiousness) and social determinants (eg, loneliness) could be of interest for the future of telemental health, considering their impact on health care use [77,78].

Facilitating Conditions

With regard to facilitating conditions, the health insurance type was not significantly associated with patient use in some studies. The frequency of internet use was also not significantly associated with patient satisfaction in 1 single study. More research is needed in this area to identify potential facilitators of telemental health use and satisfaction.

Effort and Performance Expectancy

With regard to effort and performance expectancy, no study included determinants from these constructs. Considering that these 2 dimensions are key elements of the UTAUT, future research should urgently include determinants from this area.

Study Quality

Overall, the quality of the included studies was mainly good or fair and did not vary substantially between the different studies. Most studies included large samples and some included even very large electronic medical record data sets [41,44]. However, the generalizability of our results is limited considering that the evidence mainly came from North America and Western countries and because of differences in psychiatric care and telemental health services. Most studies did not provide participation rates, sample size justification, power description, or variance and effect estimates, which are important information sources for the interpretation of the associations and the detection of potential biases (eg, selection bias).

Future Research

Considering the findings of our systematic review, multiple research gaps were identified. In general, the inclusion of theoretical models is needed in future studies to set a more consistent focus on important determinants and to assure comparability of the studies. Future research should consider different types of use behavior (eg, frequency of use, adoption, and attendance) and satisfaction (different scales or areas). Established scales should be used to measure the outcomes rather than single items (especially for satisfaction) because single items are more prone to bias. Moreover, to improve the understanding of the relationships between the different determinants and their effects on patient use and satisfaction, future studies that examine the influencing chain and process behind the outcomes are needed. In addition, future studies should explore whether certain telemental health formats (eg, telephone, video, or asynchronous formats) are especially suited for the treatment of specific diagnoses (eg, depression, anxiety, or schizophrenia). Furthermore, longitudinal studies are needed to verify the findings and test for potential changes over time. Longitudinal studies are also of interest to see whether findings regarding use and satisfaction during the pandemic also apply to postpandemic circumstances. For instance, a recent qualitative study found that remote services were only seen as a good alternative to in-person mental health services during extreme circumstances [79]. Additional qualitative research is needed, for example, to explore the barriers of users who do not indicate high use or satisfaction rates to make telemental health services more accessible and user friendly in the future.

With regard to the UTAUT dimensions, major research gaps were revealed. In particular, for the dimensions effort and performance expectancy, psychosocial influence and facilitating conditions research is missing in the respective literature. However, these dimensions could be valuable starting points for interventions, as they could potentially be influenced or adapted over time to improve use rates and satisfaction with telemental health services.

Strengths and Limitations

Our systematic review was registered in PROSPERO and conducted in accordance with PRISMA guidelines to ensure the quality and transparency of the manuscript. A double-screening approach was used to screen 3 databases, which generally was found to be advanced in comparison with single screening and lead to fewer missed studies in the screening process [80]. In addition, data extraction and study quality assessment were performed by 2 reviewers. Furthermore, this review is the first to evaluate the existing literature on the determinants of use and satisfaction with synchronous telemental health services during the COVID-19 pandemic.

However, this study has some limitations. Only peer-reviewed quantitative studies were included. Therefore, potentially meaningful studies were not considered (eg, from the gray literature). Nevertheless, this step promoted the quality of the included studies and the comparability of the findings. In addition, only German and English language articles were screened, whereby relevant articles in other languages could have been missed. Finally, no meta-analysis was performed because of the high heterogeneity in study designs, outcomes, and effect measures.

Conclusions

The extensive implementation of synchronous telemental health services during the pandemic triggered new research in this field. This systematic review was the first to synthesize studies that observed the determinants of patient use and satisfaction with these services. Significant heterogeneity was observed among the included studies. The findings revealed potential target groups (eg, female and young patients with mild symptoms) for future postpandemic telemental health interventions. However, the findings also revealed that patient groups that were especially burdened during the pandemic (such as older patients with severe symptoms) were harder to reach, and efforts are required to address such groups. Finally, knowledge gaps in the recent literature were highlighted, which call for future quantitative and qualitative research to secure and expand the recent findings. This could help to better understand barriers as well as individual preferences and eventually improve telemental health services in the future.

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Authors' Contributions

AN, AH, and H-HK developed the concept and search strategy for this systematic review. AH supervised the study. Study selection, data extraction, and quality assessment were performed by AN and JB; AH was consulted in case of any disagreement in these processes. The manuscript was written by AN and critically revised by AH and H-HK. Text and tables were formatted by AN and JB. All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

None declared.

Multimedia Appendix 1

List of all included studies in the narrative synthesis.
[DOCX File , 24 KB-Multimedia Appendix 1]

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Abbreviations

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses
UTAUT: Unified Theory of Acceptance and Use of Technology

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Multimedia Appendix 1

List of all included studies in the narrative synthesis

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7. Publication 4: Determinants of Patient Use of Telemental Health Services: Representative Cross-Sectional Survey From Germany

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Original Paper

Determinants of Patient Use of Telemental Health Services: Representative Cross-Sectional Survey From Germany

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Abstract

Background: Telemental health services effectively address major challenges in mental health care delivery. To maximize the potential of the services, it is essential to facilitate patient use and reduce use disparities. Nevertheless, determinants of patient use of telemental health services have been scarcely investigated thus far.

Objective: We aimed to identify determinants of patient use of telemental health services since the onset of the COVID-19 pandemic and in the last 4 weeks.

Methods: In December 2023, we conducted a cross-sectional, quota-based (gender and age group) online survey. The sample comprised individuals aged 18 to 74 years, who had been using mental health services since March 2020 (n=2082). Telemental health service use was assessed using items that inquired whether individuals had used the services since March 2020 or currently (in the last 4 weeks). Logistic regressions were computed to test the associations of socioeconomic, access, health, COVID-19–related, psychosocial, and service factors, as well as personality and provider characteristics with patient use.

Results: Younger age, a more positive patient attitude toward telemental health services, a more positive provider attitude toward using the services, and higher provider skills for using the services were positively associated with patient use of telemental health services since the onset of the COVID-19 pandemic. When exclusively looking at current use, positive associations with full-time employment, lower neuroticism, a more positive provider attitude toward the services, and use of the services to avoid stigmatization, long waiting times, or inconvenient scheduling were observed. Access, health, and COVID-19–related factors were not associated with patient use (since the onset of the COVID-19 pandemic and currently).

Conclusions: Beyond socioeconomic factors, personality, and a positive patient attitude toward the services, patient use of telemental health services was associated with a positive provider attitude toward using the services and higher provider skills for using the services, which underscores the need for provider support and training in telemental health care. Furthermore, avoiding stigmatization and higher convenience of the services were associated with patient use, which highlights the substantial potential of the services to address current mental health care challenges.

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Keywords: telemental health; telepsychiatry; teletherapy; telemedicine; digital health; patient use; service use

Introduction

Background

Numerous reviews reported unmet needs and critical gaps in mental health care provision worldwide [1-3]. Critical factors contributing to this issue include provider shortages, ineffective collaboration, organizational issues, limited access to care, mental health stigma, and discrimination [4-6]. Inadequate mental health treatment can lead to several adverse outcomes, such as chronic and severe disease courses, greater risk of suicide or premature mortality, and high

economic costs [2]. Considering that more than a billion people are affected by mental or addictive disorders globally [7], it is crucial to improve and transform the future landscape of the mental health care provision.

Telemental health services offer a potential solution to major challenges in the provision of mental health care [8,9]. Telemental health may be defined as the use of telecommunications or videoconferencing technology to provide mental health services [10]. The delivery of telemental health services can be carried out via synchronous services (eg, video or telephone calls), asynchronous services (eg, mobile apps, web-based interventions, and email), or hybrid combinations [11]. The services may enhance access to mental health care, decrease waiting times, save costs, reduce stigmatization, and help to facilitate screening, diagnosis, and monitoring of mental illnesses [8,9,12]. Furthermore, multiple past studies confirmed the effectiveness of synchronous as well as asynchronous telemental health services and found comparable results to in-person services in terms of clinical effectiveness, diagnostic reliability, efficacy, working alliance, attrition rates, and patient satisfaction [13-18].

The strengths of telemental health services played a significant role during the COVID-19 pandemic, when in-person mental health services were restricted. Telemental health services allowed the continuation of mental health care while minimizing physical contact and the risk of infection. Consequently, telemental health service use increased remarkably worldwide [19,20]. For instance, 90.5% of mental health professionals from 100 countries (n=1206) stated to have either started or increased telemental health service use since the onset of the COVID-19 pandemic. Also in Germany, which is the focus of our study, the COVID-19 pandemic accelerated the digital transformation of the health care system, supported by the adoption of laws such as the Digital Healthcare Act [21] and the Digital Health Applications Ordinance [22]. The proportion of contract physicians and psychotherapists using telemedicine in Germany increased from 6.1% in 2019 to 24.6% in 2021, with telemental health services accounting for up to 86% of this increase [23].

Similar to other high-income countries, the German mental health care system struggles with challenges such as provider shortages alongside increasing need for care, regional differences in supply density (eg, underserved rural areas), long waiting times for treatment, stigmatization and discrimination, ineffective collaboration, and the provision of (long-term) care for severe cases [24,25]. Telemental health services have the potential to help overcome these obstacles. For example, the services can deliver care regardless of location, are accessible to mobility-restricted patients, reduce travel and waiting times, and provide greater levels of anonymity (eg, [8,12]). Therefore, increasing the use of telemental health services may be crucial for improving the quality, efficiency, and accessibility of mental health care in the future.

Postpandemic research highlights the consistency of international telemedicine use and its potential to address mental health care challenges beyond those presented by the COVID-19 pandemic [26,27]. Despite the continued use of telemedicine, disparities in use and acceptance of the services persist. Differences in access, socioeconomic and health factors, technological difficulties, the digital divide, privacy and security concerns, regulatory and legal issues, and clinical limitations were identified as potential causes of these disparities [26,27]. Furthermore, higher attrition rates for telemental health services were observed for certain remote service delivery models and among providers with lower levels of experience [18]. Reducing variation in use and ensuring consistent adherence to telemental health services is crucial for the effectiveness of future services, which serve as a meaningful tool in addressing current mental health care challenges.

Identifying determinants of patient use of telemental health services may help to minimize use disparities and prevent attrition. Nevertheless, existing research regarding this topic is limited, particularly from Germany. In a recently published systematic review, we included 10 studies on determinants of patient use of synchronous telemental health services during the COVID-19 pandemic (published between March 2020 and June 2023), which observed mostly mixed or nonsignificant associations [28]. Only some initial indications were found for the relationship of female sex, younger age, and lower psychological symptom severity with a higher probability of patient use. No study from Germany exploring determinants of patient use was included in this review [28].

More recent studies with samples from the United States and Canada also considered mostly synchronous services and highlighted the association of female gender, younger age, higher education, higher socioeconomic status, urban residency, speaking English at home, nonrefugee status, lower-risk chief complaints, better self-rated health, caregiver status, access to family physician, and higher eHealth literacy with higher probability of telemental health service use [29-32]. In a sample from South Korea, associations of female gender, older age, previous hospitalization, higher number of outpatient visits, comorbidity, and more severe diagnoses with higher odds of telemental health services use were observed, which partly contrasts with previous findings [33]. Very few recent studies with German samples exist, which identified male gender, younger age, higher education, having acute or residual symptoms, performance and effort expectancy, and electronic literacy as determinants of greater intention to or actual use of the services [34-37].

Objective and Relevance

Determinants of telemental health service use are scarcely investigated. Particularly, research focusing on determinants of patient use of asynchronous services and the postpandemic context is almost completely missing. Therefore, the aim of this study was to identify determinants of patient use of telemental health services since the onset of the COVID-19 pandemic and in the last 4 weeks. We will focus on a representative sample from Germany, as the German context has been understudied thus far, despite the high potential of telemental health services in this country.

We will focus on key determinants anticipated to be associated with patient use of telemental health services, based on existing literature and theory:

1. Socioeconomic factors: factors such as gender, age, education, or living area were repeatedly linked with telemental health service use in previous studies (eg, [28,29]). According to the Unified Theory of Acceptance and Use of Technology (UTAUT) [38], gender and age may be influential factors in shaping the behavioral intention to use telemedicine.
2. Access factors: previous studies have identified limited broadband internet access as a major barrier to telemental health service use [39,40]. While insurance status has been associated with health care use in Germany (such as increased general physician visits among the statutory insured [41]), the association of insurance status with telemental health service use requires further investigation.
3. Health factors: while higher severity of mental illness was associated with lower probability of telemental health service use in past research [28-30], physical health limitations were linked to higher use of telemedicine services (eg, [42,43]).
4. Psychosocial factors: associations of psychosocial characteristics with health care use (such as loneliness with higher health care use [44]) call for further investigation in telemental health services. The psychosocial UTAUT dimensions and their proven association with telemedicine use require further evaluation in the German mental health context.
5. COVID-19–related factors: COVID-19–related fear or preventive behaviors were found to be associated with telemedicine use in previous studies [42,45], which may also be applicable for telemental health care.
6. Personality: higher levels of agreeableness, extraversion, openness to experience, and particularly higher neuroticism, were associated with increased health care use [46], which was also confirmed in single studies on telemental health services [47-49].
7. Provider and service factors: beyond patient characteristics, patient use of telemental health services may be facilitated by provider attributes or service properties [50].

Telemental health services represent a valuable solution to some of the major challenges in the current provision of mental health care. Consequently, increasing the use of the services should be prioritized. Examining these determinants of patient use of telemental health services may help to uncover disparities in use and access among mental health patients, identify specific target groups and those needing additional support, and highlight potential facilitators and barriers to using the services. This knowledge may ultimately enhance the widespread use of future services. In response to the COVID-19 pandemic, telemental health services were implemented globally [19,20]. While synchronous telemental health services were used on a wide scale during this period, asynchronous service use lagged behind [20]. Expanding knowledge on the determinants of patient use of asynchronous telemental health services may help to realize the potential of the services for mental health patients and contribute to a more comprehensive understanding of telemental health service users. While telemental health services were widely used during the pandemic, the use behavior of mental health patients in the postpandemic context remains to be explored. As severe restrictions disappeared and extensive in-person visit availability returned, determinants of patient use may vary and are of particular interest for future service use.

Methods

Sample

We created an online questionnaire, which was pretested in November 2023 (n=13). After pretesting, minor refinements were made to the questionnaire, and the data collection was carried out between December 1 and December 15, 2023. Participants were recruited by the market research firm Bilendi, which is an ISO 20252:2019-certified online sample provider. We collected cross-sectional data from the general adult population in Germany (18-74 years) and only included individuals who had been using mental health services since March 2020. In addition, participants were recruited based on predetermined quotas for gender and age, reflecting mental health service use rates in Germany [51,52]. In total, 2178 individuals participated in the online survey.

Ethical Considerations

The incentive system employed by Bilendi is based on a point system or payment of cash. For the purpose of our survey, participants received a real-time cash payment upon successful completion of the questionnaire, with amounts ranging from €0.90 to €1.80 (conversion rate: US $1=€0.924 in 2023). Panel members are able to opt out of the panel at all times. Anonymized data were provided by Bilendi after the data collection was completed. All participants provided informed consent, and the study was approved by the Local Psychological Ethics Committee of the University Medical Center Hamburg-Eppendorf (LPEK-0683).

Dependent Variable

Patient use of telemental health services was assessed with a single item that inquired whether individuals had used telemental health services as part of their mental health treatment since March 2020. In March 2020, the World Health Organization officially declared COVID-19 a pandemic [53]. During that time, multiple measures to prevent spreading of the virus were implemented, also in Germany. This included extensive changes from in-person health service delivery to remote service forms [23]. Therefore, this date served as a starting point for our telemental health service use measurement. Furthermore, past users of telemental health services were asked to report the frequency of their telemental health service use in the last 4 weeks. Participants who reported using the services at least once in the last 4 weeks were categorized as current users (see Table S1 in Multimedia Appendix 1 for detailed overview of the included variables and their measurement).

Independent Variables

The association of various determinants with patient use and current use of telemental health services was tested. The determinants were chosen based on theoretical considerations, past findings, and research gaps [28,34-37]. Consequently, we included socioeconomic, access, health, COVID-19–related, psychosocial, and personality factors as well as provider characteristics as determinants. Regarding the current use of telemental health services, we also examined its relationship with service factors (see Table S1 in Multimedia Appendix 1 for detailed overview of the included variables and their measurement).

A number of socioeconomic factors were observed. This included gender (male, female, and diverse or intersex), age, employment status (unemployed, full-time employed, part-time employed, and other), area lived in (urban, mostly urban, and rural), living situation (living with a partner in the same household, living with a partner without a common household, widowed or partner deceased, and single or divorced), migration background (yes or no), and having children or grandchildren (yes or no). The International Standard Classification of Education 1997 (ISCED-97) [54] was used to classify the participants' educational level. The ISCED-97 levels were summarized into 3 groups, indicating a low (ISCED levels 0-2), medium (ISCED levels 3 and 4), or high (ISCED levels 5 and 6) educational level. In addition, the monthly household net income was categorized into tertiles (low, medium, and high) using 13 given income categories (1=less than €500, 2=€500 to under €1000, 3=€1000 to under €1500, 4=€1500 to under €2000, 5=€2000 to under €2500, 6=€2500 to under €3000, 7=€3000 to under €3500, 8=€3500 to under €4000, 9=€4000 to under €4500, 10=€4500 to under €5000, 11=€5000 to under €6000, 12=€6000 to under €8000, and 13=€8000 or higher; conversion rate: US $1=€0.924 in 2023). This assessment of household income is consistent with other large surveys, including the German Health Interview and Examination Survey for Adults (DEGS) [55] or the Hamburg City Health Survey [56].

