



Digitization in gynecology and obstetrics in times of COVID-19: Results of a national survey

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ARTICLE INFO

Keywords:

Digitization
Telemedicine
Tele-gynecology
Survey
COVID-19

ABSTRACT

Introduction: In the COVID-19 pandemic, many consultations had to be cancelled, postponed, or converted to a virtual format. The use of telemedicine in the management of Women's Health Care could support doctors (tele-gynecology). This study analyses the use and perception of telemedicine applications among gynecologists in Germany.

Materials and methods: This prospective cross-sectional study was based on a survey of gynecologists in Germany during the COVID-19 pandemic. Descriptive statistics were calculated, and regression analyses were performed to show correlations.

Results: The gynecologists expect telemedicine to be used in gynecology and obstetrics. 76.4% (365/478) of the respondents rated their knowledge of telemedicine as insufficient. The majority of respondents (437/478, 91.6%) said they did not currently use telemedicine, although 67.3% (321/478) would like to do so. Obstacles to the introduction of telemedicine include the purchase of technical equipment (325/478, 68.1%), administration (305/478, 64.0%) and poor reimbursement (233/478, 48.9%). Gynecologists surveyed would prefer telemedicine to communicate directly with other doctors (388/478, 81.2%) rather than to communicate with patients (228/478, 47.8%). In the treatment phases, 73.2% (349/478) of the respondents would use telemedicine during follow-up. Half of the respondents would choose tele counseling as a specific approach to improving care (246/478, 51.5%).

Conclusion: Telemedicine in gynecology finds little use but high acceptance. The absence of a structured framework is an obstacle to effective implementation. Training courses should be introduced to improve the limited knowledge in the use of telemedicine. More research in tele-gynecology is needed. These include large-scale randomized controlled trials, economic analyses and the exploration of user preferences.

1. Introduction

The COVID-19 pandemic has fundamentally changed countless aspects of life around the world (Wooliscroft et al., 2020). The processes of everyday life and working life have changed. Keeping distance, adhering to hygiene regulations and restrictions on contact have been determining the lives of people around the world and in Europe for more than a year (Seyed Hosseini et al., 2020). In Germany, the next wave of the Covid 19 pandemic has just begun. The number of infections is

increasing every day. The health sector is affected enormously. In addition to the changes in the acute treatment of COVID-19 disease, many other changes have occurred in the day-to-day medical care since then. Planned operations have been postponed, examinations and therapies have also been postponed. The aim was to create more free capacities for the treatment of SARS-CoV-2 patients (Römmele et al., 2020). Just at the beginning of the COVID-19 pandemic, changes and reductions in gynecological care were made, which continue to this day (Mallick et al., 2020). Due to pandemic containment measurements,

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<https://doi.org/10.1016/j.invent.2021.100478>

Received 14 August 2021; Received in revised form 26 October 2021; Accepted 1 November 2021

Available online 11 November 2021

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many patient appointments had to be cancelled or were switched to telephone or video advice. However, the clinical care of the patients had to be continued. New concepts and ideas were used. The topic of Digitization was driven forward by the COVID-19 pandemic. Digitization is the umbrella term for the digital transformation of society. It refers to the transition from the age of analog technologies to the age of digital technologies and digital innovation. This affects all areas of life. Digitization is also affecting the healthcare sector (Jandoo, 2020). Digital technologies are fundamentally changing the health sector today. The collective term “digital health” – also known as e-health – encompasses various technologies and applications that modernize the healthcare system (Samland and Hertling, 2020). People in the healthcare sector use the Internet to obtain information and use wearables and apps to collect and evaluate health data. Telemedicine comprises health telematics applications which are purely medical in nature, and which support the medical and treatment-related cooperation of health professionals with each other and with patients in the context of prevention, diagnosis, therapy, and rehabilitation. In the case of remote treatment, patients communicate with a doctor by phone and/or internet. The medical consultation can be done via chat and video. Exclusive advice or treatment via communication media is available if there has been no prior physical contact between doctor and patient (Hertling et al., 2021). While some medical disciplines have made further progress in the implementation of e-health, other disciplines remain largely untouched (Cuffaro et al., 2020). E-health can positively influence patient care and open new treatment paths. Many practitioners believe that telemedicine has great potential for managing patient care. Digitization affects 90% of the healthcare system and has already brought many changes for both patients and doctors, which have decisively influenced the patient-doctor relationship (Campisi et al., 2020). Patients are willing to use e-health to improve their disease status and monitor symptoms and disease activity. The use of e-health has also increased in recent years (Crawford and Serhal, 2020). For the successful development and implementation of e-health concepts for the management of Women's Health Care, the perspective of the gynecologist is crucial (Lowery, 2020). The central question is whether and how an adequate treatment can be performed digitally in the future in this responsible medical sector. This study explored the acceptance, use and perception of e-health in the form of telemedicine applications by gynecologists in Germany. Changes in these aspects were observed particularly during the COVID-19 pandemic (Crawford and Serhal, 2020).

