BMJ Open

How COVID-19 has affected general practice consultations, stress and income – survey evidence from Ireland

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2020-044685
Article Type:	Original research
Date Submitted by the Author:	14-Sep-2020
Complete List of Authors:	Homeniuk, Robyn; Irish College of General Practitioners, Research and Innovation Collins, Claire; Irish College of General Practitioners, Research
Keywords:	Telemedicine < BIOTECHNOLOGY & BIOINFORMATICS, COVID-19, PRIMARY CARE

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

How COVID-19 has affected general practice consultations, stress and income – survey evidence from Ireland

Robyn Homeniuk[a] and Claire Collins[b]

a. Research Officer, Department of Research and Innovation Irish College of General Practitioners, 4-5 Lincoln Place, Dublin D2. Email: robyn.homeniuk@icgp.ie
b. Director, Department of Research and Innovation Irish College of General Practitioners, 4-5 Lincoln Place, Dublin D2. Email: Claire.collins@icgp.ie

Abstract

Objectives

How general practice is delivered in many countries has drastically changed due to the COVID-19 pandemic. This study aimed to answer the question of how general practice has changed in Ireland in response to COVID-19.

Design

The Irish College of General Practitioners surveyed its membership before and after the global pandemic hit Ireland using an online survey instrument to capture consultation rates and mode of delivery.

Setting

This study focuses on primary care, specifically general practice, in Ireland.

Participants

A total of 526 general practices across Ireland submitted responses to the survey in February 2020 before the global pandemic; 680 general practices responded to the second survey in June 2020.

Main outcome measures

The type of consultations by general practitioners and practice nurses in both surveys is the main outcome measure used in this study. Practice changes and stress factors facing general practitioners were also used to gauge changes caused by the pandemic response.

Results

The proportion of telemedicine general practitioner appointments increased from 10.5% to 56.9%. Changing work practices and income concerns have replaced workload as the most significant stressor for general practitioners. The majority (84%) reported reduced practice profit.

Conclusions

While the world gets used to a new normal, it is clear that the way general practice is delivered will not return to as before and that increased telemedicine is likely. However, it is necessary to assess the impact of this shift on patient health and to assess healthcare provider and patient experience to ensure continued high-quality care and patient safety.

Strengths and Limitations

- **A key strength of this study is the large number of general practitioners who engaged with the surveys. It was possible to survey a third of all practices in Ireland at both time points.**
- **One of the weaknesses of the study is that the survey was self-selecting, which could have biased the responses in some cases. Furthermore, it was not possible to identify practices and match their responses from the first to the second survey.**
- **We did not collect sociodemographic information, hence it was not possible to control for deprivation levels and other factors that may affect health care utilisation.**
- **Due to the large number of responding practices, we were able to get data covering every county in Ireland in both the pre-COVID-19 and during COVID-19 surveys. The volume of responses makes our findings more generalizable.**

Introduction

A cluster of 'atypical viral pneumonia' cases was diagnosed in Wuhan City, China in December 2019 [1]. By 9 January 2020, Chinese authorities found the cause of the outbreak was a novel coronavirus [2] – later named COVID-19. The WHO declared an international public health emergency [3] and by the end of February 2020, Ireland had its first case. National lockdown measures commenced in March 2020 and included recommendations for general practitioners (GPs) to observe physical distancing, wear personal protective equipment (PPE), and use telephone triage and appointments to reduce face-to-face appointments [4]. Epidemiologists globally have been monitoring the progression of this infection while governments have been developing and deploying emergency pandemic responses. The need to have global and national emergency management plans is well documented [3] since the outbreak of SARS in 2003. Previous outbreaks have proven that contagious diseases can put intense pressure on health systems, especially on general practice as it is the frontline of the medical response [5]. GPs have expressed their past uncertainty about how to respond to a pandemic [5]. Indeed, in response to the H1N1 pandemic, primary care staff struggled with implementing new workflows [6]. In Ireland, comprehensive preparedness plans are in place for handling public health emergencies. These plans follow WHO [7] and ECDC [8] guidance and are coordinated by the National Public Health Emergency Team [9].

The majority of GPs in Ireland are self-employed, getting paid based on the number of patients they see annually; last year the Irish Health Service Executive (HSE) reported €429.14m in GP fees, €160.09m in allowances, and €0.31m for development [10]. This makes up 69% of GP reimbursement, with the remaining portion paid by private health insurance and out of pocket payments [11]. Before the start of this pandemic, general practice saw an increasingly high workload due to its position as the centrepiece of Irish healthcare [12]. A tendency towards acute, reactive care pushed the Irish health system to maximum capacity, and as demand grew so did the need for added investment in community-based care [13]. With the onset of COVID-19, the face of general practice in Ireland, as in many countries, drastically changed, with developing clinical models [14] and consultation strategies having an impact on primary care [15]. Irish GPs quickly noticed that patients with acute and chronic conditions were avoiding attending appointments, virtually or not [16]. Continuity of routine care might be at risk because of the pandemic, and the general health of the population is a key concern for primary care [13].

This paper reports on the changes experienced and in particular those in consultation rates and delivery methods in Irish general practice during the COVID-19 pandemic. At the beginning of February 2020, the ICGP surveyed its membership before the global pandemic reached Irish shores. In June 2020, the ICGP again surveyed its membership regarding the impact of COVID-19 on general practice.

Methods

In early 2020, the Irish College of General Practitioners (ICGP) – the professional body for GPs in Ireland - designed an online survey to capture practice activities, stressors, and demographic details regarding general practices in Ireland.

It was distributed to 3,378 members both before (February 2020) and during (June 2020) the coronavirus pandemic. It was not sent to trainees, retired GPs, or GPs registered in Ireland working abroad. The second survey was updated to include additional questions and response categories

that specifically related to the pandemic. The survey sample was self-selecting, with the survey period open for a n/two-week period to ensure a significant number of responses were received.

Only one survey for each practice was requested. Ethical approval for both surveys was obtained and consent from practices for participation and data processing was confirmed at the start of each survey. The online survey was fully anonymous and no IP addresses were collected.

All data is based on survey responses as there is no national data extraction from Irish general practice where GPs are self-employed and provide services to public patients under a contract with the national Health Service Executive (HSE). Consultation rates include face-to-face consultations, telephone consultations, home visits and visits to nursing homes reported by practices who responded to the survey. Data was returned on the most recent working day. The figure for GPs on the day was used to calculate mean consultations per GP daily. Out of hours services in Ireland are provided and recorded separately and hence are not included in these figures. The Irish Department of Health has previously reported just under one million out-of-hours GP contacts in 2019 [17]. To determine per person figures, we used the most recent population estimation released by the Central Statistics Office [18], which was 4,921,500 as of April 2019.

We conducted the analysis using SPSS V25 software, using descriptive analysis. For numerical data, means were used for comparisons and to conduct statistical tests as appropriate. Average consultation numbers are based on the consultation numbers provided by the survey, and workforce information from previous research [13, 19] was used to extrapolate findings. Chi-square tests were used for categorical comparisons. Pearson's and Spearman's tests were used to test for correlation between continuous variables. T-tests and F-tests were used to compare means as appropriate. Missing data was removed when completing calculations.

Results

Survey Population

There were 526 valid responses in the first survey - 32% of all 1635 practices in Ireland [20], with 1508.42 FTE GPs overall working in these practices and 1257.90 (83%) FTE GPs working on the day where clinical activity was recorded. In this sample, approximately one fifth (19%) of the practices were single-handed. The average number of FTE GPs at group practices was 3.3. At least one practice nurse (PN) was employed at 94% of practices with a total of 630.33 FTE PNs overall and 85% of FTE PNs working on the day of data collection. On average, practices employed 1.2 FTE PNs, although a third of practices had less than one FTE PN.

City practices comprised 37% of the total, with 44% of practices located in towns and 19% in villages. There was at least one practice recorded in every county.

In the second survey, there were 680 valid responses, estimated at 42% of all practices in Ireland. A total of 1632.10 FTE GPs worked in these practices with 1104.85 FTE GPs working on the day when clinical activity was recorded. In contrast to pre-COVID-19 figures, this is a 15% reduction in FTE GPs available during the clinical hours. There were slightly more single-handed practices in this sample at just over a quarter (28%). Group practices employed an average of 3.0 FTE GPs.

A PN was employed by 90.2% of the practices with a total of 789.05 FTE PNs overall. On the day clinical activity was recorded, 508.95 FTE PNs were available, which means 65% of nurses were working.

City practices comprised 36% of the total, with 46% of practices located in towns and 18% in villages and at least one practice responding in every county.

Consultations

An average of 29 consultations was recorded per working FTE GP per day before COVID-19, 87.3% of appointments occurred face-to-face, 10.5% were telemedicine and the remainder were visits to homes and nursing homes.

Considering the most recent recorded population in Ireland [18] – we estimate Irish people visit their GP an average of 4.4 times each year.

Pre-COVID-19, PNs completed 26 consultations daily on average, split between telemedicine (18%) and face-to-face appointments.

During-COVID-19, consultation rates have changed significantly as has the mode of consultation. Between 1104.85 FTE GPs, the daily average per GP was 23 consultations. Based on reported rates, the new average consultation number per person per year would be 2.8 visits.

Over half of the GP consultations occurred via telemedicine and video (57%) and 41% occurred face to face. In Figure 1, the proportion of consultation by each consultation method for GPs and PNs at each time point are shown.

[Figure 1]

Figure 1 ***GP and PN Consultations Before and During COVID-19***

In the second survey, the daily average was 17 consultations per FTE PN.

Before the pandemic, GPs conducted an average of eight telemedicine consultations daily increasing to an average of 13 during the pandemic. The overall average daily consultation rate for GPs decreased from 29 to 27 per day over the same period. Face-to-face appointments decreased from 87% to 41% of all GP consultations, with the average per practice decreasing from 62 in February to 20 in June 2020. Comparatively, before the pandemic, PNs conducted an average of 4.5 telemedicine consultations daily increasing to 5.5 in the second survey. Face-to-face appointments dropped from 82.4% to 67.6 % of all PN consultations. Before the pandemic began, practice nurses had a higher proportion of telemedicine appointments than GPs – 17.6% of PN appointments in February 2020 compared to only 10.5% of GP appointments. In the second survey, 56.9% of GP appointments were via telemedicine compared to 32.4% of PN appointments.

What is causing the most stress for GPs?

In the first survey, from a list of items provided, 55% of GPs completing the survey on behalf of their practice considered workload as the most significant stressor GPs face. Following this, work-life balance (14%) and availability of locums (11%) were considered common sources of stress. In the free-text portion of the survey, GPs said it was hard to separate the stressors because the heavy workload affects things like work/life balance. In the second survey, five new categories reflecting

recent changes were added to the list. Figure 2 shows the change between options provided in the survey question that asked GPs to choose their most significant source of stress.

[Figure 2]

Figure 2 ***Most Significant Stressor for GPs***

In the second survey in June 2020, during the COVID-19 pandemic, respondents considered that the main sources of stress for GPs were changing work practices (29%) and income concerns (27.1%). Only 12.7% considered the workload as the main stressor for GPs at this time.

Practice changes

Overall, 84.3% of practices reported a decrease in profitability during the pandemic, although only half of the practices had gone through a formal business performance assessment. Across all practice sizes, there is an expected average decrease in profitability of 35.2% and an average of 17% for an increase in profitability. Only 19% of practices were expecting an increase in profitability.

More group practices completed formal business assessments comparing profit from the first two months of 2020 (before COVID-19), 57% of group practices had done this compared to 32% of single-handed practices. Single-handed practices were estimating an average loss of 42% of profits compared to the average estimate of 33% loss for group practices. The lower number of formal assessments by single-handed practices could explain part of this difference, through overestimates by GPs when completing the survey.

A statistically significant negative correlation ($p = .013$) between practice size and estimated percentage change in profit was found when using the Pearson correlation test ($r = -1.119$) indicating the percentage change in profit went down as the number of FTE GPs increased.

To manage the financial impact of COVID-19, 45% of practices made changes to reduce the strain. In the following chart, the proportion of these 308 practices taking different actions is visible. The most popular measure was to ask staff to take their annual leave early.

There were no significant relationships between practice size and implementing the listed measures.

One in three practices told us they had staff who were affected by redundancies, reduced hours or reduced salary. The most affected staff has been receptionists with 48% of practices who reduced staff highlighting these staff. Following that, 39%, salaried GPs and practice nurses were affected by these changes. Forty-six GPs left comments as well, most highlighting that they had been the one to reduce their personal salary for the sake of keeping their staff. Figure 3 shows the proportion of practices that used the following methods to recover income during the pandemic.

[Figure 3]

Figure 3 ***Measures implemented by practices to alleviate financial concerns***

Respondents were asked if they had noticed a decline in certain patient groups. Overall, there was a reported decline in non-COVID-19 related consultations. Almost all practices, 93%, noticed a decline for under 6's, 80% saw a decline for over 70's, 77% had less non-COVID-19 visits from people with chronic conditions, and 57% saw a decline in visits from people with mental health concerns. Figure 4 shows the decline in non-COVID-19 related consultations from each of these patient groups at group and single-handed practices. Single-handed practices had a larger decline in all but the under 6 year old patient group.

[Figure 4]

Figure 4 ***Reported decline in non-COVID-19 patient groups*** *by practice type*

Discussion

Principal Findings

The proportion of the practices' FTE staff on duty decreased from 83% of FTE GPs and 85% of FTE PNs to 68% and 64% respectively. The average number of daily consultations per FTE has dropped by six for GPs and seven for PNs. The extrapolated average annual GP consultation rate per head of population decreased from 4.4 per annum to 2.8 per annum based on our data. Practices' finances have been impacted as well, with 84.3% reporting reduced profits.

A shift to telemedicine was observed from 10.5% of all GP consultations and 17.6% of PN consultations pre-COVID-19 to 57% and 32% respectively in June 2020.

Another key difference was the change in significant reported stressors for GPs. Pre-COVID-19, the workload in general practice was viewed as the most significant source of stress by 55% of respondents. In the second survey, a shift was observed with changing practice requirements (27%) and income (25%) considered as the two major sources of stress with workload only mentioned by 12%.

Strengths and weaknesses of the study

Our surveys are based on a self-selecting sample for both surveys which comes with inherent bias. The responding samples are different and we cannot do a direct practice-based comparison; however, key comparisons indicated that the samples were comparable. We did not collect information that would allow for meaningful geographical analyses, and therefore could not account for regional and socioeconomic differences which could affect consultation rates. Data is based on reported data and not from data extracted from general practice systems and hence may lead to under- or over-reporting. Finally, our national figures are extrapolated data from two points in time rather than continuously updated information. As the pandemic is ongoing, there are likely unknown factors that could affect consultation rates.

One of the key strengths in these surveys is the number of FTE GPs represented. In the pre-COVID-19 survey, there were 1,508.42 FTE GPs represented, employed by the 526 responding practices. In the post-COVID-19 survey, 1,647.75 FTE GPs from 680 responding practices were represented. This means 43% and 48% of registered GPs and an estimated 32% and 42% respectively of practices in Ireland were captured in each survey.

Interpretation in terms of international literature/Strengths and weaknesses compared to other literature

Since the beginning of the COVID-19 pandemic, there have been many changes rapidly implemented in healthcare across the world and they are having an impact on clinicians [15, 21]. Our study showed a decrease in GP appointments and overall in general practice (GPs and PNs). This is similar to reports in the UK [22], where the NHS has noticed a 30% decrease in the number of GP appointments compared to the same time in 2019.

Our study shows a substantial shift from 12.4% of all consultations in general practice in Ireland delivered via telemedicine to 51.5%. The UK reports are varied; however, they show a similar shift to digital consultations. With an overall 30% drop in all consultations, GPs reported consultations changing from 90-95% face-to-face to 85% remote [21, 22]. The current UK estimates are higher than ours; however, their telemedicine rate pre-COVID-19 was also higher [22]. Spain also reports an increase in the use of virtual consultations, at 68.3% during the pandemic [23]. The proportion of face-to-face GP consultations decreased from 87% to 41% in our study, showing a similar reduction to England where proportions changed from 70% to 23% [24].

The majority (84%) of our practices reported reduced practice profit, and this has been seen elsewhere with GPs in the United States of America turning to crowdfunding to help their practices [25] and most Australian GP practices also taking a hit to their income [26].

In our second survey during the COVID-19 pandemic, changing practice requirements and financial concerns practice were the key stressors for GPs. Across Europe, new ways of working and uncertainty are putting new stress on family medicine [27].

The extrapolated average annual consultation rate per head of population decreased from 4.4 per annum to 2.8 per annum based on our data. This has been reported elsewhere in Ireland [4] and abroad [22, 23, 28].

Similar studies comparing the impact of COVID-19 on practice consultation rates and delivery methods are rare. Much of the literature to date on delivery type changes are based on commentaries and not actual measurements [23, 27]. Some countries have national registers/data return systems, for example in the UK [23], from which data is more reliable and accurate than our method. However, there is no central data registry from general practice in Ireland and our data is limited to relying on self-reported survey data, albeit based on actual practice in-house records. A key strength of this paper is that it adds to the knowledge base in terms of the potential impact of the COVID-19 pandemic on general practice, including on stressors and finances, in the current void of such literature.