We controlled for differences in access factors. Since differences in regulations and complexity regarding the use of telemedicine exist for the different insurance types in Germany, this factor was considered (statutory health insurance or private health insurance). Furthermore, the internet quality at the patient's home was assessed (fast and stable; fast, but not stable; stable, but not fast; and neither fast nor stable or no internet connection at home).

In addition, health factors were examined. This included depressive and anxiety symptoms. Depressive symptoms were measured using the Patient Health Questionnaire-9 (PHQ-9) [57]. The PHQ-9 is a well-established self-report measure of depression severity in the last two weeks, which consists of 9 items with a sum score ranging from 0 to 27 (higher values indicate more severe depressive symptoms). The German version of the PHQ-9 was found to be highly reliable (Cronbach α=0.88) and valid (sensitivity=95% and specificity=86%) [58]. In our sample, the Cronbach α of the scale was .88 and McDonald ω was .89. Anxiety symptoms were assessed with the widely used Generalized Anxiety Disorder Scale-7 (GAD-7) [59]. The GAD-7 comprises 7 items measuring anxiety symptoms in the last 2 weeks (sum score range 0-21, higher values indicate more severe anxiety symptoms). The German version of the GAD-7 has good reliability (Cronbach α=0.89) and validity [60]. For our sample, Cronbach α and McDonald ω were both 0.90. In addition, we assessed the presence of chronic physical illnesses (yes or no) as well as self-rated health using a 5-point Likert scale (ranging from 1=very bad to 5=very good).

We also examined COVID-19–related factors, including COVID-19 vaccination status (yes or no) and fear of COVID-19. Fear of COVID-19 was assessed with the 7-item Fear of COVID-19 Scale (FCV-19S) [61]. Higher FCV-19S scores indicate greater fear of COVID-19 (sum score range 7-35). The German version of the FCV-19S was found to exhibit good psychometric properties [62]. The scales' Cronbach α and McDonald ω were both 0.92 in our sample.

We observed several psychosocial determinants. The 6-item De Jong Gierveld Loneliness Scale [63] was used to measure loneliness. The scales' mean score ranges between 0=absence of loneliness and 11=complete loneliness. The scale was found to measure loneliness in a valid and reliable way, and reached a Cronbach α of 0.80 and McDonald ω of 0.79 in our sample. We also examined perceived social support by family and friends using the 6-item Lubben Social Network Scale (LSNS-6) [64]. The sum score of the LSNS-6 ranges between 0 and 30 (higher values indicate greater perceived social support). The good psychometric properties of the German version of the LSNS-6 were evaluated in the past [64]. In our sample, Cronbach α was 0.85 and McDonald ω was 0.82. In addition, we observed life satisfaction using the 5-item Satisfaction with Life Scale (SWLS) [65]. The sum score for the SWLS ranges between 5=extremely dissatisfied and 35=extremely satisfied. The German version of the SWLS was found to be a valid and reliable measure of life satisfaction [66]. In our sample, the SWLS had a Cronbach α and McDonald ω of 0.91. Furthermore, we included self-efficacy as determinant and assessed it with the 3-item Short Scale for Measuring General Self-efficacy Beliefs (Allgemeine Selbstwirksamkeit Kurzskala [ASKU]) [67]. The ASKU mean score ranges between 1 and 5 (higher scores indicate greater self-efficacy). We used the German version of the ASKU, which has favorable psychometric properties [67] and had a Cronbach α and McDonald ω of 0.89 in our study. Furthermore, we assessed the patient's attitude towards telemental health services using the Unified Theory of Acceptance and Use of Technology-Patient version questionnaire (UTAUT-P) [68], which shows adequate psychometric properties [68]. Also in our sample, the scale shows a Cronbach α and McDonald ω of 0.87. The UTAUT-P consists of 14 items (sum score range 14-70, higher values indicate more positive attitudes), which examine 4 factors, including the patients' therapy quality expectancy, convenience, ease of use, and pressure from others. The scale was designed to explore patient

attitudes toward telepsychotherapy in clinical practice and research and is based on the well-established framework of the UTAUT [38]. So far, no validated German translation of the UTAUT-P exists. Consequently, a German translation of the UTAUT-P was created by 2 specialized translators from the professional translation agency tolingo (translation carried out by the first and editing by a second specialized translator; ISO 17100-certified). Considering existing guidelines for the cross-cultural adaptation of self-report measures [69], we made additional refinements to the translation to improve its semantic, idiomatic, experiential, and conceptual equivalence before pretesting the questionnaire.

To test for the association of personality with patient use of telemental health services, we included the Big Five Inventory–Socio-Economic Panel (BFI-S) [70] in our online survey. The BFI-S is based on the 44-item Big Five Inventory [71] and consists of 15 items measuring conscientiousness, extraversion, openness, agreeableness, and neuroticism (each with 3 items). The scale was developed in the context of the Socio-Economic Panel and was found to have mostly acceptable psychometric properties [72]. In our sample, Cronbach α and McDonald ω for the big five personality dimensions ranged between 0.51 (agreeableness) and 0.77 (extraversion).

We additionally asked participants to describe the characteristics of their providers. Similar to former telemedicine research [73,74], we examined provider characteristics through patient ratings. The provider's attitude toward telemental health services was measured using a single item asking the patients whether they agree that their mental health provider has a positive and open attitude toward telemental health services (ranging from 1=strongly disagree to 5=strongly agree). In addition, provider skills were explored using a single item asking patients whether they agree that their mental health provider has the necessary skills and competencies to use telemental health services without any problems (ranging from 1=strongly disagree to 5=strongly agree).

Finally, we tested for associations of service factors with the current use of telemental health services. We asked participants whether they use telemental health services to avoid stigmatization, for example, to avoid meeting familiar people in mental health facilities (ranging from 1=not true at all to 5=completely true). Furthermore, the level of convenience, which telemental health services offer, was observed (yes, shorter waiting times and easier scheduling of first appointment; yes, shorter waiting times; yes, easier scheduling of first appointment; and no).

Statistical Analysis

First, descriptive sample characteristics were computed. Second, multiple logistic regressions were performed to explore the association of the determinants with patient use. Previously, model assumptions for logistic regressions were verified (eg, absence of multicollinearity). The first regression model examined associations with patient use of telemental health services since the onset of the pandemic and included all independent variables except service factors. Furthermore, we performed additional logistic regression analyses for this outcome (patient use since the pandemic) with subgroups for different telemental health service types (video, telephone, and asynchronous services) and for the two most prevalent psychiatric diagnoses in Germany (anxiety and affective disorder [75]). The second regression model investigated associations with current use of telemental health services, also including service factors as independent variables. All independent variables were included simultaneously in each of the regression models. Given that a small number of missing values were present in one independent variable (monthly household net income: 4.4% missing), listwise deletion was used to address this issue. Notably, all other variables had no missing values. Statistical significance was considered at an alpha level of $P<.05$. Stata (version 18.0; StataCorp) [76] was used for the statistical analyses. Stata's "alpha" command and "omegacoef" tool [77] were used to calculate Cronbach α and McDonald ω for all included scales.

Results

Sample Characteristics

The descriptive characteristics of all included variables are presented in Table 1. The analytic sample included 2082 individuals, of which 40% (833/2082) were men, 59.7% (1,243/2082) women, and 0.3% (6/2082) diverse or intersex. The sample included individuals from the general adult population in Germany (18-74 years), with a mean age of 45.7 (SD 11.8) years. Telemental health service use since the onset of the pandemic was reported by 44.5% (926/2082) of the sample. Among all participants, 23.2% (484/2082) had used video services, 20.6% (429/2082) telephone services, and 12.4% (285/2082) asynchronous services. Furthermore, 62.3% (560/899) of the telemental health service users in our analytic sample were classified as current users.

Table 1. Sample characteristics (N=2082).

Variables	Values
Reported use of telemental health services	
Since the onset of the COVID-19 pandemic, n (%)	
Yes	926 (44.5)
No	1156 (55.5)

Video services, n (%)	
Yes	484 (23.2)
No	1598 (76.8)
Telephone services, n (%)	
Yes	429 (20.6)
No	1653 (79.4)
Asynchronous services, n (%)	
Yes	285 (12.4)
No	1824 (87.6)
Current use among past users (in the last 4 weeks), n (%)	
Yes	560 (62.3)
No	339 (37.7)
Socioeconomic factors	
Gender, n (%)	
Men	833 (40.0)
Women	1,243 (59.7)
Diverse or intersex	6 (0.3)
Age (range 18-74), mean (SD)	45.7 (11.8)
Educational level[a], n (%)	
Low educational level (ISCED 0-2)	242 (11.6)
Medium educational level (ISCED 3-4)	1,043 (50.1)
High educational level (ISCED 5-6)	797 (38.3)
Employment status, n (%)	
Unemployed	709 (34.1)
Full-time employed	830 (39.9)
Part-time employed	387 (18.6)
Other	156 (7.5)
Monthly household net income (€)[b], n (%)	
Low income (0 to under 2000)	804 (38.6)
Medium income (2000 to under 3500)	683 (32.8)
High income (3500 or higher)	595 (28.6)
Area lived in, n (%)	
Urban	1004 (48.2)
Mostly urban	781 (37.5)
Rural	297 (14.3)
Living situation, n (%)	
Living with partner in the same household	1123 (53.9)
Living with partner without a common household	114 (5.5)
Partner deceased or widowed	58 (2.8)
Single or divorced	787 (37.8)
Migration background, n (%)	
Yes	262 (12.6)
No	1820 (87.4)
Have children, n (%)	
Yes	1156 (55.5)
No	926 (44.5)
Have grandchildren, n (%)	
Yes	334 (16.0)
No	1748 (84.0)

Access factors	
Insurance type, n (%)	
Statutory health insurance	1946 (93.5)
Private health insurance	136 (6.5)
Internet connection quality at home, n (%)	
Fast and stable	1420 (68.2)
Fast, but not stable	273 (13.1)
Stable, but not fast	227 (10.9)
Neither fast nor stable or no internet connection at home	162 (7.8)
Health factors	
Depressive symptoms[c] (range 0-27), mean (SD)	12.2 (6.3)
Anxiety symptoms[d] (range 0-21), mean (SD)	9.7 (5.4)
Presence of at least 1 chronic physical illness, n (%)	
Yes	1021 (49.0)
No	1061 (51.0)
Self-rated health (range 1-5), mean (SD)	2.9 (0.9)
COVID-19–related factors	
Received COVID-19 vaccination, n (%)	
Yes	1828 (87.8)
No	254 (12.2)
Fear of COVID-19[e] (range 7-35), mean (SD)	13.4 (6.5)
Psychosocial factors	
Loneliness[f] (mean score range 1-14), mean (SD)	2.6 (0.7)
Perceived social support by family and friends[g] (range 0-30), mean (SD)	11.7 (5.7)
Life satisfaction[h] (range 5-35), mean (SD)	17.3 (7.2)
Self-efficacy[i] (mean score range 1-5), mean (SD)	3.3 (0.9)
Attitude towards telemental health services[j] (range 14-70), mean (SD)	43.2 (10.1)
Personality[k]	
Conscientiousness (range 3-21), mean (SD)	15.7 (3.4)
Extraversion (range 3-21), mean (SD)	12.3 (4.1)
Agreeableness (range 3-21), mean (SD)	15.1 (3.1)
Openness (range 3-21), mean (SD)	14.1 (3.9)
Neuroticism (range 3-21), mean (SD)	14.9 (3.7)
Provider characteristics	
Provider attitude toward telemental health services (range 1-5), mean (SD)	3.1 (1.1)
Provider skills for using telemental health services (range 1-5), mean (SD)	3.4 (1.1)
Service factors	
Use of the services to avoid stigmatization (range 1-5), mean (SD)	2.0 (1.2)
Higher convenience of telemental health services, n (%)	
Yes, shorter waiting times and easier scheduling of first appointment	201 (21.7)
Yes, shorter waiting times	237 (25.5)
Yes, easier scheduling of first appointment	78 (8.4)
No	412 (44.4)

[a]The educational level was measured using the International Standard Classification of Education 1997 (ISCED-97). Higher values indicate a higher educational level.
[b]conversion rate: US $1=€0.924 in 2023,
[c]Depressive symptoms were measured using the Patient Health Questionnaire-9 (PHQ-9). Higher values indicate higher depressive symptoms.
[d]Anxiety symptoms were measured using the Generalized Anxiety Disorder Scale-7 (GAD-7). Higher values indicate higher anxiety symptoms.
[e]Fear of COVID-19 was measured using the Fear of COVID-19 Scale (FCV-19S). Higher values indicate higher fear of COVID-19.
[f]Loneliness was measured using the De Jong Gierveld Loneliness Scale. Higher values indicate higher loneliness.

[g]Perceived social support by family and friends was measured using the Lubben Social Network Scale-6 (LSNS-6). Higher values indicate higher perceived social support by family and friends.
[h]Life satisfaction was measured using the Satisfaction with Life Scale (SWLS). Higher values indicate higher life satisfaction.
[i]General self-efficacy was measured using the Short Scale for Measuring General Self-efficacy Beliefs (Allgemeine Selbstwirksamkeit Kurzskala [ASKU]). Higher values indicate higher self-efficacy.
[j]Attitude toward telemental health services was measured using the Unified Theory of Acceptance and Use of Technology-Patient version (UTAUT-P). Higher values indicate more positive attitudes toward telemental health services.
[k]Personality was measured using the Big Five Inventory–Socio-Economic Panel (BFI-S). Higher values indicate higher levels of the different personality traits.

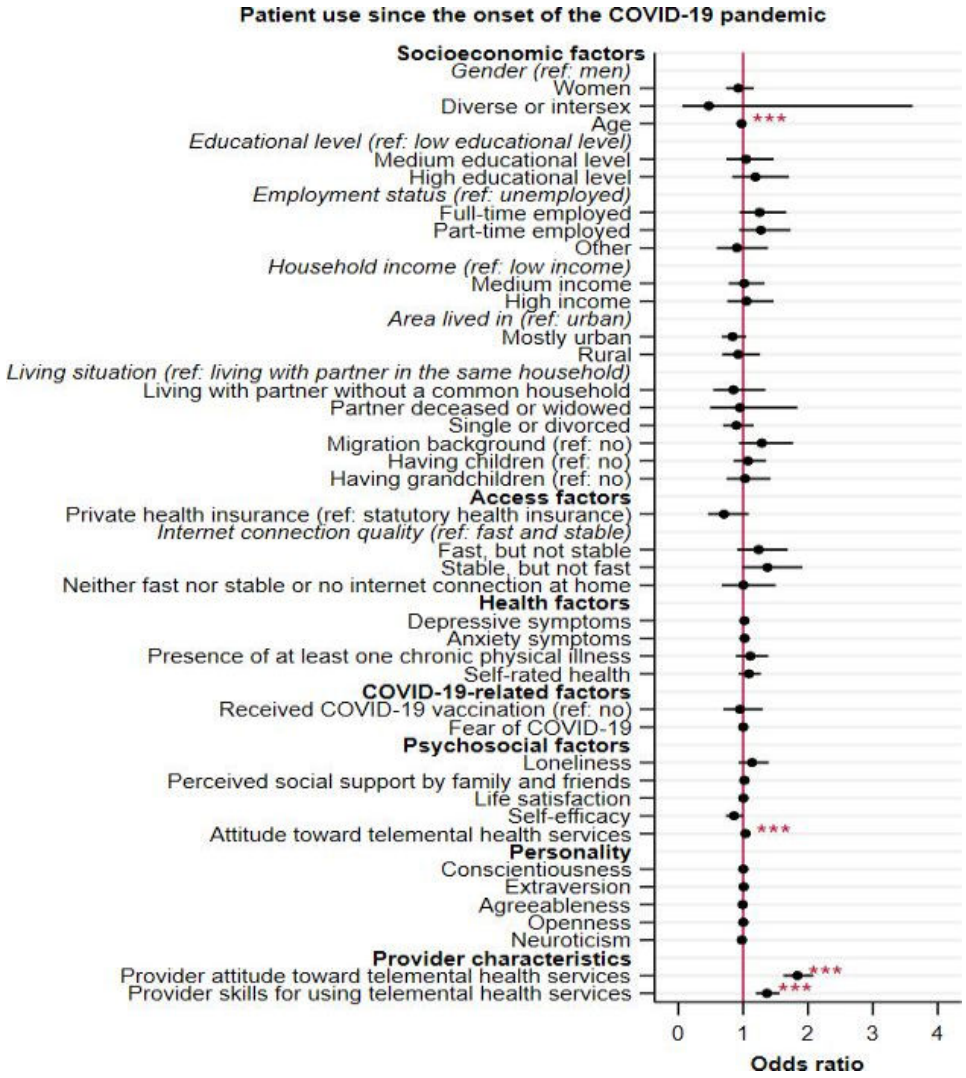
Regression Analyses

Patient Use Since the Onset of the COVID-19 Pandemic

In Figure 1, results of the multiple logistic regression for determinants of telemental health service use since the onset of the pandemic are summarized (see Table S1 in Multimedia Appendix 2 for detailed results). Patient use of telemental health services was significantly associated with younger age (OR 0.97, 95% CI 0.96-0.98; *P*<.001), a positive patient attitude towards telemental health services (OR 1.04, 95% CI 1.02-1.05; *P*<.001), a positive provider attitude towards telemental health services (OR 1.84, 95% CI 1.62-2.08; *P*<.001), and higher provider skills for using the services (OR 1.37, 95% CI 1.20-1.56; *P*<.001).

