Factors associated with the availability of virtual consultations in primary care across 20 countries: A cross-sectional study

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Submitted to: Journal of Medical Internet Research
on: August 06, 2024

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Abstract

Background: Virtual consultations represent a notable change in healthcare delivery following the COVID-19 pandemic. Understanding the dynamics of virtual consultations is critical in assessing healthcare system resilience and adaptability in times of crisis.

Objective: (1) To describe the availability and hours of use of telephone, video and human chat consultations before and during the COVID-19 pandemic period, and (2) identify factors associated with their availability.

Methods: Primary Care Physicians (PCPs) from 20 upper-middle and high-income countries completed a cross-sectional online survey in 2020. Factors associated with availability were investigated using chi-squared tests and effect size (ES) estimates calculated.

Results: A total of 1,370 PCPs were included in this study (85.4% of the total sample of 1,605). Telephone consultations were the most frequently available type of virtual consultations before and during the pandemic (73.1% and 90.4%, respectively). Significant increases in availability and use were observed during the pandemic for all the types of virtual consultations. The largest absolute increase in availability was observed for video consultations (39.5%), followed by telephone (17.3%) and chat (8.6%) (all P<.0001). The largest increase in use was observed for telephone consultations (+11.0 hours per week, P<.0001).

Digital maturity of the practice was weakly associated with availability of video consultations both before (ES: 0.2) and during (ES: 0.2) the pandemic (P<.0001 for both), and with chat consultations before the pandemic only (ES: 0.1, P=.001). Greater availability of video and chat consultations was found in PCPs who had completed digital health training, both before and during the pandemic (P<.0001 for all). There was significant country-level variation in the use and availabilities of the technologies between both time periods. The association between country and the availability of telephone consultations changed from strong (ES: 0.5, P<.0001) to weak (ES: 0.2, P=.03), while the relationship between country and video consultations changed from moderate (ES: 0.3, P<.0001) to strong (ES: 0.5, P<.0001).

Conclusions: Our study demonstrates the transformative impact of the COVID-19 pandemic on the availability of virtual consultations globally, and how contextual factors, predominantly digital maturity, digital health training, and country, were associated with the availability of virtual consultations. Further exploration of drivers of availability, particularly at the national level, is needed to ensure sustained and effective implementation of virtual consultations.

(JMIR Preprints 06/08/2024:65147)
DOI: https://doi.org/10.2196/preprints.65147

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Factors associated with the availability of virtual consultations in primary care across 20 countries: A cross-sectional study

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Word count: 3844 (including in-text references)

Abstract

Background: Virtual consultations represent a notable change in healthcare delivery following the COVID-19 pandemic. Understanding the dynamics of virtual consultations is critical in assessing healthcare system resilience and adaptability in times of crisis.
Objective: (1) To describe the availability and hours of use of telephone, video and human chat consultations before and during the COVID-19 pandemic period, and (2) identify factors associated with their availability.
Methods: Primary Care Physicians (PCPs) from 20 upper-middle and high-income countries completed a cross-sectional online survey in 2020. Factors associated with availability were investigated using chi-squared tests and effect size (ES) estimates calculated.
Results: A total of 1,370 PCPs were included in this study (85.4% of the total sample of 1,605). Telephone consultations were the most frequently available type of virtual consultations before and during the pandemic (73.1% and 90.4%, respectively). Significant increases in availability and use were observed during the pandemic for all the types of virtual consultations. The largest absolute increase in availability was observed for video consultations (39.5%), followed by telephone (17.3%) and chat (8.6%) (all $P<.0001$). The largest increase in use was observed for telephone consultations (+11.0 hours per week, $P<.0001$). Digital maturity of the practice was weakly associated with availability of video consultations both before (ES: 0.2) and during (ES: 0.2) the pandemic ($P<.0001$ for both), and with chat consultations before the pandemic only (ES: 0.1, $P=.001$). Greater availability of video and chat consultations was found in PCPs who had completed digital health training, both before and during the pandemic ($P<.0001$ for all). There was significant country-level variation in the use and availabilities of the technologies between both time periods. The association between country and the availability of telephone consultations changed from strong (ES: 0.5, $P<.0001$) to weak (ES: 0.2, $P=.03$), while the relationship between country and video consultations changed from moderate (ES: 0.3, $P<.0001$) to strong (ES: 0.5, $P<.0001$).

Conclusions: Our study demonstrates the transformative impact of the COVID-19 pandemic on the availability of virtual consultations globally, and how contextual factors, predominantly digital maturity, digital health training, and country, were associated with the availability of virtual consultations. Further exploration of drivers of availability, particularly at the national level, is needed to ensure sustained and effective implementation of virtual consultations.

Keywords: digital health, virtual consultations, primary care

Introduction

The emergence of virtual consultations, defined as remote healthcare interactions facilitated by digital technologies, is a significant evolution in healthcare delivery. Telephone, video,

and chat consultations may be more accessible than in-person appointments, as they offer rapid real-time communications with providers without a need to travel [1]. Despite these potential benefits, before the COVID-19 pandemic, these technologies, particularly telephone consultations, were steadily gaining traction, but had not reached widespread integration into most mainstream primary healthcare systems [2, 3].

During the COVID-19 pandemic, virtual care became vital to the safe and efficient continuation of primary care delivery, when minimising in-person encounters was essential to protect both healthcare staff and patients from the risk of infection [4, 5]. Many health systems adopted some form of 'virtual first' approach to primary healthcare provision. The initial virtual encounter aimed to manage patients' needs without in-person contact wherever possible while reserving 'higher risk' face-to-face visits for those at greatest need, and where physical examination was deemed to be essential.

