

BMJ Open Association between telehealth use and general practitioner characteristics during COVID-19: findings from a nationally representative survey of Australian doctors

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ABSTRACT

Objective To investigate factors associated with the use of telehealth by general practitioners (GPs) during COVID-19.

Design A nationally representative longitudinal survey study of Australian doctors analysed using regression analysis.

Setting General practice in Australia during the COVID-19 pandemic.

Participants 448 GPs who completed both the 11th wave (2018–2019) of the Medicine in Australia: Balancing Employment and Life (MABEL) Survey and the MABEL COVID-19 Special Online Survey (May 2020).

Outcome measures Proportion of all consultations delivered via telephone (audio) or video (audiovisual); proportion of telehealth consultations delivered via video.

Results 46.1% of GP services were provided using telehealth in early May 2020, with 6.4% of all telehealth consultations delivered via video. Higher proportions of telehealth consultations were observed in GPs in larger practices compared with solo GPs: between +0.21 (95% CI +0.07 to +0.35) and +0.28 (95% CI +0.13 to +0.44). Greater proportions of telehealth consultations were delivered through video for GPs with appropriate infrastructure and for GPs with more complex patients: +0.10 (95% CI +0.04 to +0.16) and +0.04 (95% CI +0.00 to +0.08), respectively. Lower proportions of telehealth consultations were delivered via video for GPs over 55 years old compared with GPs under 35 years old: between –0.08 (95% CI –0.02 to –0.15) and –0.15 (95% CI –0.07 to –0.22), and for GPs in postcodes with a higher proportion of patients over 65 years old: –0.005 (95% CI –0.001 to –0.008) for each percentage point increase in the population over 65 years old.

Conclusions GP characteristics are strongly associated with patterns of telehealth use in clinical work.

Infrastructure support and relative pricing of different consultation modes may be useful policy instruments to encourage GPs to deliver care by the most appropriate method.

INTRODUCTION

In March 2020, the World Health Organisation declared COVID-19 as a pandemic.

Strengths and limitations of this study

- We use data from the Medicine in Australia: Balancing Employment and Life Survey, which contains a very rich set of general practitioner (GP) personal and practice characteristics.
- We use data from two time periods allowing the examination of associations between pre-COVID-19 physician characteristics and patterns of telehealth use during COVID-19.
- We focus only on GPs; further research on factors affecting telehealth uptake for other health practitioners is needed.
- Countries differ in population, prevalence of COVID-19, regulations for containing COVID-19 and support for the healthcare system. Generalisations of our results should consider such cross-country differences.

Within weeks, the pandemic has transformed medical practice as telehealth emerged as a critical model of healthcare delivery.¹ Previous research has shown that a large proportion of outpatient visits, for various specialties, can be clinically managed via telehealth.¹ It has been used in many settings during the pandemic response: palliative care,² urgent care,³ behavioural health,⁴ after-hours hospital medicine,⁵ rehabilitation therapies,⁶ clinical practice for musculoskeletal injuries⁷ and emergency room triage.⁸

In many countries, healthcare use fell significantly at the height of the pandemic's first wave in March and April. For example, the number of in-person outpatient visits in the USA dropped by over 60% in March and April compared to that in 2019.⁹ During this period, telehealth visits rose rapidly. As in-person visits rebounded in June, telehealth visits declined and have now stabilised, but at a higher rate than that prior to COVID-19.⁹

Increased use of telehealth was observed in areas with more COVID-19 cases.⁹

Similar patterns of use have been occurring in Australia. Between March and June 2020, in-person general practitioner (GP) consultations declined by 25% compared with March–June 2019.¹⁰ In March and April 2020, the Australian Government introduced new Medicare items to reimburse telephone (audio only) and video (audio-visual) consultations provided by GPs, other specialists, nurse practitioners and allied health professionals.¹¹ Previously to this, Medicare did not provide any payment for telehealth provided by GPs. Funding was introduced in 2011 only for specialists providing care to patients in rural areas. During March–June 2020, 13 million telehealth consultations, 28.3% of all GP consultations, were delivered to Australians, at the cost of \$525.8 million (or 26.6% of all GP consultations) to the Australian government.¹⁰ Although Medicare items were introduced for both telephone and video calls, almost all telehealth GP consultations (97.2%) were provided by telephone.¹⁰ The use of telehealth GP services rapidly expanded and by June it has more than offset the decline in in-person consultations.¹⁰ Like the USA, the use of telehealth is positively related to number of cases.¹² In August, there were large differences across the eight Australian states and territories in the number of cases, with Victoria experiencing a second wave. States that had the virus under control had rates of telehealth use of between 3% and 7%, while states with higher new daily cases and tougher restrictions had rates of up to 18% of visits to all types of health professionals.¹²