When computing further subgroup analyses for this outcome for different service types (video, telephone, and asynchronous services) and psychiatric diagnoses (anxiety and affective disorder), these relationships also reached statistical significance. However, additional positive associations of migration background, full-time or part-time employment, higher loneliness, higher perceived social support by family and friends, and greater fear of COVID-19 with patient use of telemental health services were found in single models. Additional negative associations of being a woman, being single or divorced, having private health insurance, higher self-efficacy, and higher neuroticism with patient use were found in some models (see Tables S1-S5 in Multimedia Appendix 3 for detailed results).

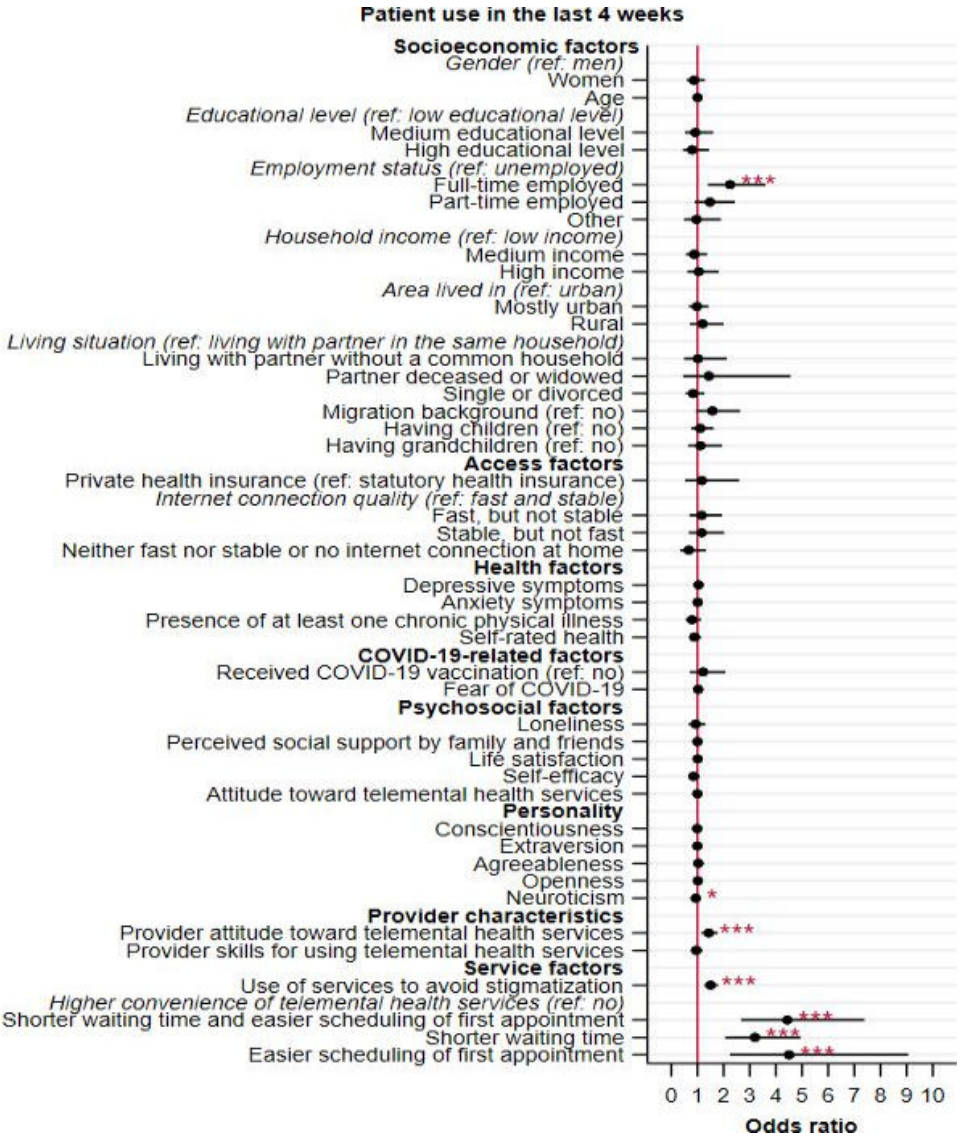
Figure 1. Results of logistic regression for determinants of telemental health service use since the onset of the COVID-19 pandemic among the total sample (N=2082). Odds ratios with 95% CIs are presented. ref: reference category. *** *P*<.001.



Patient Use in the Last 4 Weeks

When considering the current use of telemental health services, some significant relationships with the determinants were observed (see Figure 2). Multiple logistic regression revealed positive associations of full-time employment (OR 2.25, 95% CI 1.40-3.60; *P*<.001), lower levels of neuroticism (OR 0.94, 95% CI 0.88-1.00; *P*=.046), and a positive provider attitude towards the services (OR 1.43, 95% CI 1.16-1.77; *P*<.001) with the current use of telemental health services. Furthermore, service factors were exclusively included in this model and higher avoidance of stigmatization (OR 1.50, 95% CI 1.26-1.80; *P*<.001), shorter waiting times and easier scheduling of the first appointment (OR 4.44, 95% CI 2.67-7.38; *P*<.001), as well as shorter waiting times (OR 3.20, 95%CI 2.07-4.94; *P*<.001) and easier scheduling (OR 4.51, 95% CI 2.24-9.06; *P*<.001) individually, were positively associated with the current use of telemental health services (see Table S2 in Multimedia Appendix 2 for detailed results).

Figure 2. Results of logistic regression for determinants of current use of telemental health services among past users (n=899). Odds ratios with 95% CIs are presented. ref: reference category. * $P<.05$, *** $P<.001$.



Discussion

Principal Findings

In this study, we examined determinants of use (since the onset of the COVID-19 pandemic) and current use (in the last 4 weeks) of telemental health services in a representative sample of mental health care users from Germany (in terms of gender and age group). Overall, we found that telemental health service use was positively associated with younger age, a more positive patient attitude toward telemental health services, a more positive provider attitude toward using the services and higher provider skills for using the services. These findings were supported by additional subgroup analyses for service type (video, telephone, and asynchronous services) and psychiatric diagnoses (anxiety and affective disorder). When exclusively looking at current use of telemental health services, positive associations with full-time employment, lower neuroticism, a more positive provider attitude toward the services, use of the services to avoid stigmatization, long waiting times, and inconvenient scheduling were observed. We examined a wide variety of determinants, which have been rarely studied in the past, and therefore, our study provides novel insights into the use behavior of mental health patients regarding telemental health services.

Relation to Previous Research

When observing the association of socioeconomic characteristics with telemental health service use since the pandemic, mostly nonsignificant associations were found in our sample. This may suggest that telemental health service use is not linked to socioeconomic differences in Germany. No associations of socioeconomic characteristics with remote health consultation use were also found in the German SHARE sample [42]. In contrast, other telemedicine research from Germany found associations of male sex, younger age, higher or lower education, living with a partner in the same household, and having children younger than 18 years with telemedicine use during the pandemic [35,37,43,78-80]. These mixed findings call for further exploration of socioeco-

nomic disparities in telemedicine use particularly focusing on mental health patients.

Nevertheless, we found a significant association of younger age with higher likelihood of telemental health service use in our sample. Previous studies focusing on the German as well as the international context also observed this relationship [28,29,35-37]. This finding may highlight the growing grey digital divide in digital health care, which calls for action in practice and research to prevent the exclusion of older patients in remote health care [81]. Regarding current telemental health services use, only full-time employment status was associated with a higher likelihood of patient use of the services in the last 4 weeks. Full-time employed individuals may continue to value the convenience and travel time savings associated with remote services, even beyond the pandemic. In addition, full-time employed individuals may be more frequently exposed to digital devices, resulting in fewer barriers to telemental health service use. Accordingly, being employed was associated with digital health literacy in the past [82]. More studies are required to examine this relationship in postpandemic circumstances.

None of the included access factors were significantly associated with telemental health service use in our sample. The majority of mental health patients in Germany seems to have access to telemental health services, regardless of variations in internet connection quality at home or differences in individual insurance regulations. This is in line with previous international studies, which also observed no relationship between insurance status and patient use of synchronous telemental health services [83-85]. Nevertheless, disparities in access to broadband internet have been identified as a main barrier to telemedicine use in multiple international studies [39,40], which should be considered in the global context. For instance, Curtis et al [86] examined a large sample of American households and found that broadband internet access was substantially lower in rural households, racial or ethnic minority households, households with no health insurance, less educated and lower-income household.

Surprisingly, neither mental nor physical health factors had a relationship with telemental health service use in our sample. Therefore, telemental health services seem to be accessible to various patient groups. The strengths of remote services may benefit both, patients with good mental or physical health and those with severe mental or physical illness. While healthier patients may value the increased accessibility and convenience of the services in their everyday life (eg, reduced travel time and more flexibility), patients with severe health limitations may appreciate lower barriers to using remote services (eg, no travelling to appointments required and greater comfort at home). However, past findings regarding health determinants are mixed. International studies found significant associations of higher psychological symptom severity with smaller probability of telemental health service use [28-30]. Nevertheless, bad physical and mental health was associated with a higher frequency or probability of telemental health service use in recent studies [29,33,87-90]. Likewise, a study observing a German sample of adults affected by depression found that patients with acute or residual depressive symptoms were more likely to use telemental health services compared to individuals who were symptom-free [36]. More research is needed to clarify the relationship of physical and mental health with telemental health service use, particularly in German samples.

COVID-19–related determinants were not significantly associated with service use in our sample. This is in contrast to research observing significant associations of COVID-19–related challenges or fear with general telemedicine use in Germany during the pandemic [42,45,80,91]. This might be attributed to the later time period during which our data were collected. Throughout the course of the pandemic, fear of COVID-19 has decreased [92], which may have also resulted in a reduction of its associated telemedicine use. In addition, our sample included only mental health patients, who might have felt less threatened by COVID-19 compared to patients with serious physical illnesses, such as cancer or chronic respiratory diseases.

Most of the included psychosocial characteristics were not associated with patient use of telemental health services. Psychosocial factors such as loneliness or life satisfaction might be less influential compared to provider characteristics and service factors, which have a more immediate and direct influence on the patients' decision to use telemental health services. Nevertheless, significant associations with the patients' attitude towards telemental health services were observed in our study. The UTAUT dimensions, which were used to measure the patients' attitude towards the services, have previously been associated with general telemedicine use [93] and also appear to act as a major determinant of patient use of telemental health services. Higher expected therapy quality, convenience, ease of use, and pressure from others, which were measured by the UTAUT-P, might increase patient motivation and reduce resistance to using the services. However, current use of telemental health services was not significantly associated with the patient's UTAUT scores. Therefore, the UTAUT dimensions may play an important role in the initial use of telemental health services, while other factors may be more critical for the continued use of the services (eg, service factors or personal experience). Accordingly, only single UTAUT dimensions (ie, performance expectancy, social influence) were associated with continued use (intention) in previous telemedicine studies [94,95]. Future studies are required for further examination of this relationship.

None of the examined personality traits were associated with telemental health service use, which suggests that the patients' use behavior is not majorly affected by their personality. However, current use of the services was associated with lower levels of neuroticism. This is surprising since previous research on telemental health service use and engagement examined a positive relationship with higher levels of neuroticism [47-49,96]. The previous studies argue that individuals with higher neuroticism perceive greater disease threat and are engaging in more favorable health behaviors [47,49,96], which may contribute to higher

telemental health service use. A possible explanation for this contrast might be that patients with high neuroticism prefer in-person visits due to a higher need for emotional support. In the postpandemic period, when current use was assessed in our study, the availability of in-person visits returned and may have become the preferred option. Other prepandemic studies observed nonsignificant associations of neuroticism with the intention to use or actual use of telemental health services [97-99]. These mixed findings highlight the need for further research on the association of personality with patient use of telemental health services, particularly for neuroticism and the postpandemic context.

A positive provider attitude toward telemental health services was positively associated with patient use of telemental health services. Thus, mental health care providers play a crucial role in facilitating patient use and have accordingly been identified as gatekeepers to telemental health service use in numerous studies [50]. Even though providers were found to have positive attitudes toward telemental health services, multiple barriers to service use still exist [100]. For example, German mental health professionals reported legal aspects, data protection regulations, lack of personalization, safety concerns, the quality of technical equipment, and lack of information on evidence and regulations as main barriers in a recent study [101]. Therefore, providing guidelines, resources, and support for providers may be beneficial in the future to enable widespread use of the services (eg, [50]). Likewise, better provider skills for using the services were associated with increased patient use of telemental health services in our study, which further underscores the need for provider support to increase patient use of the services.

Regarding current telemental health service use, we additionally examined associations with service factors. Using the services to avoid stigmatization (eg, to avoid meeting familiar people in mental health facilities) was associated with higher probability of current use. Recent reviews also stated that telemental health services can help to overcome the barrier of stigma associated with seeking mental health treatment [102,103]. Therefore, telemental health services may play a crucial role in facilitating use of mental health care. Furthermore, shorter waiting times and easier scheduling of appointments via telemental health services were associated with current use, which further highlights the services' potential for patients. Access issues such as long waiting times and lengthy scheduling processes are a barrier to mental health treatment not only in Germany [25], but also globally [9,12]. Telemental health services are a valuable resource in tackling this issue.

Strengths and Limitations

We used data from a representative sample of mental health patients in Germany with respect to gender and age [51,52]. Thus, the use behavior of a wide range of mental health patients was inspected. Furthermore, we observed a number of independent variables and gained new insights into their association with patient use of telemental health services. More specifically, our study adds new knowledge to the current literature, regarding socioeconomic, access, health, COVID-19–related, psychosocial, and service factors as well as personality, and provider characteristics. Furthermore, we considered different service types, psychiatric diagnoses, and the postpandemic context, areas for which the existing research is limited. The included variables were measured using validated and reliable questionnaires, which adds to the credibility of our findings.

However, some limitations should be noted. We observed cross-sectional data, which limits conclusions regarding causality and longitudinal stability of the observed associations. Consequently, future longitudinal studies are needed to secure our findings. Since we conducted an online survey, our sample of mental health patients may be more likely to have access to and skills for using online services, which might have caused some selection bias. Nevertheless, the great majority of the German population has access to a sufficient internet connection. Furthermore, since we only considered anxiety and affective disorders in subgroup analyses, it remains to be explored whether determinants of patient use of telemental health service vary across other specific samples, such as individuals with other serious mental illnesses (eg, schizophrenia or bipolar disorder) or those in forensic settings. Finally, we only included patients from Germany, which restricts the generalizability of the findings to other countries. Future international research is required to draw conclusions regarding country-specific health care systems.

Conclusion

Expanding the knowledge on determinants of telemental health service use is essential to increase accessibility to and widespread use of the services. Patient characteristics, such as younger age or positive attitudes toward the services, were associated with increased service use, which may help to define target groups for telemental health services. Nevertheless, efforts are needed to also reach older patients and positively influence patient attitudes toward the services to increase overall service use. Future studies focusing on nonusers might contribute to identifying crucial barriers and misconceptions regarding telemental health services. This is increasingly important in the light of the potential and ongoing development of the digital mental health care landscape. Beyond the examined services, emerging technologies such as virtual reality or artificial intelligence are gaining prominence in the treatment of mental illness, and these innovations may play an increasing role in mental health care [104].

Apart from patient characteristics, provider skills for using and attitude toward the services as well as service factors (reduced stigmatization and higher convenience) showed significant relationships with the outcome. Therefore, providers play an essential role in facilitating patient use of telemental health services. Service awareness among providers should be promoted, along with offers of support and training. Furthermore, telemental health services represent a possible solution to nonuse of mental health services due to fear of stigmatization and inconvenience of service use (eg, long waiting times), which was supported by

our findings. This is essential for addressing unmet needs in the provision of mental health care and should be actively promoted to both patients and providers.

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Conflicts of Interest

None declared.

Multimedia Appendix 1

Included variables and their measurement.
[DOCX File (Microsoft Word File), 29 KB-Multimedia Appendix 1]

Multimedia Appendix 2

Detailed results of logistic regression for determinants of telemental health service use.
[DOCX File (Microsoft Word File), 23 KB-Multimedia Appendix 2]

Multimedia Appendix 3

Detailed results of logistic regressions for determinants of telemental health service use for different service types and psychiatric diagnoses.
[DOCX File (Microsoft Word File), 36 KB-Multimedia Appendix 3]

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Abbreviations

ASKU: Allgemeine Selbstwirksamkeit Kurzskala
BFI-S: Big Five Inventory–Socio-Economic Panel
FCV-19S: 7-item Fear of COVID-19 Scale
ISCED-97: International Standard Classification of Education 1997
LSNS-6: 6-item Lubben Social Network Scale
PHQ-9: Patient Health Questionnaire-9
SWLS: Satisfaction with Life Scale
UTAUT: Unified Theory of Acceptance and Use of Technology
UTAUT-P: Unified Theory of Acceptance and Use of Technology-Patient version

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Multimedia Appendix 1

Table S1. Included variables and their measurement.