Throughout the pandemic, Primary care physicians (PCPs) faced barriers in adopting and implementing virtual consultations to differing degrees depending on the specific technology, with potential consequences impacting the quality of care delivered to patients. The ability of PCPs to effectively transition to virtual service delivery depends on multiple factors, including 1) organisational and policy incentives, 2) digital infrastructure capacity and investment, and 3) the digital health skills of PCPs and patient populations [2, 3, 6]. These factors may have resulted in variation in adoption and utilisation of virtual consulting technologies between PCPs and providers from different settings. [3]

With growing demand for rapid and convenient access to primary care, alongside financial constraints requiring efficiency gains, virtual care appeared as an attractive solution to enhance patient accessibility. Consequently, virtual consultations continue as a core component of healthcare delivery in many upper middle- and high-income countries beyond the pandemic [3].

Examining the landscape of virtual healthcare technologies before and during the pandemic can help us better understand the magnitude of the transition to these new models of care. However, how the availability and uptake of virtual consultations varied across PCPs from different settings, including different countries, is uncertain.

The aim of this study was to analyse access and use of virtual consultations before and during the pandemic, and factors associated with availability of virtual consulting technologies between PCPs from different settings. Specific aims include: (1) to analyse the availability and hours of use of telephone, video and chat consultations before and during the COVID-19 pandemic, and (2) to identify factors associated with their availability.

Methods

Study design

This study used data from a cross-sectional online questionnaire completed by PCPs of 20 upper-middle- and high-income countries (Australia, Brazil, Canada, Chile, Colombia, Croatia, Finland, France, Germany, Ireland, Israel, Italy, Poland, Portugal, Spain, Slovenia, Sweden, Türkiye, United Kingdom, United States). The research was conducted by the inSIGHT Research Group, a consortium of academic primary care researchers from the 20 countries previously listed. The study adheres to the STROBE guidelines for reporting observational studies [7].

Data collection

Participants were eligible if they were practising PCPs in one of the 20 countries listed above, between March and September 2020. The study was conducted between June to September 2020. National leads in each country invited PCPs through their formal organisations or

personal networks via email or social media (i.e., Facebook and Twitter). The questionnaire was available in English, French, German, Italian, Spanish, and Portuguese. A complete description of the study protocol, including the full questionnaire and power analyses, has been previously published [8].

Study variables

Participants were asked to answer whether chat (i.e., using a text-based messaging system), telephone or video consultations were available in their practice before or during the COVID-19 pandemic (from 11th March 2020). Respondents ticked a box for each period considered (i.e., before or during the COVID-19 pandemic) to indicate a technology was available in that period.

Respondents were subsequently asked how many hours they spent per week on each type of consultation in each time period. Before analysis, hours per week spent on each of the three virtual consultation technologies were cleaned to remove answers of ≥100 hours per week. A response of greater than zero hours spent on a technology was considered evidence for the technology being available. This study focuses on an analysis of PCPs who responded to any questions on availability and/or hours of use of virtual consultation technologies.

Predictor variables included: country, urbanicity (rural, mixed, urban), and practice digital maturity. Practice digital maturity was assessed using the digital maturity framework developed by Flott et al. which considers the six dimensions of usage, resources, and abilities (organizational and individual), interoperability, general evaluation methodology, and impact [9]. PCPs could agree or disagree with six statements about their practice's digital maturity, corresponding with the six dimensions. A digital maturity score was calculated for each PCP by granting 1 point for each statement with which the PCP indicated agreement, giving a possible range of 0 to 6 where a score of 6 indicates high digital maturity. PCPs were also asked whether they have completed training on digital technologies before or during the COVID-19 pandemic.

Statistical analysis

The total number of hours spent per week before and during the pandemic on virtual consultation technologies was calculated for PCPs who reported availability of at least one of the technologies in the period. For PCPs who reported the technology as available in both time periods, the number of hours spent by PCPs on each technology before and during the COVID-19 pandemic were compared using paired Wilcoxon signed rank tests, and the relationship between the predictors and change in hours of use of each technology was investigated using univariable linear regression models.

McNemar tests were conducted to compare availability of each technology before and during the COVID-19 pandemic period. Absolute differences in the percentage of PCPs with each technology available in each time period were described. Plots were created to visualise changes in technology availability and hours of use by country of PCP employment.

Cramer's V was calculated to estimate the effect size of practice factors upon the variation in the availability of digital technologies before and during the COVID-19 pandemic. Cramer's V estimates of effect size (ES) to describe the strength of association between the predictors and outcomes were categorised as weak (0.0-0.29), moderate (0.30-0.49), or strong (≥0.50). The change in percentage of PCPs with each technology available was visualised by country. *P*-values for statistical tests were adjusted for multiple comparisons using the Holm-Bonferroni method [10]. All analyses were performed in R version 4.3.0 [11], and a significance level of 0.05 was used throughout.

Ethics

Ethical approval was granted by the Imperial College Research Ethics Committee (Reference 20IC5956), which oversees health-related research with human participants. Survey participants gave their written informed consent to participate in the study.

Results

Characteristics of PCPs included, and of their respective practices

This study includes responses from 1,370 PCPs, representing 85.4% of the total sample of 1,605 (Table 1).

Table 1. Characteristics of 1,370 participants.