2. Materials and methods

These surveys regarding the use of e-health applications in the form of telemedicine in the age of COVID-19 were administered to gynecologists (specialists and residents). This study is based on the study on telemedicine applications of the European League Against Rheumatism, EULAR for short. It is a non-profit scientific organization that was the first European association to investigate telemedicine applications in patient care management (Krusche et al., 2020).

The responsible ethics committee of the University in Jena was informed and did not object to the study (Reg.-No: 2019-1456-Bef). The web-based survey was prepared by four members of the Working Group Young Gynecology and Obstetrics of the German Society for Gynecology and Obstetrics (Arbeitsgemeinschaft Junges Forum der Deutschen Gesellschaft für Gynäkologie und Geburtshilfe (DGGG)). The German Society for Gynecology and Obstetrics is one of the largest scientific medical societies worldwide with more than 7500 members (Powley et al., 2016a). This study was initiated by the DGGG due to the current developments in the field of e-health. The four members are renowned experts in the field of telemedicine applications research in healthcare. The aim of this study is to gain initial insights into the attitudes, acceptance, use and barriers of telemedicine applications in the field of gynecology and obstetrics among physicians, and subsequently to provide guidance to physicians in decision-making in specific situations

regarding telemedicine applications. They are based on current scientific findings and best practices in practice and ensure greater safety in medicine but should also take economic aspects into account. In order to investigate the identified areas of interest, the panel of experts conducted a questionnaire in two separate online meetings based on individual literature searches. The study questionnaires have a web-based design according to published guidelines for questionnaire research (Ebert et al., 2018; Hasson et al., 2000; <https://www.dggg.de/die-dggg>). The choice of questions for the questionnaire was based on both comparable work and on the quality criteria for online questionnaires (<https://www.dggg.de/die-dggg>). The survey was created in SurveyMonkey TM (SurveyMonkey, San Mateo, CA). The web-based survey (SurveyMonkey Inc.) was conducted from 1 October 2020 to 30 March 2021. The study was conducted in compliance with current data protection regulations and the Helsinki Declaration. The methodology and results were reported according to the checklist for reporting the results of Internet e-surveys (Tuoff, 1970). The other members of the Working Group Young Gynecology and Obstetrics of the German Society for Gynecology and Obstetrics (Arbeitsgemeinschaft Junges Forum der Deutschen Gesellschaft für Gynäkologie und Geburtshilfe (DGGG)) were asked to provide feedback on the format, completeness, clarity, and procedure for the validation process (Lowery, 2020; Ebert et al., 2018). The survey was pilot tested to 15 gynecologists to gauge the need to refine wording and format and to check whether the predefined response options were exhaustive. Minor revisions were made. Accordingly, the questionnaire was modified. A 23-part, self-managed online questionnaire was developed for physicians. They consisted of binominal questions, questions in categorical Likert scales (6 levels) and open questions and was entitled ‘Digitization in Gynecology and Obstetrics in times of COVID-19’. The main sections were as follows: (1) sociodemographic data, (2) basic use of digital health applications (DHAs), (3) telemedicine: Knowledge and application, (4) tele-gynecology (obstacles and benefits). One aim of the survey was to shorten the interview duration to a maximum of 15 min in order to keep the dropout rate as low as possible and to motivate the respondents to answer as many questions as possible (Uhlig et al., 2014; Eysenbach, 2004). At the time of the survey, about 19,151 gynecologists were working in Germany. Of these, almost 6300 worked in a hospital and 9150 of them worked in a private practice (<https://www.bundesärztekammer.de/ueber-uns/aerztestatistik/aerztestatistik-2020/>). A total of 1785 gynecologists worked in Central Germany. The survey was sent to 1785 gynecologists in Central Germany (federal states of Thuringia, Saxony-Anhalt and Saxony). The contact details of potential participants in Central Germany were provided by the Association of Statutory Health Insurance Physicians (Kernder et al., 2021). The questionnaire was distributed to the physicians via e-mail. Participants were informed that their data would be strictly confidential and anonymous. The information letter was part of the email. Access to the study was granted with a survey link. All participants gave their consent. There were no exclusion criteria for participation.

