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Impact of COVID-19 on emergency department attendance in an Australia hospital: a parallel convergent mixed methods study

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ABSTRACT

Objectives The COVID-19 pandemic has changed the way people are accessing healthcare. The aim of this study was to examine the impact of COVID-19 on emergency department (ED) attendance for frequent attenders and to explore potential reasons for changes in attendance.

Design This convergent parallel mixed methods study comprised two parts.

Setting An interrupted time-series analysis evaluated changes in ED presentation rates; interviews investigated reasons for changes for frequent ED users in a culturally and linguistically diverse setting.

Participants A total of 4868 patients were included in the time series. A subgroup of 200 patients were interviewed, mean age 66 years (range 23–99).

Results Interrupted time-series analysis from 4868 eligible participants showed an instantaneous decrease in weekly ED presentations by 36% (p<0.001), with reduction between 45% and 67% across emergency triage categories. 32% did not know they could leave home to seek care with differences seen in English versus non-English speakers (p<0.001). 35% reported postponing medical care. There was a high fear about the health system becoming overloaded (mean 4.2 (±2) on 6-point scale). Four key themes emerged influencing health-seeking behaviour: fear and/or avoidance of hospital care; use of telehealth for remote assessment; no fear or avoidance of hospital care; not leaving the house for any reason.

Conclusions This study demonstrated reduced ED use by a vulnerable population of previously frequent attenders. COVID-19 has resulted in some fear and avoidance of hospitals, but has also offered new opportunity for alternative care through telehealth.

Strengths and limitations of this study

- This study is the first to assess the impact of COVID-19 on the health-seeking behaviours of people who had demonstrated a pattern of frequent attendance at the emergency department prior to the pandemic.
- More than 75% of participants in this study were from migrant or refugee backgrounds and more than two-thirds spoke a preferred language that was not English.
- The study seeks to understand reasons for changes in health-seeking behaviour from the patient's perspective through interviews with a subsample of this population.
- A limitation is that study findings are from a single hospital network in Melbourne and results may not be generalisable to other hospital populations.

INTRODUCTION

One of the unexpected indirect consequences of the COVID-19 pandemic has been avoidance of care for people with pre-existing chronic and complex health and psychosocial conditions. Leading health authorities have expressed concern that there will be a secondary wave of deaths arising from individuals who fail to access care in a timely way.[1–3] Hospital emergency departments (EDs) play an important role in the provision of first line care for serious symptoms, illnesses and injuries that are less able to be managed in primary care, as well as for management of less serious health concerns. In Australia and globally there have been reports of significant reductions in ED presentations,[1 2] including up to a 50% reduction in trauma presentations,[4] and up to a 30% reduction in presentation rates for stroke and acute myocardial infarction (AMI).[5 6]

Australia is a multicultural country, with almost 30% of Australians born overseas and over 200 languages spoken.[7] Residents of the northern suburbs of Melbourne are more culturally diverse than the Australian

average, with more than 40% of residents born overseas.[8] The area has lower income, educational attainment and health literacy than Victorian state averages.[8–10] Approximately 10% of Victoria's population live in the northern suburbs of Melbourne, however, one-third of Victoria's COVID-19 cases were located in this area at the height of the pandemic, reflecting the greater vulnerabilities to COVID-19 experienced in this community.

Frequent attenders to ED may be especially vulnerable to problems associated with COVID-19 enforced lockdowns. They are a heterogenous group with chronic and complex physical and/or mental health needs, substance abuse and psychosocial issues. They are more likely to be adversely affected by social isolation and are also at higher-than-average risk of contracting COVID-19 and having severe disease.[11] Frequent users who also have low English proficiency are additionally at risk due to issues with understanding information and applying it to their situation.[11] It is pertinent and timely to examine the drivers behind changes in the health-seeking behaviours of this population, whom we consider to be a vulnerable group in the context of COVID-19.

The aims of this study were to (1) describe the impact of COVID-19 on ED attendance for frequent users with existing chronic and complex conditions in a culturally and linguistically diverse setting, and (2) explore potential reasons for changes in attendance.

METHODS

Design

A parallel convergent mixed methods design was used for this study consisting of: an interrupted time-series analysis to describe changes in service use pre-COVID-19 compared with during COVID-19, and interviews to explore reasons for changes in ED attendance.