At the time of the data collection in this paper (up to 17 May 2020), there were 7075 COVID-19 cases in Australia (27.9 cumulative cases per 10 000 population) and 100 deaths.¹³ The number of new cases was either falling or remaining steady across all states and territories from a peak in mid-March.¹³ During this time, restrictions included mandatory hotel self-isolation for overseas arrivals, restrictions on indoor and outdoor gatherings, and a travel ban on foreign nationals entering Australia. At the end of April, some states and territories began to ease some restrictions. On 8 May, the Australian government announced a national framework for easing restrictions with a review every 3 weeks, with states and territories doing this at their own pace.

In Australia, all GPs and around 80% of physicians in other specialties do at least some work in private practice¹⁴ and are paid by fee-for-service. Fewer face-to-face visits lead to lower revenue, and without new funding for telehealth consultations, many physicians in Australia will have experienced significant falls in revenue. However, even for GPs who interact with the same number of patients, income may still fall because the fee for each telehealth consultation may have been lower compared with fees charged for face-to-face consultations pre-COVID-19. GPs can set any fee they wish, with Medicare (Australia's tax-financed universal single payer) providing a fixed subsidy for each service provided. If the fee is above the

fixed subsidy, the patient pays an out-of-pocket payment. If the fee is the same as the subsidy, there is no out-of-pocket payment—known as 'bulk billing'. If a patient's out-of-pocket expenses reach a certain threshold in a calendar year, a higher subsidy is provided by Medicare.

Medicare telehealth items were initially required to be bulk-billed, but this was changed after a few weeks. Evidence suggests that GPs and other specialists charge higher fees and bulk-bill less if they are located in more affluent areas.^{15–17} For these physicians, the use of telehealth could have resulted in a larger fall in income compared with physicians who already bulk-billed, given a lower fee for telehealth consultations compared with charging higher fees for face-to-face consultations before COVID-19. GPs may be reluctant to increase fees for telehealth in the face of uncertain and falling demand.

Since telehealth provides a new model of care for patients and providers, it is important to understand factors driving its uptake. The aim of this paper was to examine the associations between physician, practice and area characteristics and use patterns of telehealth consultations in the general practice setting using regression analysis of Australian national data.

METHODS

Data

Data were from the Medicine in Australia: Balancing Employment and Life (MABEL) longitudinal survey of doctors. This comprised 11 annual waves from 2008 to 2018,¹⁸ plus a COVID-19 Short Online Survey (SOS) sent out in May 2020.¹⁹ The sample frame for each wave of MABEL and the COVID-19 SOS was the AMPCo Medical Directory of Australia, a database containing information on the population of Australian doctors. Those who responded to the Wave 1 MABEL survey formed the baseline cohort for MABEL. In each subsequent annual wave, surveys were sent to doctors who have responded in any previous waves, plus a new cohort each year of new doctors entering the Australian medical workforce. All surveys were voluntary.

MABEL wave 11 was sent to respondents who had completed a survey in any previous wave, plus new GPs entering the workforce since wave 10.²⁰ The survey questions and online processes were developed and tested using face-to-face interviews and three pilot surveys prior to the main survey mailout of wave 1 in 2008. In every subsequent wave, a pilot survey was conducted to test new questions and online processes. Wave 11 GPs were approached by mailed letter that included a paper survey, login details if they preferred to respond online through the secure study website, as well as an explanatory statement providing information about the study. GPs were sent three reminders over a 6-month period (from September 2018 to March 2019).²⁰ The online version of wave 11 contained 81 questions for GPs who have responded in previous waves, or 93 questions for new doctors, distributed across 11 pages. Doctors were able to

review and change their answers through a back button if desired; they were also directed to subsequent questions if some questions were not relevant. Once a user had submitted a completed survey, it was never displayed a second time. As this is a panel survey and responses from respondents across waves had to be linked over time, the survey was not anonymous and each individual was allocated a unique identifier to enable longitudinal tracking.

The COVID-19 SOS was established as a one-off survey to examine the experiences of doctors during the pandemic and was sent to GPs and non-GP specialists who had previously completed any MABEL survey since 2008 and had a valid email address. The survey questions were developed by MABEL researchers (including a GP) and online processes were tested through trials by MABEL researchers. There was no pilot survey to potential respondents due to the necessity to administer the survey quickly during COVID-19. Doctors were approached by email only and received one email reminder after 6 days, with the survey closing after 10 days (14–24 May 2020). The initial email invitation contained an explanatory statement describing the purpose and nature of the survey, as well as a link to the secure MABEL survey study website, where doctors may provide consent and login to complete the short web-based survey that contained 27 questions across three pages. The COVID-19 SOS had the same online setup as the online version of wave 11.