Variables		Survey Items	Response
Patient Use	Since the onset of the COVID-19 pandemic	Did you use telemental health services as part of your mental health treatment since March 2020?	Yes, no
	Current use	How often do you currently use telemental health services as part of your mental health treatment (i.e., in the last 4 weeks)?	Daily, several times a week, once a week, one to three times a month, less often
	Service Type	Which services did you use?	Video services (online therapy via video consultations), telephone services (therapy over the phone), digital health apps (e.g., Selfapy, Mindable, elona therapy), online intervention/training (e.g., edupression.com, Novego), other
Socioeconomic	Gender	What is your gender?	Male, female, diverse/intersex
	Age	In which year were you born?	Year of birth
	Education	International Standard Classification of Education 97 (low, medium, high)	
	Employment status	What is your current employment situation?	Full-time employed, part-time employed, unemployed, other
	Household income	What is the average monthly net income of your household?	Less than 500 €, 500 € to under 1,000 €, 1,000 € to under 1,500 €, 1,500 € to under 2,000 €, 2,000 € to under 2,500 €, 2,500 € to under 3,000 €, 3,000 € to under 3,500 €, 3,500 € to under 4,000 €, 4,000 € to under 4,500 €, 4,500 € to under 5,000 €, 5,000 € to under 6,000 €, 6,000 € to under 8,000 €, 8,000 € or higher
	Residential form of partnership	What is your current relationship status?	Living with a partner in the same household, living with a partner without a common household, widowed/partner

			deceased, single/divorced
	Area lived in	What is the postcode of your current place of residence?	Categorization into urban, mostly urban, and rural according to postcode
	Migration background	Do you have a migrant background? A person has a migration background if they themselves or at least one of their parents were not born with German citizenship.	Yes, no
	Presence of own (grand)children	Do you have children/grandchildren?	Yes, no
Access	Insurance type	What is your current insurance?	Statutory health insurance, private health insurance
	Internet connection quality	Do you have a stable (uninterrupted) and fast (smooth, fast loading of content) Internet connection?	Yes, I have a fast and stable internet connection; my internet connection is fast, but not stable; My internet connection is stable, but not fast; No, my internet connection is neither fast nor stable/I do not have an internet connection at home
Health	Depression	9-item Patient Health Questionnaire-9 (PHQ-9), scores ranging from 0 to 27, higher values indicate more severe depressive symptoms	
	Anxiety	7-item Generalized Anxiety Disorder Scale-7 (GAD-7), scores ranging from 0 to 21, higher values indicate more severe anxiety symptoms	
	Physical illness	Do you have at least one chronic physical illness (e.g., diabetes, heart disease)?	Yes, no
	Self-rated health	How would you rate your current state of health?	Very bad, bad, average, good, very good
COVID-19	Vaccination status	Have you received at least one COVID-19 vaccination?	Yes, no
	Fear	7-item Fear of COVID-19 Scale (FCV-19S), scores ranging from 7 to 35, higher values indicate greater fear of COVID-19	
Psychosocial	Loneliness	6-item De Jong Gierveld Loneliness Scale, scores ranging from 1 to 4, higher values indicate higher levels of loneliness	
	Social support	6-item Lubben Social Network Scale (LSNS-6), scores ranging from 1 to 30, higher values indicate greater perceived social support	
	Life satisfaction	5-item German version of the Satisfaction with Life Scale (SWLS), scores ranging from 1 to 5, higher values indicate greater life satisfaction	
	Self-efficacy	3-item Short Scale for Measuring General Self-efficacy Beliefs ([Allgemeine Selbstwirksamkeit Kurzskala] ASKU), scores	

		ranging from 1 to 5, higher values indicate greater self-efficacy	
	Attitude toward telemedicine	14-item Unified Theory of Acceptance and Use of Technology-Patient version questionnaire (UTAUT-P), scores ranging from 17 to 70, higher values indicate more positive attitudes	
	Personality	15-item Big Five Inventory-SOEP (BFI-S)	
Provider	Attitude	Now think about your current psychotherapist/psychiatrist/doctor. To what extent do the following statements apply? If you are not currently undergoing mental health treatment, please think of your last psychotherapist/psychiatrist/doctor. My therapist has a positive and open attitude towards telemental health services (e.g., offers and advertises them).	Strongly disagree, disagree, neither, agree, strongly agree
	Skills	My therapist has the necessary skills to use telemental health services successfully and without problems (e.g., has technical skills and knowledge of the digital programs).	Strongly disagree, disagree, neither, agree, strongly agree
Service	Stigmatization	Do you use telemental health services as part of your mental health treatment to avoid stigmatization (e.g., to avoid meeting people you know in mental health facilities)?	Not true at all, not quite true, partially true, fairly true, completely true
	Higher Convenience	Do you use telemental health services as part of your mental health treatment because the waiting time for treatment is shorter, or it was easier to make a first appointment than with the usual face-to-face formats?	Yes, shorter waiting times and easier scheduling of first appointment; yes, shorter waiting times; yes, easier scheduling of first appointment; no

Multimedia Appendix 2

Table S1. Results of logistic regression for determinants of telemental health service use since the COVID-19 pandemic among the total sample (n=2,082).

Variables	Values
Socioeconomic factors	
Gender (ref: men)	
Women	0.93 (0.74 - 1.16)
Diverse or intersex	0.47 (0.06 - 3.61)
Age	0.97*** (0.96 - 0.98)
Educational level (ref: low educational level)	
Medium educational level	1.04 (0.74 - 1.47)
High educational level	1.19 (0.83 - 1.71)
Employment status (ref: unemployed)	
Full-time employed	1.25 (0.94 - 1.66)
Part-time employed	1.27 (0.94 - 1.73)
Other	0.90 (0.59 - 1.38)
Household income (ref: low income)	
Medium income	1.02 (0.78 - 1.33)
High income	1.05 (0.75 - 1.47)
Area lived in (ref: urban)	
Mostly urban	0.84 (0.67 - 1.05)
Rural	0.92 (0.68 - 1.26)
Living situation (ref: living with partner in the same household)	
Living with partner without a common household	0.85 (0.54 - 1.34)
Partner deceased or widowed	0.95 (0.49 - 1.84)
Single or divorced	0.90 (0.69 - 1.16)
Migration background (ref: no)	1.29 (0.94 - 1.77)
Having children (ref: no)	1.07 (0.85 - 1.35)
Having grandchildren (ref: no)	1.03 (0.74 - 1.42)
Access factors	
Private health insurance (ref: statutory health insurance)	0.70 (0.46 - 1.09)
Internet connection quality at home (ref: fast and stable)	
Fast, but not stable	1.24 (0.91 - 1.69)

Stable, but not fast	1.37 (0.99 - 1.91)
Neither fast nor stable or no internet connection at home	1.00 (0.67 - 1.50)
Health factors	
Depressive symptoms	1.02 (0.99 - 1.05)
Anxiety symptoms	1.02 (0.99 - 1.06)
Presence of at least one chronic physical illness (ref: no)	1.11 (0.89 - 1.39)
Self-rated health	1.09 (0.93 - 1.27)
COVID-19-related factors	
Received COVID-19 vaccination (ref: no)	0.95 (0.69 - 1.30)
Fear of COVID-19	1.00 (0.98 - 1.02)
Psychosocial factors	
Loneliness	1.14 (0.93 - 1.39)
Perceived social support by family and friends	1.02 (1.00 - 1.04)
Life satisfaction	1.00 (0.98 - 1.03)
Self-efficacy	0.86 (0.73 - 1.01)
Attitude toward telemental health services	1.04*** (1.02 - 1.05)
Personality	
Conscientiousness	1.00 (0.97 - 1.04)
Extraversion	1.01 (0.98 - 1.04)
Agreeableness	0.99 (0.96 - 1.03)
Openness	1.00 (0.97 - 1.03)
Neuroticism	0.98 (0.94 - 1.02)
Provider characteristics	
Provider attitude toward telemental health services	1.84*** (1.62 - 2.08)
Provider skills for using telemental health services	1.37*** (1.20 - 1.56)
Constant	0.01*** (0.00 - 0.06)
Observations	2,082
Pseudo R-squared	0.210

Note. Odds Ratios are reported with 95% confidence interval in parentheses. *** p<0.001, ** p<0.01, * p<0.05.

Table S2. Results of logistic regression for determinants of current use of telemental health services among past users (n=899).

Variables	Values
Socioeconomic factors	
Gender (ref: men)	
Women	0.87 (0.59 - 1.29)
Diverse or intersex	-
Age	1.00 (0.99 - 1.02)
Educational level (ref: low educational level)	
Medium educational level	0.92 (0.52 - 1.60)
High educational level	0.80 (0.44 - 1.44)
Employment status (ref: unemployed)	
Full-time employed	2.25*** (1.40 - 3.60)
Part-time employed	1.48 (0.90 - 2.43)
Other	0.96 (0.49 - 1.90)
Household income (ref: low income)	
Medium income	0.88 (0.56 - 1.37)
High income	1.05 (0.61 - 1.81)
Area lived in (ref: urban)	
Mostly urban	0.98 (0.68 - 1.42)
Rural	1.20 (0.72 - 2.00)
Living situation (ref: living with partner in the same household)	
Living with partner without a common household	1.02 (0.49 - 2.13)
Partner deceased or widowed	1.43 (0.45 - 4.56)
Single or divorced	0.84 (0.55 - 1.27)
Migration background (ref: no)	1.58 (0.94 - 2.63)
Having children (ref: no)	1.11 (0.76 - 1.61)
Having grandchildren (ref: no)	1.12 (0.64 - 1.94)
Access factors	
Private health insurance (ref: statutory health insurance)	1.17 (0.53 - 2.59)
Internet connection quality at home (ref: fast and stable)	
Fast, but not stable	1.16 (0.69 - 1.94)
Stable, but not fast	1.16 (0.67 - 2.02)

Neither fast nor stable or no internet connection at home	0.67 (0.34 - 1.33)
Health factors	
Depressive symptoms	1.04 (0.99 - 1.09)
Anxiety symptoms	1.01 (0.96 - 1.07)
Presence of at least one chronic physical illness (ref: no)	0.79 (0.55 - 1.14)
Self-rated health	0.89 (0.69 - 1.15)
COVID-19-related factors	
Received COVID-19 vaccination (ref: no)	1.22 (0.72 - 2.07)
Fear of COVID-19	1.03 (1.00 - 1.06)
Psychosocial factors	
Loneliness	0.93 (0.67 - 1.30)
Perceived social support by family and friends	1.00 (0.97 - 1.04)
Life satisfaction	1.01 (0.98 - 1.04)
Self-efficacy	0.85 (0.66 - 1.09)
Attitude toward telemental health services	1.00 (0.98 - 1.02)
Personality	
Conscientiousness	0.99 (0.94 - 1.05)
Extraversion	1.00 (0.95 - 1.05)
Agreeableness	1.03 (0.97 - 1.10)
Openness	1.02 (0.97 - 1.07)
Neuroticism	0.94* (0.88 - 1.00)
Provider characteristics	
Provider attitude toward telemental health services	1.43*** (1.16 - 1.77)
Provider skills for using telemental health services	0.95 (0.75 - 1.20)
Service factors	
Use of services to avoid stigmatization	1.50*** (1.26 - 1.80)
Higher convenience of telemental health services (ref: no)	
Shorter waiting times and easier scheduling of first appointment	4.44*** (2.67 - 7.38)
Shorter waiting times	3.20*** (2.07 - 4.94)
Easier scheduling of first appointment	4.51*** (2.24 - 9.06)
Constant	0.11

	(0.01 - 1.37)
Observations	899
Pseudo R-squared	0.255

Note. Odds Ratios are reported with 95% confidence interval in parentheses. *** p<0.001, ** p<0.01, * p<0.05.

Multimedia Appendix 3

Table S1. Results of logistic regression for determinants of patient use of video services since the COVID-19 pandemic among the total sample (n=2,082).

Variables	Values
Socioeconomic factors	
Gender (ref: men)	
Women	0.68**
	(0.52 - 0.90)
Diverse or intersex	0.50
	(0.04 - 6.53)
Age	0.96***
	(0.95 - 0.98)
Educational level (ref: low educational level)	
Medium educational level	1.24
	(0.80 - 1.93)
High educational level	1.54
	(0.98 - 2.42)
Employment status (ref: unemployed)	
Full-time employed	1.37
	(0.96 - 1.95)
Part-time employed	1.42
	(0.97 - 2.08)
Other	1.14
	(0.68 - 1.91)
Household income (ref: low income)	
Medium income	1.25
	(0.91 - 1.73)
High income	1.26
	(0.86 - 1.87)
Area lived in (ref: urban)	
Mostly urban	0.92
	(0.71 - 1.21)
Rural	1.00
	(0.69 - 1.45)
Living situation (ref: living with partner in the same household)	
Living with partner without a common household	1.03
	(0.61 - 1.75)
Partner deceased or widowed	0.67
	(0.25 - 1.74)
Single or divorced	0.96
	(0.70 - 1.31)
Migration background (ref: no)	1.04
	(0.73 - 1.49)
Having children (ref: no)	1.11
	(0.84 - 1.47)
Having grandchildren (ref: no)	0.78
	(0.51 - 1.20)
Access factors	
Private health insurance (ref: statutory health insurance)	0.74
	(0.44 - 1.23)
Internet connection quality at home (ref: fast and stable)	
Fast, but not stable	1.20
	(0.83 - 1.73)

Stable, but not fast	1.05 (0.69 - 1.60)
Neither fast nor stable or no internet connection at home	0.71 (0.39 - 1.28)
Health factors	
Depressive symptoms	1.01 (0.98 - 1.05)
Anxiety symptoms	0.99 (0.95 - 1.03)
Presence of at least one chronic physical illness (ref: no)	0.97 (0.74 - 1.26)
Self-rated health	1.09 (0.91 - 1.31)
COVID-19-related factors	
Received COVID-19 vaccination (ref: no)	1.03 (0.70 - 1.52)
Fear of COVID-19	1.01 (0.99 - 1.03)
Psychosocial factors	
Loneliness	1.09 (0.86 - 1.39)
Perceived social support by family and friends	1.01 (0.98 - 1.03)
Life satisfaction	1.00 (0.98 - 1.03)
Self-efficacy	0.82* (0.68 - 0.99)
Attitude toward telemental health services	1.06*** (1.04 - 1.07)
Personality	
Conscientiousness	0.98 (0.94 - 1.02)
Extraversion	1.02 (0.99 - 1.06)
Agreeableness	0.99 (0.95 - 1.04)
Openness	1.02 (0.98 - 1.05)
Neuroticism	0.99 (0.95 - 1.04)
Provider characteristics	
Provider attitude toward telemental health services	1.72*** (1.47 - 2.00)
Provider skills for using telemental health services	1.53*** (1.29 - 1.82)
Constant	0.00*** (0.00 - 0.01)
Observations	2,082
Pseudo R-squared	0.258

Note. Odds Ratios are reported with 95% confidence interval in parentheses. *** p<0.001, ** p<0.01, * p<0.05.

Table S2. Results of logistic regression for determinants of patient use of telephone services since the COVID-19 pandemic among the total sample (n=2,082).

Variables	Values
Socioeconomic factors	
Gender (ref: men)	
Women	0.92 (0.71 - 1.20)
Diverse or intersex	0.85 (0.08 - 8.71)
Age	0.98* (0.97 - 1.00)
Educational level (ref: low educational level)	
Medium educational level	1.12 (0.75 - 1.68)
High educational level	1.17 (0.77 - 1.78)
Employment status (ref: unemployed)	
Full-time employed	1.23 (0.88 - 1.72)
Part-time employed	1.40 (0.98 - 2.01)
Other	0.92 (0.55 - 1.55)
Household income (ref: low income)	
Medium income	1.02 (0.75 - 1.40)
High income	1.08 (0.74 - 1.58)
Area lived in (ref: urban)	
Mostly urban	1.00 (0.77 - 1.30)
Rural	1.31 (0.93 - 1.85)
Living situation (ref: living with partner in the same household)	
Living with partner without a common household	1.09 (0.66 - 1.79)
Partner deceased or widowed	0.85 (0.38 - 1.86)
Single or divorced	0.74 (0.55 - 1.00)
Migration background (ref: no)	1.41* (1.00 - 1.99)
Having children (ref: no)	1.17 (0.89 - 1.52)
Having grandchildren (ref: no)	0.91 (0.62 - 1.32)
Access factors	
Private health insurance (ref: statutory health insurance)	0.91 (0.56 - 1.49)
Internet connection quality at home (ref: fast and stable)	
Fast, but not stable	1.03 (0.72 - 1.47)
Stable, but not fast	1.24 (0.83 - 1.83)

Neither fast nor stable or no internet connection at home	1.15 (0.71 - 1.84)
Health factors	
Depressive symptoms	1.02 (0.99 - 1.06)
Anxiety symptoms	1.00 (0.96 - 1.04)
Presence of at least one chronic physical illness (ref: no)	1.08 (0.84 - 1.39)
Self-rated health	0.96 (0.81 - 1.14)
COVID-19-related factors	
Received COVID-19 vaccination (ref: no)	0.76 (0.53 - 1.08)
Fear of COVID-19	1.03** (1.01 - 1.05)
Psychosocial factors	
Loneliness	1.14 (0.90 - 1.43)
Perceived social support by family and friends	1.01 (0.99 - 1.04)
Life satisfaction	0.99 (0.96 - 1.01)
Self-efficacy	0.94 (0.79 - 1.12)
Attitude toward telemental health services	1.02** (1.01 - 1.03)
Personality	
Conscientiousness	1.01 (0.97 - 1.05)
Extraversion	1.01 (0.98 - 1.05)
Agreeableness	1.01 (0.97 - 1.06)
Openness	1.00 (0.97 - 1.04)
Neuroticism	0.98 (0.94 - 1.02)
Provider characteristics	
Provider attitude toward telemental health services	1.49*** (1.28 - 1.73)
Provider skills for using telemental health services	1.42*** (1.20 - 1.67)
Constant	0.01*** (0.00 - 0.03)
Observations	2,082
Pseudo R-squared	0.140

Note. Odds Ratios are reported with 95% confidence interval in parentheses. *** p<0.001, ** p<0.01, * p<0.05.