Setting

In Australia, the largest outbreak of COVID-19 to date was in Melbourne in 2020, accounting for 75% of all Australian cases (n=20 330 on 24 October), and 90% of all deaths (n=817). In response to rising COVID-19 case numbers, a state of emergency was declared in Victoria on 16 March 2020. On 23 March, stage 3 restrictions were implemented that limited travel out of the home. These were lifted for a short period of time from 13 May to 8 July when restrictions were reintroduced. On 2 August, the Victorian government imposed a stage 4 lockdown, adding a night-time curfew, further restriction of daytime activities (including imposing a 5 km radius for essential shopping and exercise) and large financial penalties for breaches. Cases in Victoria peaked on 5 August, when 725 new cases were reported in the state over a 24-hour period. The state of emergency was extended seven times and remained in place until 8 November 2020.

Northern Health (NH) is the major provider of hospital services in the northern Melbourne metropolitan region. It has the busiest ED in Victoria.

Patient and public involvement

This project was reviewed by an ethics committee that included consumer representatives who provided feedback on the interview questions and on study methods. All participants were patients of NH and all will be provided a report of findings. There was no other patient or public involvement in this research.

Participants and procedure

Describing the impact of COVID-19 on ED attendance for frequent attenders

Data were sourced from the NH data warehouse. A request was made for all hospital attendances from the period of 1 January 2019 to 30 September 2020. To identify the most vulnerable cohort of patients, we used a case-finding algorithm developed by the Victorian Department of Health and Human Services (HealthLinks prediction algorithm) to identify patients who met the criteria and who were predicted to continue their pattern of attendance (online supplemental material A).[12] The algorithm is designed to identify patients most at risk of preventable hospital admissions, with escalating ED attendance being one of a number of predictor variables. To determine the effect of COVID-19 on attendance, we conducted an interrupted time-series analysis[13] separately for the HealthLinks group (frequent attenders), and the remaining group (non-frequent attenders). Weekly attendance data were separated into two phases: pre-impact (1 January 2019 to 16 March 2020) and post-COVID-19 (16 March to 30 September 2020). 16 March was chosen as the impact date to reflect the timing of the declaration of the State of Emergency. This included 63 weekly time points pre-impact and 28 time points post-impact. Based on the distribution of the data, a standard segmented linear regression model was chosen to describe whether COVID-19 impacted the (1) level and (2) trend of weekly hospital presentations. A change in trend was investigated by introducing an interaction term between the week number and phase (pre vs post COVID-19). We expected an immediate effect of COVID-19, so a time-lag was not introduced between phases. Presentations to ED were observed to be lower in the 2 weeks surrounding 1 January 2019 and 2020. A sensitivity analysis was therefore used to investigate the seasonal effect of these dates on the overall results of the simpler, unadjusted model. Autocorrelation was investigated using the Durbin-Watson test.

Further inspection of the HealthLinks cohort was considered by stratifying patients by their most severe Australasian Triage Scale[14 15] triage category over the study period, with a Wilcoxon signed-rank test used to test for change between 19 March to 22 September 2019 period and 17 March to 20 September 2020 period. We also collected data on the top categories for which a change in presentation rate has been identified.

Exploring potential reasons for changes in attendance

Computer-generated random sampling was used to select a representative subsample of 200 patients for interview from

the HealthLinks cohort across age, gender and chronic and complex health conditions. A sample of 200 was considered above the required number to reach thematic saturation but would provide insight across a range of culturally and linguistically diverse groups.[16] We employed stratified sampling to include limited English proficiency patients from our top spoken languages (Arabic, Turkish, Italian, Assyrian/Chaldean, Macedonian, Greek, Vietnamese, Punjabi, Mandarin, Persian, Nepali, Hindi and Urdu). Exclusion criteria were: inability to provide informed consent, speaking a language other than those in the top 10, hearing impairment impacting ability to participate in a telephone interview.

Telephone interviews were conducted from 6 July to 24 August 2020, over the peak of the pandemic in Melbourne. All interviews were conducted by experienced researchers and an interpreter where required. Verbal consent was gained and an explanatory statement was mailed to participants. Participants could withdraw during and up to 2 weeks following participation. We used an interview guide that included both open-ended and closed-ended questions adapted from a WHO survey.[17] To address the study aims, we analysed responses to the following questions:

1. Can you name the four reasons you are allowed to leave home during stage 3/stage 4 restrictions? (binary).
2. Have you avoided/postponed any appointments during COVID-19? (binary).
3. How worried are you about the health system being overloaded? (scale).
4. What is your understanding of what you can do to manage your health conditions at the moment? (open).