For this paper, responses from GPs were used and included GPs who responded to both the MABEL wave 11 survey in 2018–19 and the COVID-19 SOS in May 2020, and who were undertaking clinical practice and remained in the same work location across both surveys. Both completed and partially completed questionnaires were analysed to use the maximal sample size for each question. Data were stored on a secure server accessed only by MABEL researchers.

Dependent variables

The COVID-19 SOS included the following question: ‘In your MOST RECENT WEEK at work, what PERCENTAGE (%) of patients did you consult with using the following: Face-to-face, Video consultations, Telephone consultations, Not applicable (write NA)’. The respondents were asked to allocate 100% across the above three types of consultation.

Using responses from the aforementioned question, we calculated two dependent variables: (1) the proportion of telehealth (either by video or by phone) among all patient interactions and (2) the proportion of telehealth by videoconferencing among all telehealth (video and telephone) consultations.

Independent variables

We categorised independent variables to four categories.

Physician characteristics

GPs’ personal attributes such as their age, gender, hours worked per week before COVID-19 (from 2018–19),

whether they are living with partner/spouse before COVID-19 (from 2018–19), have children (from 2018–19), have fellowship of medical college(s) and are qualified overseas. Also included were the percentage of patients each GP bulk-billed and fees charged for an initial consultation in 2018–19 to examine if those who charged higher prices (lower bulk billing) were more likely to use telehealth to make up for lost income.

Practice characteristics

GPs’ practice characteristics such as the number of GPs in the practice, the number of practice nurses, administrative staff and allied health professionals (from 2018–19). In 2018–19, we also asked how often respondents had used video consultations for clinical care, indicating their previous capacity and experience.

Patient characteristics

A key issue for GPs is the potential fall in demand for face-to-face medical visits induced by COVID-19. In the COVID-19 SOS, we asked: ‘Comparing your most recent week at work with BEFORE the pandemic, what has been the impact of the COVID-19 pandemic on the average number of patients you interact with per week? (Include ALL patients you interacted with in ALL SETTINGS)’, with response options: increased by less than 10%, 10%–20%, more than 20%, no change, and fallen by less than 10%, 10%–20%, 20%–30%, 30%–40%, 40%–50% and more than 50%. For analysis, we regrouped these responses to no fall; fallen by less than 20%, 20%–40% and more than 40%. To control for patient complexity, we included GPs’ level of agreement with the statement: ‘The majority of my patients have complex health and social problems’ (from 2018–19), those agreed or strongly agreed are categorised as facing on average more complex patients than others.

Area characteristics

Characteristics of each GP’s practice postcode were obtained from the Australian Bureau of Statistics and included (1) quartiles of the socioeconomic status (SES) of the population, measured using the Socio-Economic Indexes for Areas (SEIFA) Index of Relative Disadvantage; (2) the proportion of the population over 65 years old in the postcode of each GP’s practice; and (3) rurality measured using the Modified Monash Model (MMM) classification: major cities (MM1), areas within 20 km of town with 50 000 population (MM2), areas within 15 km of town with 15 000–50 000 population (MM3), areas within 10 km of town with 5000–15 000 population (MM4) and all other remote and rural areas (MM5–7) are grouped with MM4 for the analysis.

Statistical analysis

We conducted both ordinary least squares (OLS) regression and fractional response generalised linear models, given that the dependent variables are proportions. In the OLS regressions, we use inverse probability weights calculated by comparing the sample to the population of GPs in Australia to help ensure national representativeness with respect to

age, gender, qualified overseas, rurality, state/territory and SES of GPs' work location. Details of these calculations are provided in the MABEL user manual and follow standard practice in large scale household panel surveys.²⁰ In addition, the variables used to calculate weights were also used as independent variables in OLS regressions. Results from OLS and fractional response generalised linear model are almost identical, so we report results from OLS regressions with weights. We ran two regression models, one for each dependent variable. Both regression models included the same set of independent variables mentioned earlier.

There is evidence of an association between the use of telehealth and the number of COVID-19 cases. There are no publicly available national data on the number of COVID-19 cases by postcode or other small areas during April and May. In the analysis, we therefore include dummy variables for each state and territory that captures all unobserved factors between states and territories, including the number of COVID-19 cases. SEIFA and MMM will also capture differences in the number of cases across SES and rurality.

Patient and public involvement

Patients or the public were not directly involved in the design, conduct or writing of this research. Select Australian GPs and non-GP specialists were surveyed via email during data collection.