Only fully completed questionnaires were included in the subsequent analysis. The results were analyzed using Survey Monkey TM and the Statistical Package for the Social Sciences, SPSS (Version 22.0, SPSS Inc., Chicago, IL, USA). Descriptive statistics included quantities, percentages, median scores and ranges for ordinal variables. The chi square test was applied for the analyses of influencing parameters. The p-value of less than 0.05 was considered significant.

3. Results

3.1. Quantitative data

3.1.1. Epidemiological data of respondents

Out of 1785 gynecologists, 704 participated in this study. Of the 704 questionnaires answered, 478 (67.9%) were fully completed and could be included in the study. The response rate was thus 39.4%. Of the 704

questionnaires answered, 226 questionnaires (32.1%) were incomplete. Thus, the inclusion rate (478/1785) was 26.8%. Four hundred and seventy-eight gynecologists have completed the survey. The mean age of the participants was 36.4 years \pm 13.8 years and the majority were female (n = 329, 67%). 55% (n = 263) were clinicians in a university hospital, 34% in a non-university hospital and almost 11% of gynecologists are outpatient. Details of the participants are given in Table 1.

3.1.2. Basic use and acceptance of digital health applications (DHAs)

3.1.2.1. Basic use. All gynecologists are able to use digital health applications. Seventy-six percent (n = 320) of gynecologists considered the use of DHAs to treat the patient's disease to be useful, while only 2.8% (n = 13) disagreed. The reason for consulting a gynecologist showed no influence on the assessment of the value of digital health applications (p = 0.351). No significant difference in gender, age, or degree of training was noted. Gynecologists at university hospitals rated the usefulness of the digital health applications in the management of Women's Health Care medicine higher than physicians at non-university hospitals or private practices (p < 0.001). No significant differences were found in terms of gender, age, level of education and employment. Due to the COVID-19 pandemic, attitudes towards DHAs changed. 50.3% of gynecologists (n = 240) rated the use as positive and 66.6% (n = 318) reported using DHAs more frequently since the COVID-19 pandemic (Table 2).

3.1.2.2. Acceptance of digital health apps. At the time of the survey, gynecologists reported the highest acceptance of video consultation (27%, 129/478), informative DHAs (24%, 115/478) and digital symptom testers (24%, 114/478). Digital disease-related questionnaires (8%, 38/478), diary-DHA (7%, 34/478) as well as therapy-DHA (5%, 24/478) and self-taken blood samples with digital access (5%, 24/478) showed a low level of acceptance among the gynecologists (Fig. 1).

3.1.2.3. Telemedicine: knowledge and application. A total of 76.4% (365/478) of respondents rated their knowledge of telemedicine as 4 (unsatisfactory), 5 (bad) or 6 (very bad). The minority (127/478, 26.7%) rated their knowledge of telemedicine as 1 (very good), 2 (good) or 3 (satisfactory). The majority (437/478, 91.6%) do not currently use telemedicine, but 67.3% (321/478) said they would like to use it. The three main barriers to the introduction of telemedicine, according to respondents, were the purchase of technology and equipment (325/478, 68.1%), administration (305/478, 64.0%) and insufficient remuneration (233/478, 48.9%). Details are given in Table 3.