	Characteristic	Number (%)
Age category		
	Under 30	79 (5.8)
	30-39	434 (31.7)
	40-49	356 (26.0)
	50-59	289 (21.1)
	60-69	192 (14.0)
	70+	16 (1.2)
	Prefer not to answer	4 (0.3)
	Missing	0 (0.0)
Gender		
	Female	827 (60.4)
	Male	535 (39.1)
	Other	1 (0.1)
	Prefer not to answer	7 (0.5)
	Missing	0 (0.0)
Urbanicity		
	Mixed	307 (22.4)
	Rural	211 (15.4)
	Urban	852 (62.2)
	Missing	0 (0.0)
Years of PCP Experience		
	< 5 years	265 (19.3)
	5 - 10 years	295 (21.5)
	10 - 15 years	210 (15.3)
	15 - 20 years	156 (11.4)
	> 20 years	444 (32.4)
	Missing	0 (0.0)
Digital Maturity Score		
	0	108 (7.9)
	1	112 (8.2)
	2	130 (9.5)
	3	249 (18.2)
	4	268 (19.6)
	5	234 (17.1)

	6	269 (19.6)

The majority (60.4%, n=827) of the respondents were female and 57.6% (n=790) were aged between 30-49 years. Almost a third (32.4%) of the respondents had clinical experience of more than 20 years. PCPs spent a median of 36 (Interquartile Range: 28.0-40.0) hours on clinical work per week. The highest proportion of the respondents (62.2%, n=852) worked in practices based in urban areas. The median digital maturity score of their practices as reported by PCPs was 4 (Interquartile Range: 2-5). Training on digital-first technologies was undertaken by 312 (22.8%) PCPs before the pandemic and by 375 (27.4%) PCPs during the pandemic period. A breakdown of PCP characteristics by country is available in Multimedia Appendix Tables 1 and 2.

Use of digital technologies

PCPs reported spending a median of 3.0 hours per week using these tools (IQR 1.0-5.0), increasing to 15.0 (IQR 8.0-25.0) during the pandemic period (*P*<.0001). Hours spent per week on specific technologies are shown in Table 2.

Table 2. Average change in hours spent on virtual consultations before and during COVID-19, amongst PCPs who had the technology available in both time periods. [a]

Technology	Denominator	Mean hours spent per week before the pandemic	Mean hours spent per week during the pandemic	**Mean difference in hours, mean (SE)[b]**	*P*
Telephone consultations	883	3.8	14.2	+11.0 (0.5)	<.0001
Video consultations	127	1.3	4.3	+4.5 (0.2)	<.0001
Chat consultations (i.e., using a messaging system)	365	2.4	5.3	+3.4 (0.2)	<.0001

[a] Test statistics and p-values correspond to two-sample Wilcoxon tests. SE = Standard Error.
[b] The mean difference describes the mean of the change in hours spent by each PCP on the technology

The average number of hours per week spent on each type of virtual consultation increased during the pandemic (Table 2). The greatest change was observed for time spent on telephone consultations (+11.0 hours/week, *P*<.0001), with 91.8% of PCPs reporting an increase in time spent.

Country of PCP employment was associated with changes in hours spent per week on telephone (R^2 = 0.2, *P*<.0001) and chat consultations (R^2 = 0.1, *P*=.001), but not with changes in hours spent on video consultations (R^2 = 0.1, *P*=.73). The increase in hours spent per week on telephone consultations was largely driven by PCPs from Poland, Spain, Canada, Chile, and Portugal, who spent more than 15 additional hours per week on telephone consultations during the COVID-19 pandemic compared to before (Figure 1).

No association was found between changes in hours of use of any of the three virtual consultation technologies and any of practice digital maturity score, training, or urbanicity (Multimedia Appendix Figure 1).

Availability of virtual consultations before and during the COVID-19 pandemic

Before the pandemic, telephone consultations were the most frequently available virtual consultation technology (73.1%, n=1,002), followed by chat consultations (33.7%, n=462) and video consultations (12.8%, n=176). During the pandemic, telephone consultations remained the most frequently available solution (90.3%, n=1,238), followed by video consultations (52.3%, n=717) and chat consultations (42.3%, n=580).
Statistically significant increases were observed for all types of virtual consultation during the pandemic. During the pandemic, telephone consultations remained the most commonly available technology (90.4%, n=1,238) (Figure 2). The largest absolute increase in availability was observed for video consultations (+39.5%, *P*<.0001) (Figure 2 and Multimedia Appendix Table 3).
Of the 365 PCPs who lacked access to telephone consultations before the COVID-19 pandemic, 87.7% gained availability to this type of virtual consultation during the crisis. Correspondingly, 49.3% (n = 584), and 21.8% (n = 196) of PCPs who previously did not have access to video consultations, or chat consultations, respectively, reported gaining access to these technologies during the COVID-19 pandemic period.

Factors associated with availability

Before the COVID-19 pandemic, practice urbanicity was weakly associated with availability of telephone consultations (ES=0.1, *P*<.001). Digital health training was weakly associated with availability of video (*P*<.0001) and chat consultations (*P*=.04). Digital maturity score was weakly associated with increased availability of video consultations (*P*<.0001) and chat consultations (*P*=.001). There was moderate to strong association between country and availability of each of the technologies (Figure 2) (ES range: 0.3-0.5, *P*<.0001 for all).
During the pandemic, significant associations remained between availability and country, digital health training, and digital maturity score (Figure 2). Country persisted as significantly associated with the availability of chat consultations (*P*<.0001), video consultations (*P*<.0001) and telephone consultations (*P*=0.03). Digital maturity score remained only weakly associated with the availability of video consultations (*P*<.0001), but not with telephone or chat consultations. Digital health training was weakly associated with the availability of video (as observed before the pandemic), but also with chat consultations (*P*<.0001 for both). Practice digital maturity score was no longer associated with chat consultations during the pandemic.
The strength of univariable associations between the availability of the technologies and the predictors differed before and during the COVID-19 pandemic. The strength of the associations between country and telephone consultations decreased from strong to weak between the two time periods. In contrast, the strength of association between video consultations and country increased from moderate to strong.
A detailed overview of the nature of such associations is provided in the sections below.