RESULTS

Summary characteristics of GPs

MABEL wave 11 had a response rate from GPs of 32.4% (3258/10 070). The COVID-19 SOS had a response rate from GPs of 12.6% (927/7345). The number of GPs in clinical practice who completed both surveys and had complete data for all dependent and independent variables was 448, and these were used in the analysis. The characteristics of those included in the analysis are shown in [table 1](#).

Use of telehealth was high, with GPs self-reporting that 46.1% of all patient consultations were provided using telehealth in early May 2020. GPs also reported that of all telehealth consultations, 6.4% used video consultations ([table 1](#)). This self-reported snapshot is higher than the national data from Medicare on the number of services for the whole month of May, where our calculations show that 34.2% (4 379 570/12 796 424) of GP consultations were provided by telehealth, and that of all telehealth consultations, 2.9% (127 912/4 379 570) were provided by video. Over 21% were overseas trained. Only 4.7% (21/448) of GPs were in solo practice, and 31.3% (140/448) were in a practice with at least 10 doctors. On average, 61.7% of patients seen by GPs in our sample were bulk-billed in 2018–19. About 8.5% (38/448) of GPs reported a decrease of over 40% in the number of in-person patient interactions in May 2020; 20.3% (91/448) of GPs reported a decrease of 20%–40%; and another 29.2% (131/448) reported a decrease of up to 20%.

Table 1 Summary statistics of GPs in analysis sample

	GPs, n (%) (N=448)
Dependent variables	
Fraction of patient interactions using telehealth, mean (SD)	0.46 (0.30)
Fraction of telehealth interactions using video, mean (SD), n=428	0.06 (0.18)
GP characteristics	
Female	247 (55.1)
Age (years)	
<35	62 (13.8)
35–39	30 (6.7)
40–44	52 (11.6)
45–49	43 (9.6)
50–54	52 (11.6)
55–59	75 (16.7)
60–64	60 (13.4)
65–69	44 (9.8)
70 or higher	30 (6.7)
Living with partner or spouse	381 (85.0)
Have children	249 (55.6)
Overseas trained	97 (21.7)
Has fellowship of college	285 (63.6)
Hours worked per week, mean (SD)	36.17 (12.62)
% of patients bulk-billed, mean (SD)	61.67 (30.72)
Fee for standard level B consultation (\$), mean (SD)	67.59 (17.70)
Practice characteristics	
Practice size	
Solo	21 (4.7)
2–3 docs	46 (10.3)
4–5 docs	89 (19.9)
6–9 docs	152 (33.9)
10 or more docs	140 (31.3)
Number of allied health professionals, mean (SD)	2.02 (3.71)
Number of nurses, mean (SD)	3.16 (2.28)
Number of admin staff, mean (SD)	5.58 (3.08)
Videoconferencing capacity	
Not applicable	269 (60.0)
Applicable but never used	64 (14.3)
Applicable and have experience	115 (25.7)
Patient characteristics	
Majority of patients have complex health and social problems	322 (71.9)
Number of patient interactions:	
No decrease	188 (42.0)
Decreased by less than or equal to 20%	131 (29.2)
Decreased by between 20% and 40%	91 (20.3)

Continued

Table 1 Continued

	GPs, n (%) (N=448)
Decreased by more than 40%	38 (8.5)
Area characteristics	
SES quartile	
1	70 (15.6)
2	114 (25.4)
3	117 (26.1)
4	147 (32.8)
Per cent of population >65 years old, mean (SD)	16.31 (5.72)
Rurality (MMM)	
MM1	293 (65.4)
MM2	45 (10.0)
MM3	39 (8.7)
MM4-7	71 (15.8)
State	
Australian Capital Territory	6 (1.3)
New South Wales	117 (26.1)
Northern Territory	14 (3.1)
Queensland	91 (20.3)
South Australia	47 (10.5)
Tasmania	13 (2.9)
Victoria	120 (26.8)
Western Australia	40 (8.9)

Rurality is defined using the MMM: MM1, MM2, MM3, MM4 and MM5–7 are grouped with MM4 for the analysis. SES is defined using the ABS SEIFA Index of Disadvantage of the postcode of the GP's practice and are in quartiles. Most disadvantaged is the bottom quartile (0%–25%) of disadvantage.

ABS, Australian Bureau of Statistics; GP, general practitioner; MM1, major cities; MM2, areas within 20 km of town with 50 000 population; MM3, areas within 15 km of town with 15 000–50 000 population; MM4, areas within 10 km of town with 5000–15 000 population; MM5–7, all other remote and rural areas; MMM, modified Monash model; SEIFA, Socio-Economic Indexes for Areas; SES, socioeconomic status; SES, socioeconomic status.