Implications for practice

GPs are motivated by altruism to work during pandemics despite the high personal risk, and they are enthusiastic about further training and information [5]. However, despite preparedness planning, implementing pandemic policies faces multiple obstacles [5]. GPs are facing rapidly changing patient flows, clinical algorithms, new care pathways, and the need for new ways of delivering high-quality care [14, 23, 27, 29]. Irish GPs have implemented many changes during the COVID-19 pandemic. The RACGP recommends 'a planned and coordinated approach' when implementing a telehealth service [30]; however, due to the urgent nature of the current situation, this has not been possible. Maintaining the quality of healthcare is important in sustaining a healthy workforce, which is essential to support a healthy economy during and after the pandemic.

Ireland, like many other countries, has taken massive steps towards the regular use of remote consultations, seemingly overnight, with previous trepidation regarding continuity of care and safety falling away out of necessity [31].

Ireland has two health strategies promoting the use of technology to enable patient-centred care nationally. Sláintecare, the current healthcare strategy in Ireland, aims to establish a national health fund that will help deliver universal healthcare and introduce comprehensive eHealth infrastructure [11]. This strategy supported the 2013 eHealth strategy, which had an objective of more affordable and more personalised care for all by capitalising on technology [32]. During the pandemic, practices across the country have swiftly transitioned to using technology such as Healthmail, electronic health records, and video or telephone consultations. Before the COVID-19 pandemic began, clinicians in primary care had used telemedicine interventions [33], but it was not the main form of care. Changes adopted during this pandemic accelerated the digitalisation of healthcare in Ireland and could lead the way to the increased adoption of digital care.

Telemedicine has been viewed as a way to lower costs and see more patients [15] but was rare in Irish general practice up to now, and here, as elsewhere, there was some resistance and concern [15]. However, the current COVID-19 pandemic has resulted in remote consultations being recommended for all GPs [4]. Recommendations like these made in response to the pandemic could bring about lasting changes to the health system [21]. We need to know that the changes are effective and identify possible future health implications for patients.

Furthermore, a noted decrease in consultations for non-COVID related symptoms has been observed. This could have serious impacts on patient safety with calls on patients not to self-diagnose or delay seeking treatment [16, 28]. Patients are also changing the way they use health services, with more emphasis on self-care [16]. Patient feedback will be invaluable for maintaining lasting benefits.

The COVID-19 pandemic has the potential to change general practice forever, and this does not only apply in Ireland but has been noted elsewhere [14, 15, 21, 23]. The adoption of 'total triage' systems has been seen during this pandemic whereby GPs can decide the mode of follow-up consultation, whether that is face-to-face, video call or telephone. As we look to a post-COVID landscape, there is a case for general practice retaining this to allow more flexibility in how consultations are delivered according to the needs and preferences of patients. However, telephone triage does not reduce GP workload, so we need to evaluate the impacts on workload and patient-centred care [34]. While it is unlikely that we will maintain this level of remote consultations, it is expected that how general practice functions will not return to as it was before [34, 35].

However, we should not lose sight of the relationship between the GP and patient and the importance of good communication and trust [15, 29, 34, 36]. Telemedicine does not work for all patients, and there is a need to establish what works best for different patients [15, 27]. We need to evaluate the impact of remote consultations during the COVID-19 response and understand how these impact on patient experience, health inequalities and patient-centred care.

Since the beginning of June 2020, renewed efforts have been made to reassure and encourage the public to continue seeking medical advice from their GPs by making an appointment [36, 37].

Unanswered questions and future research

How general practice is delivered will not return to as before; increased telemedicine is likely. It is necessary to assess the impact of this shift on patient health and to assess healthcare provider and

patient experience to ensure continued high-quality care and patient safety. Furthermore, we need to understand the impact of changing work requirements and evolving consultation techniques on general practice workload and practice income and viability.

DECLARATIONS

Abbreviations

ECDC – European Centre for Disease Prevention and Control

ESRI – Economic and Social Research Institute

FTE – Full time equivalent

GP - General Practitioner

HSE - Health Service Executive

ICGP - Irish College of General Practitioners

NHS – National Health Service (UK)

PN - Practice Nurse

PPE – Personal protective equipment

RACGP – Royal Australian College of General Practitioners

WHO - World Health Organisation

Competing interests

All authors have completed the *Unified Competing Interest form* (available on request from the corresponding author) and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years, no other relationships or activities that could appear to have influenced the submitted work.

Ethics approval and consent to participate

Ethical approval was obtained for the study from the Irish College of General Practitioners Research Ethics Committee.

Public and patient involvement

Patents and members of the public were not involved in this research because it was not relevant to

the study questions. The study focused on changes experienced by general practitioners who were involved in the study design as members of the ICGP board.

Consent for publication

Not applicable.

Availability of data and materials

The data is available on reasonable request to the corresponding author.

Funding
No funding was received for this work.

Authors' contributions
CC was the project principal investigator. She conceived the project idea, designed the questionnaire, undertook the data collection, supervised the data analysis and contributed to the paper.

RH was the project research assistant. She analysed the data, undertook the analysis and contributed to the paper.

Both authors have read and approved the final paper.

Name of guarantor: Claire Collins.

Transparency declaration

The authors affirm that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

Acknowledgements
The authors wish to acknowledge the valuable contribution and time given by all participants.

References

1. WHO Newsroom. *Timeline of WHO's response to COVID-19.* [Internet] Geneva: World Health Organisation; 29 June 2020 [updated 30 July 2020]. Available from: https://www.who.int/china/news/detail/09-01-2020-who-statement-regarding-cluster-of-pneumonia-cases-in-wuhan-china [Accessed 24th August 2020]
2. WHO. *WHO Statement regarding cluster of pneumonia cases in Wuhan, China.* [Internet] Geneva: World Health Organisation; 9 January 2020. Available from: https://www.who.int/china/news/detail/09-01-2020-who-statement-regarding-cluster-of-pneumonia-cases-in-wuhan-china [Accessed 24th August 2020]
3. WHO. *WHO Director-General's statement on IHR Emergency Committee on Novel Coronavirus (2019-nCoV).* [Internet] Geneva: World Health Organisation; 30 January 2020. Available from: https://www.who.int/dg/speeches/detail/who-director-general-s-

statement-on-ihr-emergency-committee-on-novel-coronavirus-(2019-ncov) [Accessed 24th August 2020]

4. HSE/HPSC. *Guiding principles for Infection Prevention and Control when returning to routine General Practice during pandemic v2.1.* [Internet] Dublin: Health Protection Surveillance Centre; 10 July 2020. Available from: https://www.hpsc.ie/a-z/respiratory/coronavirus/novelcoronavirus/guidance/primarycareguidance/adviceriskassessmentandmanagementofpatients/Guiding%20principles%20IPC%20GP.pdf [Accessed 24th August 2020]
5. Patel MS, Phillips CB, Pearce C, Kljakovic M, Dugdale P, Glasgow N. General practice and pandemic influenza: a framework for planning and comparison of plans in five countries. *PLoS One* 2008 May 28;3(5):e2269.
6. Kunin M, Engelhard D, Thomas S, Ashworth M, Piterman L. Challenges of the Pandemic Response in Primary Care during Pre-Vaccination Period: A Qualitative Study. *Isr.J.Health.Policy.Res.* 2015 Oct 15;4:32-015-0028-5. eCollection 2015.
7. WHO. *2019 Novel Coronavirus (2019-nCoV): Strategic Preparedness and Response Plan.* [Internet] Geneva: World Health Organisation; 2020 [Draft as of 3 February 2020]. Available from: https://www.who.int/docs/default-source/coronaviruse/srp-04022020.pdf?ua=1 [Accessed 24th August 2020]
8. European Centre for Disease Prevention and Control. *Infection prevention and control for COVID-19 in healthcare settings – Fourth update.* [Internet] 3 July 2020. ECDC: Stockholm; 2020. Available from: https://www.ecdc.europa.eu/en/publications-data/infection-prevention-and-control-and-preparedness-covid-19-healthcare-settings [Accessed 25th August 2020]
9. NPHET. *National Public Health Emergency Team (NPHET) COVID-19 Subgroup : Guidance and Evidence Synthesis.* [Internet] Dublin: Department of Health; 6 May 2020 [Last updated 4 August 2020]. Available from: https://www.gov.ie/en/collection/07d750-nphet-covid-19-subgroup-guidance-and-evidence-synthesis/ [Accessed 25th August 2020]
10. HSE. *Primary Care Reimbursement Service Statistical Analysis of Claims and Payments 2019.* [Internet] Dublin: Health Care Executive Primary Reimbursement Service; 2020. Available from: https://www.hse.ie/eng/staff/pcrs/pcrs-publications/annual-report-2019.pdf [Accessed 25th August 2020]
11. Committee on the Future of Healthcare. *Sláintecare Report.* [Internet] Dublin: Houses of the Oireachtas; May 2017. Available from: https://www.gov.ie/pdf/?file=https://assets.gov.ie/165/270718095030-1134389-Slaintecare-Report-May-2017.pdf#page=1 [Accessed 25th August 2020]
12. Crosbie B, O'Callaghan ME, O'Flanagan S, Brennan D, Keane G, Behan W. A real-time measurement of general practice workload in the Republic of Ireland: a prospective study. *Br.J.Gen.Pract.* 2020 Jun 25;70(696):e489-e496.
13. Department of Health. *Health Service Capacity Review 2018 Executive Report: Review of Health Demand and Capacity Requirement in Ireland to 2031 – Findings and Recommendations.* London: PA Knowledge Limited; 2018. Available from: https://assets.gov.ie/10131/5bb5ff12463345bbac465aaf02a2333d.pdf [Accessed 25th August 2020]
14. Liu Y, Wang Z, Ren J, Tian Y, Zhou M, Zhou T, et al. A COVID-19 Risk Assessment Decision Support System for General Practitioners: Design and Development Study. *J.Med.Internet Res.* 2020 Jun 29;22(6):e19786.

15. Verhoeven V, Tsakitzidis G, Philips H, Van Royen P. Impact of the COVID-19 pandemic on the core functions of primary care: will the cure be worse than the disease? A qualitative interview study in Flemish GPs. *BMJ Open* 2020 Jun 17;10(6):e039674-2020-039674.
16. Thompson S. Patients who regularly see doctors are not doing so for fear of COVID-19. *Irish Times.* [Internet] April 4th 2020. Available from: https://www.irishtimes.com/life-and-style/health-family/patients-who-regularly-see-doctors-are-not-doing-so-for-fear-of-covid-19-1.4217859 [Accessed 25th August 2020]
17. Government of Ireland. *Health in Ireland: Key Trends 2019.* [Internet] Dublin: Department of Health; 2019. Available from: https://www.gov.ie/en/publication/f1bb64-health-in-ireland-key-trends-2019/ [Accessed 25th August 2020]
18. CSO. *CSO Statistical Release: Population and Migration Estimates.* [Internet] Cork: Central Statistics Office; April 2019. Available from: https://www.cso.ie/en/releasesandpublications/er/pme/populationandmigrationestimateapril2019/ [Accessed 25th August 2020]
19. HSE. *Medical Workforce Planning: Future Demand for General Practitoners 2015-2025.* [Internet] Dublin: National Doctor Training and Planning, HR Directorate, Health Service Executive; September 2015. Available from: https://www.hse.ie/eng/staff/leadership-education-development/met/plan/gp-medical-workforce-planning-report-sept-2015.pdf [Accessed 25th August 2020]
20. Smith S, Walsh B, Wren M, Barron S, Morgenroth E, Eighan J, et al. *Geographic profile of healthcare needs and non-acute healthcare supply in Ireland.* ESRI Research Series: 90. [Internet] Dublin: The Economic and Social Research Institute; July 22 2019. Available from: https://www.esri.ie/system/files/publications/RS90_0.pdf [Accessed 28th August 2020]
21. The Health Foundation. *How might COVID-19 affected people's ability to see their GP? COVID-19 Chart Series.* [Internet] London: The Health Foundation; 1 May 2020. Available from: https://www.health.org.uk/news-and-comment/charts-and-infographics/how-might-covid-19-have-affected-peoples-ability-to-see-GP [Accessed 25th August 2020]
22. NHS. Letter to: Chief executives of all NHS trusts and foundation trusts; CCG Accountable Officers; GP practices and Primary Care Networks; Providers of community health services; NHS 111 providers. *IMPORTANT - FOR ACTION - SECOND PHASE OF NHS RESPONSE TO COVID19.* From the Chief Executive Sir Simon Stevens & Chief Operating Officer Amanda Pritchard. [Internet] London: NHS; 29 April 2020. Available from: https://www.england.nhs.uk/coronavirus/wp-content/uploads/sites/52/2020/04/second-phase-of-nhs-response-to-covid-19-letter-to-chief-execs-29-april-2020.pdf [Accessed 25th August 2020]
23. Munoz MA, Lopez-Grau M. Lessons learned from the approach to the COVID-19 pandemic in urban primary health care centres in Barcelona, Spain. *Eur.J.Gen.Pract.* 2020 Dec;26(1):106-107.
24. RCGP. *General practice in the post Covid world: Challenges and opportunities for general practice.* [Internet] London: Royal College of General Practitioners; 2020. Available from: https://www.rcgp.org.uk/-/media/Files/News/2020/general-practice-post-covid-rcgp.ashx?la=en [Accessed 25th August 2020]
25. Rubin R. COVID-19's Crushing Effects on Medical Practices, Some of Which Might Not Survive. *JAMA* 2020 Jun 18.
26. Nelson F. Half of GP Clinics losing more than 30% of Revenue: Survey. *Medical Republic.* [Internet] 3 April 2020. Available from: http://medicalrepublic.com.au/half-gp-clinics-losing-more-than-30-of-revenue-survey/26948 [Accessed 25th August 2020]

27. de Sutter A, Llor C, Maier M, Mallen C, Tatsioni A, van Weert H, et al. Family medicine in times of 'COVID-19': A generalists' voice. *Eur.J.Gen.Pract.* 2020 Dec;26(1):58-60.
28. Bostock N. Millions of patients 'avoiding calls to GP' during COVID-19 pandemic. *GP Online.* [Internet] 25 April 2020. https://www.gponline.com/millions-patients-avoiding-calls-gp-during-covid-19-pandemic/article/1681384 [Accessed 25th August 2020]
29. Marshall M, Howe A, Howsam G, Mulholland M, Leach J. COVID-19: a danger and an opportunity for the future of general practice. *Br.J.Gen.Pract.* 2020 May 28;70(695):270-271.
30. RACGP. *Implementation guidelines for video consultations in general practice: A telehealth initiative.* 3rd Edition. [Internet] East Melbourne Victoria: The Royal Australian College of General Practitioners; September 2012. Available from: https://www.racgp.org.au/download/Documents/Telehealth/videoconsultguidelinesv3.pdf [Accessed 25th August 2020]
31. Mulholland P, Cahill N. Has Covid-19 hastened the age of telemedicine? *Medical Independent.* [Internet] 10 April 2020. Available from: https://www.medicalindependent.ie/has-covid-19-hastened-the-age-of-telemedicine/ [Accessed 25th August 2020]
32. HSE/Department of Health. *eHealth Strategy for Ireland.* [Internet] Dublin: Department of Health; 2013. Available from: https://www.gov.ie/en/publication/6b7909-ehealth-strategy-for-ireland/ [Accessed 25th August 2020]
33. Gilligan P, Bennett A, Houlihan A, Padki A, Owen N, Morris D, et al. The Doctor Can See You Now: A Key Stakeholder Study Into The Acceptability Of Ambulance Based Telemedicine. *Ir.Med.J.* 2018 Jun 7;111(6):769.
34. Thornton J. Covid-19: how coronavirus will change the face of general practice forever. *BMJ* 2020 Mar 30;368:m1279.
35. Cullen P. Coronavirus: Patients asked to visit GP surgery only if they have an appointment. *Irish Times.* [Internet] 10 March 2020. Available from: https://www.irishtimes.com/news/health/coronavirus-patients-asked-to-visit-gp-surgery-only-if-they-have-an-appointment-1.4198571 [Accessed 25th August 2020]
36. Campbell JL, Fletcher E, Britten N, Green C, Holt TA, Lattimer V, et al. Telephone triage for management of same-day consultation requests in general practice (the ESTEEM trial): a cluster-randomised controlled trial and cost-consequence analysis. *Lancet* 2014 Nov 22;384(9957):1859-1868.
37. HSE. *Coronavirus: Get urgent medical help for non-coronavirus symptoms.* [Internet] 5 June 2020. Available from: https://www2.hse.ie/conditions/coronavirus/get-urgent-medical-help-for-non-coronavirus-symptoms.html [Accessed 25th August 2020]