Responses to binary questions were presented as proportions and for the total sample size of 200 would infer an estimated maximum margin of error of ±6.2% (for a subgroup of 50, the margin of error increased to ±14%). Fear and worry were expressed as means±SD. χ^2 (and Fisher's Exact test when values <5) to assess whether responses differed for age (dichotomised to <65/≥65), gender (male/female) or language (English/non-English).

Open-ended responses were analysed using content analysis. Content analysis condenses text into small parts (described as 'meaning units'), which are labelled using pre-formulated coding rules which concisely describe the condensed text.[18] Two independent researchers developed the meaning units and applied the coding. The level of agreement of the coders was measured using Cohen's kappa, a statistical measure of inter-rater reliability.[19] We considered a kappa coefficient of 0.7 or above sufficient evidence of demonstrably similar results on extracts from the data.[19]

RESULTS

Describing the impact of COVID-19 on ED attendance for frequent attenders

A total of 4868 patients met the HealthLinks algorithm criteria for inclusion in the study. Of these, 4679 (96%) people presented to ED at least once between 1 January 2019 and 21 September 2020. Figure 1A provides a plot for the interrupted time-series analysis of weekly ED presentations. At the impact point of COVID-19, there was an immediate reduction in weekly ED presentations by 36% (p<0.001). There was also a further 1% reduction in presentations per week from the point of impact (p<0.001). The Durbin-Watson test indicated no evidence of autocorrelation. There was evidence of seasonality however this did not change the outcome of the simpler, unadjusted model (see online supplemental material B,C for coefficients).

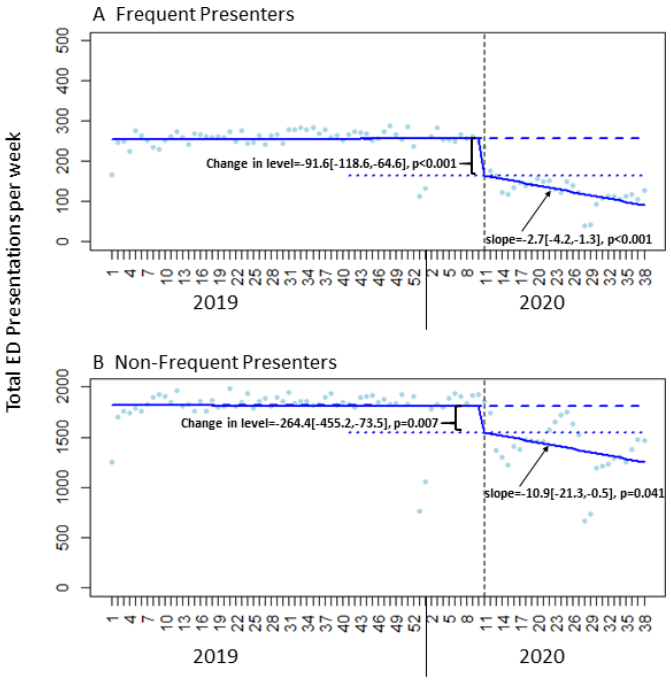

Figure 1 The vertical dashed line is at the 16 March coinciding with commencement of the Victorian State of Emergency. The X-axis values represent year and week within that year. For example, 2019-40 represents the 40th week in 2019. The horizontal dashed blue line represents the expected trajectory of ED presentations if COVID-19 pandemic had not occurred. The horizontal dotted blue line describes the change in level of weekly ED presentations at the point of impact (16 March 2020). ED, emergency department.

Figure 1B provides an illustrative comparison of weekly ED presentations for those not identified as frequent presenters. There were 105 062 patients in the cohort who presented to ED but who were not HealthLinks patients over the same timeframe. At the point of COVID-19, ED presentations for this cohort significantly reduced by 15% (p=0.007) from baseline, with a further reduction of 0.6% per week from baseline (p=0.041).