Country variations

Availability of chat consultations varied greatly by country for both time periods, ranging from 9.0-78.7% for before the COVID-19 pandemic, and 6.5-75.4% during the pandemic.

Most countries showed only small changes in availability of chat consultations from before to during the COVID-19 pandemic (Figure 4**)**. The largest changes in availability were observed for PCPs from Chile (+38.5%), Colombia (+33.3%), Brazil (+33.3%), and the UK (+23.6%). Changes in availability of <10% were observed for PCPs from 13 of the 20 countries surveyed.

There was less variation in availability of telephone consultations between countries during the COVID-19 pandemic period compared to before (Figure 3). Before the pandemic, availability of telephone consultations across countries ranged from 25.0% to 100.0%, while during the pandemic, availability ranged from 78.4% to 100.0%. There were distinct differences in change in telephone consultation availability by country. Average availability of telephone consultations decreased amongst PCPs from countries which reported >90% availability of telephone consultations prior to the COVID-19 pandemic while increases in availability were observed for all other countries.

Availability of video consultations was low across all countries before the COVID-19 pandemic period, with less than 35% of PCPs from each country reporting having them available (Range: 1.1-33.4%). Availability of video consultations increased on average for PCPs from all countries, to differing degrees by country (Figure 3). The largest increases were observed for PCPs from the UK (+81.8%), followed by PCPs from France (+71.4%), Colombia (+60.0%), and Ireland (+57.8%).

Urbanicity

Before the pandemic, the percentage of PCPs with telephone consultations available was highest amongst those from rural practices (83.4%), compared to mixed (77.5%) or urban settings (69.0%). This difference by practice urbanicity did not persist into the pandemic period. Availabilities of video and chat consultations were similar across PCPs from urban, mixed, and rural settings in both time periods.

Digital health training

Higher availability of video consultations was reported amongst PCPs who had completed, versus never completed, training in digital-first technologies, both before (18.0% vs 9.0%, $P<.0001$) and during (61.1% vs 45.8%, $P<.0001$) the pandemic. PCPs who had completed training reported greater availability of chat consultations before (37.8% vs 30.7%, $P=0.04$) and during (49.5% vs 37.0%, $P<.0001$) the pandemic period.

Digital maturity

Availability of video consultations before and during the pandemic was greater amongst PCPs from more digitally mature practices. Availability of chat consultations was highest in PCPs from practices with a digital maturity score of 6 (42.7%), followed by 4 (39.6%) and 1 (35.7%). After adjustment for multiple testing, there was no association detected between digital maturity and availability of chat consultations during the pandemic.

Discussion

Principal Results

Telephone consultations were the most frequently available type of virtual consultations both before and during the pandemic (73.1% and 90.4%, respectively). Significant increases in availability during the pandemic were observed for all the types of virtual consultations, alongside significant increases in hours spent on every type of virtual consultation. The largest increase in availability was observed for video consultations, whereas a smaller change emerged in availability of chat consultations.

Regarding the factors associated with availability, PCPs from rural practices reported greater availability of telephone consultations before the COVID-19 pandemic but this association did not persist into the pandemic. Practice digital maturity was significantly (although weakly) associated with the availability of video consultations both before and during the pandemic, and with chat consultations before the pandemic only. Digital health training was weakly associated with the availability of both video and chat consultations, both before and during the pandemic.

There was significant country-level variation in the hours of use and availabilities of the technologies between both time periods (Figures 1 and 4). The association between country and the availability of telephone consultations changed from strong to weak, while the relationship between country and video consultations changed from moderate to strong. There was similarly strong country-level variation in availability of chat consultations in both periods.

Comparison with Prior Work

Telephone consultations were the most frequently available and used virtual consultation modality, increasing during the pandemic compared with before. Their higher use and uptake were likely driven by their lower resource requirements and maintenance costs compared to video and chat consultations [6, 12]. Additionally, telephones are readily available to most patients and telephone consultations were already widely used in primary care in many places (**Figure 4**) [3], reducing the need for additional infrastructure or training. Supporting this, telephone consultation availability was independent of practice digital maturity level or training in digital-first technologies, unlike video or chat technologies (Figure 2).

Before the pandemic, rural PCPs reported greater availability of telephone consultations compared to PCPs from urban or mixed settings. This is unsurprising, given the benefits of virtual consultations where geographic isolation can limit healthcare accessibility [13]. However, during the pandemic, availability of telephone consultations became similarly high amongst PCPs from rural, mixed, and urban settings, likely attributable to the need for social isolation and consequent adoption of telephone consultations in urban areas. Future research should address whether these changes persisted in the post-pandemic period.

Smaller increases were apparent in the availability and use of chat consultations during the pandemic, compared with video. This may reflect specific implementation barriers for this type of virtual consultation, alongside their perception as an adjunct to, rather than as a replacement for, other consultation methods [14]. Previous UK research found that most online consultations required in-person or telephone follow-up [15, 16]. There are safety considerations with chat consultations, including the challenges of identifying patient cues solely from written communication [17]. The proportionately greater increase in availability of video is likely explained by the ability to see the patient, which contributes substantially to