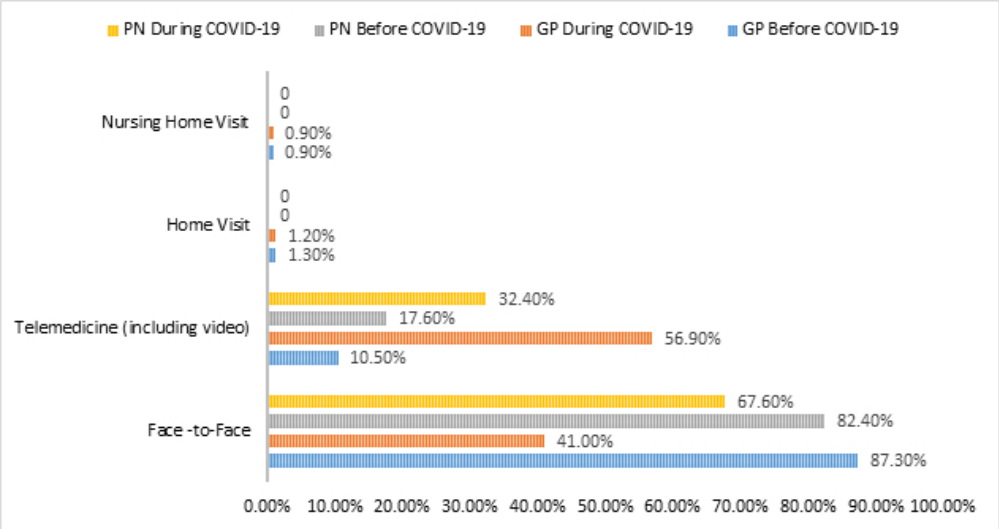
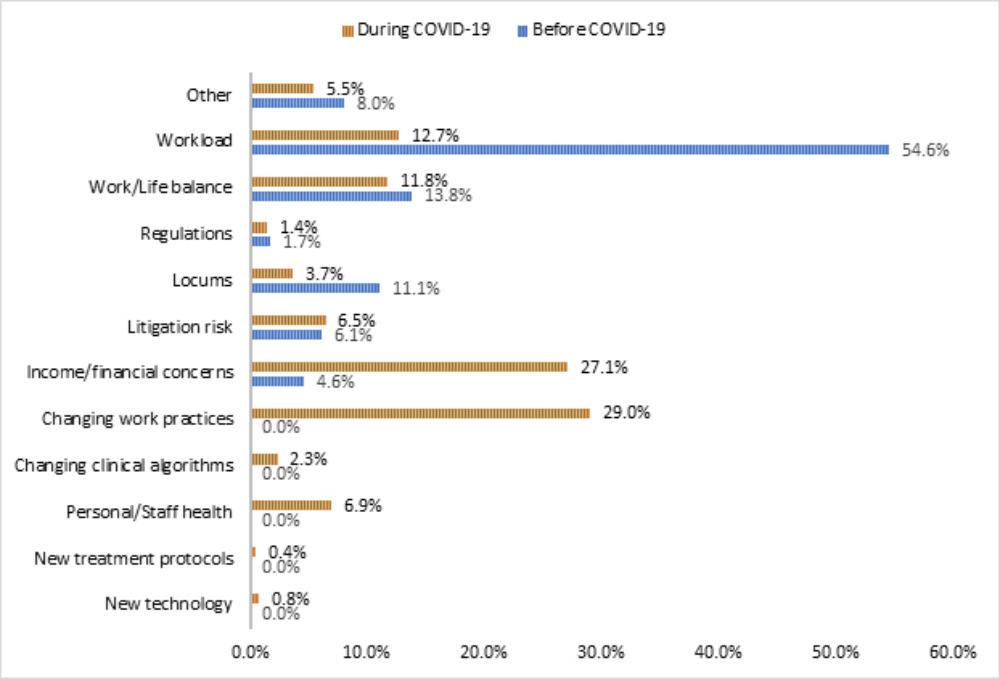


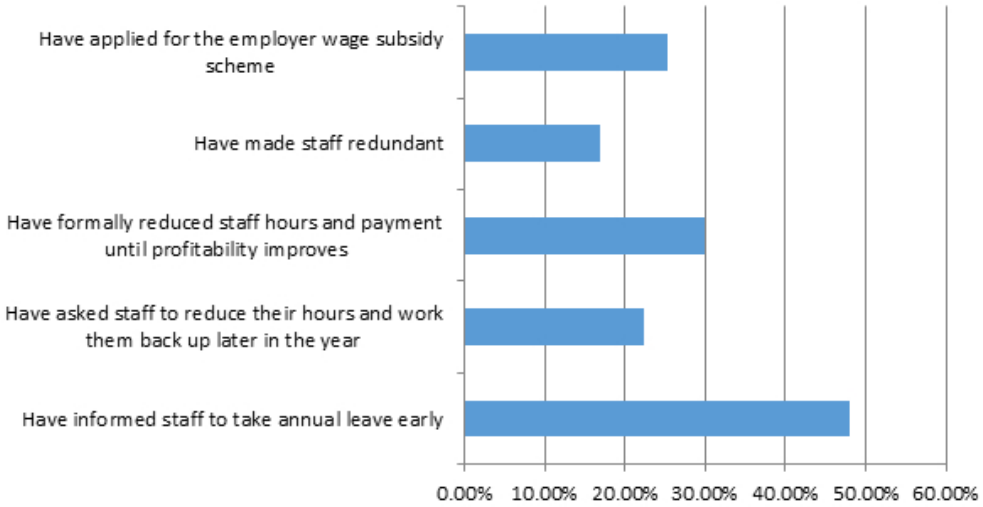
Figure 1 General Practitioner and Practice Nurse Consultations Before and During COVID-19

167x88mm (96 x 96 DPI)



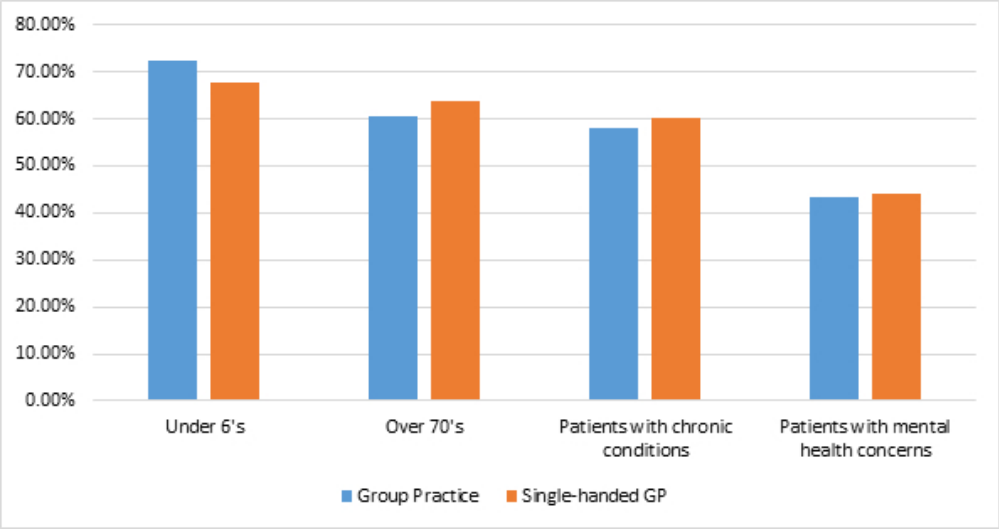
Most significant stressors for GPS

164x111mm (96 x 96 DPI)



Measures implemented by practices to alleviate financial concerns

156x82mm (96 x 96 DPI)



Reported decline in non-COVID-19 visits from patient groups by practice type

157x83mm (96 x 96 DPI)

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	3
Methods			
Study design	4	Present key elements of study design early in the paper	3
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	4
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	4
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*4*
Bias	9	Describe any efforts to address potential sources of bias	8
Study size	10	Explain how the study size was arrived at	4
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	4
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	4
		(*b*) Describe any methods used to examine subgroups and interactions	4
		(*c*) Explain how missing data were addressed	4
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	4
		(*e*) Describe any sensitivity analyses	4

Continued on next page

Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	4
		(b) Give reasons for non-participation at each stage	n/a
		(c) Consider use of a flow diagram	n/a
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	4
		(b) Indicate number of participants with missing data for each variable of interest	4-8
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	*4-8*
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	4-8
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	4-8
Discussion			
Key results	18	Summarise key results with reference to study objectives	8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	8-9
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	9-10
Generalisability	21	Discuss the generalisability (external validity) of the study results	10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	12

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

How COVID-19 has affected general practice consultations and income – General Practitioner population survey evidence from Ireland

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2020-044685.R1
Article Type:	Original research
Date Submitted by the Author:	08-Dec-2020
Complete List of Authors:	Homeniuk, Robyn; Irish College of General Practitioners, Research and Innovation Collins, Claire; Irish College of General Practitioners, Research
Primary Subject Heading:	General practice / Family practice
Secondary Subject Heading:	Health services research
Keywords:	Telemedicine < BIOTECHNOLOGY & BIOINFORMATICS, COVID-19, PRIMARY CARE

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

How COVID-19 has affected general practice consultations and income – General Practitioner population survey evidence from Ireland

Robyn Homeniuk[a] and Claire Collins[b]

a. Research Officer, Department of Research, Irish College of General Practitioners, 4-5 Lincoln Place, Dublin D2. Email: robyn.homeniuk@icgp.ie
b. Director of Research and Innovation, Department of Research, Irish College of General Practitioners, 4-5 Lincoln Place, Dublin D2. Email: claire.collins@icgp.ie

Abstract

Objectives

How general practice is delivered in many countries has drastically changed due to the COVID-19 pandemic. This study aimed to answer the question of how general practice has changed in Ireland in response to COVID-19.

Design

The Irish College of General Practitioners surveyed its membership before and after the global pandemic hit Ireland using an online survey instrument to capture consultation rates and mode of delivery.

Setting

This study focuses on primary care, specifically general practice, in Ireland.

Participants

A total of 527 general practices across Ireland submitted responses to the survey in February 2020 before the global pandemic; 532 general practices responded to a survey during the pandemic in June 2020. This covers 32% practices in Ireland.

Main outcome measures

The type of consultations by general practitioners and practice nurses in both surveys is the main outcome measure used in this study. Other changes such as the perceived change in attendance by certain patient groups and practice income is also reported.

Results

The proportion of telemedicine general practitioner consultations significantly ($p<0.01$) increased from 10.6% (CI 95% 10.3%, 10.9%) to 57.0% (CI 95% 56.4%, 57.6%). The majority of practices (80.2%) reported reduced practice profit. A statistically significant relationship was found between practice size and estimated percentage change in profit ($p <0.01$) showing that smaller practices reported higher estimated profit loss. Respondents reported decline in non-COVID-19 related consultations among certain patient cohorts - 90.2% for children under six years old; 77.8% for patients over 70 years.

Conclusions

It is clear that the way general practice is delivered will not return to as before and that increased telemedicine is likely. However, it is necessary to assess the impact of this shift on patient health and to assess healthcare provider and patient experience to ensure continued high-quality care and patient safety.

Strengths and Limitations

- **A key strength of this study is the large number of general practitioners who engaged with the surveys. It was possible to survey a third of all practices in Ireland at both time points.**
- **One of the weaknesses of the study is that the survey was self-selecting, which could have biased the responses in some cases. Furthermore, it was not possible to identify practices and match their responses from the first to the second survey.**

- **We did not collect sociodemographic information, hence it was not possible to control for deprivation levels and other factors that may affect health care utilisation.**
- **Due to the large number of responding practices, we were able to get data covering every county in Ireland in both the pre-COVID-19 and during COVID-19 surveys. The volume of responses makes our findings more generalizable.**

Introduction

A cluster of 'atypical viral pneumonia' cases was diagnosed in Wuhan City, China in December 2019 [1]. By 9 January 2020, Chinese authorities found the cause of the outbreak was a novel coronavirus [2] – later named COVID-19. The WHO declared an international public health emergency [3] and by the end of February 2020, Ireland had its first case. National lockdown measures commenced in March 2020 and included recommendations for general practitioners (GPs) to observe physical distancing, wear personal protective equipment (PPE), and use telephone triage and appointments to reduce face-to-face appointments [4]. Epidemiologists globally have been monitoring the progression of this infection while governments have been developing and deploying emergency pandemic responses. The need to have global and national emergency management plans is well-documented [3] since the outbreak of SARS in 2003. Previous outbreaks have proven that contagious diseases can put intense pressure on health systems, especially on general practice, as it is the frontline of the medical response [5]. GPs have expressed their past uncertainty about how to respond to a pandemic [5]. Indeed, in response to the H1N1 pandemic, primary care staff struggled with implementing new workflows [6]. In Ireland, comprehensive preparedness plans are in place for handling public health emergencies. These plans follow WHO [7] and ECDC [8] guidance and are coordinated by the National Public Health Emergency Team [9].

General practitioners (GPs in Ireland operate as private professionals charging patients not covered under the public system a fee per visit. The State pays GPs on a capitation basis for patients covered under the public system. Around 43% of Irish people qualify for free healthcare access either through the public system known as the General Medical Services (GMS) card (32.4%) or a GP only card (10.4%); the remainder pay privately for GP visits [10]. GPs are critical for managing the increasing amount of chronic illnesses such as heart diseases, diabetes, and asthma – 80% of all visits to the GP are for chronic care management [11]. In 2015, the first step towards universal healthcare in Ireland was taken when children under 6 years old and adults over 70 years old became eligible for free GP care [11]. Patients in the latter group accounted for 25% of GP consultations and 31% of practice nurse visits in 2016 [12]. Before the start of this pandemic, general practitioners faced a heavy workload managing the majority of care needs [11], completing more than 25 consultations daily and additional time spent on administration lead to GPs working nearly 10 hours in a day [13]. The need to move more care into the community is the central point of the current healthcare strategy in Ireland [14]. Another key point in the reform strategy is to achieve universal healthcare by expanding current entitlements and move to a preventative care model [11].

With the onset of COVID-19, the face of general practice in Ireland, as in many countries, drastically changed, with developing clinical models [15] and consultation strategies having an impact on primary care [16]. GPs quickly noticed a decrease in the number of appointments being scheduled by patients while practice costs increased and income decreased [17]. Continuity of routine care might be at risk because of the pandemic, and the general health of the population is a key concern for primary care [16].This paper reports on the changes experienced and in particular, those in consultation delivery methods in Irish general practice during the COVID-19 pandemic. At the beginning of February 2020, the ICGP surveyed its membership before the global pandemic reached Irish shores. In June 2020, the ICGP again surveyed its membership regarding the impact of COVID-19 on general practice.

Methods

In early 2020, the Irish College of General Practitioners (ICGP) – the professional body for GPs in Ireland - designed an online survey to capture practice activities, stressors, and demographic details regarding general practices in Ireland. The survey was developed in order to measure general practice activity, as this information is not yet routine collected in Ireland. It was the intention to periodically repeat the survey with ICGP members to build a dataset to enable better resource planning in primary care, however, because of the COVID-19 pandemic, a decision was taken to adjust the survey accordingly.

It was distributed to 3,378 members both before (February 2020) and during (June 2020) the coronavirus pandemic. It was not sent to trainees, retired GPs, or Irish GPs working abroad. The second survey was updated to include additional questions and response categories that specifically related to the pandemic. Before each survey was sent out, eight GPs piloted the survey. A population survey approach was taken therefore; no additional sampling techniques were used. The survey sample was self-selecting, with the survey period open for a two-week period to ensure a significant number of responses was received.

The questionnaire was developed specifically for use in the survey. The questionnaire before the pandemic had 14 items, which covered the number of GPs and practice nurses, consultation activity and hours worked, stressors and practice demographic information. The questionnaire conducted during the pandemic had 25 items, as it gained new items pertaining to changes introduced because of COVID-19. Questions regarding stress, hours worked, appointment availability and pandemic response were included to obtain a better understand of the state of general practice.

There was no eligibility criteria to complete the survey. Only one survey for each practice was requested. Ethical approval from the ICGP Research Ethics Committee for both surveys was obtained and consent from practices for participation and data processing was confirmed at the start of each survey. The online survey was fully anonymous and no IP addresses were collected.

All data is based on survey responses. Consultation rates include face-to-face consultations, telephone and video consultations (referred to as telemedicine), home visits and visits to nursing homes reported by practices who responded to the survey. Data was returned regarding the most recent working day. Out of hours services in Ireland are provided and recorded separately and hence are not included in these figures. The definitions for city, town and village are based on Central Statistics Office [18] definitions - rural is an area where less than 1,500 people live, a town has a population between 1,500 and 49,999, and cities have a population >50,000.

We conducted the analysis using SPSS V25 software, using descriptive analysis. For numerical data, means were used for comparisons and to conduct statistical tests as appropriate. A *p*-value of <0.05 was used to indicate statistical significance. Chi-square tests were used for categorical comparisons. Pearson's and Spearman's tests were used to test for correlation between continuous variables. T-tests and F-tests were used to compare means as appropriate Outliers were defined as those outside 1.5 times the interquartile range and were removed from calculations.

Results

Survey Population

There were 527 responses in the pre-COVID-19 survey- 32.2% of all 1,635 practices in Ireland [19] with 1,510.4 full time equivalent (FTE) GPs employed in these practices, 1,251.4 FTE GPs (82.9%) on duty on the day on which consultation data is based. In this sample, approximately one fifth (19.4%)

of the practices were single-handed. The average number of FTE GPs at group practices was 3.3. At least one part-time practice nurse was employed at 93.6% (n=519) of practices with 632.33 FTE practice nurses overall and 84.5% of FTE practice nurses working on the day of data collection. On average, practices employed 1.2 FTE practice nurses, although 31.4% of practices employed between 0.20 and 0.90 FTE practice nurses.

City practices comprised 37.6% of the total, with 43.8% of practices located in towns and 18.6% in villages. There was at least one practice recorded in every county.

In the during COVID-19 survey, there were 532 responses, estimated at 32.5% of all practices in Ireland. A total of 1271.7 FTE GPs were employed in these practices with 1104.9 FTE GPs (86.9%), working on the day on which consultation numbers were recorded. There were slightly more single-handed practices in this sample at just over a quarter (28.4%). Group practices employed an average of 3.0 FTE GPs.

A practice nurse was employed by 89.8 % (n=521) of the practices with a total of 605.4 FTE practice nurses overall. On the day clinical activity was recorded, 509.0 FTE practice nurses (n=511) were available, which means 84.1% of the employed nurses were working.