3.1.2.4. Tele-gynecology. A total of 79.4% (380/478) of the respondents considered telemedicine to be useful in gynecology. When asked who should interact with telemedicine, 81.2% (388/478) answered doctor-physician, 47.8% (233/478) doctor-patient and 23.8% (114/478)

Table 1
Respondent characteristics (n (%)).

Characteristics	Gynecologists (n = 478) (100%)
Women	320 (67)
Age (years)	
21–30	167 (35)
31–40	101 (21)
41–50	115 (24)
51–60	57 (12)
>60	38 (8)
Consultant	273 (58)
Resident	205 (42)
Place to work	
University hospital	263 (55)
Non-university hospital	162 (34)
Private practice	52 (11)

Table 2

Use of digital health applications before and during the COVID-19 pandemic, n (%).

Characteristics	Gynecologists n = 478 (100%)
<i>I think the use of digital health applications in the form of medical apps, video consultations and online pharmacy orders are useful for disease management, n (%)</i>	
I don't agree at all	0 (0)
I don't agree	13 (2.8)
Neutral	145 (30.3)
I agree	202 (42.2)
I fully agree	118 (24.7)
<i>Has the COVID 19 pandemic changed your attitude to digital health applications? n (%)</i>	
Positively changed	240 (50.3)
Negatively changed	17 (3.5)
Unchanged	221 (46.2)
<i>Have you been using digital health applications more frequently since the COVID 19 pandemic?, n (%)</i>	
Yes	318 (66.6)
No	160 (33.4)
<i>I feel able to use digital health apps, n (%)</i>	
I don't agree at all	0 (0)
I don't agree	0 (0)
Neutral	0 (0)
I agree	376 (78.6)
I fully agree	102 (21.4)

Doctor assistant (multiple answers were possible). From the respondents' point of view, this is useful for aftercare (73.2%, n = 349) and for emergency appointments (55.9%, n = 267). 64.6% (n = 308) of the gynecologists indicated that a time-synchronous digital consultation could complement physical appointments. In addition, 78.2% (n = 373) of gynecologists indicated that they would cancel an appointment on site if the patient's disease is stable and the patient is able to indicate their well-being by using a DHA (Table 4). Participants were asked to identify specific digital tools that could support gynecological patient care management. The most frequently selected topics were tele-consultation (313/478, 65.5%), tele-diagnostics (271/478, 56.7%) and video consultations (260/478, 54.4%). This was followed by online appointments (205/478, 42.9%), e-learning (150/478, 31.4%), patient apps (106/478, 22.3%), digital screening (101/478, 21.2%), portable devices (46/478, 9.8%), telesurgery (15/478, 3.1%), and other instruments (9/478, 1.8%).

4. Discussion

4.1. Main results

To the best of our knowledge, we have conducted the largest nationwide survey on the use of telemedicine in Germany in the field of gynecology for the promotion and implementation of telemedicine. Almost 80% of gynecologists surveyed generally consider the overall use of tele-gynecology to be useful and over two-thirds of respondents want to use telemedicine in their daily practice and welcome the wide range of approaches to telemedicine. However, only a minority of doctors had already used telemedicine at the time of the survey. Barriers to take-up, such as limited knowledge, costs, purchase of technical equipment, and insufficient reimbursement, were clearly identified by respondents. The results shed light on how telemedicine can support gynecological care from a medical point of view, thus simplifying conservative and familiar communication formats, such as information exchange with colleagues and direct information exchange with patients. The survey shows a high level of acceptance in the field of telemedicine consultation/tele counseling. Although various tools already exist, their development for gynecological applications is not as advanced as in intensive care and cardiology, for example. This is reflected in the relatively small number of respondents using telemedicine at the time of the survey. There is a fundamentally high acceptance of telemedicine applications in the