Table S3. Results of logistic regression for determinants of patient use of asynchronous services since the COVID-19 pandemic among the total sample (n=2,082).

Variables	Values
Socioeconomic factors	
Gender (ref: men)	
Women	0.82 (0.59 - 1.13)
Diverse or intersex	1.02 (0.07 - 15.09)
Age	0.97*** (0.96 - 0.99)
Educational level (ref: low educational level)	
Medium educational level	1.20 (0.69 - 2.07)
High educational level	1.45 (0.83 - 2.53)
Employment status (ref: unemployed)	
Full-time employed	2.56*** (1.62 - 4.05)
Part-time employed	2.03** (1.23 - 3.36)
Other	1.61 (0.83 - 3.12)
Household income (ref: low income)	
Medium income	1.08 (0.72 - 1.61)
High income	1.16 (0.73 - 1.83)
Area lived in (ref: urban)	
Mostly urban	0.82 (0.60 - 1.13)
Rural	0.82 (0.52 - 1.29)
Living situation (ref: living with partner in the same household)	
Living with partner without a common household	0.74 (0.39 - 1.41)
Partner deceased or widowed	0.85 (0.30 - 2.39)
Single or divorced	0.63* (0.43 - 0.92)
Migration background (ref: no)	0.79 (0.51 - 1.21)
Having children (ref: no)	1.20 (0.86 - 1.66)
Having grandchildren (ref: no)	0.88 (0.54 - 1.46)
Access factors	
Private health insurance (ref: statutory health insurance)	1.00 (0.58 - 1.72)
Internet connection quality at home (ref: fast and stable)	
Fast, but not stable	1.04 (0.68 - 1.59)
Stable, but not fast	0.60 (0.34 - 1.07)

Neither fast nor stable or no internet connection at home	0.56 (0.27 - 1.17)
Health factors	
Depressive symptoms	1.03 (0.99 - 1.08)
Anxiety symptoms	1.03 (0.98 - 1.08)
Presence of at least one chronic physical illness (ref: no)	1.04 (0.76 - 1.42)
Self-rated health	1.12 (0.91 - 1.39)
COVID-19-related factors	
Received COVID-19 vaccination (ref: no)	1.36 (0.85 - 2.19)
Fear of COVID-19	1.02 (1.00 - 1.05)
Psychosocial factors	
Loneliness	1.00 (0.76 - 1.33)
Perceived social support by family and friends	0.99 (0.96 - 1.02)
Life satisfaction	1.00 (0.97 - 1.03)
Self-efficacy	0.98 (0.79 - 1.22)
Attitude toward telemental health services	1.03** (1.01 - 1.05)
Personality	
Conscientiousness	0.96 (0.91 - 1.01)
Extraversion	0.98 (0.94 - 1.02)
Agreeableness	1.03 (0.98 - 1.08)
Openness	1.02 (0.97 - 1.06)
Neuroticism	0.92** (0.88 - 0.97)
Provider characteristics	
Provider attitude toward telemental health services	1.53*** (1.26 - 1.85)
Provider skills for using telemental health services	0.85 (0.69 - 1.03)
Constant	0.03** (0.00 - 0.28)
Observations	2,082
Pseudo R-squared	0.166

Note. Odds Ratios are reported with 95% confidence interval in parentheses. *** p<0.001, ** p<0.01, * p<0.05.

Table S4. Results of logistic regression for determinants of telemental health service use among patients with an anxiety diagnosis since the COVID-19 pandemic (n=983).

Variables	Values
Socioeconomic factors	
Gender (ref: men)	
Women	0.99 (0.69 - 1.40)
Diverse or intersex	-
Age	0.97** (0.96 - 0.99)
Educational level (ref: low educational level)	
Medium educational level	0.94 (0.58 - 1.51)
High educational level	1.23 (0.74 - 2.05)
Employment status (ref: unemployed)	
Full-time employed	1.16 (0.76 - 1.78)
Part-time employed	1.24 (0.80 - 1.94)
Other	1.17 (0.62 - 2.19)
Household income (ref: low income)	
Medium income	0.86 (0.58 - 1.29)
High income	0.90 (0.55 - 1.47)
Area lived in (ref: urban)	
Mostly urban	0.89 (0.63 - 1.25)
Rural	0.80 (0.50 - 1.28)
Living situation (ref: living with partner in the same household)	
Living with partner without a common household	0.70 (0.35 - 1.41)
Partner deceased or widowed	0.68 (0.22 - 2.09)
Single or divorced	0.86 (0.58 - 1.27)
Migration background (ref: no)	1.52 (0.94 - 2.47)
Having children (ref: no)	0.93 (0.65 - 1.32)
Having grandchildren (ref: no)	1.07 (0.65 - 1.76)
Access factors	
Private health insurance (ref: statutory health insurance)	0.45* (0.22 - 0.90)
Internet connection quality at home (ref: fast and stable)	
Fast, but not stable	0.92 (0.57 - 1.50)
Stable, but not fast	1.24 (0.76 - 2.01)

Neither fast nor stable or no internet connection at home	1.04 (0.55 - 1.95)
Health factors	
Depressive symptoms	1.03 (0.98 - 1.07)
Anxiety symptoms	1.00 (0.95 - 1.06)
Presence of at least one chronic physical illness (ref: no)	1.02 (0.73 - 1.42)
Self-rated health	1.20 (0.95 - 1.53)
COVID-19-related factors	
Received COVID-19 vaccination (ref: no)	0.80 (0.50 - 1.27)
Fear of COVID-19	0.99 (0.96 - 1.01)
Psychosocial factors	
Loneliness	1.44* (1.06 - 1.96)
Perceived social support by family and friends	1.04* (1.00 - 1.07)
Life satisfaction	1.02 (0.99 - 1.06)
Self-efficacy	0.71** (0.56 - 0.89)
Attitude toward telemental health services	1.03*** (1.01 - 1.05)
Personality	
Conscientiousness	0.96 (0.91 - 1.01)
Extraversion	1.02 (0.98 - 1.07)
Agreeableness	1.02 (0.96 - 1.07)
Openness	1.04 (0.99 - 1.08)
Neuroticism	0.96 (0.90 - 1.02)
Provider characteristics	
Provider attitude toward telemental health services	1.92*** (1.58 - 2.32)
Provider skills for using telemental health services	1.50*** (1.23 - 1.84)
Constant	0.01*** (0.00 - 0.13)
Observations	983
Pseudo R-squared	0.253

Note. Odds Ratios are reported with 95% confidence interval in parentheses. *** p<0.001, ** p<0.01, * p<0.05.

Table S5. Results of logistic regression for determinants of telemental health service use among patients with an affective disorder diagnosis since the COVID-19 pandemic (n=1,470).

Variables	Values
Socioeconomic factors	
Gender (ref: men)	
Women	0.92 (0.69 - 1.22)
Diverse or intersex	0.14 (0.01 - 2.29)
Age	0.98*** (0.96 - 0.99)
Educational level (ref: low educational level)	
Medium educational level	0.97 (0.64 - 1.47)
High educational level	1.13 (0.73 - 1.75)
Employment status (ref: unemployed)	
Full-time employed	1.04 (0.74 - 1.45)
Part-time employed	1.40 (0.98 - 2.00)
Other	1.02 (0.62 - 1.69)
Household income (ref: low income)	
Medium income	1.00 (0.72 - 1.37)
High income	1.03 (0.69 - 1.55)
Area lived in (ref: urban)	
Mostly urban	0.85 (0.65 - 1.12)
Rural	0.93 (0.64 - 1.36)
Living situation (ref: living with partner in the same household)	
Living with partner without a common household	0.68 (0.39 - 1.20)
Partner deceased or widowed	1.01 (0.46 - 2.20)
Single or divorced	0.92 (0.67 - 1.26)
Migration background (ref: no)	1.18 (0.78 - 1.78)
Having children (ref: no)	1.12 (0.85 - 1.49)
Having grandchildren (ref: no)	0.92 (0.62 - 1.37)
Access factors	
Private health insurance (ref: statutory health insurance)	0.87 (0.51 - 1.47)
Internet connection quality at home (ref: fast and stable)	
Fast, but not stable	0.92 (0.64 - 1.34)
Stable, but not fast	1.24 (0.82 - 1.87)

Neither fast nor stable or no internet connection at home	1.19 (0.75 - 1.90)
Health factors	
Depressive symptoms	1.03 (1.00 - 1.07)
Anxiety symptoms	1.01 (0.97 - 1.06)
Presence of at least one chronic physical illness (ref: no)	1.02 (0.78 - 1.33)
Self-rated health	1.04 (0.86 - 1.26)
COVID-19-related factors	
Received COVID-19 vaccination (ref: no)	0.81 (0.55 - 1.20)
Fear of COVID-19	1.00 (0.97 - 1.02)
Psychosocial factors	
Loneliness	1.24 (0.98 - 1.58)
Perceived social support by family and friends	1.02 (1.00 - 1.05)
Life satisfaction	1.01 (0.99 - 1.04)
Self-efficacy	0.93 (0.77 - 1.12)
Attitude toward telemental health services	1.03*** (1.02 - 1.04)
Personality	
Conscientiousness	1.01 (0.97 - 1.06)
Extraversion	1.00 (0.97 - 1.04)
Agreeableness	1.01 (0.97 - 1.05)
Openness	1.01 (0.98 - 1.05)
Neuroticism	0.98 (0.93 - 1.03)
Provider characteristics	
Provider attitude toward telemental health services	2.00*** (1.71 - 2.33)
Provider skills for using telemental health services	1.36*** (1.16 - 1.60)
Constant	0.01*** (0.00 - 0.04)
Observations	1,470
Pseudo R-squared	0.219

Note. Odds Ratios are reported with 95% confidence interval in parentheses. *** p<0.001, ** p<0.01, * p<0.05.

8. Publication 5: Determinants of Patient Satisfaction With Telemental Health Services in Germany: Representative Cross-Sectional Postpandemic Survey Study

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Original Paper

Determinants of Patient Satisfaction With Telemental Health Services in Germany: Representative Cross-Sectional Postpandemic Survey Study

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Abstract

Background: Increasing patient satisfaction with telemental health services is crucial for promoting widespread implementation and ensuring consistent utilization rates in the future, where these services could be a beneficial addition to routine mental health care. Nevertheless, knowledge regarding determinants of patient satisfaction with telemental health services is very limited.

Objective: This study aimed to identify determinants of patient satisfaction with telemental health services.

Methods: A cross-sectional, quota-based (quotas: gender and age group), web-based survey was conducted in December 2023 in Germany. The sample included individuals aged 18-74 years who had received telemental health services since March 2020 (N=854). Patient satisfaction with video, telephone, and asynchronous services was measured using the Telemedicine Satisfaction Questionnaire or the Client Satisfaction Questionnaire adapted to internet-based interventions. The association of socioeconomic, access, health, psychosocial, personality, and COVID-19-related factors, as well as patient preferences and provider characteristics with patient satisfaction, was tested using multiple linear regressions.

Results: A positive patient attitude towards telemental health services and greater fear of COVID-19 as well as a positive and open provider attitude and higher provider skills for using the services were positively associated with patient satisfaction in all service groups ($P<.05$). Furthermore, the patients' educational level, employment status, relationship status, certain personality factors, technology commitment, loneliness, self-efficacy, and internet connection quality at home were significantly associated with satisfaction in at least 1 service group. Physical and mental health determinants were not significantly associated with the outcome.

Conclusions: Satisfaction with telemental health services is particularly associated with psychosocial characteristics, individual preferences, and attitudes of patients, which should be considered when addressing target groups for the services. Furthermore, positive provider attitudes towards and higher skills for using the services are heavily associated with patient satisfaction. Training and support for providers should be prioritized to promote patient satisfaction and widespread use of future services.

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Keywords: telemental health; telepsychiatry; teletherapy; telemedicine; digital health; patient satisfaction; patient preferences

Introduction

Background

Mental illnesses are a leading cause of disability and were estimated to account for up to 16% of global disability-adjusted life years [1]. Even though the mental illness incidence rate is predicted to slowly decrease over the next years, the number of affected individuals and deaths due to mental illnesses is expected to grow further [2]. Particularly in the wake of the COVID-19 pandemic, an increase in the prevalence of mental illnesses was observed [3,4].

To deal with the increased demand for mental health care and the limited availability of in-person services during the pandemic, telemental health services have become indispensable. According to the National Institute of Mental Health [5], telemental health is defined as the use of telecommunications or videoconferencing technology to provide mental health care services. Overall, a 154% increase in telehealth visits in March 2020 compared to March 2019 was observed in the United States [6]. The specialty with the highest telemedicine use during the pandemic was behavioral health [7]. In a sample of mental health care providers from Florida (United States), the number of providers using telemedicine daily increased from 17% to 40% during the pandemic, and they expected to continue using telemedicine services as much or even more in the future [8]. Accordingly, the global use of telemental health services remained at a greater level compared to the prepandemic period and is anticipated to further expand in future mental health care [9].

Telemental health services can be delivered via synchronous services (eg, video or telephone calls), asynchronous services (eg, mobile apps, web-based interventions, and email), or hybrid combinations [10]. These service types have different approaches and are often used for different purposes in clinical practice [11]. Whereas the direct real-time interactions delivered via synchronous services allow almost similar treatment to in-person visits, asynchronous services are rather used for assessment or as a supplement to in-person care [11]. Telemental health services were found to be effective. Multiple reviews evaluated the effectiveness of synchronous services and suggested similar outcomes to in-person services as well as high diagnostic reliability between virtual and in-person visits [12-14]. For example, a meta-analysis of 20 randomized controlled trials by Shaker et al [14] found comparable results (synchronous video vs in-person consultations) for treatment efficiency, patient satisfaction, attrition rates, and working alliance in patients diagnosed with posttraumatic stress, mood, and anxiety disorders. Recent reviews also point towards the clinical effectiveness of asynchronous telemental health services [15-18]. For instance, a systematic review by O'Keefe et al [15] examined that asynchronous services may improve psychiatric symptoms and adherence rates, and are effective for diagnosis and scheduling activities.

General strengths of telemental health services include increased access to care, cost and time savings as well as greater convenience and flexibility (eg, [19,20]). Therefore, telemental health services have the potential to address and help mitigate future mental health care challenges such as physician shortages or increased demand for care due to population aging or in refugee populations, stigmatization associated with visiting mental health facilities, and provision of care in rural areas [20,21]. Telemental health services enable location-independent care, which can help to balance out supply shortages (eg, in rural areas and for specific or minority patient groups) and eliminate access issues (eg, for mobility-restricted individuals or long travel times). The services can be adapted to the individual preferences and needs of patients and offer some degree of anonymity [19,20].

Patients were found to be greatly satisfied with telemental health services [12-15]. A review by Sharma and Devan [12] highlighted that particularly in children and adolescents, satisfaction rates were high. They found that patients valued strengths such as greater ease in discussing sensitive topics and comfortability. In addition, specific patient groups including patients with limited mobility, patients living in rural areas as well as patients from prison or forensic settings were especially satisfied [12]. Furthermore, patients seem to prefer hybrid models for future mental health care [12,19]. High patient satisfaction is crucial for promoting widespread acceptance of telemental health services and preventing attrition in future remote mental health care. Knowledge about the determinants of patient satisfaction with these services is essential to ensure and enhance satisfaction with these services. Nevertheless, the determinants of patient satisfaction with telemental health services have been scarcely investigated thus far.

In response to this research gap, we recently published a systematic review regarding determinants of patient use and satisfaction with synchronous telemental health services during the COVID-19 pandemic [22]. Considering information from 10 studies on patient satisfaction, we mostly observed nonsignificant associations of socioeconomic factors, health, service factors, experience, psychosocial factors, and facilitating conditions with satisfaction. However, potential relationships with some psychosocial (eg, COVID-19-related stress or fear) and service factors (eg, greater satisfaction with video compared to telephone services) were identified. Furthermore, the need for future studies, particularly focusing on effort and performance expectancy, psychosocial factors as well as facilitating conditions was highlighted [22]. More recent studies also found no association of patient satisfaction with socioeconomic determinants (such as gender, age, marital status, or occupation), insurance status, psychiatric diagnosis, or frequency of telemental health service use [23-26]. However, relationships of higher education, urban residence, and low or high income with patient satisfaction were found in individual studies [23,24,26]. In addition, technical difficulties, unstable internet access, and worsening of depressive or anxiety symptoms were associated with lower patient satisfaction in one study [23]. Only limited research exists on asynchronous telemental health services. Individual studies found associations of women gender, higher self-regulation, and patient status with patient satisfaction [27,28].