Sample representativeness

Table 2 shows differences between GPs in our sample and the population of GPs in Australia. These differences were adjusted for in the analyses by the use of inverse probability weights.²⁰ We report results after these weight adjustments, though the results from the unweighted analysis are very similar.

Factors affecting the overall use of telehealth from regression results

The overall use of telehealth did not vary by GP age, gender, family characteristics, fellowship, whether overseas trained or by hours worked in 2018–19 (table 3). The values presented in the table represent the effect of a unit change in the independent variable on the proportion

Table 2 t-Tests of differences in means between GPs in estimation sample and AMPCo population of GPs

	GPs in estimation sample, % (N=448)	GP population (AMPCo 2020), % (N approx. 34 500)	P value
Female	55.1	47.0	<0.001
Age (years)			
<35	13.8	14.1	0.87
35–39	6.7	9.9	0.03
40–44	11.6	12.9	0.41
45–49	9.6	11.8	0.15
50–54	11.6	11.8	0.88
55–59	16.7	12.6	0.009
60–64	13.4	11.0	0.11
65–69	9.8	8.2	0.22
70 or higher	6.7	7.6	0.46
Overseas trained	21.7	44.0	<0.001
Rurality (modified Monash model)			
MM1	65.4	72.4	<0.001
MM2	10.0	9.5	0.71
MM3	8.7	7.3	0.24
MM4-7	15.8	10.8	<0.001
SES quartile			
1	15.6	17.6	0.27
2	25.4	24.4	0.60
3	26.1	25.1	0.62
4	32.8	32.9	0.96
State			
Australian Capital Territory	1.3	1.7	0.57
New South Wales	26.1	30.0	0.07
Northern Territory	3.1	0.9	<0.001
Queensland	20.3	20.4	0.97
South Australia	10.5	6.9	0.003
Tasmania	2.9	2.3	0.38
Victoria	26.8	24.4	0.25
Western Australia	8.9	10.0	0.43

Values are bolded to denote statistical significance ($p < 0.10$).

Rurality is defined using the modified Monash model: MM1, MM2, MM3, MM4 and MM5–7 are grouped with MM4 for the analysis. SES is defined using the ABS SEIFA Index of Disadvantage of the postcode of the GP's practice, and are in quartiles. Most disadvantaged is the bottom quartile (0%–25%) of disadvantage.

ABS, Australian Bureau of Statistics; GP, general practitioner; MM1, major cities; MM2, areas within 20 km of town with 50 000 population; MM3, areas within 15 km of town with 15 000–50 000 population; MM4, areas within 10 km of town with 5000–15 000 population; MM5–7, all other remote and rural areas; SEIFA, Socio-Economic Indexes for Areas; SES, socioeconomic status.