City practices comprised 34.5 % of the total, with 45.8% of practices located in towns and 19.8% in villages and at least one practice responding in every county. Practice characteristics from both surveys are shown in Table 1.

Table 1: Practice Characteristics

	Pre-COVID-19	S.E. of mean or lower and upper bounds (%)	During COVID-19	S.E. of mean or lower and upper bounds (%)
Total Number of practices	527		532	
Number of Single-Handed Practices	102		151	
Number of Group Practices	425		382	
Number of FTE GPs Overall	1510.4 (n=527)		1271.7 (n=532)	
Mean GPs overall	2.9	0.1	2.4	0.07
Number of FTE GPs on the Day	1251.4 (n=537)		1104.9 (n=532)	
Mean GPs on day	2.40	0.06	2.1	0.06
Percent of Practices with at least a part-time PN	93.6% (n=519)	91.2%, 95.6%	89.8% (n=521)	86.9%, 92.3%
Number of FTE PNs Overall	632.3 (n=519)		605.4 (n=521)	
Mean PNs overall	1.2	0.05	1.2	0.05

Number of FTE PNs on the day	534.3 (n=515)		509.0 (n=511)	
Mean PNs on day	1.0	0.03	1	0.05
Practices located in a City	37.6%	33.4%, 41.9%	34.5%	30.4%, 38.7%
Practices located in a Town	43.8%	39.6%, 48.2%	45.8%	41.5%, 50.1%
Practices Located in a village	18.6%	15.4%, 22.2%	19.8%	16.5%, 23.4%
95% confidence interval				

In both cases, practices received the questionnaire via email and an additional reminder email. The number of practices that provided valid responses defined as providing information for overall and on the day data, was comparable. There were an additional five responses during COVID-19; the geographic spread of the practices was similar though there was a small increase in single-handed practices responding however, this did not have a significant impact when comparing consultation methods.

Consultations

In the survey pre-COVID-19 87.2% (95% CI 86.9%, 87.6%) of appointments occurred face-to-face, 10.6% (95% CI 10.3%, 10.9%) were telemedicine and the remainder were visits to homes and nursing homes.

During COVID-19, the mode of consultation changed significantly. Over half of the GP consultations occurred via telemedicine (57.0%, 95% CI 56.4%, 57.6%); and 40.9% (95% CI 40.3%, 41.5%) occurred face-to-face with the remaining visits to homes or nursing homes. In Table 2 the proportion of consultation by each consultation method for GPs and practice nurses at each time point are shown.

Table 2: Summary of Consultations

Consultation Method	Pre COVID-19 Percent of Consultations	Lower and Upper bounds (%)	During COVID-19 Percent of Consultations	Lower and Upper bounds (%)
GP Face-to-Face	87.2%	86.9%, 87.6%	40.9%	40.3%, 41.5%
GP Telemedicine (including video, telephone and other remote)	10.6%	10.3%, 10.9%	57.0%	56.4%, 57.6%
GP home visits	1.3%	1.2%, 1.4%	1.2%	1.0%, 1.3%
GP nursing home visits	0.9%	0.8%, 1.0%	0.9%	0.8%, 1.0%
PN Face-to-Face	82.3%	81.7%, 82.9%	67.6%	66.6%, 68.6%
PN Telemedicine (including video, telephone and other remote)	17.7%	17.1%, 18.3%	32.4%	31.4%, 33.4%
95% confidence interval				

Face-to-face appointments decreased from 87.2% to 40.9% of all GP consultations and consultations by telemedicine increased from 10.6% to 57.0% of reported consultations.

Pre-COVID-19, 17.7% (95% CI 17.1%, 18.3%) or practice nurse consultation were via telemedicine and 82.3 % were face-to-face (95% CI 81.7%, 82.9%). During the pandemic, consultations via telemedicine made up 32.4% (95% CI 31.4%, 33.4%) and the rest were conducted face to face (67.6%; 95% CI 66.6%, 68.6%).

Before the pandemic began, practice nurses had a higher proportion of telemedicine appointments than GPs – 17.7% of practice nurse appointments in February 2020 compared to only 10.6% of GP appointments. During COVID-19 57.0% of GP, appointments were via telemedicine compared to 32.4% of practice nurse appointments.

Respondents were asked if they had noticed a decline in certain patient groups. Overall, there was a reported decline in non-COVID-19 related consultations. Almost all practices - 90.2% (CI 95% 87.7%, 92.8%) - noticed a decline for children under six years old and 77.8% (95% CI 74.3%, 81.4%) saw a decline for patients over 70 years (two patient groups with free GP care). A total of 74.1% (95% CI 70.3%, 77.8%) of practices reported a reduction in non-COVID-19 visits from people with chronic conditions, and 55.1% (95% CI 50.8%, 59.3%) reported a decline in visits from people with mental health concerns. Table 3 shows the decline in non-COVID-19 related consultations from each of these patient groups at group and single-handed practices.

Table 3: Decline in non-COVID-19 consultations by key patient groups and practice type.

	Single-Handed Practices Percentage (n=151)	Group Practices Percentage (n=381)
Children under 6 years old	85.4% (79.8%, 91.1%)	92.5% (89.4%, 94.8%)
Adults over 70	80.1% (73.8%,86.5%)	76.9% (72.7%, 81.1%)
People with Chronic Conditions	74.8% (67.9%, 81.8%)	73.8% (69.3%, 78.2%)
People with mental health concerns	55.0% (47.0%, 62.9%)	55.1 % (50.1%, 60.1%)
* Percentages were calculated as the number of responses for each practice type with a 95% confidence interval. The total number of responses for this question was 465 (90.5%, 87.6%, 92.9%). ** Patients under 6 years old and over 70 years old receive free GP care, as do some patients with chronic conditions and mental health concerns. They are known to use GP services more frequently, which is why these specific groups were asked about.		

Practice income impact

Overall, 80.2% (95% CI 76.8%, 83.6%) of practices (n=530) reported a decrease in profitability during the pandemic, although only half of the practices had gone undertaken a formal review of their accounts. Across all practice sizes, there is an expected average decrease in profitability of 34.8%

and an average of 17.0% for an increase in profitability. Only 20 (3.8%, 95% CI 2.2%, 5.4%) practices were expecting an increase in profitability.

More group practices completed formal account reviews assessing the change in practice income and profit - 54.9% (n=363) of group practices had done this compared to 31.1% (n=141) of single-handed practices. Single-handed practices were estimating an average loss of 38.6% (S.E. 1.7) of profits compared to the average estimate of 30.8% (S.E. 0.97) loss for group practices. The lower number of formal assessments by single-handed practices could explain part of this difference, through overestimates by GPs when completing the survey.

A small but statistically significant relationship between practice size and estimated percentage change in profit was found using a linear regression (R square = 0.04, p <0.01) showing that as practice size decreased the estimated percentage of profit loss increased.

To manage the financial impact of COVID-19, 308 (57.9%) of the practice had implemented changes to accommodate lost profit that occurred. The most popular measure was to ask staff to take their annual leave early.

There were no significant relationships between practice size and implementing the listed measures.

A total of 233 (43.8%, 95% CI 39.6%, 48.0%) practices indicated they had staff who were affected by redundancies, reduced hours or reduced salary. The most affected staff has been receptionists with 93 (17.5%, 95% CI 14.3%, 20.7%) practices selecting this option. Following that, 83 (15.6%, 95% CI 12.5%, 18.7%) practices had practice nurses who were affected and 81 (15.2%, 95% CI 12.2%, 18.3%) practices with salaried GPs were affected. Forty-six GPs left comments as well, most highlighting that they had been the one to reduce their personal salary for the sake of keeping their staff. Table 4 shows the proportion of practices that used the following methods to recover income during the pandemic.

Table 4: Measures introduced to help the business manage the financial effects of COVID-19

Answer Choices	Single-Handed Practice Percentage (n=151)	Group Practice Percentage (n=382)
Have informed staff to take annual leave early	13.9% (8.4%, 19.4%)	32.6% (27.8%, 37.3%)
Have asked staff to reduce their hours and work them back up later in the year	8.0% (3.6%, 12.3%)	14.4% (10.9%, 18.0%)
Have formally reduced staff hours and payment until profitability improves	10.6% (5.7%, 15.5%)	19.7% (15.7%, 23.7%)
Have made staff redundant	9.3% (4.7%, 13.9%)	9.7% (6.7%, 12.7%)
Have applied for the employer wage subsidy scheme	9.9% (5.2%, 14.7%)	16.5% (12.8%, 20.3%)
* Percentages calculated based on the total number of each practice type using 95% confidence intervals. 233 practices submitted responses to this question which us 45.3% (41.0%, 49.8%) of the total sample.		

Discussion

Principal Findings

A shift to telemedicine was observed from 10.6% of all GP consultations and 17.7% of practice nurse consultations pre-COVID-19 to 57.0% and 32.4% respectively during the COVID-19 response.

More than half of practices saw decreases in non-COVID-19 related consultations from vulnerable patient groups. Particularly, non-COVID-19 related visits from patients under 6 and over 70 – who receive free GP care – decreased despite usually being high users of health services.

Finally, practices' finances have been impacted, with 80.2% reporting reduced profit. Moreover, two-fifths of practices had staff affected by redundancy, reduced hours or reduced salary as a measure to offset the financial impact of the pandemic.

Strengths and weaknesses of the study

Our surveys are based on a self-selecting sample for both surveys, which comes with inherent bias. The responding samples are different and we cannot do a direct practice-based comparison; however, key comparisons indicated that the samples were comparable. We did not collect information that would allow for meaningful geographical analyses, and therefore could not account for regional and socioeconomic differences, which could affect consultation methods. Data is based on reported data and not from data extracted from general practice systems and hence may lead to under- or over-reporting. Additionally, we did not collect patient population information so adjustment for disability could not be completed or compared nationally.

One of the key strengths in these surveys is the number of FTE GPs represented. In the pre-COVID-19 survey, there were 1510.4 FTE GPs represented, employed by the 527 responding practices. In the post-COVID-19 survey, 1271.7 (n=532) FTE GPs from the responding practices were represented. This means an estimated 32.2% and 32.5% respectively of practices in Ireland were captured in each survey. In addition, the representation of both single-handed and group practices was similar to national figures [20]. While complex geographical information was not collected, both samples have at least one practice in all part of the country with more in cities such as Dublin and Cork, which is consistent with the geographic spread of practices, previously reported [21].

Interpretation in terms of international literature/Strengths and weaknesses compared to other literature

Since the beginning of the COVID-19 pandemic, there have been many changes rapidly implemented in healthcare across the world and they are having an impact on clinicians [16, 17]. Our study showed a decrease in GP appointments and overall in general practice (GPs and PRACTICE NURSEs). This is similar to reports in the UK [22], where the NHS has noticed a 30% decrease in the number of GP appointments compared to the same time in 2019.

Our study shows a substantial shift from 12.4% of all consultations in general practice in Ireland delivered via telemedicine to 50.7%. The UK reports are varied; however, they show a similar shift to telemedicine consultations. With an overall 30% drop in all consultations, GPs reported consultations changing from 90-95% face-to-face to 85% remote [22, 23]. The current UK estimates are higher than ours; however, their telemedicine rate pre-COVID-19 was also higher [22]. Spain also

reports an increase in the use of virtual consultations, at 68.3% during the pandemic [24]. The proportion of face-to-face GP consultations decreased from 87.2% to 40.9% in our study, showing a similar reduction to England where proportions changed from 70% to 23% [25].

The majority (80.2%) of our practices reported reduced practice profit, and this has been seen elsewhere with GPs in the United States of America turning to crowdfunding to help their practices, and GPs in Belgium and Australia also felt the effect of changing remuneration during COVID-19 [16, 17, 26].

Similar studies comparing the impact of COVID-19 on practice consultations are rare. Much of the literature to date on delivery type changes are based on commentaries and not actual measurements [24, 27]. However, a handful of recent publications about the use of healthcare during the pandemic. A recent German study with 1,095 GPs and patients aged 65 or older, found that there was a 14% decrease in consultations in May 2020 compared to the same time last year, and the rate of diabetes, dementia, depression, cancer and stroke diagnoses decreased during lockdown (between -17% and -26%) [28]. In a survey of Australian GPs, 73% of practices had a reduction in bookings and 77% had a decrease in practice income meanwhile telephone calls (93%) and practice costs (81%) increase[17]. These results support our survey's findings that these challenges have also been experienced by GPs in Ireland. A key strength of this paper is that it adds to the knowledge base in terms of the potential impact of the COVID-19 pandemic on general practice in the current void of such literature.

Implications for practice

GPs are motivated by altruism to work during pandemics despite the high personal risk, and they are enthusiastic about further training and information [5]. However, despite preparedness planning, implementing pandemic policies faces multiple obstacles [5]. GPs are facing rapidly changing patient flows, clinical algorithms, new care pathways, and the need for new ways of delivering high-quality care [16, 17, 24, 27, 28, 29]. Irish GPs have implemented many changes during the COVID-19 pandemic. The RACGP recommends 'a planned and coordinated approach' when implementing a telehealth service [30]; however, due to the urgent nature of the current situation, this has not been possible. Maintaining the quality of healthcare is important in sustaining a healthy workforce, which is essential to support a healthy economy during and after the pandemic.

Ireland, like many other countries, has taken massive steps towards the regular use of remote consultations, seemingly overnight, with previous trepidation regarding continuity of care and safety falling away out of necessity [16, 29]. The rapid national adoption of telemedicine consultations as well as electronic prescribing has presented opportunity; however, GPs are concerned that without as much face-to-face contact, critical non-verbal communication is missing from consultations and in some cases, telephone consults are insufficient to address patient concerns [16].

Ireland has two health strategies promoting the use of technology to enable patient-centred care nationally. Sláintecare, the current healthcare strategy in Ireland, aims to establish a national health fund that will help deliver universal healthcare and introduce comprehensive eHealth infrastructure [11]. This strategy supported the 2013 eHealth strategy, which had an objective of more affordable and more personalised care for all by capitalising on technology [31]. During the pandemic, practices across the country have swiftly transitioned to using technology such as a secure email facility between health care providers (Healthmail), e-prescribing, and telemedicine (video and telephone) consultations. Before the COVID-19 pandemic began, clinicians in primary care had used telemedicine interventions [29], but it was not the main form of care. Changes adopted during this

pandemic accelerated the digitalisation of healthcare and trepidation regarding widespread adoption have fallen away out of necessity [29]. This could lead the way to lasting adoption of technology such as e-prescribing and telephone and video consultations after the pandemic.

Telemedicine has been viewed as a way to lower costs and see more patients [32, 33, 34] but was rare in Irish general practice up to now, and here, as elsewhere, there was some resistance and concern [16]. However, the current COVID-19 pandemic has resulted in telemedicine consultations being recommended for all GPs [4]. Recommendations like these made in response to the pandemic could bring about lasting changes to the health system [22]. Patients have adapted to telemedicine consultations being the standard method of consultation; previous studies found that patients found video consultations acceptable [32] but age (over 60) and computer proficiency were found to negatively impact a patient's acceptability [33, 34]. Telemedicine has been invaluable during the outbreak of COVID-19, as it has enabled routine care to continue to some degree however, patients who are digitally disadvantaged were found to be from populations already experiencing greater health risks - such as older people and those in lower socioeconomic classes [32, 34]. Going forward, special attention must be given to reducing health inequalities exasperated by recent changes in care.

Furthermore, a noted decrease in consultations for non-COVID related symptoms has been observed in our survey. Patients, who are most vulnerable, such as people over 65, have also been avoiding seeking care in other countries [16, 26, 28]. This could have serious impacts on health outcomes and patient safety with calls on patients not to self-diagnose or delay seeking treatment [16, 26, 28]. Patients are also changing the way they use health services, with more emphasis on self-care [16, 24, 28]. However, not all patients will have the same capacity for caring for their health without the level of support a GP or practice nurse can provide with face-to-face consultations. More research on patient and physician satisfaction and whether health outcomes are impacted by consultation types is needed to develop guidelines and policies on how frequently remote consultations can be used. Patient feedback will be invaluable for maintaining lasting benefits.

The COVID-19 pandemic has the potential to change general practice forever, and this does not only apply in Ireland but has been noted elsewhere [15, 16, 17, 22, 24, 28]. The adoption of 'total triage' systems has been seen during this pandemic whereby GPs can decide the mode of follow-up consultation, whether that is face-to-face, video call or telephone. As we look to a post-COVID landscape, there is a case for general practice retaining this to allow more flexibility in how consultations are delivered according to the needs and preferences of patients. However, telephone triage does not reduce GP workload, so we need to evaluate the impacts on workload and patient-centred care [16, 32, 33, 34]. While it is unlikely that we will maintain this level of telemedicine consultations, it is expected that how general practice functions will not return to as it was before [29, 35].

However, we should not lose sight of the relationship between the GP and patient and the importance of good communication and trust [16, 26, 27, 29, 32, 33]. Telemedicine does not work for all patients or health problems, and there is a need to establish what works best for different patients [16, 27, 32, 33, 34]. We need to evaluate the impact on patient experience, health inequalities and patient-centred care [33, 36].

Since the beginning of June 2020, renewed efforts have been made to reassure and encourage the public to continue seeking medical advice from their GPs by making an appointment [36].

Unanswered questions and future research

How general practice is delivered will not return to as before; increased telemedicine is likely. It is necessary to assess the impact of this shift on patient health and to assess healthcare provider and patient experience to ensure continued high-quality care and patient safety. Furthermore, we need to understand the impact of changing work requirements and evolving consultation techniques on general practice workload and practice income and viability.