the confidence of professionals in making a clinical assessment [18].
Adherence to data privacy regulations poses a particular challenge for implementing chat consultations, potentially discouraging uptake. Fulfilment of the legal obligation to record and store patient information can be difficult for chat consultations, necessitating PCPs to keep separate clinical records [19-21]. Most commonly used commercial messaging systems (e.g., Telegram, iMessage, WhatsApp) do not comply with health data privacy and security regulations [19, 21]. Despite potential non-adherence to ethical or data privacy guidelines, commercial instant-messaging providers are widely used for clinical purposes by patients and healthcare staff [20, 22-24].
Among the factors examined, country had the strongest association with availability of virtual consultation technologies and was the only significant predictor of change in hours of use. The varied ability to transition to virtual service delivery between countries is likely attributable to various governance and infrastructural factors. Some countries have national long-term digitisation goals for primary care, including strategies for virtual consultation adoption [25, 26]. Coupled with guidelines on their effective and safe use [27, 28], these would have facilitated greater adoption by PCPs. Countries also varied in their organisational and IT readiness to incorporate new consultation technologies into existing operations [29]. In the case of video and chat, regional variation in the availability of suitable platforms, internet coverage, and smart devices may have affected the feasibility of these consultations, contributing to a digital divide [12, 30]. Implementation of video consultations in some countries was impeded by the need to update national health data regulations [2] and reimbursement policies [3, 6, 13, 27].

Country-level variation in telephone consultation availability reduced during the pandemic compared to before, while the variation for video consultations increased (Figures 2 and 3). This indicates that the COVID-19 pandemic amplified discrepancies in barriers and facilitators of video consultation implementation between countries. Before the COVID-19 pandemic, video consultations were in the earlier stages of adoption in many countries, whereas telephone consultations were already widely available (**Figure 4**) and easier to scale up, for reasons previously stated [3]. Future research should investigate whether these barriers persisted and sustained country-level differences in video consultation implementation beyond the pandemic.

Strengths and Limitations

A primary strength of our study is the large number of PCPs surveyed from twenty countries, which included a mix of urban and rural settings, during a critical transition period for primary care service delivery. However, the findings must be interpreted in light of some accompanying weaknesses. The generalizability of the study's findings may be limited by the reduced representativeness introduced by use of convenience sampling. Convenience sampling may introduce some self-selection bias for PCPs who hold stronger views about the research topic and are more vocal in sharing their experiences. Use of an anonymous online survey, disseminated via email and social media, prevented the identification of whether multiple respondents were employed at the same organization. Nonetheless, these sampling strategy limitations are inherent to most survey-based studies and should not detract from the value of our findings.

Additionally, the survey was not available in all the languages spoken by the countries surveyed which possibly excluded some PCPs from participating or affected their

interpretation of questions. The study did not consider the type or size of healthcare organisations. Smaller practices may have incurred greater difficulties in transitioning to virtual service delivery models, particularly those in lower income areas, due to facing higher operating costs [6, 12]. Another limitation is that PCPs were surveyed exclusively from upper-middle and high-income countries, restricting the generalizability of the findings to healthcare systems of similar economic contexts.

Lastly, there has likely been significant changes in the implementation and perceptions of digital health technologies since the survey administration. Nevertheless, these findings reflect a critical period for understanding the adaptability of healthcare systems in times of crisis.

Implications for policy and practice

Understanding the variations in the availability of virtual consultation technologies within and between countries is essential to ensuring that their continued use does not impose additional barriers. While the pandemic reduced country-level discrepancies in availability of telephone consultations, a widening gap emerged with the availability of video consultations. Further investigation is needed to determine if these disparities reflect variations in patient, clinician, or healthcare organization preferences, or if they stem from digital capacity limitations.

To fully harness the potential of digital health innovations, healthcare providers must possess a robust understanding of their capabilities, limitations, and ethical implications. However, despite the finding of a positive relationship between training in digital first technologies and availability of chat and video consultations, less than a third (27.4%) of PCPs had completed such training. There is therefore a need for comprehensive digital health training for physicians, ensuring that they are equipped with the digital literacy essential for delivering optimal patient care in the modern healthcare landscape.

As video consultations experienced the most significant rise, it is crucial to establish through further research whether this pattern persists in current practice, and whether this consultation modality offers substantial advantages beyond simply reducing in-person interactions. It is possible that video consultations served primarily as a tool for clinical risk mitigation during the pandemic; as restrictions on in-person appointments have stopped, the high utilization of video consultations may have declined [29]. This underlines the need for further studies to understand the post-pandemic landscape.

Conclusions

This study highlights the significant role the COVID-19 pandemic played in driving the global adoption of virtual consultations in primary care. The increased use of virtual consultation technologies during the COVID-19 pandemic underscores the flexibility of primary care systems to adapt rapidly to the constraints imposed by the pandemic. This shift enabled continued service delivery while minimizing exposure risks for both patients and healthcare staff.

This research identified contextual factors, particularly country of practice, digital health training and practice digital maturity, as key factors associated with the availability of these technologies. Although the COVID-19 motivated increased usage of virtual consultations overall, it also revealed widened discrepancies between countries in their ability to implement video consultations. Systems-level research is necessary to identify the country-level facilitators and barriers towards implementation of video consultations, to ensure their

continued use.

Acknowledgments

ALN and the inSIGHT group contributed to the conception and design of the study. GK contributed to data preparation and analysis. GK, ALN, TB, GGr, and BH contributed to interpretation of results and drafting the manuscript. AC, CC, DP, EL, GGu, GJ, HL, JC, KN, LL, RH, RT, AM, AM, and TK revised the manuscript. All authors provided critical review and approved the final version of the manuscript.
ALN, GGr, GK, BH and AM are supported by the National Institute for Health and Care Research (NIHR) Applied Research Collaboration Northwest London. ALN is also funded by the NIHR Patient Safety Research Collaborative, with infrastructure support from Imperial NIHR Biomedical Research Centre. The views expressed in this publication are those of the authors and not necessarily those of NIHR or the Department of Health and Social Care.