**Table 3** Multivariable linear regression results

Dependent variables: both in [0,1]	Fraction of patients interacted with using telehealth		Fraction of telehealth interactions using video	
	Marginal effects (95% CI)	P value	Marginal effects (95% CI)	P value
GP characteristics				
Female	0.0372 (-0.0256 to 0.1001)	0.24	-0.0240 (-0.0624 to 0.0144)	0.22
Age (years)				
<35 (reference group)				
35–39	-0.0305 (-0.1537 to 0.0927)	0.63	-0.0638 (-0.1399 to 0.0124)	0.10
40–44	-0.0144 (-0.1332 to 0.1045)	0.81	-0.0495 (-0.1216 to 0.0225)	0.18
45–49	-0.0526 (-0.1717 to 0.0664)	0.39	-0.0163 (-0.0904 to 0.0579)	0.67
50–54	-0.0707 (-0.1895 to 0.0482)	0.24	-0.0657 (-0.1382 to 0.0067)	0.08
55–59	-0.0756 (-0.1798 to 0.0285)	0.15	-0.1100 (-0.1736 to -0.0464)	<0.001
60–64	-0.0627 (-0.1756 to 0.0502)	0.28	-0.0848 (-0.1535 to -0.0161)	0.02
65–69	0.0379 (-0.0842 to 0.1599)	0.54	-0.1487 (-0.2237 to -0.0736)	<0.001
70 or higher	0.0440 (-0.0856 to 0.1736)	0.50	-0.1049 (-0.1871 to -0.0228)	0.01
Living with partner or spouse	0.0485 (-0.0410 to 0.1381)	0.29	-0.0166 (-0.0709 to 0.0378)	0.55
Have children	-0.0036 (-0.0726 to 0.0655)	0.92	-0.0100 (-0.0527 to 0.0327)	0.65
Overseas trained	-0.0163 (-0.0742 to 0.0416)	0.58	0.0095 (-0.0264 to 0.0455)	0.60
Has fellowship of college(s)	0.0267 (-0.0359 to 0.0894)	0.40	0.0281 (-0.0109 to 0.0671)	0.16
Hours worked per week	-0.0012 (-0.0036 to 0.0012)	0.32	-0.0019 (-0.0034 to -0.0004)	0.01
% of patients bulk-billed	0.0004 (-0.0008 to 0.0016)	0.51	-0.0003 (-0.0010 to 0.0004)	0.42
Fee for standard level B consultation (\$)	0.0013 (-0.0006 to 0.0033)	0.18	0.0011 (-0.0001 to 0.0023)	0.07
Practice characteristics				
Practice size				
1 (reference group)				
2–3	0.2129 (0.0609 to 0.3648)	0.006	-0.0526 (-0.1543 to 0.0492)	0.31
4–5	0.2102 (0.0694 to 0.3509)	0.003	-0.1167 (-0.2119 to -0.0214)	0.02
6–9	0.2192 (0.0792 to 0.3591)	0.002	-0.1381 (-0.2325 to -0.0437)	0.004
10 or more	0.2842 (0.1288 to 0.4396)	<0.001	-0.1237 (-0.2280 to -0.0195)	0.02
Number of allied health professionals	-0.0029 (-0.0109 to 0.0052)	0.48	-0.0079 (-0.0128 to -0.0030)	0.002
Number of nurses	-0.0013 (-0.0166 to 0.0140)	0.87	0.0119 (0.0023 to 0.0216)	0.02
Number of admin staff	-0.0050 (-0.0167 to 0.0066)	0.40	0.0005 (-0.0068 to 0.0077)	0.90
Videoconferencing capacity				
Not applicable (reference group)				
Applicable but never used	0.0436 (-0.0369 to 0.1240)	0.29	0.0064 (-0.0437 to 0.0564)	0.80
Applicable and have experience	0.0757 (-0.0180 to 0.1694)	0.11	0.1019 (0.0434 to 0.1605)	<0.001
Patient characteristics				
Majority of patients have complex health and social problems	0.0155 (-0.0466 to 0.0775)	0.62	0.0402 (0.0019 to 0.0785)	0.04
Number of patient interactions				
No decrease (reference group)				
Decreased by less than 20%	-0.0296 (-0.0985 to 0.0393)	0.40	-0.0097 (-0.0517 to 0.0323)	0.65
Decreased by between 20% and 40%	-0.0028 (-0.0756 to 0.0700)	0.94	-0.0413 (-0.0866 to 0.0041)	0.07
Decreased by more than 40%	0.0973 (-0.0064 to 0.2011)	0.07	-0.0467 (-0.1114 to 0.0181)	0.16
Area characteristics				

Continued

Table 3 Continued

Dependent variables: both in [0,1]	Fraction of patients interacted with using telehealth		Fraction of telehealth interactions using video	
	Marginal effects (95% CI)	P value	Marginal effects (95% CI)	P value
SES quartiles				
1 (reference group)				
2	0.0587 (−0.0333 to 0.1506)	0.21	−0.0497 (−0.1073 to 0.0079)	0.09
3	0.0561 (−0.0319 to 0.1440)	0.21	−0.0095 (−0.0652 to 0.0462)	0.74
4	0.0541 (−0.0363 to 0.1444)	0.24	−0.0672 (−0.1246 to −0.0098)	0.02
Per cent of population >65 years old	−0.0015 (−0.0073 to 0.0042)	0.60	−0.0045 (−0.0080 to −0.0010)	0.01
Rurality (modified Monash model)				
MM1 (reference group)				
MM2	−0.0933 (−0.2143 to 0.0277)	0.13	−0.1029 (−0.1778 to −0.0280)	0.007
MM3	−0.0346 (−0.1561 to 0.0868)	0.58	−0.0886 (−0.1633 to −0.0139)	0.02
MM4-7	−0.0549 (−0.1695 to 0.0597)	0.35	−0.0667 (−0.1379 to 0.0046)	0.07
State				
New South Wales/Australian Capital Territory (reference group)				
Victoria	0.0488 (−0.0288 to 0.1263)	0.22	0.0108 (−0.0367 to 0.0584)	0.65
Queensland	−0.1372 (−0.2143 to −0.0601)	<0.001	−0.0414 (−0.0889 to 0.0061)	0.09
South Australia	−0.0666 (−0.1761 to 0.0429)	0.23	−0.0727 (−0.1404 to −0.0050)	0.04
Western Australia	−0.0676 (−0.1715 to 0.0363)	0.20	−0.0441 (−0.1073 to 0.0192)	0.17
Northern Territory	−0.3059 (−0.6195 to 0.0076)	0.06	−0.0452 (−0.2613 to 0.1709)	0.68
Tasmania	0.1412 (−0.0628 to 0.3452)	0.17	0.0337 (−0.0944 to 0.1617)	0.61
Constant	0.1524 (−0.1607 to 0.4655)	0.34	0.3680 (0.1722 to 0.5639)	<0.001
R ²	0.184		0.204	
Observations	448		428	