DECLARATIONS

Abbreviations

ECDC – European Centre for Disease Prevention and Control

ESRI – Economic and Social Research Institute

FTE – Full time equivalent

GP - General Practitioner

HSE - Health Service Executive

ICGP - Irish College of General Practitioners

NHS – National Health Service (UK)

PN - Practice Nurse

PPE – Personal protective equipment

RACGP – Royal Australian College of General Practitioners

WHO - World Health Organisation

Competing interests

All authors have completed the *Unified Competing Interest form* (available on request from the corresponding author) and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years, no other relationships or activities that could appear to have influenced the submitted work.

Ethics approval and consent to participate

Ethical approval was obtained for the study from the Irish College of General Practitioners Research Ethics Committee.

Public and patient involvement

Patents and members of the public were not involved in this research because it was not relevant to

the study questions. The study focused on changes experienced by general practitioners who were involved in the study design as members of the ICGP board.

Consent for publication

Not applicable.

Availability of data and materials

The data is available on reasonable request to the corresponding author.

Funding
No funding was received for this work.

Authors' contributions
CC was the project principal investigator. She conceived the project idea, designed the questionnaire, undertook the data collection, supervised the data analysis and contributed to the paper.

RH was the project research assistant. She analysed the data, undertook the analysis and contributed to the paper.

Both authors have read and approved the final paper.

Name of guarantor: Claire Collins.

Transparency declaration

The authors affirm that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

Acknowledgements
The authors wish to acknowledge the valuable contribution and time given by all participants.

References

1. WHO Newsroom. *Timeline of WHO's response to COVID-19.* [Internet] Geneva: World Health Organisation; 29 June 2020 [updated 30 July 2020]. Available from: https://www.who.int/china/news/detail/09-01-2020-who-statement-regarding-cluster-of-pneumonia-cases-in-wuhan-china [Accessed 24th August 2020]
2. WHO. *WHO Statement regarding cluster of pneumonia cases in Wuhan, China.* [Internet] Geneva: World Health Organisation; 9 January 2020. Available from: https://www.who.int/china/news/detail/09-01-2020-who-statement-regarding-cluster-of-pneumonia-cases-in-wuhan-china [Accessed 24th August 2020]
3. WHO. *WHO Director-General's statement on IHR Emergency Committee on Novel Coronavirus (2019-nCoV).* [Internet] Geneva: World Health Organisation; 30 January 2020. Available from: https://www.who.int/dg/speeches/detail/who-director-general-s-

statement-on-ihr-emergency-committee-on-novel-coronavirus-(2019-ncov) [Accessed 24th August 2020]

4. HSE/HPSC. *Guiding principles for Infection Prevention and Control when returning to routine General Practice during pandemic v2.1.* [Internet] Dublin: Health Protection Surveillance Centre; 10 July 2020. Available from: https://www.hpsc.ie/a-z/respiratory/coronavirus/novelcoronavirus/guidance/primarycareguidance/adviceriskassessmentandmanagementofpatients/Guiding%20principles%20IPC%20GP.pdf [Accessed 24th August 2020]
5. Patel MS, Phillips CB, Pearce C, Kljakovic M, Dugdale P, Glasgow N. General practice and pandemic influenza: a framework for planning and comparison of plans in five countries. *PLoS One* 2008 May 28;3(5):e2269.
6. Kunin M, Engelhard D, Thomas S, Ashworth M, Piterman L. Challenges of the Pandemic Response in Primary Care during Pre-Vaccination Period: A Qualitative Study. *Isr.J.Health.Policy.Res.* 2015 Oct 15;4:32-015-0028-5. eCollection 2015.
7. WHO. *2019 Novel Coronavirus (2019-nCoV): Strategic Preparedness and Response Plan.* [Internet] Geneva: World Health Organisation; 2020 [Draft as of 3 February 2020]. Available from: https://www.who.int/docs/default-source/coronaviruse/srp-04022020.pdf?ua=1 [Accessed 24th August 2020]
8. European Centre for Disease Prevention and Control. *Infection prevention and control for COVID-19 in healthcare settings – Fourth update.* [Internet] 3 July 2020. ECDC: Stockholm; 2020. Available from: https://www.ecdc.europa.eu/en/publications-data/infection-prevention-and-control-and-preparedness-covid-19-healthcare-settings [Accessed 25th August 2020]
9. NPHET. *National Public Health Emergency Team (NPHET) COVID-19 Subgroup : Guidance and Evidence Synthesis.* [Internet] Dublin: Department of Health; 6 May 2020 [Last updated 4 August 2020]. Available from: https://www.gov.ie/en/collection/07d750-nphet-covid-19-subgroup-guidance-and-evidence-synthesis/ [Accessed 25th August 2020]
10. HSE. *Primary Care Reimbursement Service Statistical Analysis of Claims and Payments 2019.* [Internet] Dublin: Health Care Executive Primary Reimbursement Service; 2020. Available from: https://www.hse.ie/eng/staff/pcrs/pcrs-publications/annual-report-2019.pdf [Accessed 25th August 2020]
11. Committee on the Future of Healthcare. *Sláintecare Report.* [Internet] Dublin: Houses of the Oireachtas; May 2017. Available from: https://www.gov.ie/pdf/?file=https://assets.gov.ie/165/270718095030-1134389-Slaintecare-Report-May-2017.pdf#page=1 [Accessed 25th August 2020]
12. Department of Health. *Sláintecare Action Plan 2019.* [Internet] Dublin: Department of Health; 2019. Available from: https://assets.gov.ie/22606/4e13c790cf31463491c2e878212e3c29.pdf [Accessed 28th August 2020]
13. Crosbie B, O'Callaghan ME, O'Flanagan S, Brennan D, Keane G, Behan W. A real-time measurement of general practice workload in the Republic of Ireland: a prospective study. *Br.J.Gen.Pract.* 2020 Jun 25;70(696):e489-e496.
14. Department of Health. *Health Service Capacity Review 2018 Executive Report: Review of Health Demand and Capacity Requirement in Ireland to 2031 – Findings and Recommendations.* London: PA Knowledge Limited; 2018. Available from: https://assets.gov.ie/10131/5bb5ff12463345bbac465aaf02a2333d.pdf [Accessed 25th August 2020]

15. Liu Y, Wang Z, Ren J, Tian Y, Zhou M, Zhou T, et al. A COVID-19 Risk Assessment Decision Support System for General Practitioners: Design and Development Study. *J.Med.Internet Res.* 2020 Jun 29;22(6):e19786.
16. Verhoeven V, Tsakitzidis G, Philips H, Van Royen P. Impact of the COVID-19 pandemic on the core functions of primary care: will the cure be worse than the disease? A qualitative interview study in Flemish GPs. *BMJ Open* 2020 Jun 17;10(6):e039674-2020-039674.
17. Kippen R, O'Sullivan B, Hickson H, Leach M, Wallace G. A national survey of COVID-19 challenges, responses and effects in Australian general practice. *Aust J Gen Pract.* 2020 Nov;49(11):745-751. doi: 10.31128/AJGP-06-20-5465.
18. CSO. *CSO Statistical Release: Population and Migration Estimates.* [Internet] Cork: Central Statistics Office; April 2019. Available from: https://www.cso.ie/en/releasesandpublications/er/pme/populationandmigrationestimateapril2019/ [Accessed 25th August 2020]
19. HSE. *Medical Workforce Planning: Future Demand for General Practitoners 2015-2025.* [Internet] Dublin: National Doctor Training and Planning, HR Directorate, Health Service Executive; September 2015. Available from: https://www.hse.ie/eng/staff/leadership-education-development/met/plan/gp-medical-workforce-planning-report-sept-2015.pdf [Accessed 25th August 2020]
20. O'Kelly M, Teljeur C, O'Kelly F, Ni Shulleabhain A, O'Dowd T. *Structure of General Practice in Ireland 1982 – 2015.* [Internet] Dublin: Trinity College Dublin/Irish College of General Practitioners; 2016. Available from: https://www.tcd.ie/medicine/public_health_primary_care/assets/pdf/structure-of-general-practice-2016.pdf [Accessed 28th August 2020]
21. Smith S, Walsh B, Wren M, Barron S, Morgenroth E, Eighan J, et al. *Geographic profile of healthcare needs and non-acute healthcare supply in Ireland.* ESRI Research Series: 90. [Internet] Dublin: The Economic and Social Research Institute; July 22 2019. Available from: https://www.esri.ie/system/files/publications/RS90_0.pdf [Accessed 28th August 2020]
22. The Health Foundation. *How might COVID-19 affected people's ability to see their GP? COVID-19 Chart Series.* [Internet] London: The Health Foundation; 1 May 2020. Available from: https://www.health.org.uk/news-and-comment/charts-and-infographics/how-might-covid-19-have-affected-peoples-ability-to-see-GP [Accessed 25th August 2020]
23. NHS. Letter to: Chief executives of all NHS trusts and foundation trusts; CCG Accountable Officers; GP practices and Primary Care Networks; Providers of community health services; NHS 111 providers. *IMPORTANT - FOR ACTION - SECOND PHASE OF NHS RESPONSE TO COVID19.* From the Chief Executive Sir Simon Stevens & Chief Operating Officer Amanda Pritchard. [Internet] London: NHS; 29 April 2020. Available from: https://www.england.nhs.uk/coronavirus/wp-content/uploads/sites/52/2020/04/second-phase-of-nhs-response-to-covid-19-letter-to-chief-execs-29-april-2020.pdf [Accessed 25th August 2020]
24. Munoz MA, Lopez-Grau M. Lessons learned from the approach to the COVID-19 pandemic in urban primary health care centres in Barcelona, Spain. *Eur.J.Gen.Pract.* 2020 Dec;26(1):106-107.
25. RCGP. *General practice in the post Covid world: Challenges and opportunities for general practice.* [Internet] London: Royal College of General Practitioners; 2020. Available from: https://www.rcgp.org.uk/-/media/Files/News/2020/general-practice-post-covid-rcgp.ashx?la=en [Accessed 25th August 2020]

26. Rubin R. COVID-19's Crushing Effects on Medical Practices, Some of Which Might Not Survive. *JAMA* 2020 Jun 18.
27. de Sutter A, Llor C, Maier M, Mallen C, Tatsioni A, van Weert H, et al. Family medicine in times of 'COVID-19': A generalists' voice. *Eur.J.Gen.Pract.* 2020 Dec;26(1):58-60.
28. Michalowsky B, Hoffmann W, Bohlken J, Kostev K. Effect of the COVID-19 Lockdown on Disease Recognition and Utilization of Healthcare Services in the Older Population in German: A Cross-sectional Study. Age and Ageing. 2020.
29. Marshall M, Howe A, Howsam G, Mulholland M, Leach J. COVID-19: a danger and an opportunity for the future of general practice. *Br.J.Gen.Pract.* 2020 May 28;70(695):270-271.
30. RACGP. *Implementation guidelines for video consultations in general practice: A telehealth initiative.* 3rd Edition. [Internet] East Melbourne Victoria: The Royal Australian College of General Practitioners; September 2012. Available from: https://www.racgp.org.au/download/Documents/Telehealth/videoconsultguidelinesv3.pdf [Accessed 25th August 2020]
31. HSE/Department of Health. *eHealth Strategy for Ireland.* [Internet] Dublin: Department of Health; 2013. Available from: https://www.gov.ie/en/publication/6b7909-ehealth-strategy-for-ireland/ [Accessed 25th August 2020]
32. Thiyagarajan A, Grant C, Griffiths F, Atherton H. Exploring patients' and clinicians' experiences of video consultations in primary care: a systematic scoping review. BJGP open. 2020;4(1).
33. Johnston S, MacDougall M, McKinstry B. The use of video consulting in general practice: semi-structured interviews examining acceptability to patients. BMJ Health & Care Informatics 2016;23:doi: 10.14236/jhi.v23i2.141
34. Gilligan P, Bennett A, Houlihan A, Padki A, Owen N, Morris D, et al. The Doctor Can See You Now: A Key Stakeholder Study Into The Acceptability Of Ambulance Based Telemedicine. *Ir.Med.J.* 2018 Jun 7;111(6):769.
35. Thornton J. Covid-19: how coronavirus will change the face of general practice forever. *BMJ* 2020 Mar 30;368:m1279.
36. HSE. *Coronavirus: Get urgent medical help for non-coronavirus symptoms.* [Internet] 5 June 2020. Available from: https://www2.hse.ie/conditions/coronavirus/get-urgent-medical-help-for-non-coronavirus-symptoms.html [Accessed 25th August 2020]

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	5
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*5*
Bias	9	Describe any efforts to address potential sources of bias	5
Study size	10	Explain how the study size was arrived at	4-6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	5
		(*b*) Describe any methods used to examine subgroups and interactions	5
		(*c*) Explain how missing data were addressed	5
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	5
		(*e*) Describe any sensitivity analyses	5

Continued on next page

Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5-6
		(b) Give reasons for non-participation at each stage	n/a
		(c) Consider use of a flow diagram	n/a
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	5-6
		(b) Indicate number of participants with missing data for each variable of interest	5-9
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	7
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	*4-8*
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	5-9
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	5-9
Discussion			
Key results	18	Summarise key results with reference to study objectives	10
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	10
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	10-11
Generalisability	21	Discuss the generalisability (external validity) of the study results	11-12
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

How COVID-19 has affected general practice consultations and income – General Practitioner cross-sectional population survey evidence from Ireland

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2020-044685.R2
Article Type:	Original research
Date Submitted by the Author:	08-Feb-2021
Complete List of Authors:	Homeniuk, Robyn; Irish College of General Practitioners, Research and Innovation Collins, Claire; Irish College of General Practitioners, Research
Primary Subject Heading:	General practice / Family practice
Secondary Subject Heading:	Health services research
Keywords:	Telemedicine < BIOTECHNOLOGY & BIOINFORMATICS, COVID-19, PRIMARY CARE

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

How COVID-19 has affected general practice consultations and income – General Practitioner cross-sectional population survey evidence from Ireland

Robyn Homeniuk[a] and Claire Collins[b]

a. Research Officer, Department of Research, Irish College of General Practitioners, 4-5 Lincoln Place, Dublin D2. Email: robyn.homeniuk@icgp.ie
b. Director of Research and Innovation, Department of Research, Irish College of General Practitioners, 4-5 Lincoln Place, Dublin D2. Email: claire.collins@icgp.ie

Abstract

Objectives

How general practice is delivered in many countries has drastically changed due to the COVID-19 pandemic. This study aimed to answer the question of how general practice has changed in Ireland in response to COVID-19.

Design

The Irish College of General Practitioners surveyed its membership before and after the global pandemic hit Ireland using a cross-sectional online survey instrument to capture consultation rates and mode of delivery.

Setting

This study focuses on primary care, specifically general practice, in Ireland.

Participants

526 general practices across Ireland submitted responses to the survey in February 2020 before the global pandemic; 538 general practices responded to the second survey during the pandemic in June 2020. This covers 32% and 33% of practices in Ireland, respectively.

Main outcome measures

The type of consultations by general practitioners and practice nurses in both surveys is the main outcome measure used in this study. Other changes such as the perceived change in attendance by certain patient groups and practice income are also reported.

Results

Face-to-face consultations decreased from a median of 26 IQR (21.3, 30) to a median of 8 (6, 13) during – a significant drop ($p<0.001$). Whilst GP telemedicine consultations increased ($p<0.001$) median of 2.4 IQR (0, 5.33) to a median of 11.33 IQR (6, 19). The majority of practices (80.0%) reported reduced practice profit. Respondents reported decline in non-COVID-19 related consultations among certain patient cohorts – 90.0% for children under six years old; 77.7% for patients over 70 years.

Conclusions

It is likely that the way general practice is delivered will not return to as before and that increased telemedicine can be expected. However, it is necessary to assess the impact of this shift on patient health and to assess healthcare provider and patient experience to ensure continued high-quality care and patient safety.

Strengths and Limitations

- **A key strength of this study is the large number of general practitioners who engaged with the surveys. It was possible to survey a third of all practices in Ireland at both time points.**
- **Due to the large number of responding practices, we were able to get data covering every county in Ireland in both the pre-COVID-19 and during COVID-19 surveys. The volume of responses makes our findings more generalizable.**

- **The timing of the survey was another key strength of the study, as we were able to capture clinical activity data before COVID-19 change and then rapidly collect information after the initial wave of the pandemic.**
- **One of the weaknesses of the study is that design used a self-selecting cross-sectional survey, which could have biased the responses in some cases. It was not possible to identify practices and match their responses from the first to the second survey for direct comparison nor was it possible to determine casual relationships.**
- **Another weakness was that we did not collect sociodemographic information, hence it was not possible to control for deprivation levels and other factors that may affect health care utilisation.**

Introduction

A cluster of 'atypical viral pneumonia' cases were diagnosed in Wuhan City, China in December 2019 [1]. By 9 January 2020, Chinese authorities found the cause of the outbreak was a novel coronavirus [2] – later named COVID-19. The WHO declared an international public health emergency [3] and by the end of February 2020, Ireland had its first case. National lockdown measures commenced in March 2020 and recommended that general practitioners (GPs) observe physical distancing, wear personal protective equipment (PPE), and use telephone triage and appointments to reduce face-to-face contact [4]. Epidemiologists globally have been monitoring the progression of this infection while governments have been developing and deploying emergency pandemic responses. The need to have global and national emergency management plans has been well-documented [3] since the outbreak of SARS in 2003. Previous outbreaks have proven that contagious diseases can put intense pressure on health systems, especially on general practice, as it is the frontline of the medical response [5]. GPs have expressed their past uncertainty about how to respond to a pandemic [5]. Indeed, in response to the H1N1 pandemic, primary care staff struggled with implementing new workflows [6]. In Ireland, comprehensive preparedness plans are in place for handling public health emergencies. These plans follow WHO [7] and ECDC [8] guidance and are coordinated by the National Public Health Emergency Team [9].