Data availability statement

Any additional data are available upon reasonable request from the corresponding author.

Conflicts of interests

BH also works for eConsult Health Ltd, provider of a platform for online consultations for NHS primary, secondary and urgent / emergency care.

Abbreviations

EHR: Electronic Health Record
ES: Effect Size
NIHR: National Institute of Health and Care Research
PCP: Primary Care Physician
STROBE: STrengthening the Reporting of OBservational studies in Epidemiology

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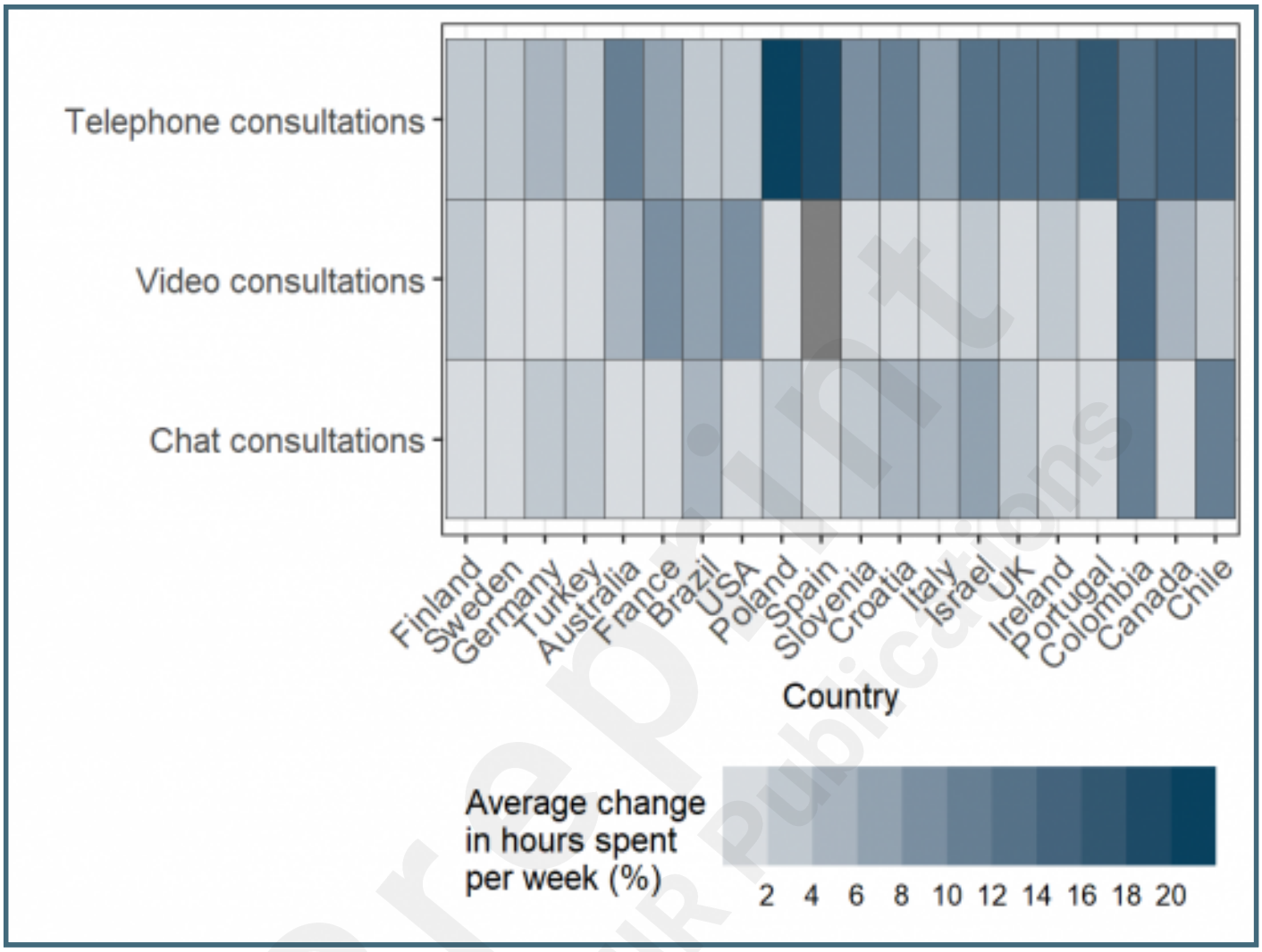
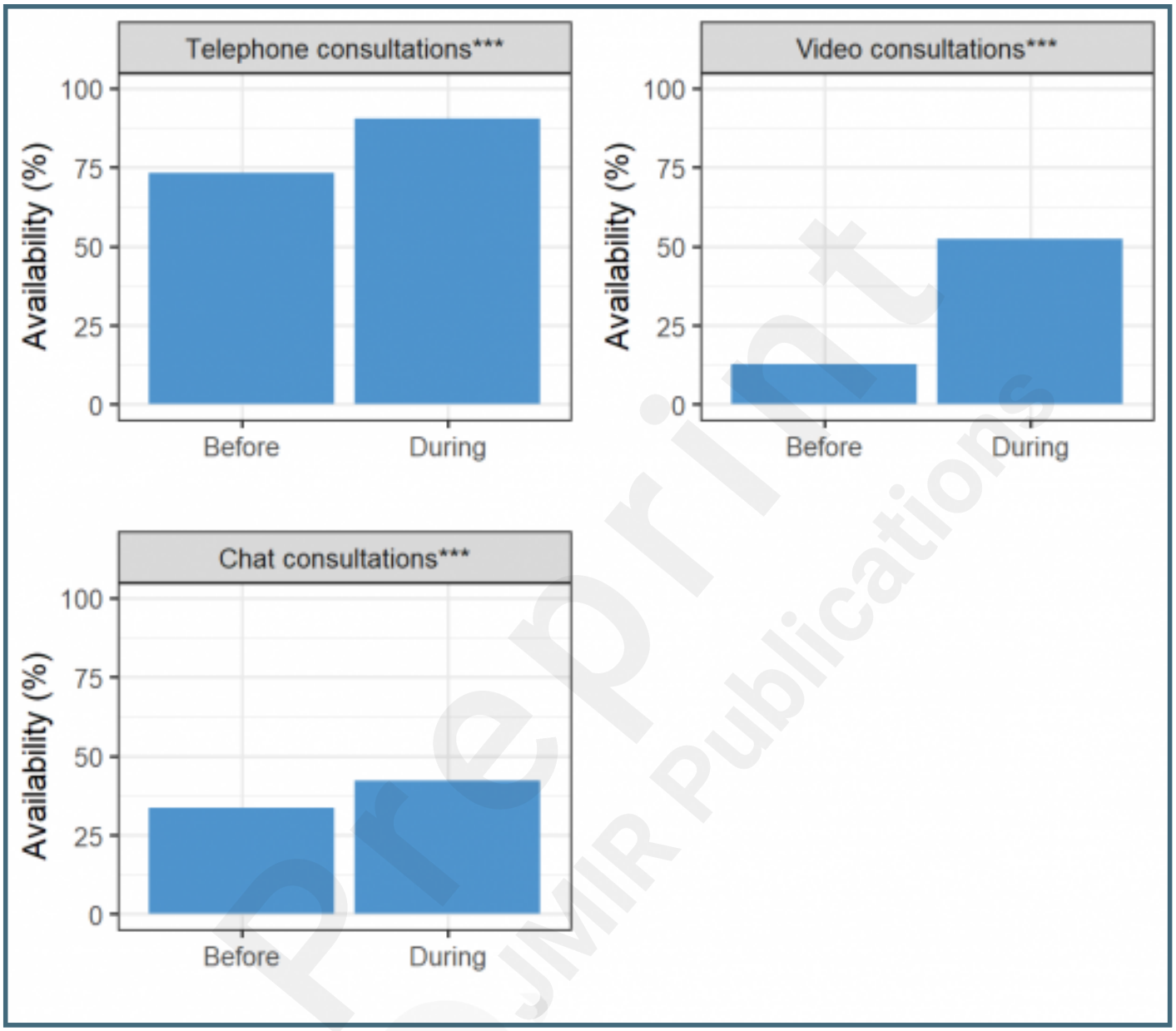
Supplementary Files