Values are bolded to denote statistical significance ($p < 0.10$). Results are from multivariable linear regression with inverse probability weights to ensure population representativeness. Weights were calculated by comparing the sample to the population of GPs in Australia to help ensure national representativeness with respect to age, gender, qualified overseas, rurality, state/territory, and SES of GP's work location. Rurality is defined using the modified Monash model: MM1, MM2, MM3; MM4 and MM5–7 are grouped with MM4 for the analysis. SES is defined using the ABS SEIFA Index of Disadvantage of the postcode of the GP's practice and are in quartiles. Most disadvantaged is the bottom quartile (0%–25%) of disadvantage.

ABS, Australian Bureau of Statistics; GP, general practitioner; MM1, Major cities; MM2, areas within 20 km of town with 50 000 population; MM3, areas within 15 km of town with 15 000–50 000 population; MM4, areas within 10 km of town with 5000–15 000 population; MM5–7, all other remote and rural areas; SEIFA, Socio-Economic Indexes for Areas; SES, socioeconomic status.

of consultations conducted using telehealth. There was a strong positive relationship between practice size and telehealth use. The proportion of telehealth consultations was between 0.21 and 0.28 higher for GPs in larger practices compared with GPs in solo practice. There was no evidence of an association between the use of telehealth and the prices charged before COVID-19 (bulk billing and fees). The proportion of telehealth consultations was 0.10 higher for those who reported that the number of patients had fallen by more than 40%, compared with those who reported no decrease. There was no relationship with the number of other staff in the practice, nor with previous use of video consultations. There was no relationship between the use of telehealth and patient complexity, the percentage of the population over 65

years old, or the SES or rurality of the GP's work location. Compared with GPs in New South Wales, the use of telehealth by GPs in Queensland was 0.14 lower compared with GPs in New South Wales/Australian Capital Territory, and 0.31 lower for GPs in the Northern Territory.

Factors affecting use of telehealth via video consultations from regression results

Many physician and practice characteristics affect the proportion of telehealth consultations via video. The proportion of telehealth consultations conducted using video was lower for older GPs (over 55 years old) by between 0.08 and 0.15 compared with GPs under 35 years old, was lower for GPs who worked longer hours in 2018–19, and was lower for GPs in larger practices (four or



more GPs) by between 0.12 and 0.14 compared with solo GPs. GPs who charged higher prices before COVID-19 had higher use of video consultations, with only weak evidence that those who lost patients (between 20% and 40% fall in the number of patients) were less likely to use video. GPs with more allied health professionals were less likely to use video, and those with more nurses were more likely to use video. In addition, the proportion of telehealth consultations conducted using video was 0.10 higher for GPs in practices with videoconferencing infrastructure and had prior experience in using videoconferencing in 2018–19 compared with GPs whose practice does not have videoconferencing infrastructure. GPs in practices that have infrastructure but never used in 2018–19 are not more likely to use video consultations than those who do not have the infrastructure.

Patient characteristics played a stronger role in the use of video consultations, where the proportion of telehealth consultations conducted using video was 0.04 higher for GPs who agreed or strongly agreed that the majority of their patients had complex health and social problems, while GPs in areas with a higher proportion of population aged over 65 years were less likely to use video consultations, as were GPs located in areas of relatively high SES (least disadvantaged quartile of SEIFA) where the proportion was 0.07 lower relative to the most disadvantaged quartile. Rurality of GPs' practice location seems to play a major role in the uptake of video consultations. Compared with GPs in cities, the proportion of telehealth using video was 0.10 lower for GPs in inner regional areas (MM2), 0.09 lower for GPs in MM3 and 0.07 lower for GPs in the most rural areas (MM4–7). Telehealth consultations were less likely to be provided through video in Queensland and South Australia compared with New South Wales.

DISCUSSION

Main findings and contributions

To our knowledge, this is the first study to examine the association between physician, practice, and area characteristics and telehealth use patterns during COVID-19. We found that the uptake of overall telehealth during COVID-19 seemed to be unrelated to most GP and patient characteristics, with some evidence of variation across states and territories, presumably reflecting attitudes to the differences in the number of cases. In addition, GPs in larger practices and GPs who had experienced a fall in patient numbers of more than 40% were also more likely to use telehealth during COVID-19.