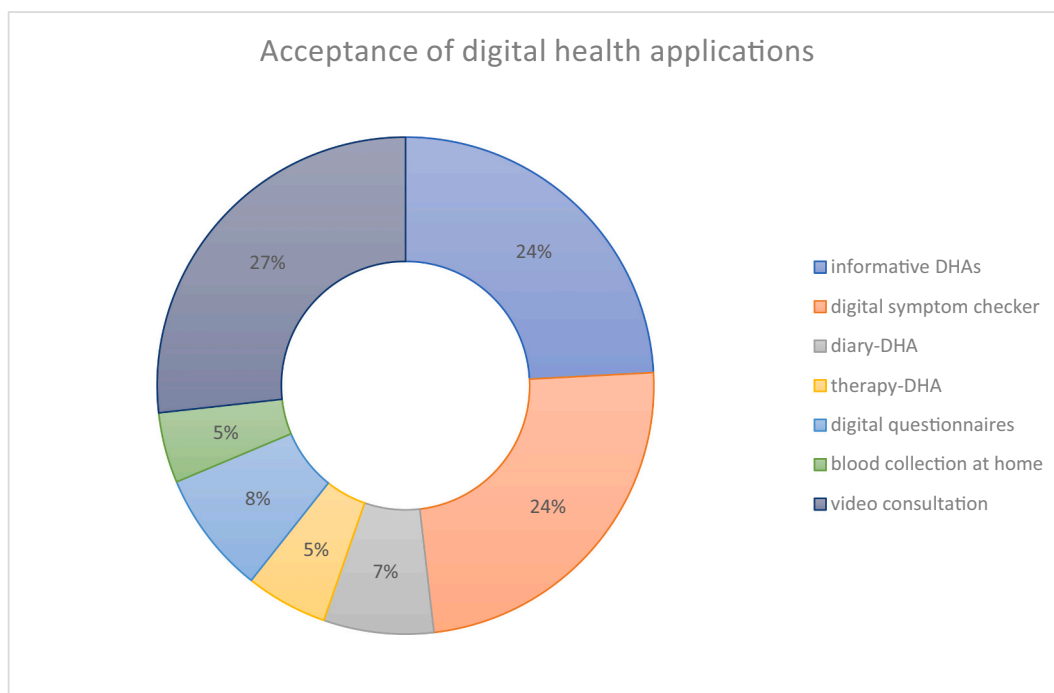


Fig. 1. An overview of the Acceptance of digital health apps of the gynecologists in percent.

Table 3
Telemedicine: knowledge and use.

Question	Gynecologists n (%)
How do you rate your own knowledge of telemedicine?	
Total	478 (100)
1 (very good)	23 (4.8)
2 (good)	45 (9.4)
3 (satisfactory)	59 (12.3)
4 (unsatisfactory)	179 (37.4)
5 (bad)	104 (21.8)
6 (very bad)	68 (14.2)
Do you use telemedicine?	
Total	478 (100)
Yes	41 (8.4)
No	437 (91.6)
Do you want to use telemedicine?	
Total	478 (100)
Yes	321 (67.3)
No	157 (32.7)
Is something keeping you from using telemedicine?	
Total	478 (100)
Yes	427 (89.3)
No	51 (10.7)
What's stopping you from using telemedicine? (Multiple selection possible)	
total	478 (100)
Purchase of technological equipment	325 (68.1)
Administration	305 (64.0)
insufficient remuneration	233 (48.9)
Data security	218 (45.6)
Lack of involvement of colleagues	159 (33.2)
Technical understanding of patients	130 (27.2)
Poor Internet connection	123 (25.7)

aftercare sector among the surveyed physicians, so doctors indicated that a synchronized digital consultation could replace physical appointments with digital formats and can cancel an appointment on site. A high potential for the application of tele-gynecology may be in the areas of prevention, monitoring of diseases or the course of therapy.

Table 4
Implementation of tele-gynecology in patient care management.