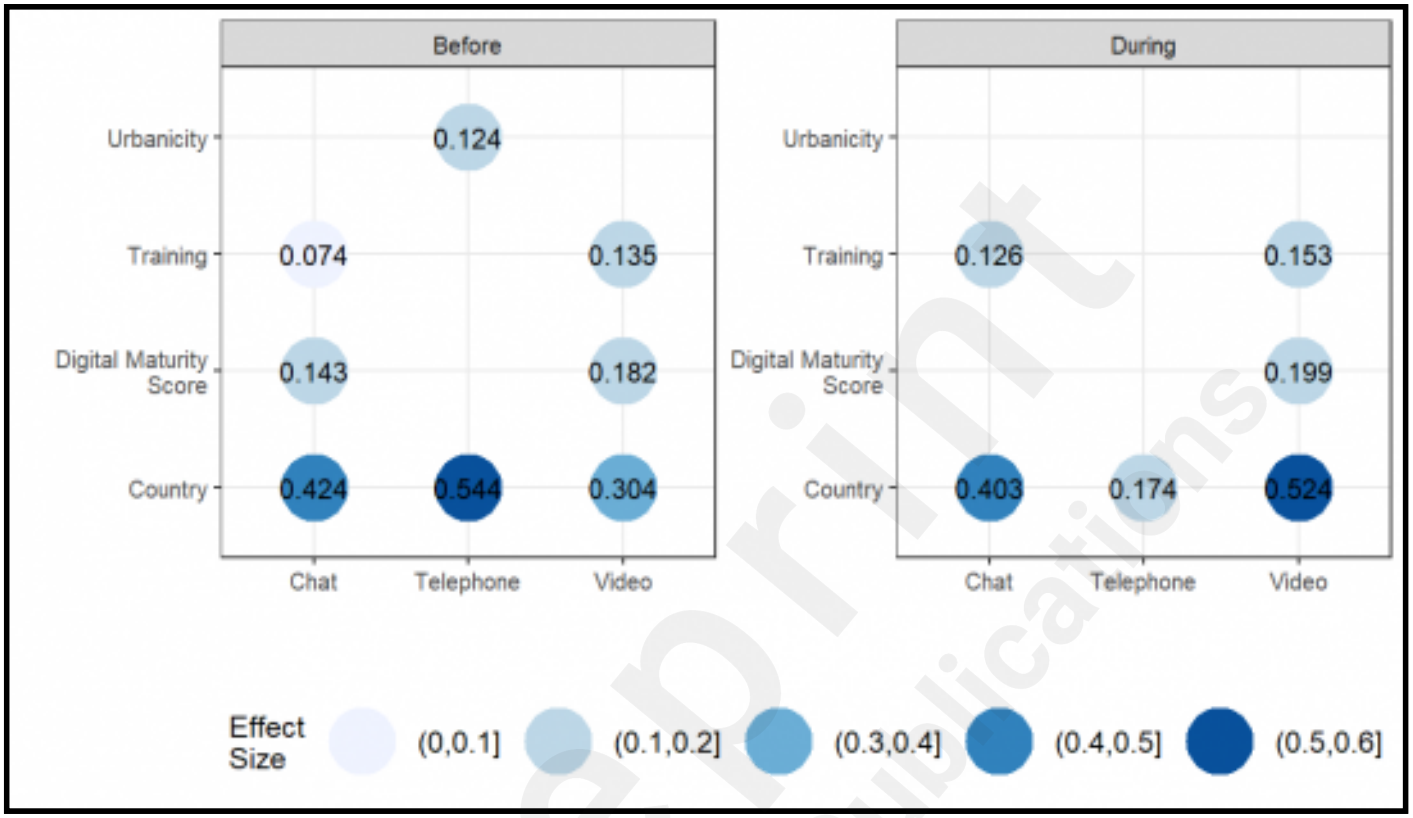
Figures

Mean change in hours spent per week on virtual consultation technologies by country of PCP employment. Grey cells indicate where no data was available for change in hours of use.

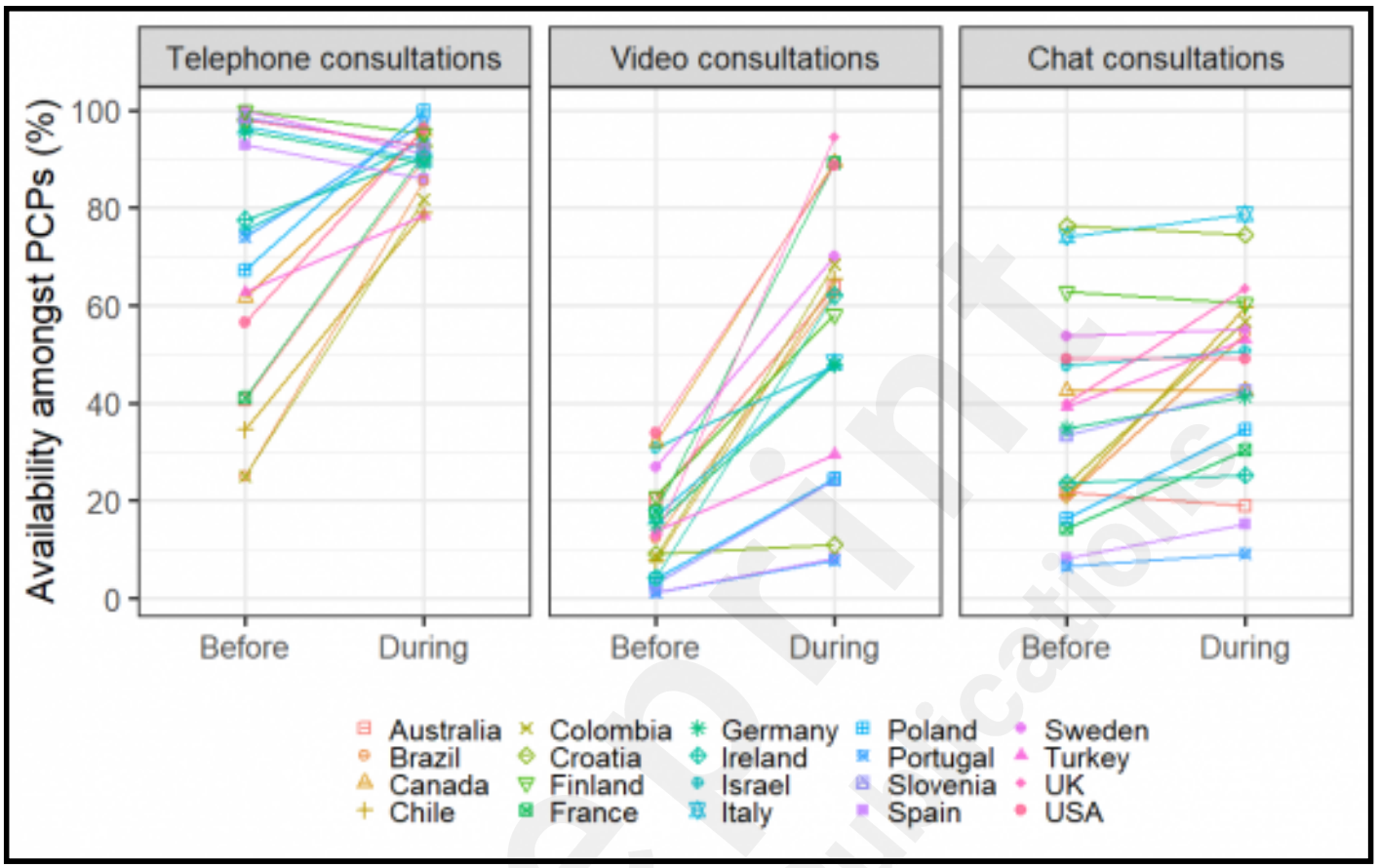




Effect size of PCP and practice factors on availability of digital consultation technologies before and during the COVID-19 pandemic. Effect sizes correspond to Cramer's V measures of association; larger effect sizes indicate a stronger relationship between the predictor and availability. Estimates for non-significant relationships are not shown.



Absolute difference in percentage of PCPs from each country reporting the technology as available before vs during the COVID-19 pandemic.



Multimedia Appendixes

Untitled.

URL: http://asset.jmir.pub/assets/ba2ec17e1812ed59cfbadc6af3ef56a6.docx

CONSORT (or other) checklists

Untitled.

URL: http://asset.jmir.pub/assets/271c7b165c72a3643936e7cf745fc236.pdf