Table 1 provides an overview of the change in rates of ED presentations by triage category for the two time periods 19 March to 22 September 2019 and 17 March to 20 September 2020 for the eligible cohort. There was a statistically significant difference in ED presentations across the two timeframes when stratified by triage category (p<0.001 for categories 1–4 and p=0.013 for category 5), with the largest decrease being seen for triage categories three and four (−62% and −66%, respectively).

Table 1 ED presentations for HealthLinks patients by Australasian Triage Scale triage category

Category	2019 total presentations*	2020 total presentations*	% difference	P value
Resuscitation (1)	195	102	−48	<0.001
Emergency (2)	3488	1929	−45	<0.001
Urgent (3)	3072	1169	−62	<0.001
Semi-urgent (4)	339	114	−66	<0.001
Non-urgent (5)	12	4	−67	0.013

*Data date ranges: 19 March to 22 September 2019 and 17 March to 20 September 2020.
ED, emergency department.

Table 2 provides an overview of the top 10 largest reductions in presentations by diagnostic categories. In terms of overall percentage change, the largest decrease in presentations was for viral infections. In raw numbers, the largest decrease was for chest pain.

Exploring potential reasons for changes in attendance

We approached 272 individuals to participate in the interviews before reaching our target of 200 participants (response rate 73.5%). Twenty-nine countries of origin and 11 languages were represented in the group. Mean age was 66 years (range 23–99) (online supplemental material D). 14.5% of participants (n=29) were unable to complete all questions in the interviews. Those who did not complete were slightly older (mean age 71, SD 16) and 25 spoke limited English and were interviewed using interpreters. All who did not complete cited their reason for incompletion as fatigue.

Table 3 provides an overview of participants' understanding about restrictions, their health-seeking behaviours and their fear and worry about the health system becoming overloaded. Only 66% of participants identified that they could leave home to seek medical care, with those speaking English 1.4 times more likely to report this than those with limited English proficiency (p<0.001). Over one-third of respondents (35%) reported they had postponed medical care since the pandemic began, and those who spoke proficient English were significantly more likely to have postponed or cancelled an appointment than those with limited English proficiency (p −0.001). There was a high level of fear about the health system becoming overloaded, with the mean score on a 0–6 scale being 4.2 (±2). There was no significant difference in mean scores in age, gender or language spoken.

Table 4 provides an overview of the content analysis for the question 'What is your understanding of what you are allowed to do to manage your health conditions at the moment?' Four key themes emerged from the data on influences on, or changes to, health-seeking behaviour. These were: fear and/or avoidance of hospital care; use of telehealth to connect to general practitioner (GP) for remote assessment; no fear or avoidance of hospital care; not leaving the house for any reason. There was substantial to almost perfect agreement between the two raters on the first application of content analysis by two reviewers, with kappa coefficients ranging from 0.83 to 0.93.

Almost one-third of participants reported they would not attend the hospital for care for fear of contracting COVID-19. A further one-third reported no fear about coming to the hospital. Forty per cent of participants

Table 2 Top 10 diagnostic categories based on change for HealthLinks patients

Category	2019 total presentations*	2020 total presentations*	% difference
Acute/lower respiratory tract infection, chest	156	35	−78
Renal colic	130	32	−75
(Unknown)—people left before diagnosis	131	35	−73
Collapse/faint/vasovagal attack/micturition/syncope. Excludes syncope caused by heat	114	34	−70
Dizziness/vertigo	146	47	−68
Chest pain	815	339	−58
Backache, unspecified	117	50	−57
Abdominal/flank pain/cramps/intestinal colic	541	256	−53
Chronic obstructive pulmonary disease (COPD)	185	104	−44
Congestive cardiac failure	168	100	−40

*Data date ranges: 19 March to 22 September 2019 and 17 March to 20 September 2020.

Table 3 Participants' understanding of restrictions, health-seeking behaviours and fear about the health system