In addition, in the uptake of video consultations, more GP and patient characteristics played a role. For example, older GPs, particularly those over 55 years old, were less likely to use video. GPs who see more complex patients were more likely to use video, which is reassuring given concerns about the quality of care and telehealth use. Areas with more patients over 65 years old were less likely to use video; this may capture difficulties that older

patients have in using videoconferencing software or their preference to talk on the phone or visit face-to-face. We also found that larger practices were less likely to use video compared with practices with fewer GPs but more likely to use overall telehealth. This is after controlling for patient complexity, SES and rurality of these practices, and so it may be more likely to be related to how larger practices are organised. For example, this could be because the use of video consultations requires infrastructure that could be more difficult to implement quickly across larger practices and integrate with appointment systems and practice workflow, while smaller practices may have more flexibility to use easily accessible video calling applications.

Overall, the use of video consultants is low in Australia compared with similar countries such as the UK and USA.²¹ Understanding factors that affect the uptake of videoconferencing is particularly helpful to integrate high-quality telehealth in routine care after the pandemic.

Limitations

This research has several limitations. First, the COVID-19 SOS attracted a lower response rate than previous MABEL surveys, partly because doctors were approached by email, which has been shown to have lower response rates, and that the COVID-19 SOS was also open for only 10 days and included only one reminder. In contrast, MABEL wave 11 doctors were approached using a mailed letter with three reminders over a 6-month period. While GPs in our sample are different to the population of Australian GPs along some dimensions (table 2), these differences were adjusted for in our analysis by using inverse probability weights to help ensure national representativeness with respect to doctor age, gender, whether qualified overseas, rurality, state/territory and SES of GPs' work location. These weights are based on the national sample frame for MABEL, and results comparing the OLS models with and without weights were very similar.

Second, given evidence of a positive association between number of confirmed COVID-19 cases and telehealth usage, it would have been ideal to have access to nationally consistent data on the number of confirmed COVID-19 cases by postcode or other small area. However, such data are unavailable at the time of writing. Nonetheless, we include state and territory dummy variables to capture all unobserved variations across states and territories, including the number of COVID-19 cases. We also include rurality and area-level socioeconomic indicator variables.

Finally, we have limited patient-level characteristics, but we have included area-level variables such as SES, rurality and patient complexity. There could be unobserved patient and/or population factors that are correlated with telehealth use and the independent variables. We therefore present associations rather than causal effects.

Policy implications

Telephone and video consultations were funded by Medicare for the first time during the COVID-19 pandemic in Australia, primarily to reduce infection between patients and health professionals, but also to help mediate the loss in income for some GPs from the sudden fall in face-to-face consultations.

In the past few months, telehealth has emerged as a critical tool in ensuring timely delivery of healthcare, and its rate of use has grown rapidly. It is important to understand what works and what does not to inform health policies that encourage the optimal blend of healthcare delivery methods while maintaining quality of care. A key issue that emerged during the pandemic was that most telehealth consultations were being provided by telephone rather than video. Telehealth services were originally designed to be delivered via video, but almost all GP telehealth has been delivered via phone in Australia. For an obvious problem or follow-up, a phone consultation may be appropriate, but for some patients with more complicated conditions, video would offer a higher-quality interaction.²² Our findings suggest that infrastructure for, and prior use of, video consultations may play a role in their uptake, and so additional support should be provided to GPs. For instance, this could include funding and training for video consultation software, and/or its integration into practice information technology systems, and appropriate training modules for GPs to ensure clinical outcomes can be maximised when using video or phone calls. It remains to be seen whether the relative pricing of video and telephone consultations (and relative to face-to-face consultations) should be used to discourage the use of telephone consultations relative to video and face-to-face. The current Medicare funding arrangement reimburses telephone and video consultations equally, and perhaps lowering the rate of reimbursement for telephone consultations relative to video and face-to-face consultations will help discourage their use and promote higher-quality doctor–patient interactions.

CONCLUSIONS

The results provide a snapshot of the use of telehealth by GPs around 2 months after new funding was introduced. The level of uptake is a function of both the risk of infection from COVID-19 and the introduction of new Medicare funding. Both factors are at play and it will not be until COVID-19 is controlled will the ‘true’ rate of telehealth consultations be revealed. However, it is likely to be lower than it is currently as patients who chose not to attend in-person consultations for fear of infection during the pandemic chose to return to face-to-face consultations. As well as infrastructure support, further thought is required on relative fees to ensure that appropriate care is provided while maintaining convenience for patients.

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