As a result of the COVID-19 pandemic, synchronous as well as asynchronous telemental health services were also widely implemented in Germany, which is the focus of our study. Already in November 2019, the Digital Healthcare Act was approved to promote the digital transformation of the German health care system [29]. For instance, this includes regulations that facilitate the prescription of mobile health apps, provision of web-based video consultations, and integration of digital provider networks. Furthermore, the Digital Health Applications Ordinance [30] was approved in April 2020, which regulates policies for digital health applications in Germany regarding security, quality, data protection, and data security. Consequently, the use of digital health applications increased during the pandemic in Germany. The overall telemedicine use among contract physicians and psychotherapists increased from 6.1% (2019) to 24.6% (2021) [31]. Telemental health services were used most frequently in Germany and accounted for 86.3% of all offered telemedicine services in 2021 [31].

Future mental health care challenges are highly relevant to high-income countries also including Germany (eg, physician shortages, aging population, and mental health care for refugees) and research indicates unmet needs in the current provision of mental health care in Germany [32]. Telemental health services could play a significant role in addressing these issues. Very few studies from Germany have found high patient satisfaction with the services, which was associated with newer patient status (ie, patients who had just started outpatient telephone therapy compared to patients in ongoing therapy who switched to telephone services) and video services (compared to telephone services) but not with age, gender, symptom severity, stress, psychosocial functioning, or computer skills [28,33-35].

Objective

Increasing patient satisfaction with telemental health services is vital for their successful and widespread implementation, potentially serving as a valuable addition to the future of routine mental health care. Currently, there is generally limited evidence regarding the determinants of patient satisfaction with telemental health services and multiple research gaps exist that are listed as follows:

1. Psychosocial determinants and individual patient preferences may be critical, as they potentially are modifiable towards greater patient satisfaction (eg, [36,37]).
2. There is unclear evidence regarding differences in socioeconomic, health, and access factors, and their impact on patient satisfaction. These factors might pose additional hurdles for telemental health service users, potentially impacting their satisfaction levels.
3. Little is known about the relationship of provider characteristics and patient satisfaction. Since provider characteristics were found to be connected to patient satisfaction with telemedicine (eg, [38,39]), they might also be a key factor contributing to patient satisfaction.
4. Studies considering asynchronous services and the postpandemic context (ie, simultaneous availability of in-person and remote services) are lacking.

Nevertheless, these factors may be critical for better understanding patient preferences in the current landscape of mental health care. Therefore, our study aimed to identify determinants of patient satisfaction with telemental health services in Germany.

Methods

Sample

Cross-sectional data of the general adult population in Germany (18-74 y) were collected by the market research firm Bilendi, an International Organization for Standardization (ISO) 20252:2019-certified sample provider. The inclusion criteria were as follows: individuals who had been using mental health services since March 2020 were considered for participation in the web-based survey. In addition, participants were recruited based on quotas for gender and age, which were derived from mental health service utilization rates in Germany [32,40] to promote the representativeness of our sample. The web-based questionnaire was pretested in November 2023 including 13 individuals (n=8 women) to assess clarity and accuracy of the questionnaire and check for potential bias. Very minor amendments were made after pretesting. Eventually, the data collection was carried out between December 1 and December 15, 2023. Overall, 2178 adults took part in the web-based survey. Since we wanted to examine satisfaction among patients who already had experience with telemental health services, only individuals who reported past use of these services were included in our study (N=854).

Ethical Considerations

Participants received compensation from Bilendi, which included real-time cash payments ranging from 0.90€ to 1.80€ (conversion rate in 2023: US $1=€0.924) upon completion of the questionnaire. After data collection was finalized, Bilendi supplied an anonymized data set. All participants provided informed consent and Bilendi panel members are able to opt out of the panel at any time. The study was approved by the Local Psychological Ethics Committee of the University Medical Center Hamburg-Eppendorf (LPEK-0683).

Dependent Variable

Patient satisfaction with telemental health services was measured using validated instruments. For synchronous telemental health services, including video and telephone services, the Telemedicine Satisfaction Questionnaire was used (TSQ; [41]). The questionnaire consists of 14 items with a 5-point Likert scale (ranging from 1=strongly disagree to 5=strongly agree), which assesses the quality of care, similarity to in-person encounters, and the overall perception of the interaction. Therefore, the TSQ sum score can range between 14 and 70, with higher values indicating

greater satisfaction. The TSQ was evaluated in the past and shows favorable psychometric properties [41]. In our sample, Cronbach α and McDonald ω for the TSQ were 0.94 for video services and 0.93 for telephone services. Since the original version of the TSQ was published in English, the questionnaire was translated into German by 2 specialized translators from the professional translation agency Tolingo (translation carried out by the first and editing by a second specialized translator; ISO 17100-certified). Guided by existing guidelines for the cross-cultural adaptation of self-report measures (eg, [42]), we further refined the translation to enhance its semantic, idiomatic, experiential, and conceptual equivalence before pretesting the questionnaire. Experts from the fields of health services research and psychology were involved in this process.

Satisfaction with asynchronous services was measured with the Client Satisfaction Questionnaire adapted to internet-based interventions (CSQ-I; [43]). The CSQ-I consists of 8 items, which measure the general satisfaction of the patients with the intervention and the help they received as well as the likelihood of recommending and reusing the services using a 4-point Likert scale (ranging from 1=does not apply to me to 4=does totally apply to me). The overall CSQ-I score can range between 8 and 32, with higher values indicating greater levels of satisfaction. The German version of the CSQ-I showed very good reliability and construct validity [43]. When measuring patient satisfaction with asynchronous telemental health services in our study, the CSQ-I showed a Cronbach α and McDonald ω of 0.95.

Independent Variables

Multiple determinants and their association with patient satisfaction with telemental health services were observed. Based on theoretical consideration, past findings and research gaps (eg, [22]), socioeconomic, access, health, psychosocial, personality, and COVID-19-related factors, as well as patient preferences (based on the Unified Theory of Acceptance and Use of Technology; UTAUT [44]), were included as determinants. In addition, we considered provider characteristics to test their potential relationship with patient satisfaction.

Socioeconomic factors that were observed in our study included gender (men, women, diverse or intersex), age, employment status (unemployed, full-time employed, part-time employed, and other), area lived in (urban, mostly urban, and rural), living situation (living with a partner in the same household, living with a partner without a common household, widowed or partner deceased, single or divorced) and migration background (no and yes). The educational level of participants was classified based on the (International Standard Classification of Education 1997; ISCED-97; [45]). The ISCED-97 levels were aggregated into 3 groups indicating a low (ISCED levels 0-2), medium (ISCED levels 3 and 4), or high (ISCED levels 5 and 6) educational level. Furthermore, the monthly household net income was categorized into tertiles (low, medium, and high) based on 13 given income categories (1=less than €500; 2=€500 to under €1000; 3=€1000 to under €1500; 4=€1500 to under €2000; 5=€2000 to under €2500; 6=€2500 to under €3000; 7=€3000 to under €3500; 8=€3500 to under €4000; 9=€4000 to under €4500; 10=€4500 to under €5000, 11=€5000 to under €6000; 12=€6000 to under €8000; 13=€8000 or higher; conversion rate in 2023: US $1=€0.924). This assessment of household income is similar to other large surveys such as the German Health Interview and Examination Survey for Adults (Studie zur Gesundheit Erwachsener in Deutschland [46]) or the Hamburg City Health Survey [47].

Different access factors were examined. Due to differences in regulations and complexity regarding the use of telemedicine, different insurance types (statutory health insurance and private health insurance) were included as determinants. In addition, the internet connection quality at the patients' home was considered (fast and stable; fast, but not stable; stable, but not fast; neither fast nor stable or no internet connection at home).

Health factors included the number of psychiatric diagnoses that patients received since March 2020 and the presence of chronic physical illnesses (no and yes). Furthermore, self-rated health was measured using a 5-point Likert scale (ranging from 1=very bad to 5=very good).

Psychosocial factors that were observed are loneliness and general self-efficacy. Loneliness was measured using the 6-item De Jong Gierveld Loneliness Scale [48], which has good psychometric properties [48]. Also in our sample, the scales' Cronbach α was 0.80 and McDonald ω was 0.79. In addition, general self-efficacy was measured with the 3-item Short Scale for Measuring General Self-efficacy Beliefs (Allgemeine Selbstwirksamkeit Kurzskala; ASKU [49]). The German version of the ASKU was found to measure self-efficacy in a reliable and valid way [49]. The scales' Cronbach α and McDonald omega were 0.89 in our study.

Personality was assessed using the Big Five Inventory–Socio-Economic Panel (BFI-S) [50]. The BFI-S contains 15 items, which measure conscientiousness, extraversion, openness, agreeableness, and neuroticism (each with 3 items). The scale was developed as part of the Socio-Economic Panel and is based on the original 44-item Big Five Inventory [51]. The BFI-S shows mostly acceptable reliability and validity [52]. Cronbach α and McDonald ω for the 5 dimensions ranged between 0.51 (agreeableness) and 0.77 (extraversion) in our sample.

COVID-19-related factors that we controlled for are COVID-19 vaccination status (no and yes) and fear of COVID-19. The 7-item Fear of COVID-19 Scale was used to measure fear of COVID-19 [53]. The German version of the 7-item Fear of COVID-19 Scale shows good psychometric properties [54] and reached a Cronbach α and McDonald ω of 0.92 in our sample.

Patient preferences that were examined are attitude towards telemental health services and technology commitment. The attitude towards telemental health services was assessed using the Unified Theory of Acceptance and Use of Technology-Patient version (UTAUT-P; [55]), which is

a 14-item self-report measure to explore patient attitudes towards telepsychotherapy in clinical practice and research. The instrument is based on the well-established framework of the UTAUT [44] and was adapted to the context of patients receiving telepsychotherapy. The UTAUT-P includes four factors, which evaluate the patients' therapy quality expectancy, convenience, ease of use, and pressure from others. It shows adequate validity and reliability [55] and Cronbach α and McDonald ω were 0.87 in our sample. Since the UTAUT-P is only available in English, it also had to be translated into German by 2 specialized translators from Tolingo for our study (translation carried out by the first and editing by a second specialized translator; ISO 17100-certified). Again, the translation was reviewed by a group of experts before the questionnaire was pretested, as recommended in existing guidelines (eg, [42]). Furthermore, technology commitment was measured with the technology commitment (Kurzskala Technikbereitschaft) 12-item short scale [56]. The scale focuses on willingness to use technology and measures technology acceptance, technology competence, and technology control beliefs. The German version of the scale has favorable psychometric properties [56] and had a Cronbach α of 0.84 and McDonald ω of 0.80 in our sample.

To observe the relationship of provider characteristics with patient satisfaction, we included the providers' attitude towards telemental health services and the provider skills for using the services as determinants. To assess the provider attitude towards the services, participants were asked whether they agree that their mental health provider has a positive and open attitude towards telemental health services (ranging from 1=strongly disagree to 5=strongly agree). For observing provider skills, participants were asked whether they agree that their mental health care provider has the necessary skills and competencies to use telemental health services without any problems (ranging from 1=strongly disagree to 5=strongly agree).

Statistical Analysis

Descriptive characteristics for all included variables were computed. To test the relationship between the determinants and patient satisfaction with telemental health services, multiple linear regressions were performed. Model assumptions for linear regression were checked in advance (eg, multicollinearity, homoscedasticity, and normality). Consequently, cluster-robust standard errors were calculated for all models to adjust for heteroscedasticity. By default, listwise deletion is applied in Stata SE 18.0 (StataCorp LLC) to deal with missing data. Therefore, additional analyses using full-information maximum likelihood models were conducted to further address missing data [57]. Stata (SE, version 18.0; [58]) was used for all statistical analyses and statistical significance was considered at an alpha level of $P<.05$. Finally, Cronbach alpha and McDonald omega for all included scales were estimated using the "alpha" command and "omegacoef" [59] tool in Stata.

Results

Sample Characteristics

In Table 1, the descriptive characteristics of all included variables are summarized. Overall, the analytic sample consisted of 854 individuals. Regarding the gender of our sample, 39.8% (340/854) of the sample were men, 60% (512/854) women, and 0.2% (2/854) diverse or intersex. The mean age of the participants was 42.3 (SD 11.1; range 18-73) years. Regarding telemental health service use, 56.6% (483/854) of the sample reported past use of video services, 50.1% (428/854) used telephone services, and 30% (256/854) used asynchronous services. The mean patient satisfaction score for video services was 55.8 (SD 10.8; range 17-70), for telephone services 53.3 (SD 10.9; range 14-70), and for asynchronous services 24.1 (SD 6; range 8-32).

Table 1. Sample characteristics (N=854).

Characteristics	Values
Reported use, n (%)	
Video services	483 (56.6)
Telephone services	428 (50.1)
Asynchronous services	256 (30)
Satisfaction measures, mean (SD)	
TSQ[a] score for video services (range 17-70, higher values indicating greater satisfaction)	55.8 (10.8)
TSQ score for telephone services (range 14-70, higher values indicating greater satisfaction)	53.3 (10.9)
CSQ-I[b] score for asynchronous services (range 8-32, higher values indication greater satisfaction)	24.1 (6)
Socioeconomic factors	
Gender, n (%)	
Men	340 (39.8)
Women	512 (60)
Diverse or intersex	2 (0.2)
Age (range 18-73 years), mean (SD)	42.3 (11.1)
Educational level (ISCED-97[c] classification), n (%)	

Characteristics	Values
Low educational level (ISCED[d] 0-2)	82 (9.6)
Medium educational level (ISCED 3-4)	389 (45.6)
High educational level (ISCED 5-6)	383 (44.8)
Employment status, n (%)	
Unemployed	192 (22.5)
Full-time employed	416 (48.7)
Part-time employed	179 (21)
Other	67 (7.8)
Household income[e] (€), n (%)	
Low income (0 to under 2000)	254 (30.8)
Medium income (2000 to under 3500)	287 (34.8)
High income (3500 or higher)	284 (34.4)
Area lived in, n (%)	
Urban	452 (52.9)
Mostly urban	293 (34.3)
Rural	109 (12.8)
Living situation, n (%)	
Living with partner in the same household	511 (59.8)
Living with partner without a common household	48 (5.6)
Partner deceased or widowed	17 (2)
Single or divorced	278 (32.6)
Migration background, n (%)	
No	722 (84.5)
Yes	132 (15.5)
Access factors	
Insurance, n (%)	
Statutory health insurance	799 (93.6)
Private health insurance	55 (6.4)
Quality of internet connection, n (%)	
Fast and stable	617 (72.3)
Fast, but not stable	113 (13.2)
Stable, but not fast	82 (9.6)
Neither fast nor stable or no internet connection at home	42 (4.9)
Health factors	
Number of psychiatric diagnoses (range 0-7), mean (SD)	2.2 (1.4)
Presence of at least one chronic physical illness, n (%)	
No	475 (55.6)
Yes	379 (44.4)
Self-rated health (range 1-5), mean (SD)	3.0 (0.9)
Psychosocial factors, mean (SD)	
Loneliness (mean score range 1-4, higher values indicate greater levels of loneliness)	2.5 (0.6)
Self-efficacy (mean score range 1-5, higher values indicate greater levels of self-efficacy)	3.4 (0.9)
Personality, mean (SD), range 3-21	
Conscientiousness	15.7 (3.3)
Extraversion	12.6 (3.9)
Agreeableness	15.2 (3)
Openness	14.7 (3.8)

Characteristics	Values
Neuroticism	14.9 (3.6)
COVID-19-related factors	
Received COVID-19 vaccination, n (%)	
No	96 (11.2)
Yes	758 (88.8)
Fear of COVID-19 (range 7-35), mean (SD)	14.3 (7.2)
Patient preferences, mean (SD)	
Attitude towards telemental health services (range 20-70)	47.8 (9.6)
Technology commitment (range 20-60)	42.6 (7.8)
Provider characteristics (range 1-5), mean (SD)	
Provider attitude towards telemental health services	3.8 (1)
Provider skills for using telemental health service use	4 (1)

[a]TSQ: Telemedicine Satisfaction Questionnaire.
[b]CSQ-I: Client Satisfaction Questionnaire adapted to internet-based interventions.
[c]ISCED-97: International Standard Classification of Education 1997.
[d]ISCED: International Standard Classification of Education.
[e]In 2023, the conversion rate was US $1=€0.924.

Regression Analyses

Results of the multiple linear regression for all models are presented in Figure 1 (see Tables S1-S3 in Multimedia Appendix 1 for detailed results). Due to the varying number of users across the different service types, the sample sizes for the regression models differed. Regarding video services (n=483), we observed a significant positive association of higher self-efficacy (β=1.05, *P*=.03), extraversion (β=0.21, *P*=.03), and fear of COVID-19 (β=0.20, *P*<.001), a positive attitude towards telemental health services (β=0.63, *P*<.001), and greater technology commitment (β=0.12, *P*<.001) with patient satisfaction. A positive provider attitude towards the services (β=1.12, *P*=.004) and higher provider skills for using the services (β=1.61, *P*=.002) were additionally associated with greater patient satisfaction.