		Age			Gender			Language		
	Overall	<65	≥65	P value	Male	Female	P value	English	Non-English	P value
Four reasons to leave home—number correctly identified (%) (n=200)										
Work	63 (31.5%)	39 (48.1%)	24 (20.2%)	<0.001	33 (32.0%)	30 (30.9%)	0.87	25 (29.4%)	38 (33.0%)	0.58
Shopping	158 (79.4%)	72 (90.0%)	86 (72.3%)	0.002	79 (77.5%)	79 (81.4%)	0.49	72 (84.7%)	86 (75.4%)	0.11
Exercise	97 (48.7%)	44 (55.0%)	53 (44.5%)	0.15	52 (51.0%)	45 (46.4%)	0.52	45 (52.9%)	52 (45.6%)	0.31
Attend medical*	131 (65.8%)	57 (71.3%)	74 (62.2%)	0.19	63 (61.8%)	68 (70.1%)	0.22	67 (78.8%)	64 (56.1%)	<0.001
Has postponed or avoided an appointment/s (n=179)	70 (35.0%)	33 (40.7%)	37 (31.1%)	0.014	32 (31.1%)	38 (39.2%)	0.22	34 (40.0%)	36 (31.3%)	0.001†
Fear and worry about the health system being overloaded‡ (n=171)	Mean 4.2 (SD 2)	4.4 (SD1.8) (n=78)	4.0 (SD 2.2) (n=93)	0.48	4.1 (SD 2.0) (n=85)	4.3 (SD 2.1) (n=86)	0.37	4.3 (SD 2.0) (n=81)	4.1 (SD 2.1) (n=90)	0.54

*Four reasons to leave home were to (1) attend workplace if providing approved essential service, (2) shop for groceries or pharmaceuticals, (3) exercise for 1 hour, (4) attend medical appointment or provide care.
†There was also a statistically significant difference in the number of missing values for English versus non-English speakers (n=6 (7%) vs 21 (18.3%), p<001).
‡Scaled response from 0 to 6, with 0 being no fear and 6 being most fearful or worried you've ever been.

Table 4 What is your understanding of what you are allowed to do to manage your health condition?

Theme	Cohen's kappa (p value)*	Agreed final total responses, n=175†	Example of responses
Fear/avoidance of hospital care	0.93, p<0.001	48 (27%)	Last night I had heart pain but I didn't go anywhere because I am scared. Would I go to the Northern (Hospital)?—no, because they have COVID-19. I am worried about going to the hospital because there are sick people and COVID-19 people at the place and health professionals are among those that test positive for COVID-19.
Would be comfortable to call general practitioner for advice/ remote assessment	0.86, p<0.001	70 (40%)	Communicate on the phone instead. I think you're allowed to call local GP if you are unwell. They get your symptoms over phone. if very unwell, come in otherwise they provide advice over phone. Can get script easily by calling ahead and doing contactless pick up.
Would be comfortable to attend or call the hospital	0.83, p<0.001	53 (30%)	If I need to go to the hospital, I would just go. I'm not worried about going to the doctor or the hospital—they would tell me not to come in if they were worried. No of the restrictions apply if you are seeking medical help, you can use common sense to seek help. Even if the hospital is more than 5 km, I'm not worried about going to the hospital. We have a great medical system and I have full faith in them.
Don't go out at all	0.93, p<0.001	8 (4%)	Don't leave house. Not allowed to go interstate, not allowed to leave home. Stay at home, not going to seek help.

*Kappa result is interpreted as follows: values ≤0 as indicating no agreement and 0.01–0.20 as none to slight, 0.21–0.40 as fair, 0.41–0.60 as moderate, 0.61–0.80 as substantial and 0.81–1.00 as almost perfect agreement (Cohen ref). Kappa results following first round of coding are presented. P values reflect a test against a minimum kappa of 0.7.
†n=25 participants did not respond to these question.
GP, general practitioner.

reported use of telehealth as a first response to health issues. A small number of participants (4%) reported not leaving the house for any reason.

DISCUSSION

This study provides both evidence of, and explanation for, a significant change in ED presentations in a group of patients with a history of frequent attendance prior to the COVID-19 pandemic. We found for this group, presentations fell by 36% and continued to fall by 1% per week, which was more than double the 15% drop and weekly reduction of 0.6% seen for non-frequent attenders. Participants with low English proficiency were less likely than those with proficient English to identify healthcare as one of the reasons they could leave home during the pandemic, suggesting they may have had greater trouble understanding and interpreting government-imposed restrictions, and may not have realised they were allowed to leave home to seek medical care. However, those with lower English proficiency were also less likely to report postponing a medical appointment than those with proficient English. While this finding might be unexpected, the content analysis indicated that the majority of participants were either using telehealth care (40%), or were not afraid to attend the hospital for appointments (30%).