General practitioners in Ireland operate as private professionals charging patients not covered under the public system a fee per visit. The State pays GPs on a capitation basis for patients covered under the public system. Around 43% of Irish people qualify for free healthcare access either through the public system known as the General Medical Services (GMS) card (32.4%) or a GP-visit only card (10.4%); the remainder pay privately for GP visits [10]. GPs are critical to managing the increasing amount of chronic illnesses such as heart diseases, diabetes, and asthma – 80% of all visits to the GP are for chronic care management [11]. In 2015, the first step towards universal healthcare in Ireland was taken when children under 6 years old and adults over 70 years old became eligible for free GP care [11]. Patients in the latter group accounted for 25% of GP consultations and 31% of practice nurse visits in 2016 [12]. Before the start of this pandemic, general practitioners faced a heavy workload managing the majority of care needs [11], completing more than 25 consultations daily, and additional time spent on administration led to GPs working nearly 10 hours in a day [13]. The need to move more care into the community is the central point of the current healthcare strategy in Ireland [14]. Another key point in the reform strategy is to achieve universal healthcare by expanding current entitlements and moving to a preventative care model [11].

With the onset of COVID-19, the face of general practice in Ireland, as in many countries, drastically changed, with developing clinical models [15] and new consultation strategies having an impact on primary care [16]. GPs quickly noticed a decrease in the number of appointments scheduled by patients, while practice costs increased and income decreased [17]. Continuity of routine care might be at risk because of the pandemic, and the general health of the population is a key concern for primary care [16]. This paper reports on the changes experienced, particularly those in consultation delivery methods, in Irish general practice during the COVID-19 pandemic. At the beginning of February 2020, the ICGP surveyed its membership before the global pandemic reached Irish shores. In June 2020, the ICGP again surveyed its membership regarding the impact of COVID-19 on general practice.

Methods

In early 2020, the Irish College of General Practitioners (ICGP) – the professional body for GPs in Ireland - designed an online survey to capture practice activities, stressors, and demographic details regarding general practices in Ireland. The survey was developed in order to measure general practice activity, as this information is not yet routinely collected in Ireland. It was the intention to periodically repeat the survey with ICGP members to build a dataset to enable better resource planning in primary care; however, because of the COVID-19 pandemic, a decision was taken to adjust the survey accordingly.

It was distributed to 3,378 members both before (February 2020) and during (June 2020) the coronavirus pandemic. It was not sent to trainees, retired GPs, or Irish GPs working abroad. The second survey was updated to include additional questions and response categories that specifically related to the pandemic. Before each survey was sent out, eight GPs piloted the survey. A population survey approach was taken; therefore, no additional sampling techniques were used. The survey sample was self-selecting, with the survey open for a two-week period to ensure a significant number of responses were received.

The questionnaire was developed specifically for use in the survey. The questionnaire before the pandemic had 14 items, which covered the number of GPs and practice nurses, consultation activity and hours worked stressors and practice demographic information. The questionnaire conducted during the pandemic had 25 items, as it gained new items pertaining to changes introduced because of COVID-19. The surveys have been included as supplemental materials 1 and 2 respectively. Questions regarding stress, hours worked, appointment availability and pandemic response were included to obtain a better understanding of the state of general practice.

There were no eligibility criteria to complete the survey. Only one survey for each practice was requested in order to obtain cross-sectional data from Irish general practice. Ethical approval from the ICGP Research Ethics Committee for both surveys was obtained and consent from practices for participation and data processing was confirmed at the start of each survey. The online survey was fully anonymous and no IP addresses were collected.

All data is based on survey responses. Consultation rates include face-to-face consultations, telephone and video consultations (referred to as telemedicine), home visits and visits to nursing homes reported by practices who responded to the survey. Data was returned regarding the most recent working day. Out of hours services in Ireland are provided and recorded separately and hence are not included in these figures. The definitions for city, town and village are based on Central Statistics Office [18] definitions - rural is an area where less than 1,500 people live, a town has a population between 1,500 and 49,999, and cities have a population 50,000 or more.

We conducted the analysis using SPSS V25 software, using descriptive analysis. For numerical data, means were used for comparisons and to conduct statistical tests as appropriate. A p-value of <0.05 was used to indicate statistical significance. Mann-Whitney U tests were used to compare the mean number of consultations per GP per day and Chi-square tests were used for categorical variables.

Results

Survey Population

There were 526 responses to the pre-COVID-19 survey- 32% of all 1,635 practices in Ireland [19]. Five hundred twenty-three practices responded to item 4, stating that 1,504.5 full time equivalent (FTE) GPs employed at these practices. In response to item 3, 526 practices reported a total of 1,253.9 FTE GPs (82.8%) on duty on the day on which consultation data is based. In this sample, approximately

one fifth (19.4%) of the practices had 1.0 FTE GP or less employed - these are considered single-handed practices. The average number of FTE GPs at group practices was 3.3. At least one part-time practice nurse was employed at 483 practices (93.8% of 515 practices who responded to this question) of practices. A total of 629.5 FTE practice nurses were employed by these practices. On the day of data collection 535.8 FTE practice nurses (n=514, 447 practices with a nurse working) were working, with an average of 1.0 FTE per practice. On average, practices employed 1.2 FTE practice nurses – although 161 practices employed between 0.20 and 0.90 FTE practice nurses.

Item 12 asked where practices were located. City practices comprised 37.5% (197) of the total, with 43.9% (231) of practices located in towns and 18.6% (98) in villages. There was at least one practice recorded in every county of Ireland.

In the survey issued during the COVID-19 response, 783 practices responded; however, 240 participants only answered the first four items and five respondents did not consent for their responses to be used – ergo 538 valid responses were received. Hence, 32.9% of all practices in Ireland were represented in the during COVID-19 survey.

Item 4 asked for the total number of FTE GPs and practices nurse; 537 practices had a total of 1276.5 FTE GPs and 526 practices reported a total of 607.2 FTE nurses. Just 56 practices had no practice nurse employed, and 12 did not respond to this question. Item 20 asked for the number of FTE GPs and practice nurses working on the day where consultation numbers were recorded; 534 practices reported that 1104.9 FTE GPs were working with an average of 2.1 FTE GPs at working each practice (SE 0.06). 513 practices reported 509.0 FTE practice nurses were available, with an average of 1.0 working per practice.

There were slightly more single-handed practices in this sample at just over a quarter (29.0%). Group practices employed an average of 2.9 FTE GPs (SE 0.08).

Item 2 asked where practices were located; a total of 537 practices responded to this question. City practices comprised 34.4 % (185) of the total, with 46.0% (247) of practices located in towns and 19.5% (105) in villages and at least one practice responding in every county. Practice characteristics from both surveys are shown in Table 1.

Table 1: Practice Characteristics

	Pre-COVID-19	During COVID-19
Total Number of practices	526	538
Number of Single-Handed Practices	101 (19.4%)	156 (29.0%)
Number of Group Practices	422 (80.2%)	382 (71.0%)
Number of FTE GPs Overall	1504.5 (n=523)	1276.5 (n=537)
Mean GPs overall	2.9 (SE 0.1)	2.4 (0.07)
Number of FTE GPs on the Day	1253.9 (n=526)	1104.9 (n=534)
Mean GPs on day	2.40 (SE 0.06)	2.1 SE(0.06)
Practices with at least a part-time PN	483 93.8% (n=515)	463 88.0%(n=526)
Number of FTE PNs Overall	629.5 (n=515)	607.2 (n=526)

Mean PNs overall	1.2 (SE 0.05)	1.2 (SE 0.05)
Number of FTE PNs on the day	534.3 (n=515)	509.0 (n=513)
Mean PNs on day	1.0 (SE 0.03)	1.0 (SE 0.05)
Practices located in a city	197 (37.6%)	185 (34.4%)
Practices located in a town	231 (43.9%)	247 (46.0%)
Practices Located in a village	98 (18.6%)	105 (19.5%)

In both cases, practices received the questionnaire via email and an additional reminder email. The number of practices that provided valid responses, defined as providing information for overall and on the day data, was comparable. By using Mann-Whitney U test it was possible to derive relationships between the mean consultations per clinician per day. There were an additional twelve responses received for the during COVID-19 survey. The geographic spread of the practices was similar, though there was a small increase in single-handed practices responding; however, this did not have a significant impact when comparing consultation methods.

In the pre-COVID-19 survey, the proportion of missing responses ranged from 0.6% to 10.5%, the questions that had more missing responses were the number of consultations completed by practice nurses, with 6.8% and 10.5% of practices skipping these questions.

Of the completed surveys the proportion of missing answers ranged from 1.1% to 56.7% in the during COVID-19 survey. The questions that had missing answers were the financial questions, items 8 to 11, with a range of 4.5% to 56.7% practices not answering these questions.

Consultations

In the survey pre-COVID-19, items 5, 7, and 8 asked the number of consultations GPs and practice nurses completed in person, using telemedicine, and in visits to homes and nursing homes. Overall, 36,821 GP consultations were recorded by 523 practices. 87.3% of appointments occurred face-to-face, 10.5% were telemedicine and the remainder were visits to homes and nursing homes.

During COVID-19, items 21, 22, 23, and 24 asked practices to report the number of GP and practice nurse consultations completed in person, using telemedicine, and in visits to homes and nursing homes. The main mode of consultation changed significantly. This time, 530 practices reported 25,596 consultations. Over half of the GP consultations occurred via telemedicine (57.0%) and 41.0% occurred face-to-face with the remaining visits to homes or nursing homes. Table 2 shows the proportion of consultations by each consultation method for GPs and practice nurses at each time point.

Table 2: Summary of Consultations

Consultation Method	Pre COVID-19 Consultations	During COVID-19 Consultations
GP Face-to-Face	Total: 32,160 Proportion: 87.3% Respondents: n=523	Total: 10,484 Proportion:41.0% Respondents: n=530
GP Telemedicine (including video, telephone and other remote)	Total: 3895 Proportion:10.5% Respondents: n=508	Total: 14,588 Proportion: 57.0% Respondents: n=523
GP home visits	Total: 483	Total: 299

	Proportion:1.3% Respondents: n=510	Proportion: 1.2% Respondents: n=517
GP nursing home visits	Total: 322 Proportion: 0.9% Respondents: n=496	Total: 225 Proportion: 0.9% Respondents: n=503
PN Face-to-Face	Total: 11,417 Proportion: 82.4% Respondents: n=490	Total: 5908 Proportion: 67.6% Respondents: 489
PN Telemedicine (including video, telephone and other remote)	Total: 2436 Proportion: 17.6% Respondents: n=471	Total: 2828 Proportion: 32.4% Respondents: 469

Face-to-face appointments decreased from 87.3% to 41.0% of all GP consultations and consultations by telemedicine increased from 10.5% to 57.0% of reported consultations. Before the start of the pandemic, 12.5% of all consultations (by GPs and practice nurses) were conducted via telemedicine compared to 51.0% after the pandemic began.

Pre-COVID-19, 490 practices reported that practice nurses completed 13,853 consultations. Just under a fifth, 17.6% (n=471), of practice nurse consultations were via telemedicine and 82.4% (n=490) were face-to-face. During the pandemic, 489 practices reported 8736 practice nurse consultations. The consultations via telemedicine made up 32.4% (n=469), with the remainder conducted face to face (67.6%; n=489).

Before the pandemic began, practice nurses had a higher proportion of telemedicine appointments than GPs – 17.6% of practice nurse appointments in February 2020 compared to only 10.5% of GP appointments. During COVID-19, 57.0% of GP appointments occurred via telemedicine compared to 32.4% of practice nurse appointments. The differences of the mean consultations per GP or nurse pre COVID-19 and during were all significantly different. For GPs, face-to-face consultations went from a median of 26 IQR (21.3, 30) to a median of 8 (6, 13) during – a significant drop ($p<0.001$). Similarly, telemedicine GP consultations went from a median of 2.4 IQR (0, 5.33) to a median of 11.33 IQR (6, 19) i.e. they went up ($p<0.001$). Furthermore, the differences pre and during were all highly significant $p<0.001$, GP visits to homes home went down, as did nurses home visits, practice nurse face to face consultations went down and practice nurse telemedicine went up.

Item 25 of the survey taken during the pandemic response asked if practices had noticed a decline in certain high traffic patient groups. Overall, there was a reported decline in non-COVID-19 related consultations. Five hundred twenty-six practices answered this question, the question was in tick-box format and practices could select any number of the options. Almost all practices – 484 practices – noticed a decline for children under six years old and 418 saw a decline for patients over 70 years (two patient groups with free GP care). Table 3 shows the decline in non-COVID-19 related consultations from each of these patient groups at group and single-handed practices.

Table 3: Decline in non-COVID-19 consultations by key patient groups and practice type.

	Number of Practices	Percent of Practices (n=538)
Children under 6 years old	Total: 484	90.0%

Adults over 70	Total: 418	77.7%
People with chronic conditions	Total: 399	74.2%
People with mental health concerns	Total: 297	55.2%

Practice income impact

In response to item 7, which asked practices whether there had been a change in profitability since the pandemic started, 80.0%, (n=536) reported a decrease in profitability. This was reported by 124 single-handed practices and 305 group practices. These practices estimated they would have a 35.1% decrease in profitability on average. However, in item 8, only 47.9% (257) practices said they had completed a formal assessment of same.

More group practices completed formal account reviews assessing the change in practice income and profit - 210 (55.0%) group practices had done this compared to just 47 (30.1%) single-handed practices. Single-handed practices estimated an average loss of 41.5%, compared to the average estimate of 32.6% for group practices. The lower number of formal assessments by single-handed practices could explain part of this difference, through overestimates by GPs when completing the survey.

Item 10 asked practices, which, if any, assistance measures to help the business manage the financial impact of COVID-19, had been put in place. Three hundred eight (57.9%) practices implemented one or more of the changes listed to accommodate for any lost profit. The most popular cost saving measure used was asking staff to take their annual leave early, with 27.1% of practices implementing this measure.

There were no significant relationships between practice size and implementing the listed measures.

Item 11 asked practices to select staff groups that had been affected by reduced hours, salary, or redundancy. Two hundred thirty three practices (43.3%) indicated they had staff that were affected. The most affected staff has been receptionists with 103 (19.1%) practices selecting this option. Following that, 83 practices (15.4%) said practices nurses had been affected. A further 83 practices stated salaried GPs were affected. Forty-six GPs left comments as well, most highlighting that they had been the one to reduce their personal salary for the sake of keeping their staff. Table 4 shows the proportion of practices that used the following methods to recover income during the pandemic.

Table 4: Measures introduced to help the business manage the financial effects of COVID-19

Answer Choices	Single-Handed Practices (n=156)	Group Practices (n=382)
Have informed staff to take annual leave early	Total: 22 Proportion: 14.1%	Total: 124 Proportion: 32.4%
Have asked staff to reduce their hours and work them back up later in the year	Total: 12 Proportion: 7.7%	Total: 56 Proportion: 14.7%

Have formally reduced staff hours and payment until profitability improves	Total: 16 Proportion: 10.3%	Total: 76 Proportion:19.9%
Have made staff redundant	Total: 15 Proportion: 9.6%	Total: 37 Proportion: 9.7%
Have applied for the employer wage subsidy scheme	Total: 15 Proportion:9.6%	Total: 63 Proportion: 16.5%

Discussion

Principal Findings

A shift to telemedicine was observed from 10.5% of all GP consultations and 17.6% of practice nurse consultations pre-COVID-19 to 57.0% and 32.4% respectively during the COVID-19 response.

More than half of practices saw decreases in non-COVID-19 related consultations from vulnerable patient groups. Particularly, non-COVID-19 related visits from patients under 6 and over 70 – who receive free GP care – decreased despite usually being frequent users of health services.

Finally, practices' finances have been impacted, with 80.0% reporting reduced profit. Moreover, two-fifths of practices had staff affected by redundancy, reduced hours or reduced salary as a measure to offset the financial impact of the pandemic.

Strengths and weaknesses of the study

Our surveys are based on a self-selecting sample, which comes with inherent bias. The responding samples are different and we cannot do a direct practice-based comparison; however, key comparisons indicated that the samples were comparable. As the study design used a cross-sectional survey approach, a key limitation was the inability to determine causal relationships between the surveys. Due to the changing atmosphere caused by COVID-19, the survey questions were updated and the second iteration was longer – this difference may have caused bias when answering questions. Furthermore, we did not collect information that would allow for meaningful geographical analyses, and therefore could not account for regional and socioeconomic differences, which could affect consultation methods. Data is based on reported data and not from data extracted from general practice systems and hence may lead to under- or over-reporting. The survey was completed by one GP per practice, which could have reduced the accuracy of practice nurse consultation figures. Additionally, we did not collect patient population information so adjustment for disability could not be completed or compared nationally. Finally, the results assume that the national picture corresponds with that of this sample of GP practices.