Question	Gynecologists n (%)
Can telemedicine be used in gynecology and obstetrics?	
Total	478 (100)
Yes	380 (79.4)
No	98 (20.6)
Which parties should use telemedicine communication? (Multiple selection possible)	
Total	478 (100)
Doctor-doctor	388 (81.2)
Doctor-patient	233 (47.8)
Doctor-medical assistant	114 (23.8)
Other combinations	78 (16.3)
No communication	43 (8.9)
In which phases can telemedicine support patient care in gynecology and obstetrics? (Multiple selection possible)	
Total	202 (100)
Screening	93 (19.4)
Initial contact	162 (33.8)
Follow-up	349 (73.2)
Emergency	267 (55.9)
Not at all	35 (7.4)
What tools could support patient care? (Multiple selection possible)	
Total	202 (100)
Tele-consultation	313 (65.5)
Tele-diagnostic	271 (56.7)
Video consultation	260 (54.4)
Online arrangements	205 (42.9)
e-Learning	150 (31.4)
Patient apps	106 (22.3)
Digital screening	101 (21.2)
Portable devices	46 (9.8)
Tele-surgery	15 (3.1)
Other possibilities	9 (1.8)
Not used	5 (1.1)

4.2. Limitations

The average age of our sample corresponds to that of German doctors as a whole (Gbeasor-Komlanvi et al., 2020). Women were over-

represented compared to the average (Gbeasor-Komlanvi et al., 2020), which may also show that female doctors are more interested in telemedicine. This survey reflects only the opinion of gynecologists. We assume a self-selection bias and a non-response bias, since the survey was probably mostly answered by physicians interested in telemedicine. An online survey was deliberately used to increase the response rate and reduce the effort for data management. The aim was to obtain an increased rate of return with the online questionnaire and to be able to complete the questionnaire within a short time, regardless of place and time. However, it can be assumed that this online survey may have generated a positive bias towards users of telemedicine. To answer the questionnaire, knowledge of the field of telemedicine is required, such as preferences for specific tools. Therefore, given the limited knowledge of doctors in the field of telemedicine, distortions are likely. In addition, we expect rapid technological developments in the field of telemedicine, so that the predefined response categories may not have been exhaustive enough. The survey was conducted in the time of COVID-19, and pre-pandemic data are pending in this area, so further research on the development of the acceptance of telemedicine applications in general and in relation to tele-gynecology is urgently needed.

4.3. Comparison with previous literature

This work provides initial basic knowledge of the application of telemedicine in the field of gynecology as well as initial insights into the new field of tele-gynecology by providing detailed user settings, needs and barriers. Therefore, we believe that the results of this study can help in the development of telemedicine solutions to integrate them into the clinical routine of patients in the treatment of gynecological disorders. Contrary to the results of a recent study that showed a negative attitude to digitization in healthcare among physicians in Germany (Kritz et al., 2013), our results have shown that physicians have a positive attitude to telemedicine.

A survey by the American Medical Association among 3500 doctors in the United States showed that less than 5% of gynecologists used telemedicine, which is significantly less than doctors from other medical disciplines, such as radiologists (43%) (Powley et al., 2016b). Although most respondents believe that tele-consultation can support gynecological patient care management, tele-consultation is rarely used. In a nationwide survey of digitization in German medical practices, only 1% of the of the participating physicians say they use videoconferencing for communication. The most frequent responses to digital usage were e-mail and basically not digital communication (Runkle et al., 2019). In the survey on digitization in German medicine, the lack of practice, security gaps in information technology (IT), the considerable costs and effort involved in the introduction of digital media technologies and an unfavorable cost-benefit ratio are identified as the main obstacles to digitization. For our survey participants, IT security vulnerabilities are of little relevance. Only 45.6% of the gynecologists, data security is an issue that prevents them from using telemedicine. Video consultations with patients appear to have considerable potential in gynecology, especially during follow-up consultations (Turoff, 1970). However, only a minority of respondents were in favor of the use of Telemedicine for initial consultations. This finding confirms the Results of a comparable rheumatology study from the United States of America (Islam et al., 2021). In addition, almost half of the respondents want to use telemedicine in direct patient contact, which contrasts with general telemedicine developments in the healthcare sector (Eysenbach, 2004; available, online-b). That's regrettable, as previous studies have shown that the use of telemedicine applications as a flexible solution can increase the independence of the medical practitioner and improve the personal knowledge and, in the long term, the self-management of patients (Coventry and Branley, 2018). Other studies suggest that health care through video consultation is as effective as after personal medical visits (Kulcsar et al., 2016; Menage, 2020). A qualitative study also reports that patients would be willing to have health data collected