The recent changes in funding arrangements in Australia that allow GPs to provide telehealth care appears to have been embraced by many of the interview participants, including those with limited English proficiency. This has possibly led to improved access to primary care, thus reducing perceived need to attend ED. This is reflected in the greater reductions seen for lower acuity conditions across triage categories 3–5 in this study. For many conditions, telehealth allows individuals to be efficiently screened and treated, and is patient-centred, reducing patient costs associated with travel and waiting times.[20] Studies have shown that there has been greater uptake of telehealth from older people during the pandemic than pre-pandemic, perhaps reflecting that this medium provides a safe alternative to face-to-face care for those at higher risk from the virus.[21–23] However, these studies also demonstrated that racial disparities that existed in the access and use of telehealth prior to the pandemic were still evident during the pandemic. Policy changes that enhance the use of telehealth for chronic disease management should continue to work toward improving engagement for disadvantaged communities to reduce disparities and improve outcomes.

Similar to our findings, many countries worldwide have seen a reduction in ED presentations, and many have seen the greatest changes in the same diagnostic categories as seen in this study, including for genitourinary, respiratory and circulatory conditions as seen in the top 10 in this study.[24–27] Some of the reductions in presentations for these higher acuity conditions have the potential be underdiagnosis due to avoidance of care and may

result in excess morbidity and mortality indirectly related to COVID-19. Of particular concern is the reduction in presentations in triage categories 1 and 2, including acute cardiovascular events, a finding consistent with studies internationally.[6 24 28] These studies agree that this partly stems from avoidance of care derived from fear, but may also be attributable to a genuine reduction in events during the pandemic due to a reduction in triggers such as air pollution, physical activity and acute emotional stress. A reduction in circulating viruses has led to fewer exacerbations of existing airways disease and reduced presentations for respiratory infections and chronic obstructive pulmonary disease, and may have resulted in reductions in the elevation of pro-inflammatory biomarkers that leads to cardiovascular events.[29] This is supported by research that demonstrates that influenza vaccination is associated with reduced risk of stroke[30] and that rates of AMI increase during influenza season.[31] There were no deaths from influenza recorded in Australia in 2020—this compares to 310 000 hospitalisations and over 900 deaths in 2019.[32] It is therefore plausible that the reduced pro-inflammatory burden on homeostasis in vulnerable patients has led to reduced rates of stroke and AMI during the pandemic.

Frequent attenders to the ED account for disproportionately high healthcare costs. Much research has focused on methods for 'diverting' patients away from EDs to primary care services with mixed success.[33] COVID-19 has provided a catalyst where large scale adoption and mainstreaming of telehealth has been tested.[34] Our research suggests that frequent attenders are adopting telehealth, and that they are capable of changes to their health-seeking behaviour if health systems are designed and provided in a way that adequately supports them. Further research is required to determine whether these observed changes are sustainable post-COVID-19. In addition, longer term studies examining excess morbidity and mortality for patients who have forgone ED care during the pandemic are required.

A limitation of the study is that participants who had limited English proficiency were over-represented in the group that did not complete all questions, and this may have impacted on the significance found for some of the outcomes. In addition, the interview cohort focused on only the top 10 most spoken languages at NH and some important groups with low representation may not have been captured. A further limitation of this study is that findings are from a single hospital network in Melbourne and results may not be generalisable. Importantly, reductions in ED presentation both in terms of rates and diagnostic categories at NH appear in line with what has been seen at other hospitals in Victoria[25] and internationally. Data on this cohort's use of GP services are not available and we can only hypothesise, based on their interview responses, that they have more readily interacted with their GPs during this time.

CONCLUSION

The second wave of COVID-19 in Victoria resulted in a significant reduction in ED attendances across the state. This study found that for patients with a history of frequent attendance prior to the COVID-19 pandemic, the reduction in presentations fell by 36% and continued to fall by 1% per week, compared with a 15% drop in non-frequent attenders and a weekly reduction of 0.6% per week. More than one-third of participants reported actively avoiding the hospital, however, the content analysis suggests that these changes in health-seeking behaviour appear to be influenced both by fear and better access to remote care as an alternative. COVID-19 has necessitated a rapid pivot towards readily accessible, remotely provided healthcare outside of the hospital and in this way it has been a driver towards achieving what multiple complex interventions could not. This finding has important implications for the planning and provision of healthcare services beyond the pandemic.

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