For telephone services (n=428), a significant negative association of a high educational level (β=−3.82, *P*=.005), full-time employment (β=−2.66, *P*=.02), unstable internet connection (β=−3.14, *P*=.02), and higher technology commitment (β=−0.14, *P*=.008) with patient satisfaction was found. Furthermore, higher loneliness (β=2.26, *P*=.009), extraversion (β=0.28, *P*=.03), agreeableness (β=0.35, *P*=.02), and fear of COVID-19 (β=0.21, *P*<.001), and a positive attitude towards telemental health services (β=0.52, *P*<.001) were associated with greater patient satisfaction with telephone services. In addition, a positive provider attitude towards (β=2.13, *P*<.001) and higher provider skills for using the services (β=1.73, *P*=.01) were positively associated with the outcome.

Patient satisfaction with asynchronous services (n=256) was negatively associated with having lost a partner or being widowed (β=−4.02, *P*=.009) and higher loneliness (β=−1.46, *P*=.02) in our sample. Furthermore, greater fear of COVID-19 (β=0.15, *P*<.001) and a positive attitude towards telemental health services (β=0.22, *P*<.001) as well as a positive provider attitude towards telemental health services (β=1.33, *P*=.002) were associated with higher patient satisfaction.

In the additional full-information maximum likelihood models (rather than listwise deletion), similar associations were found (see Tables S1-S3 in Multimedia Appendix 1 for detailed results). However, a few additional associations that reached statistical significance in the full-information maximum likelihood models were observed. This applies to the negative association between a medium educational level and patient satisfaction with telephone services (β=−2.99, *P*=.02). Furthermore, patient satisfaction with asynchronous services was additionally negatively associated with diverse or intersex gender (β=−3.44, *P*=.05), and agreeableness (β=−0.21, *P*=.04) and positively associated with living in mostly urban areas (β=1.23, *P*=.03), in the full-information maximum likelihood model.

Figure 1. Results of multiple linear regression for determinants of patient satisfaction with video, telephone, and asynchronous telemental health services. Beta coefficients with 95% CIs are presented. ref=reference category. *** $P<.001$, ** $P<.01$, * $P<.05$.

Discussion

Principal Findings

This study aimed to explore determinants of patient satisfaction with different types of telemental health services. Examining web-based survey data of the general adult population in Germany, we identified significant relationships with patient satisfaction for some of the included determinants. Variations in associations between the different service types were observed. However, psychosocial patient characteristics (including personality and fear of COVID-19), patient preferences, and provider characteristics, were associated with patient satisfaction in all service groups. Current research regarding determinants of patient satisfaction is mostly limited to synchronous telemental health services and a small variety of determinants. Therefore, our study markedly adds to the current knowledge on a range of factors, including socioeconomic, access, health, psychosocial, personality, and COVID-19-related determinants, as well as patient preferences and provider characteristics. Furthermore, valuable insights into satisfaction with asynchronous telemental health services were gained.

Relation to Previous Research

The majority of the included socioeconomic determinants was not associated with patient satisfaction with telemental health services, which was also observed in previous international studies (eg, [22,25]). In contrast to studies observing differences in access and additional barriers to using telemental health services for patients with low socioeconomic status [19,20,22], our findings may imply that patients are satisfied with telemental health services regardless of their socioeconomic status. Nevertheless, we observed significant negative associations of high education and full-time employment with patient satisfaction with telephone services. Highly educated and full-time employed individuals are likely to have increased access to and experience with (digital health) technologies [60]. Consequently, they may have higher expectations and are less satisfied with less technologically advanced telephone services. For asynchronous services, individuals who had experienced the loss of a partner reported lower satisfaction levels. This patient group may be especially burdened and require more extensive support. Synchronous services might be more suited for this group as they offer direct human interaction and increased social connectedness [11,17].

Regarding access factors, the patient's health insurance type was not associated with patient satisfaction in any service group. Therefore, variations in insurance regulations (such as ease of access, complexity of the process, or usage limitations) do not seem to constitute additional barriers for telemental health service users in Germany. Even though differences in access factors (eg, digital device ownership and availability of high-speed internet) are larger in the United States compared to Germany [61], the health insurance type

was also not associated with telemedicine satisfaction or use in studies with US samples (eg, [26,62]). Furthermore, the internet connection quality at home was not associated with satisfaction in almost all cases. The majority of our sample (617/854, 72.3%) had a fast and stable internet connection and only 4.9% (42/854) stated that they had slow and unstable, or no internet access at home. Since the majority of German telemental health service users seem to have a good internet connection at home, this factor does not appear to be a crucial determinant of patient satisfaction. Nevertheless, disparities in access persist and vary across different regions and countries (eg, [61,63]), which should be considered in the international context. Having an unstable internet connection at home was associated with lower satisfaction rates for telephone services. This might be unexpected since the internet is not needed for telephone calls. Patients might have been forced to switch to telephone services due to their unstable internet connection, although they actually preferred other service options (ie, video services that require a stable internet connection). However, future research is required to test these potential explanations.

None of the included health determinants were associated with patient satisfaction in the different service groups. Neither physical health factors nor comorbidity of psychiatric diagnoses were associated with patient satisfaction with telemental health services, which is in accordance with findings from studies with international samples [22]. This may suggest, for clinical practice, that telemental health services should not be restricted to certain patient groups. Furthermore, they have the potential to enhance treatment and access for specific patient populations, such as patients with limited mobility or patients experiencing social anxiety (eg, [20]).

For psychosocial determinants, associations with patient satisfaction were observed. Loneliness was positively associated with satisfaction with telephone services, but negatively associated with satisfaction with asynchronous services. This could mean that patients experiencing higher levels of loneliness prefer the direct real-time interaction provided by synchronous telephone services to satisfy their social needs. Compared to synchronous services, asynchronous services may be less personal (eg, no verbal or nonverbal cues from the provider) [11,17], which might have caused lower satisfaction levels in patients with higher loneliness. In addition, self-efficacy was positively associated with satisfaction with video services. Accordingly, self-efficacy was found to be associated with major UTAUT constructs as well as the intention to adopt and satisfaction with telemedicine services in the past (eg, [64]).

Furthermore, certain personality characteristics were associated with patient satisfaction. Higher levels of extraversion were associated with greater patient satisfaction with synchronous services. Highly extroverted individuals may feel more confident engaging in direct social interactions provided by synchronous services. In contrast, Cieślik et al [65] observed a negative association between extraversion and satisfaction with telemedicine-delivered inflammatory bowel disease care. More studies are needed to clarify this relationship. In addition, agreeableness was positively associated with satisfaction with telephone services in our study. Highly agreeable individuals may be more likely to adapt to and accept new treatment formats, such as telemedicine. In regard to previous research, agreeableness was positively associated with patient satisfaction with telemedicine services in one previous study [65] and negatively associated in another [66]. Additional significant associations with conscientiousness and openness were observed in the previous studies [65,66], which we did not find in our sample. These mixed findings highlight the need for further studies examining the relationship of personality and patient satisfaction with telemedicine services.

The fear of COVID-19 was associated with patient satisfaction in all patient groups in our study. Multiple previous studies also observed an association of COVID-19-related fear with patient satisfaction with telemedicine services [67-69]. Individuals with greater fear of COVID-19 might be particularly satisfied with telemedicine service options since they pose a lower risk of infection compared to in-person visits (eg, no physical contact while traveling to, waiting for, or during the appointment). In contrast, the COVID-19 vaccination status was not associated with patient satisfaction with telemental health services. Even though previous studies found that COVID-19 vaccination acceptance was positively associated with factors such as health literacy and trust in the health system (eg, [70,71]), it does not seem to be of significance for patient satisfaction with telemental health services.

Our findings suggest that telemental health service users hold predominantly positive attitudes towards the services. A significant relationship between the attitude towards telemental health services and patient satisfaction was found in all service groups in this study. The patient attitude towards telemental health services was evaluated using UTAUT dimensions, which have been associated with patient satisfaction with telemedicine services in past studies (eg, [72,73]). Performance expectancy, defined as the degree to which an individual believes that using the services will be beneficial [44], appears to particularly impact patient satisfaction with telemedicine services [72,73]. This expectancy may be influenced by external factors, such as the attitude of and support from providers. In addition, fostering positive initial experiences with the services (eg, [74]) and reducing technology anxiety (eg, [75]) might help to facilitate positive patient attitudes. Strengthening a positive attitude in patients may be beneficial for the successful implementation of future telemental health services. Furthermore, the patient's level of technology commitment was positively associated with satisfaction with video services, but negatively associated with satisfaction with telephone services. Highly technology-committed patients may prefer more technologically advanced services and value the greater possibilities, which video services offer compared to simple telephone calls. This preference should be considered when choosing a synchronous service option for mental health patients. Future research on the association of patient attitude towards telemental health services and

technology commitment with patient satisfaction is needed to further explore the initial observations highlighted by our study.

Patients rated provider attitudes and skills positively in our study. The provider characteristics seem to be heavily associated with patient satisfaction. A positive and open provider attitude towards telemental health services was positively associated with greater patient satisfaction in all telemental health service groups. This association has rarely been studied in previous studies in telemedicine research and seems to be crucial to promoting patient satisfaction [38,39]. A systematic review by Connolly et al [76] found that mental health care professionals hold predominantly positive attitudes towards telemental health services. However, mental health care professionals report barriers and concerns regarding the services, including technological difficulties, increased workload, perception of impersonality, safety concerns, and lack of support [76-79]. All of the UTAUT dimensions were identified as determinants of provider attitude, particularly performance expectancy [76,77,80]. Previous experience with the services and training appears to play a crucial role in fostering provider acceptance [76,78,80]. Creating offers of and improving support, guidelines, and training for telemental health care providers is essential [12,79,81], not only to decrease provider reluctance but also to increase patient satisfaction with the services. Correspondingly, better provider skills in using the services were associated with increased patient satisfaction with synchronous services. Compared to asynchronous services, providers are more directly involved in the delivery of synchronous services, and their skills seem to be especially important for patient satisfaction in this service group.

Strengths and Limitations

In our study, we considered patient satisfaction with both synchronous and asynchronous telemental health services and tested associations with a variety of determinants. Our study adds valuable knowledge, particularly in the area of asynchronous services and for psychosocial determinants. Furthermore, the included variables were measured using validated instruments, which contributes to the credibility of our findings. In terms of gender and age, our sample was representative of mental health patients in Germany [32,40], which enabled us to gain insight into a broad spectrum of telemental health service users. The data were assessed during the postpandemic period, suggesting that our study could help to gain a deeper understanding of satisfaction with telemental health services as in-person visit availability resumed.

Nevertheless, some limitations should be noted. The cross-sectional design of our study has certain limits, which makes it difficult to draw implications regarding causality or longitudinal stability of the observed relationships. Therefore, future longitudinal and qualitative studies are needed to explore the relationships in further detail. Furthermore, we cannot completely rule out selection bias for our sample. It might be the case that some patient groups were more likely to participate in the web-based survey or to have experience with telemental health services (eg, patients with mild psychiatric symptoms, who are highly technology-committed). However, we recruited a large quota-based sample and the vast majority of mental health patients in Germany have reasonably good access to telemental health services. Finally, disparities in access, national regulations and practices regarding telemedicine vary across countries; therefore, future studies from other countries are recommended.

Conclusion

Since determinants of patient satisfaction have been scarcely investigated thus far, we examined various determinants and their associations with patient satisfaction with telemental health services in a representative sample of mental health patients in Germany. We found that particularly psychosocial determinants, patient preferences, and provider characteristics were associated with patient satisfaction. Despite limited investigation in existing research, patient attitudes towards the services and technology commitment constitute key determinants of patient satisfaction. In addition, psychosocial determinants such as personality, loneliness, and fear of COVID-19 also appeared to have a noteworthy relationship with patient satisfaction. Therefore, when treating patients via telemental health services, it is of great importance to consider each patient individually and take their personal preferences into account.

In previous studies, clinicians were repeatedly identified as gatekeepers to telemedicine implementations [12,79], and according to our results, they also seem to play a crucial role in increasing patient satisfaction with telemental health services. Thus, finding ways to support providers and reduce barriers and misconceptions related to the provision of telemental health services should be prioritized by health care managers and researchers. In conclusion, psychosocial characteristics and individual patient preferences as well as provider characteristics may contribute to increased patient satisfaction with telemental health services, which is a key factor for the successful and widespread implementation of the services in the future.

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Conflicts of Interest

None declared.

Multimedia Appendix 1

Results of multiple linear regressions and full-information maximum likelihood models for determinants of patient satisfaction with telemental health services.
[DOCX File (Microsoft Word File), 46 KB-Multimedia Appendix 1]

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Abbreviations

ASKU: Allgemeine Selbstwirksamkeit Kurzskala
BFI-S: Big Five Inventory–Socio-Economic Panel
CSQ-I: Client Satisfaction Questionnaire adapted to internet-based interventions
ISCED: International Standard Classification of Education
ISCED-97: International Standard Classification of Education 1997
ISO: International Organization for Standardization

TSQ: Telemedicine Satisfaction Questionnaire
UTAUT: Unified Theory of Acceptance and Use of Technology

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Multimedia Appendix 1

Table S1. Results of multiple linear regression and full-information maximum likelihood model for determinants of patient satisfaction with video services.

Variables	Multiple Linear Regression	Full-Information Likelihood Model
Socioeconomic factors		
Gender (ref: men)		
Women	-1.14	-1.18
	(0.79)	(0.75)
Diverse or intersex	-2.08	-2.19
	(2.05)	(1.90)
Age	-0.03	-0.03
	(0.04)	(0.03)
Educational level (ref: low education)		
Medium educational level	-1.46	-1.18
	(1.15)	(1.10)
High educational level	-2.03+	-1.76
	(1.16)	(1.11)
Employment status (ref: unemployed)		
Full-time employed	-0.83	-1.05
	(1.06)	(1.00)
Part-time employed	0.62	0.35
	(1.10)	(1.02)
Other	0.10	-0.14
	(1.30)	(1.22)
Household income (ref: low income)		
Medium income	1.11	1.11
	(1.01)	(0.96)
High income	0.99	0.99
	(0.98)	(0.94)
Area lived in (ref: urban)		
Mostly urban	-0.51	-0.49
	(0.72)	(0.68)
Rural	1.44	1.47
	(1.00)	(0.95)
Living situation (ref: living with partner in the same household)		
Living with partner without a common household	1.95	2.10
	(1.39)	(1.34)
Partner deceased or widowed	-0.90	-0.88
	(2.28)	(2.11)
Single or divorced	-0.10	0.04
	(0.84)	(0.78)
Migration background (ref: no)	-1.27	-1.27
	(0.91)	(0.86)
Access factors		
Private health insurance (ref: statutory health insurance)	0.19	-0.14
	(1.47)	(1.34)
Internet connection quality (ref: fast and stable)		
Fast, but not stable	-1.55	-1.54+
	(0.98)	(0.91)
Stable, but not fast	-1.29	-1.29
	(1.39)	(1.34)
Neither fast nor stable or no internet connection at home	-1.87	-1.87
	(1.90)	(1.67)
Health factors		
Number of psychiatric diagnoses	-0.03	-0.04
	(0.25)	(0.23)

Presence of at least one chronic physical illness (ref: no)	0.16	0.28
	(0.73)	(0.68)
Self-rated health	0.42	0.42
	(0.48)	(0.44)
Psychosocial factors		
Loneliness	0.69	0.70
	(0.61)	(0.56)
Self-efficacy	1.05*	1.02*
	(0.48)	(0.46)
Personality		
Conscientiousness	-0.16	-0.16
	(0.12)	(0.11)
Extraversion	0.21*	0.21*
	(0.09)	(0.09)
Agreeableness	0.15	0.16
	(0.13)	(0.13)
Openness	0.11	0.12
	(0.11)	(0.10)
Neuroticism	-0.01	-0.00
	(0.11)	(0.11)
COVID-19-related factors		
Received COVID-19 vaccination (ref: no)	-0.56	-0.60
	(0.91)	(0.88)
Fear of COVID-19	0.20***	0.22***
	(0.05)	(0.05)
Patient preferences		
Attitude towards telemental health services	0.63***	0.63***
	(0.05)	(0.04)
Technology commitment	0.12*	0.11*
	(0.06)	(0.06)
Provider characteristics		
Provider attitude towards telemental health services	1.12**	1.16**
	(0.39)	(0.37)
Provider skills for using telemental health services	1.61**	1.51**
	(0.52)	(0.49)
Constant	-0.62	-0.92
	(5.05)	(4.71)
Observations	483	502
R-squared	0.63	0.63

Notes. Beta coefficients are reported. Robust standard errors in parentheses. ref = reference category. *** P<.001, ** P<.01, * P<.05, +P<.10.

Table S2. Results of multiple linear regression and full-information maximum likelihood model for determinants of patient satisfaction with telephone services.