However, a strength of these surveys is the number of practices and FTE GPs represented. In the pre-COVID-19 survey, there were 1,504.5 FTE GPs represented, employed by the 526 responding practices. In the post-COVID-19 survey, 1276.5 (n=537) FTE GPs from the 538 responding practices were represented. This means an estimated 32% and 33% respectively of all practices in Ireland were captured in each survey. While this is a good proportion, it is not a majority; therefore, the proportion of each consultation method is an estimate and should be considered as such in a national context.

Another strength is that the representation of both single-handed and group practices was similar to national figures [20] making the response more generalizable. And, while detailed geographical information was not collected, both samples included at least one practice in all parts of the country with more in cities such as Dublin and Cork, which is consistent with the geographical spread of practices previously reported [21].

Interpretation in terms of international literature/Strengths and weaknesses compared to other literature

Since the beginning of the COVID-19 pandemic, there have been many changes rapidly implemented in healthcare across the world and they are having an impact on clinicians [16, 17]. Our study showed a decrease in GP appointments and overall in general practice (GPs and practice nurses). This is similar to reports in the UK [22], where the NHS has noticed a 30% decrease in the number of GP appointments compared to the same time in 2019.

Our study showed a substantial shift from 12.5% to 51.0% of GP and practice nurse consultations in Ireland delivered via telemedicine. The UK reports are varied; however, they show a similar shift to telemedicine consultations. With an overall 30% drop in all consultations, GPs reported consultations changing from 90-95% face-to-face to 85% remote [22, 23]. The current UK estimates are higher than ours are; however, their telemedicine rate pre-COVID-19 was also higher [22]. Spain also reports an increase in the use of virtual consultations, at 68.3% during the pandemic [24]. The proportion of face-to-face GP consultations decreased from 87.3% to 41.0% in our study, showing a similar reduction to England where proportions changed from 70% to 23% [25].

The majority (80.2%) of our practices reported reduced practice profit, and this has been seen elsewhere with GPs in the United States of America turning to crowdfunding to help their practices, and GPs in Belgium and Australia also feeling the effects of changing remuneration during COVID-19 [16, 17, 26].

Similar studies comparing the impact of COVID-19 on practice consultations are rare. Much of the literature to date on delivery type changes are based on commentaries and not actual measurements [24, 27]. However, there are a handful of recent publications about the use of healthcare during the pandemic. A recent German study with 1,095 GPs and patients aged 65 or older found that there was a 14% decrease in consultations in May 2020 compared to the same time in 2019, and the rate of diabetes, dementia, depression, cancer and stroke diagnoses decreased during lockdown (between -17% and -26%) [28]. In a survey of Australian GPs, 73% of practices had a reduction in bookings and 77% had a decrease in practice income; meanwhile, telephone calls (93%) and practice costs (81%) increased [17]. These results support our survey's findings that these challenges have also been experienced by GPs in Ireland. A key strength of this paper is that it adds to the knowledge base in terms of the potential impact of the COVID-19 pandemic on general practice in the current void of such literature.

Implications for practice

GPs are motivated by altruism to work during pandemics despite the high personal risk, and they are enthusiastic about further training and information [5]. However, despite preparedness planning, implementing pandemic policies faces multiple obstacles [5]. GPs are facing rapidly changing patient flows, clinical algorithms, new care pathways, and the need for new ways of delivering high-quality care [16, 17, 24, 27, 28, 29]. Irish GPs have implemented many changes during the COVID-19 pandemic. The RACGP recommends 'a planned and coordinated approach' when implementing a

telehealth service [30]; however, due to the urgent nature of the current situation, this has not been possible. Maintaining the quality of healthcare is important in sustaining a healthy workforce, which is essential to support a healthy economy during and after the pandemic.

Ireland, like many other countries, has taken massive steps towards the regular use of remote consultations, seemingly overnight, with previous trepidation regarding continuity of care and safety falling away out of necessity [16, 29]. The rapid national adoption of telemedicine consultations as well as electronic prescribing has presented opportunity; however, GPs are concerned that without as much face-to-face contact, critical non-verbal communication is missing from consultations and in some cases, telephone consults are insufficient to address patient concerns [16].

Ireland has two health strategies promoting the use of technology to enable patient-centred care nationally. Sláintecare, the current healthcare strategy in Ireland, aims to establish a national health fund that will help deliver universal healthcare and introduce comprehensive eHealth infrastructure [11]. This strategy supported the 2013 eHealth strategy, which had an objective of more affordable and more personalised care for all by capitalising on technology [31]. During the pandemic, practices across the country have swiftly transitioned to using technology such as a secure email facility between health care providers (Healthmail), e-prescribing, and telemedicine (video and telephone) consultations. Before the COVID-19 pandemic began, clinicians in primary care had used telemedicine interventions [29], but it was not the main form of care. Changes adopted during this pandemic accelerated the digitalisation of healthcare [29]. This could lead the way to lasting adoption of technology such as e-prescribing and telephone and video consultations after the pandemic.

Telemedicine has been viewed as a way to lower costs and see more patients [32, 33, 34] but was rare in Irish general practice up to now, and here, as elsewhere, there was some resistance and concern [16]. However, the current COVID-19 pandemic has resulted in telemedicine consultations being recommended for all GPs [4]. Patients, like health care workers, have adapted to telemedicine consultations being the standard method of consultation; previous studies found that patients found video consultations acceptable [32] but age (over 60) and computer proficiency were found to negatively impact a patient's view of acceptability [33, 34]. Telemedicine has been invaluable during the outbreak of COVID-19, as it has enabled routine care to continue to some degree; however, patients who are digitally disadvantaged are often from populations already experiencing greater health risks - such as older people and those in lower socioeconomic classes [32, 34]. Going forward, special attention must be given to reducing health inequalities exacerbated by recent changes in care.

Furthermore, a noted decrease in consultations for non-COVID related symptoms has been observed in our survey. Patients who are most vulnerable, such as people over 65, have also been avoiding seeking care in other countries [16, 26, 28]. This could have serious impacts on health outcomes and patient safety with calls on patients not to self-diagnose or delay seeking treatment [16, 26, 28]. Patients are also changing the way they use health services, with more emphasis on self-care [16, 24, 28]. However, not all patients will have the same capacity for caring for their health without the level of support a GP or practice nurse can provide with face-to-face consultations. More research on patient and physician satisfaction and whether health outcomes are impacted by consultation types is needed to develop guidelines and policies on how frequently remote consultations can be used. Patient feedback will be invaluable for maintaining lasting benefits.

The COVID-19 pandemic has the potential to change general practice forever, and this does not only apply in Ireland but has been noted elsewhere [15, 16, 17, 22, 24, 28]. The adoption of 'total triage' systems has been seen during this pandemic whereby GPs can decide the mode of follow-up consultation, whether that is face-to-face, video call or telephone. As we look to a post-COVID landscape, there is a case for general practice retaining this to allow more flexibility in how consultations are delivered according to the needs and preferences of patients. However, telephone triage does not reduce GP workload, so we need to evaluate the impacts on workload and patient-centred care [16, 32, 33, 34]. While it is unlikely that we will maintain this level of telemedicine consultations, it is expected that how general practice functions will not return to as it was before [29, 35].

However, we should not lose sight of the relationship between the GP and patient and the importance of good communication and trust [16, 26, 27, 29, 32, 33]. Telemedicine does not work for all patients or health problems, and there is a need to establish what works best for different patients [16, 27, 32, 33, 34]. We need to evaluate the impact on patient experience, health inequalities and patient-centred care [33, 36].

Since the beginning of June 2020, renewed efforts have been made to reassure and encourage the public to continue seeking medical advice from their GPs by making an appointment [36].

Unanswered questions and future research

How general practice is delivered will not return to as before; increased telemedicine is likely. It is necessary to assess the impact of this shift on patient health and to assess healthcare provider and patient experience to ensure continued high-quality care and patient safety. Furthermore, we need to understand the impact of changing work requirements and evolving consultation techniques on general practice workload and practice income and viability.

DECLARATIONS

Abbreviations

ECDC – European Centre for Disease Prevention and Control

ESRI – Economic and Social Research Institute

FTE – Full time equivalent

GP - General Practitioner

HSE - Health Service Executive

ICGP - Irish College of General Practitioners

NHS – National Health Service (UK)

PN - Practice Nurse

PPE – Personal protective equipment

RACGP – Royal Australian College of General Practitioners

WHO - World Health Organisation

Competing interests

All authors have completed the *Unified Competing Interest form* (available on request from the corresponding author) and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years, no other relationships or activities that could appear to have influenced the submitted work.

Ethics approval and consent to participate

Ethical approval was obtained for the study from the Irish College of General Practitioners Research Ethics Committee.

Public and patient involvement

Patents and members of the public were not involved in this research because it was not relevant to the study questions. The study focused on changes experienced by general practitioners. General practitioners were involved in the study design as members of the ICGP Board who approved and oversaw the project.

Consent for publication

Not applicable.

Availability of data and materials

The data is available on reasonable request to the corresponding author.

Funding

The project was in part supported via a Quality Improvement Grant from Pfizer under its Global Medical Grants (reference #6216072). The funder had no role in project design, data collection, analysis, interpretation or reporting

Authors' contributions

CC was the project principal investigator. She conceived the project idea, designed the questionnaire, undertook the data collection, supervised the data analysis and contributed to the paper.

RH was the project research assistant. She analysed the data, undertook the analysis and contributed to the paper.

Both authors have read and approved the final paper.

Name of guarantor: Claire Collins.

Transparency declaration

The authors affirm that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

Acknowledgements
The authors wish to acknowledge the valuable contribution and time given by all participants. Dr. Jean Saunders', affiliated with CSCS Ireland, statistical advice on the paper is noted and appreciated.

References

1. WHO Newsroom. *Timeline of WHO's response to COVID-19.* [Internet] Geneva: World Health Organisation; 29 June 2020 [updated 30 July 2020]. Available from: https://www.who.int/china/news/detail/09-01-2020-who-statement-regarding-cluster-of-pneumonia-cases-in-wuhan-china [Accessed 24th August 2020]
2. WHO. *WHO Statement regarding cluster of pneumonia cases in Wuhan, China.* [Internet] Geneva: World Health Organisation; 9 January 2020. Available from: https://www.who.int/china/news/detail/09-01-2020-who-statement-regarding-cluster-of-pneumonia-cases-in-wuhan-china [Accessed 24th August 2020]
3. WHO. *WHO Director-General's statement on IHR Emergency Committee on Novel Coronavirus (2019-nCoV).* [Internet] Geneva: World Health Organisation; 30 January 2020. Available from: https://www.who.int/dg/speeches/detail/who-director-general-s-statement-on-ihr-emergency-committee-on-novel-coronavirus-(2019-ncov) [Accessed 24th August 2020]
4. HSE/HPSC. *Guiding principles for Infection Prevention and Control when returning to routine General Practice during pandemic v2.1.* [Internet] Dublin: Health Protection Surveillance Centre; 10 July 2020. Available from: https://www.hpsc.ie/a-z/respiratory/coronavirus/novelcoronavirus/guidance/primarycareguidance/adviceriskassessmentandmanagementofpatients/Guiding%20principles%20IPC%20GP.pdf [Accessed 24th August 2020]
5. Patel MS, Phillips CB, Pearce C, Kljakovic M, Dugdale P, Glasgow N. General practice and pandemic influenza: a framework for planning and comparison of plans in five countries. *PLoS One* 2008 May 28;3(5):e2269.
6. Kunin M, Engelhard D, Thomas S, Ashworth M, Piterman L. Challenges of the Pandemic Response in Primary Care during Pre-Vaccination Period: A Qualitative Study. *Isr.J.Health.Policy.Res.* 2015 Oct 15;4:32-015-0028-5. eCollection 2015.
7. WHO. *2019 Novel Coronavirus (2019-nCoV): Strategic Preparedness and Response Plan.* [Internet] Geneva: World Health Organisation; 2020 [Draft as of 3 February 2020]. Available from: https://www.who.int/docs/default-source/coronaviruse/srp-04022020.pdf?ua=1 [Accessed 24th August 2020]
8. European Centre for Disease Prevention and Control. *Infection prevention and control for COVID-19 in healthcare settings – Fourth update.* [Internet] 3 July 2020. ECDC: Stockholm; 2020. Available from: https://www.ecdc.europa.eu/en/publications-data/infection-prevention-and-control-and-preparedness-covid-19-healthcare-settings [Accessed 25th August 2020]
9. NPHET. *National Public Health Emergency Team (NPHET) COVID-19 Subgroup : Guidance and Evidence Synthesis.* [Internet] Dublin: Department of Health; 6 May 2020 [Last

updated 4 August 2020]. Available from: https://www.gov.ie/en/collection/07d750-nphet-covid-19-subgroup-guidance-and-evidence-synthesis/ [Accessed 25th August 2020]

10. HSE. *Primary Care Reimbursement Service Statistical Analysis of Claims and Payments 2019.* [Internet] Dublin: Health Care Executive Primary Reimbursement Service; 2020. Available from: https://www.hse.ie/eng/staff/pcrs/pcrs-publications/annual-report-2019.pdf [Accessed 25th August 2020]
11. Committee on the Future of Healthcare. *Sláintecare Report.* [Internet] Dublin: Houses of the Oireachtas; May 2017. Available from: https://www.gov.ie/pdf/?file=https://assets.gov.ie/165/270718095030-1134389-Slaintecare-Report-May-2017.pdf#page=1 [Accessed 25th August 2020]
12. Department of Health. *Sláintecare Action Plan 2019.* [Internet] Dublin: Department of Health; 2019. Available from: https://assets.gov.ie/22606/4e13c790cf31463491c2e878212e3c29.pdf [Accessed 28th August 2020]
13. Crosbie B, O'Callaghan ME, O'Flanagan S, Brennan D, Keane G, Behan W. A real-time measurement of general practice workload in the Republic of Ireland: a prospective study. *Br.J.Gen.Pract.* 2020 Jun 25;70(696):e489-e496.
14. Department of Health. *Health Service Capacity Review 2018 Executive Report: Review of Health Demand and Capacity Requirement in Ireland to 2031 – Findings and Recommendations.* London: PA Knowledge Limited; 2018. Available from: https://assets.gov.ie/10131/5bb5ff12463345bbac465aaf02a2333d.pdf [Accessed 25th August 2020]
15. Liu Y, Wang Z, Ren J, Tian Y, Zhou M, Zhou T, et al. A COVID-19 Risk Assessment Decision Support System for General Practitioners: Design and Development Study. *J.Med.Internet Res.* 2020 Jun 29;22(6):e19786.
16. Verhoeven V, Tsakitzidis G, Philips H, Van Royen P. Impact of the COVID-19 pandemic on the core functions of primary care: will the cure be worse than the disease? A qualitative interview study in Flemish GPs. *BMJ Open* 2020 Jun 17;10(6):e039674-2020-039674.
17. Kippen R, O'Sullivan B, Hickson H, Leach M, Wallace G. A national survey of COVID-19 challenges, responses and effects in Australian general practice. *Aust J Gen Pract.* 2020 Nov;49(11):745-751. doi: 10.31128/AJGP-06-20-5465.
18. CSO. *CSO Statistical Release: Population and Migration Estimates.* [Internet] Cork: Central Statistics Office; April 2019. Available from: https://www.cso.ie/en/releasesandpublications/er/pme/populationandmigrationestimateapril2019/ [Accessed 25th August 2020]
19. HSE. *Medical Workforce Planning: Future Demand for General Practitoners 2015-2025.* [Internet] Dublin: National Doctor Training and Planning, HR Directorate, Health Service Executive; September 2015. Available from: https://www.hse.ie/eng/staff/leadership-education-development/met/plan/gp-medical-workforce-planning-report-sept-2015.pdf [Accessed 25th August 2020]
20. O'Kelly M, Teljeur C, O'Kelly F, Ni Shulleabhain A, O'Dowd T. *Structure of General Practice in Ireland 1982 – 2015.* [Internet] Dublin: Trinity College Dublin/Irish College of General Practitioners; 2016. Available from: https://www.tcd.ie/medicine/public_health_primary_care/assets/pdf/structure-of-general-practice-2016.pdf [Accessed 28th August 2020]
21. Smith S, Walsh B, Wren M, Barron S, Morgenroth E, Eighan J, et al. *Geographic profile of healthcare needs and non-acute healthcare supply in Ireland.* ESRI Research Series: 90.