electronically and to accept the sharing of patient reports (PROs) between clinical encounters if it improves communication with healthcare providers and access to reliable medical information (Seeberger et al., 2020). However, a recent study has shown that doctors are reluctant to study electronic PROs because it would lead to a massive increase in their workload (Knitz et al., 2020). On the other hand, mobile apps promise to speed up diagnosis and improve patient monitoring and treatment outcomes (Solomon and Rudin, 2020). The small number of doctors would use apps to improve clinical routine (34%). This shows in contrast to previous research from 2018, in which almost half of the physicians said they were open to using health apps in clinical daily life (Knitz et al., 2019). One of the main reasons for doctors' aversion to use apps is the lack of clinical evidence (Kulcsar et al., 2016; Knitz et al., 2020). Our results show that most gynecologists accept telemedicine and are open to its use in the future.

4.4. Perspectives of tele-gynecology

COVID-19 has highlighted the importance of contactless approaches in healthcare. The pandemic is expected to increase and accelerate the willingness to use telemedicine, thus establishing and defining new standards in healthcare in the long term (Gbeasor-Komlanvi et al., 2020). The great potential of telemedicine will continue to grow in importance in the future, and there will be further, perhaps yet unknown, ways in which digital health applications can improve and make patient care safer. Further research on the implementation of tele-gynecology is urgently needed. These include large-scale randomized controlled studies on health care impacts, health economic impacts, risks and incidents, as well as specific interventions. As our results show that there is no "one-size-fits-all" solution, further research into the perspectives and preferences of doctors, patients and other telemedicine users in gynecology is essential in the field of telemedicine. This can provide the basis for individual patient and physician-adapted telemedicine options and develop and improve patient triage mechanisms for digital or analog consultation hours (Kulcsar et al., 2016; Menage, 2020). The use of digital therapies in gynecology can be used in pre-natal care or as part of awareness campaigns to prevent sexually transmitted diseases in the form of online learning courses or webinars. As physicians report on obstacles to the use of telemedicine, it seems that the structural framework for the effective implementation of tele-gynecology is not yet in place. A significant administrative burden and inadequate reimbursement structures prevented the doctors interviewed from using telemedicine. However, the main obstacle was the limited knowledge and experience of doctors in the use of telemedicine, which points to the need for the timely introduction of low-threshold training courses. General information portals as well as individual solutions for knowledge transfer are needed here. Compared to other medical disciplines, such as internal medicine or anesthesia and intensive care, telemedicine is under-represented in the field of gynecology (Pullano et al., 2021). The establishment of subject-specific sections in the leading associations could be an important foundation stone for these relevant topics in the long term. An interdisciplinary exchange with experts from other specialist sectors such as IT, the administrative sector and the legal system can support the establishment of tele-gynecology in the long term.

5. Conclusions

Our study showed that gynecologists support the implementation of tele-gynecology. Two thirds of the respondents want to establish telemedicine in their clinical routine. Respondents welcome a variety of telemedicine approaches. However, only a minority them currently use telemedicine applications. In addition, most physicians consider their knowledge of telemedicine to be insufficient. The provision of high-quality gynecological management care through telemedicine urgently requires further research, reduction of existing barriers and training of

professionals.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgement

We would like to thank the Young Forum of the DGGG for creating and establishing the questionnaire for this study. In addition, we would like to thank Dr. Isabel Graul, Dr. Franziska Loos and Prof. Dr. Martin David for their cooperation and their expertise in the field of digital applications.

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