Variables	Multiple Linear Regression	Full-Information Likelihood Model
Socioeconomic factors		
Gender (ref: men)		
Women	-1.61+	-1.37+
	(0.86)	(0.82)
Diverse or intersex	-3.92	-3.67
	(2.73)	(2.63)
Age	-0.01	-0.02
	(0.04)	(0.04)
Educational level (ref: low education)		
Medium educational level	-2.51+	-2.99*
	(1.32)	(1.24)
High educational level	-3.82**	-4.22**
	(1.35)	(1.27)
Employment status (ref: unemployed)		
Full-time employed	-2.66*	-2.86**
	(1.13)	(1.05)
Part-time employed	-1.30	-1.58
	(1.16)	(1.09)
Other	-1.00	-1.60
	(1.81)	(1.67)
Household income (ref: low income)		
Medium income	-1.76	-1.75
	(1.19)	(1.13)
High income	-1.32	-1.31
	(1.41)	(1.35)
Area lived in (ref: urban)		
Mostly urban	-0.25	-0.17
	(0.89)	(0.83)
Rural	1.18	1.12
	(1.18)	(1.14)
Living situation (ref: living with partner in the same household)		
Living with partner without a common household	-3.04+	-2.93+
	(1.61)	(1.55)
Partner deceased or widowed	-3.66+	-3.24
	(2.16)	(2.07)
Single or divorced	-1.53	-1.60
	(1.15)	(1.09)
Migration background (ref: no)	0.11	0.22
	(1.04)	(0.99)
Access factors		
Private health insurance (ref: statutory health insurance)	2.66	2.88
	(1.92)	(1.82)
Internet connection quality (ref: fast and stable)		
Fast, but not stable	-3.14*	-3.53**
	(1.32)	(1.23)
Stable, but not fast	-2.18	-2.13
	(1.48)	(1.41)
Neither fast nor stable or no internet connection at home	-0.10	-0.23
	(1.58)	(1.42)
Health factors		
Number of psychiatric diagnoses	-0.24	-0.28
	(0.34)	(0.32)
Presence of at least one chronic physical illness (ref: no)	-0.27	-0.15
	(0.82)	(0.78)

Self-rated health	0.23	0.37
	(0.57)	(0.54)
Psychosocial factors		
Loneliness	2.26**	2.16**
	(0.86)	(0.82)
Self-efficacy	-0.01	0.05
	(0.66)	(0.62)
Personality		
Conscientiousness	0.06	0.12
	(0.15)	(0.14)
Extraversion	0.28*	0.27*
	(0.13)	(0.12)
Agreeableness	0.35*	0.30*
	(0.14)	(0.14)
Openness	-0.03	-0.05
	(0.13)	(0.12)
Neuroticism	-0.11	-0.10
	(0.15)	(0.14)
COVID-19-related factors		
Received COVID-19 vaccination (ref: no)	0.56	0.75
	(1.23)	(1.18)
Fear of COVID-19	0.21***	0.20***
	(0.06)	(0.05)
Patient preferences		
Attitude towards telemental health services	0.52***	0.52***
	(0.06)	(0.05)
Technology commitment	-0.14**	-0.13**
	(0.05)	(0.05)
Provider characteristics		
Provider attitude towards telemental health services	2.13***	1.96***
	(0.56)	(0.53)
Provider skills for using telemental health services	1.73**	1.82**
	(0.67)	(0.62)
Constant	10.85+	10.66+
	(6.46)	(6.12)
Observations	428	440
R-squared	0.52	0.52

Notes. Beta coefficients are reported. Robust standard errors in parentheses. ref = reference category. *** P<.001, ** P<.01, * P<.05, +P<.10.

Table S3. Results of multiple linear regression and full-information maximum likelihood model for determinants of patient satisfaction with asynchronous services.

Variables	Multiple Linear Regression	Full-Information Likelihood Model
Socioeconomic factors		
Gender (ref: men)		
Women	-1.01	-1.13+
	(0.69)	(0.63)
Diverse or intersex	-3.52+	-3.44*
	(1.93)	(1.74)
Age	-0.01	-0.01
	(0.03)	(0.03)
Educational level (ref: low education)		
Medium educational level	-0.23	-0.36
	(1.11)	(1.01)
High educational level	-1.14	-1.00
	(1.11)	(1.00)
Employment status (ref: unemployed)		
Full-time employed	-0.22	-0.32
	(1.24)	(1.05)
Part-time employed	0.72	0.44
	(1.34)	(1.14)
Other	1.41	1.19
	(1.45)	(1.19)
Household income (ref: low income)		
Medium income	1.00	1.00
	(0.85)	(0.79)
High income	0.53	0.53
	(1.01)	(0.94)
Area lived in (ref: urban)		
Mostly urban	1.18+	1.23*
	(0.64)	(0.58)
Rural	-0.03	-0.09
	(1.27)	(1.18)
Living situation (ref: living with partner in the same household)		
Living with partner without a common household	0.31	0.32
	(0.85)	(0.76)
Partner deceased or widowed	-4.02**	-4.01**
	(1.52)	(1.45)
Single or divorced	0.22	0.28
	(0.76)	(0.68)
Migration background (ref: no)	0.22	0.15
	(0.88)	(0.81)
Access factors		
Private health insurance (ref: statutory health insurance)	-0.16	-0.26
	(0.67)	(0.61)
Internet connection quality (ref: fast and stable)		
Fast, but not stable	-1.29	-1.22
	(0.81)	(0.75)
Stable, but not fast	-2.85	-2.82+
	(1.77)	(1.48)
Neither fast nor stable or no internet connection at home	3.45+	3.36+
	(2.04)	(1.93)
Health factors		
Number of psychiatric diagnoses	-0.35+	-0.36+
	(0.21)	(0.19)
Presence of at least one chronic physical illness (ref: no)	0.27	0.38
	(0.63)	(0.56)

Self-rated health	0.54	0.61
	(0.48)	(0.43)
Psychosocial factors		
Loneliness	-1.46*	-1.42*
	(0.63)	(0.57)
Self-efficacy	0.19	0.21
	(0.47)	(0.43)
Personality		
Conscientiousness	0.06	0.09
	(0.12)	(0.11)
Extraversion	-0.16	-0.16
	(0.10)	(0.10)
Agreeableness	-0.22+	-0.21*
	(0.12)	(0.11)
Openness	0.09	0.08
	(0.11)	(0.10)
Neuroticism	0.10	0.11
	(0.10)	(0.09)
COVID-19-related factors		
Received COVID-19 vaccination (ref: no)	-0.81	-0.74
	(0.85)	(0.77)
Fear of COVID-19	0.15***	0.14***
	(0.04)	(0.04)
Patient preferences		
Attitude towards telemental health services	0.22***	0.22***
	(0.05)	(0.05)
Technology commitment	0.00	-0.01
	(0.05)	(0.05)
Provider characteristics		
Provider attitude towards telemental health services	1.33**	1.43***
	(0.43)	(0.38)
Provider skills for using telemental health services	0.62	0.66+
	(0.45)	(0.40)
Constant	9.03*	8.19*
	(4.33)	(3.96)
Observations	256	266
R-squared	0.51	0.51

Notes. Beta coefficients are reported. Robust standard errors in parentheses. ref = reference category. *** P<.001, ** P<.01, * P<.05, +P<.10.

9. Summary in English and German

9.1 Summary

Telemedicine services can help to close treatment gaps and improve the effectiveness of and access to health care. Particularly among specific patient groups, such as the aging population or individuals with mental health conditions, telemedicine services can address major health care challenges. Despite the great opportunities that telemedicine services offer, their use and acceptance still hold untapped potential. Therefore, this cumulative dissertation aimed to explore determinants of patient use of and satisfaction with telemedicine services.

To examine the use of telemedicine among middle-aged and older adults in Germany, different panel data samples were considered (*Publications 1 and 2*). The data were analyzed cross-sectionally as well as longitudinally using various regression techniques. It was found that greater psychological symptoms and health limitations were particularly associated with telemedicine use among this population. International studies on the determinants of use and satisfaction among mental health patients were evaluated as part of a systematic review (*Publication 3*). Younger age, female gender, and less severe psychological symptoms were highlighted as key determinants, and critical research gaps were identified. In response to these research gaps, an online survey was conducted in Germany (*Publications 4 and 5*). Using different regression methods, certain socioeconomic and psychosocial factors, personality, and patient attitudes towards the services were detected as important determinants of use and satisfaction. Furthermore, provider attitudes towards and skills for using the services were key determinants. The convenience of the services was an additional central determinant of patient use (including avoidance of stigmatization, long waiting times, or complicated scheduling of appointments).

This cumulative dissertation contributes crucial knowledge regarding the determinants of telemedicine use and satisfaction among major target groups. To increase telemedicine acceptance, it is important to consider individual psychosocial characteristics and attitudes of patients, while socioeconomic and access determinants appear less influential in the selected samples. Since providers are key facilitators of telemedicine use and satisfaction among patients, research and practical efforts are required to enhance provider attitudes and skills. As determinants may vary across different populations and treatment contexts, researchers and practitioners should take unique treatment situations into account to support the widespread and effective implementation of future telemedicine services.

9.2 Zusammenfassung

Telemedizin kann dabei helfen Versorgungslücken zu schließen sowie Effektivität und Zugang zur Gesundheitsversorgung zu verbessern. Insbesondere in bestimmten Patient:innengruppen, wie der alternden Bevölkerung oder Personen mit psychischen Erkrankungen, kann Telemedizin dazu beitragen wesentliche Herausforderungen in der Gesundheitsversorgung zu bewältigen. Trotz der klaren Stärken von Telemedizin, ist die Nutzung und Akzeptanz der Angebote ausbaufähig. Daher war das Ziel dieser kumulativen Dissertation, Determinanten der Nutzung und Zufriedenheit von Patient:innen mit telemedizinischen Angeboten zu untersuchen.

Um Telemedizinnutzung bei Personen im mittleren und hohen Alter in Deutschland zu untersuchen, wurden verschiedene Paneldatensätze berücksichtigt (*Publikationen 1 und 2*). Die Daten wurden quer- und längsschnittlich, mithilfe unterschiedlicher Regressionsverfahren, analysiert. Vor allem ausgeprägtere psychische Symptome und Gesundheitseinschränkungen waren dabei mit der Telemedizinnutzung assoziiert. Internationale Studien zu Determinanten der Nutzung und Zufriedenheit bei Patient:innen mit psychischen Erkrankungen wurden im Rahmen einer systematischen Übersichtsarbeit evaluiert (*Publikation 3*). Jüngeres Alter, weibliches Geschlecht und leichtere psychische Symptomatik konnten dabei als Schlüsselfaktoren herausgestellt und wichtige Forschungslücken identifiziert werden. Angesichts der bestehenden Forschungslücken, wurde eine deutschlandweite Online-Befragung durchgeführt (*Publikationen 4 und 5*). Mithilfe verschiedener Regressionsanalysen, konnten vereinzelte sozioökonomische und psychosoziale Faktoren, Persönlichkeit und Einstellung der Patient:innen als bedeutsame Determinanten der Nutzung und Zufriedenheit identifiziert werden. Zudem waren Einstellungen und Fähigkeiten von Versorger:innen zentrale Determinanten. Praktische Angebotsmerkmale waren zusätzlich wichtige Determinanten der Nutzung (Vermeidung von Stigmatisierung, langen Wartezeiten oder umständlicher Terminvereinbarung).

Diese kumulative Dissertation trägt maßgeblich zum Wissen über Determinanten der Telemedizinnutzung und -zufriedenheit in wichtigen Zielgruppen bei. Um Akzeptanz von Telemedizin zu steigern, ist die Berücksichtigung individueller psychosozialer Faktoren und Einstellungen von Patient:innen entscheidend, während sozioökonomische und Zugangsfaktoren in den untersuchten Stichproben weniger bedeutsam waren. Da Versorger:innen eine zentrale Rolle für die Steigerung der Nutzung und Zufriedenheit spielen, sollte Förderung von positiven Einstellungen und Fähigkeiten bei Versorger:innen in Forschung und Praxis priorisiert werden. Da Determinanten in unterschiedlichen Populationen und Behandlungskontexten variieren können, sollten Forschende und Praktizierende spezifische Behandlungssituationen berücksichtigen, um die weitreichende und effektive Einbindung künftiger telemedizinischer Angebote zu fördern.

10. Declaration of Personal Contribution

All of the publications included in this cumulative dissertation were authored by me, Ariana Susan Neumann, as the first author. All of the included publications were realized in cooperation with the co-authors Prof. Dr. André Hajek and Prof. Dr. Hans-Helmut König. Professor Hajek supervised all of the projects.

Publication 1: Determinants of Telemedicine Service Use Among Middle-Aged and Older Adults in Germany During the COVID-19 Pandemic: Cross-Sectional Survey Study

The research question and design of the first publication were conceptualized by me, in consultation with Professor Hajek. I conducted the data preparation, analysis, and interpretation. The first draft of the manuscript was written by me and critically revised by Professor Hajek and Professor König. I edited the first version of the manuscript according to the comments made by Professor Hajek and Professor König and submitted it for publication. I conducted the revision following the peer review, after consulting with Professor Hajek and Professor König.

Publication 2: Determinants of Having Online Health Consultations During the COVID-19 Pandemic Among Middle-Aged and Older Adults in Germany: Representative Longitudinal Survey Study

The study objective and design of the second publication were developed by me. I performed the data preparation, analysis, and interpretation with support from Professor Hajek. I drafted the first version of the manuscript, which was revised by Professor Hajek and Professor König. After addressing the comments from Professor Hajek and Professor König, I handed the final version of the manuscript in for publication. Following the peer review, I revised the manuscript in agreement with Professor Hajek and Professor König.

Publication 3: Determinants of Patient Use and Satisfaction With Synchronous Telemental Health Services During the COVID-19 Pandemic: Systematic Review

For the third publication, I developed the research question and design, in cooperation with Professor Hajek and Professor König. The study selection, data extraction, and quality assessment were conducted by me and Josephine Bokermann. In case of disagreement during the study selection and quality rating process, Professor Hajek was consulted. I wrote the first draft of the manuscript, which was critically revised by Professor Hajek and Professor König. Following the final edits based on the comments from Professor Hajek and Professor König, I submitted the manuscript for publication. In

consultation with Professor Hajek and Professor König, I carried out the revision of the manuscript after the peer review.

Publication 4: Determinants of Patient Use of Telemental Health Services: Representative Cross-Sectional Survey From Germany

I realized the data collection for the fourth publication with support from Professor Hajek. I conceptualized the research objective and design of the study. Data preparation, analysis, and interpretation were also done by me. Professor Hajek and Professor König revised the first version of the manuscript, which was written by me. After incorporating the feedback from Professor Hajek and Professor König, I handed the manuscript in for publication. The peer review was followed by a revision, which was executed by me, in consultation with Professor Hajek and Professor König.

Publication 5: Determinants of Patient Satisfaction With Telemental Health Services in Germany: Representative Cross-Sectional Postpandemic Survey Study

For the fifth publication, I realized the data collection with support from Professor Hajek. I developed the research question and design of the study. The data preparation, analysis, and interpretation were done by me. I wrote the first version of the manuscript. Professor Hajek and Professor König critically revised the manuscript, and I edited it according to their comments. I submitted the final version of the manuscript for publication. After the peer review, I revised the manuscript in agreement with Professor Hajek and Professor König.

In the process of creating this dissertation, AI-based tools, including DeepL, Grammarly, and UHHGPT, were exclusively used to support translation and language editing.

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First and foremost, I would like to extend my sincere gratitude to my supervisor, Prof. Dr. André Hajek. His confidence in my abilities and his always appreciative and outstanding professional support contributed substantially to the successful completion of this dissertation. Professor Hajek's passion for research has inspired and motivated me profoundly.

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12. Curriculum Vitae

Entfällt aus datenschutzrechtlichen Gründen.

13. Eidesstattliche Versicherung

Ich versichere ausdrücklich, dass ich die Arbeit selbständig und ohne fremde Hilfe, insbesondere ohne entgeltliche Hilfe von Vermittlungs- und Beratungsdiensten, verfasst, andere als die von mir angegebenen Quellen und Hilfsmittel nicht benutzt und die aus den benutzten Werken wörtlich oder inhaltlich entnommenen Stellen einzeln nach Ausgabe (Auflage und Jahr des Erscheinens), Band und Seite des benutzten Werkes kenntlich gemacht habe. Das gilt insbesondere auch für alle Informationen aus Internetquellen.

Soweit beim Verfassen der Dissertation KI-basierte Tools („Chatbots“) verwendet wurden, versichere ich ausdrücklich, den daraus generierten Anteil deutlich kenntlich gemacht zu haben. Die „Stellungnahme des Präsidiums der Deutschen Forschungsgemeinschaft (DFG) zum Einfluss generativer Modelle für die Text- und Bilderstellung auf die Wissenschaften und das Förderhandeln der DFG“ aus September 2023 wurde dabei beachtet.

Ferner versichere ich, dass ich die Dissertation bisher nicht einem Fachvertreter an einer anderen Hochschule zur Überprüfung vorgelegt oder mich anderweitig um Zulassung zur Promotion beworben habe.

Ich erkläre mich damit einverstanden, dass meine Dissertation vom Dekanat der Medizinischen Fakultät mit einer gängigen Software zur Erkennung von Plagiaten überprüft werden kann.

Datum .....

Unterschrift .....

Ariana Susan Neumann