[Internet] Dublin: The Economic and Social Research Institute; July 22 2019. Available from: https://www.esri.ie/system/files/publications/RS90_0.pdf [Accessed 28th August 2020]

22. The Health Foundation. *How might COVID-19 affected people's ability to see their GP? COVID-19 Chart Series.* [Internet] London: The Health Foundation; 1 May 2020. Available from: https://www.health.org.uk/news-and-comment/charts-and-infographics/how-might-covid-19-have-affected-peoples-ability-to-see-GP [Accessed 25th August 2020]
23. NHS. Letter to: Chief executives of all NHS trusts and foundation trusts; CCG Accountable Officers; GP practices and Primary Care Networks; Providers of community health services; NHS 111 providers. *IMPORTANT - FOR ACTION - SECOND PHASE OF NHS RESPONSE TO COVID19.* From the Chief Executive Sir Simon Stevens & Chief Operating Officer Amanda Pritchard. [Internet] London: NHS; 29 April 2020. Available from: https://www.england.nhs.uk/coronavirus/wp-content/uploads/sites/52/2020/04/second-phase-of-nhs-response-to-covid-19-letter-to-chief-execs-29-april-2020.pdf [Accessed 25th August 2020]
24. Munoz MA, Lopez-Grau M. Lessons learned from the approach to the COVID-19 pandemic in urban primary health care centres in Barcelona, Spain. *Eur.J.Gen.Pract.* 2020 Dec;26(1):106-107.
25. RCGP. *General practice in the post Covid world: Challenges and opportunities for general practice.* [Internet] London: Royal College of General Practitioners; 2020. Available from: https://www.rcgp.org.uk/-/media/Files/News/2020/general-practice-post-covid-rcgp.ashx?la=en [Accessed 25th August 2020]
26. Rubin R. COVID-19's Crushing Effects on Medical Practices, Some of Which Might Not Survive. *JAMA* 2020 Jun 18.
27. de Sutter A, Llor C, Maier M, Mallen C, Tatsioni A, van Weert H, et al. Family medicine in times of 'COVID-19': A generalists' voice. *Eur.J.Gen.Pract.* 2020 Dec;26(1):58-60.
28. Michalowsky B, Hoffmann W, Bohlken J, Kostev K. Effect of the COVID-19 Lockdown on Disease Recognition and Utilization of Healthcare Services in the Older Population in German: A Cross-sectional Study. Age and Ageing. 2020.
29. Marshall M, Howe A, Howsam G, Mulholland M, Leach J. COVID-19: a danger and an opportunity for the future of general practice. *Br.J.Gen.Pract.* 2020 May 28;70(695):270-271.
30. RACGP. *Implementation guidelines for video consultations in general practice: A telehealth initiative.* 3rd Edition. [Internet] East Melbourne Victoria: The Royal Australian College of General Practitioners; September 2012. Available from: https://www.racgp.org.au/download/Documents/Telehealth/videoconsultguidelinesv3.pdf [Accessed 25th August 2020]
31. HSE/Department of Health. *eHealth Strategy for Ireland.* [Internet] Dublin: Department of Health; 2013. Available from: https://www.gov.ie/en/publication/6b7909-ehealth-strategy-for-ireland/ [Accessed 25th August 2020]
32. Thiyagarajan A, Grant C, Griffiths F, Atherton H. Exploring patients' and clinicians' experiences of video consultations in primary care: a systematic scoping review. BJGP open. 2020;4(1).
33. Johnston S, MacDougall M, McKinstry B. The use of video consulting in general practice: semi-structured interviews examining acceptability to patients. BMJ Health & Care Informatics 2016;23:doi: 10.14236/jhi.v23i2.141

34. Gilligan P, Bennett A, Houlihan A, Padki A, Owen N, Morris D, et al. The Doctor Can See You Now: A Key Stakeholder Study Into The Acceptability Of Ambulance Based Telemedicine. *Ir.Med.J.* 2018 Jun 7;111(6):769.
35. Thornton J. Covid-19: how coronavirus will change the face of general practice forever. *BMJ* 2020 Mar 30;368:m1279.
36. HSE. *Coronavirus: Get urgent medical help for non-coronavirus symptoms.* [Internet] 5 June 2020. Available from: https://www2.hse.ie/conditions/coronavirus/get-urgent-medical-help-for-non-coronavirus-symptoms.html [Accessed 25th August 2020]

Practice Activity January 2020

Practice Activity

There has been a lot of media discussion regarding general practice and the ICGP would be grateful for your assistance in providing strong evidence so that we can inform this discussion and advocate on your behalf.

We fully appreciate that you are all very busy and we have kept the information requested to a minimum. We are asking for only one reply per practice - and this could be completed by any staff member. We have not made any questions mandatory. Of course, we hope you will complete as many as possible with the key questions relating to the number of consultations in the practice and the number of GPs and PNs on duty on the chosen day in the practice.

You can choose any typical working day - this could be yesterday or tomorrow - on which to provide data.

This survey should take about 5 minutes to complete. Thank you for taking time out of your already busy schedule to contribute data to inform this discussion and ensure accurate information is available directly from general practice.

Dr. Tony Cox, ICGP Medical Director

* 1. I confirm that I have read the introductory information and email invitation for this survey.
I consent to my data being used as part of this survey and any publications as a result of the findings.
I understand that my data will be retained on a secure server and for a short period will be held on a server located outside the E.U.
Data will only be held until the research is completed and it will then be deleted.

- ○ Yes I consent to the above
- ○ No I do not consent to the above, click DONE at end of survey to exit.

2. Please complete this survey in respect of any day in the surgery this week. Which day are you including data for:

- Monday
- Tuesday
- Wednesday
- Thursday
- Friday

3. How many staff (GPs and Practice Nurses) were on duty on the day you are completing this survey?Please note we are asking for full time equivalents here so if someone worked half a day that is 0.5 FTE. Please enter number in deciamal format.

FTE GPs

FTE Practice Nurses

4. How many FTEs in the practice overall? Please note we are asking for full time equivalents here so if a PN usually works three days per week that is 0.6 FTE. Please enter in decimal format.

FTE GPs

FTE Practice Nurses

5. How many face to face consultations were seen in the surgery in total on the day in question: please enter in whole number format.

By GPs

By PNs

6. Do you usually leave some appointments free to accommodate urgent/same day appointments?

Yes No

7. How many telemedicine consultations were seen on the day in question: please enter in whole number format.

By GPs

By PNs

8. How many visits by GPs were made on the day in question? Please enter in whole number format.

To homes

To nursing homes

9. On the day in question: how many hours in total did you personally work in the practice (clinical and non-clinical hours)? If you are not a GP and are completing it on behalf of the practice, please leave this question blank. Please enter in decimal format e.g. 0.5 or 2.0

10. What is the average waiting time to get a NON-URGENT appointment in your practice? Please enter in whole number format e.g. 0 or 4 etc.

For adults _____ days

For children _____ days

11. Is your practice closed to taking new patients?

	Yes	No
GMS	○	○
Private	○	○

12. Is your practice located in

- ○ A City
- ○ A Town
- ○ A Village

13. Please indicate where your practice is located:

14. What is **the most significant** stressor for GPs at the moment? Please tick only one answer.

- ○ Income
- ○ Locums
- ○ Workload
- ○ Work/Life balance
- ○ Regulations
- ○ Litigation risk
- ○ Other (please specify)

Practice Survey on COVID-19 Changes May/June 2020

Practice Survey on COVID-19 Changes May/June 2020

The ICGP would be grateful for your assistance in providing strong evidence so that we can inform discussions around practice changes during COVID-19 and the supports needed going forward for general practice.
We are asking for only one reply per practice - and this could be completed by any staff member.

We have tried to keep the information requested to a minimum but also to cover all areas so as a result the survey here will take you less than 10 minutes. We have not made any questions mandatory except the Q1 re consent. Of course, we hope you will complete as many as possible.

Thank you for taking the time to contribute data to inform this discussion and ensure accurate information is available from general practice.

* 1. I confirm that I have read the introductory information and email invitation for this survey.
I consent to my data being used as part of this survey and any publications as a result of the findings.
I understand that my data will be retained on a secure server and for a short period will be held on a server located outside the E.U.
Data will only be held until the research is completed and it will then be deleted.

- ○ Yes I consent to the above (ticking this is a requirement to proceed)
- ○ No I do not consent to the above, click DONE at end of survey to exit.

Practice Survey on COVID-19 Changes May/June 2020

2. Is your practice located in

- ○ A City
- ○ A Town
- ○ A Village

3. Please indicate where your practice is located:

4. How many FTEs GPs and Practice Nurses currently work in the practice overall? Please note we are asking for full time equivalents here so if a PN usually works three days per week that is 0.6 FTE. Please enter in DECIMAL format.

FTE GPs	
FTE Practice Nurses	

Practice Survey on COVID-19 Changes May/June 2020

Practice Changes

5. How has teamwork in the practice changed compared to before the COVID-19 changes?

- Very increased teamwork amongst the practice team
- Increased teamwork amongst the practice team
- Remained the same
- Decreased teamwork amongst the practice team
- Very decreased teamwork amongst the practice team

6. How has connectivity with other service providers (Consultants/Pharmacists) in general changed compared to before COVID-19?

	Very increased connectivity	Increased connectivity	Remained the same	Decreased connectivity	Very decreased conectivity
Consultants					
Pharmacists					

Other (please specify)

7. How is the COVID-19 pandemic affecting the practice you work in terms of profitability?

- Practice profit has improved
- No change in practice profit
- Practice profit has decreased
- I don't know if the practice profit has changed

8. If change noted, have you or someone else in your practice had the opportunity to do a formal comparison between your current business performance now compared to the first 2 months of 2020 or this time last year or is the above based on anecdotal evidence?

- ○ Yes, we have conducted a formal assessment
- ○ No, based on anecdotal or informal evidence

9. If change noted, what percentage increase or decrease do you anticipate?

0% Overall percentage change I00%

10. Has the practice you work in introduced any of the following measures to help the business manage the financial effects of COVID-19? Please tick all that apply.

- ☐ Have informed staff to take annual leave early
- ☐ Have asked staff to reduce their hours and work them back up later in the year
- ☐ Have formally reduced staff hours and payment until profitability improves
- ☐ Have made staff redundant
- ☐ Have applied for the employer wage subsidy scheme

11. If the practice you work in has made redundancies or reduced salaries/hours which of the following possible staff groups have been affected? Please tick all that apply.

- ☐ Cleaners
- ☐ Healthcare assistants
- ☐ Practice nurses
- ☐ Advanced nurse practitioners
- ☐ Practice managers
- ☐ Receptionists
- ☐ Salaried GPs
- ☐ Other (please specify)

12. What physical/consulting changes have been noticed in your practice? Please tick all that apply.

- [ ] Patients waiting outside/in car
- [ ] Triage before entering
- [ ] Limiting number of patients in waiting room
- [ ] No longer use waiting room
- [ ] Increased infection control practices
- [ ] Structural changes to reception and waiting area
- [ ] Telephone triage
- [ ] Completely managing 1st presentation fo new problem by phone
- [ ] Video consultations
- [ ] Increased use of healthmail
- [ ] Repeat prescription approach in terms of patient attending practice
- [ ] Using e-script
- [ ] Using healthmail for prescriptions
- [ ] Other (please specify)

13. Are you currently providing the following services for your patients?

	Yes	No
Face-to-face assessment for patients with symptoms who may have COVID	○	○
Face-to-face assessment for urgent medical conditions non-COVID related	○	○
Face-to-face consultations for bloods only for those with chronic conditions	○	○
Face-to-face consultations for full consult for those with chronic conditions	○	○
Childhood immunisations	○	○
Face-to-face antenatal care	○	○
Video consultations	○	○
Safety bloods for those on long-term medication if these are recommended e.g. lithium, methotrexate	○	○

14. Are you able to access the following in your area without referral to emergency department?

	Yes, similar to before	Yes, increased access	Yes, reduced access	No access	Don't Know
Chest x-ray	○	○	○	○	○
Ultrasound	○	○	○	○	○
Hospital phlebotomy	○	○	○	○	○

15. Has your local hospital service provided you with pathways to access the following services?

	Yes	No	Don't Know
Early cancer referral for suspected breast cancer	○	○	○
Early cancer referral for suspected lung cancer	○	○	○
Early referral for suspected prostate cancer	○	○	○
Urgent gynaecology access without referral to the emergency department	○	○	○
Urgent cardiac services without referral to the emergency department	○	○	○
Urgent TIA assessment service without referral to the emergency department	○	○	○

16. Has your local hospital service provided you with out-patient pathways for those with chronic conditions at the more severe end of the disease who require combined GP and consultant led care?

	Yes	No	Don't Know
Diabetes	○	○	○
Heart failure	○	○	○
Ischaemic heart disease	○	○	○
COPD	○	○	○
Asthma	○	○	○

17. Has your local hospital service provided you with access to paediatric assessment in terms of any of the following?

	Yes	No	Don't Know
Access to assessment for acute paediatric non-COVID medical conditions without the need to go to ED	◯	◯	◯
Pathways for paediatric outpatient referral for those who require consultant input for new diagnoses	◯	◯	◯
Pathways for paediatric outpatient for those with existing chronic medical conditions that require combined GP and consultant led care e.g. cystic fibrosis, diabetes	◯	◯	◯

18. Would you support the development of clearly defined care pathway between GP/community and acute services using an electronic/online system?

◯ Yes ◯ No ◯ Don't Know

19. How busy is your practice overall now compared to pre-COVID-19?

◯ Less busy ◯ The same ◯ Busier

20. Thinking about the last day of work this week in the practice - How many staff (GPs and Practice Nurses) were on duty on the day? Please note we are asking for full-time equivalents here so if someone worked half a day that is 0.5 FTE. Please enter answer in DECIMAL format.

FTE GPs

FTE Practice Nurses

21. How many face-to-face consultations were there on the last day in the practice? Please enter in WHOLE number format.

By GPs

By PNs

22. How many video consultations were there on the day in question? Please enter in WHOLE number format.

By GPs

By PNs

23. How many telemedicine consultations were there on the day in question? Please enter in WHOLE number format.

By GPs

By PNs

24. How many visits by GPs were made on the day in question? Please enter in WHOLE number format.

To homes

To nursing homes

25. Overall, have you seen a decline in non-COVID-19 related consultations from any of the following? Please tick all that apply.

- [ ] Under 6's
- [ ] Over 70's
- [ ] Patients with chronic conditions
- [ ] Patients with mental health concerns

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4-5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	5
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*5*
Bias	9	Describe any efforts to address potential sources of bias	5
Study size	10	Explain how the study size was arrived at	4-6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	5
		(*b*) Describe any methods used to examine subgroups and interactions	5
		(*c*) Explain how missing data were addressed	5
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	5
		(*e*) Describe any sensitivity analyses	5

Continued on next page

Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5-6
		(b) Give reasons for non-participation at each stage	n/a
		(c) Consider use of a flow diagram	n/a
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	5-7
		(b) Indicate number of participants with missing data for each variable of interest	5-10
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	7
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	*4-9*
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	5-10
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	5-9
Discussion			
Key results	18	Summarise key results with reference to study objectives	10
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	10
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	10-11
Generalisability	21	Discuss the generalisability (external validity) of the study results	11-14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	15

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

How COVID-19 has affected general practice consultations and income – General Practitioner cross-sectional population survey evidence from Ireland.

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2020-044685.R3
Article Type:	Original research
Date Submitted by the Author:	09-Mar-2021
Complete List of Authors:	Homeniuk, Robyn; Irish College of General Practitioners, Research and Innovation Collins, Claire; Irish College of General Practitioners, Research
Primary Subject Heading:	General practice / Family practice
Secondary Subject Heading:	Health services research
Keywords:	Telemedicine < BIOTECHNOLOGY & BIOINFORMATICS, COVID-19, PRIMARY CARE

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

How COVID-19 has affected general practice consultations and income – General Practitioner cross-sectional population survey evidence from Ireland

Robyn Homeniuk[a] and Claire Collins[b]

a. Research Officer, Department of Research, Irish College of General Practitioners, 4-5 Lincoln Place, Dublin D2. Email: robyn.homeniuk@icgp.ie
b. Director of Research and Innovation, Department of Research, Irish College of General Practitioners, 4-5 Lincoln Place, Dublin D2. Email: claire.collins@icgp.ie

Abstract

Objectives

How general practice is delivered in many countries has drastically changed due to the COVID-19 pandemic. This study aimed to answer the question of how general practice has changed in Ireland in response to COVID-19.

Design

The Irish College of General Practitioners surveyed its membership before and after the global pandemic hit Ireland using a cross-sectional online survey instrument.

Setting

This study focuses on primary care, specifically general practice, in Ireland.

Participants

In February 2020 before the global pandemic, 526 general practices across Ireland submitted responses to the survey; 538 general practices responded to the second survey during the pandemic in June 2020. This covers 32% and 33% of practices in Ireland, respectively.

Main outcome measures

The type of consultations by general practitioners and practice nurses in both surveys is the main outcome measure reported in this paper. Other changes such as the perceived change in attendance by certain patient groups and practice income are also reported.

Results

Face-to-face consultations significantly ($p<0.001$) decreased from a median of 26 (IQR 21.3, 30) to a median of 8 (IQR 6, 13). GP telemedicine consultations increased ($p<0.001$) from a median of 2.4 (IQR 0, 5.33) to a median of 11.33 (IQR 6, 19). The majority of practices (80.0%) reported reduced practice profit. Respondents reported a decline in non-COVID-19 related consultations among certain patient cohorts – 90.0% for children under six years old; 77.7% for patients over 70 years.

Conclusions

It is likely that the way general practice is delivered will not return to as it was before the COVID-19 pandemic and increased telemedicine can be expected. However, it is necessary to assess the impact of this shift on patient health and to assess healthcare provider and patient experience to ensure continued high-quality care and patient safety.

Strengths and Limitations

- **A key strength of this study is the large number of general practitioners who engaged with the surveys. It was possible to survey a third of all practices in Ireland at both time points.**
- **Due to the large number of responding practices, data covers every county in Ireland in both the pre-COVID-19 and during COVID-19 surveys. This and the volume of responses makes our findings more generalizable.**
- **The timing of the survey was another key strength of the study, as we were able to capture clinical activity data before COVID-19 and then rapidly collect information after the initial wave of the pandemic.**

- **One of the weaknesses of the study is the design - a self-selecting cross-sectional survey - which could have biased the responses. It was not possible to identify practices and directly match their responses from the first to the second survey.**
- **Another weakness was that we did not collect sociodemographic information, hence it was not possible to control for deprivation levels and other factors that may affect health care utilisation.**

Introduction

A cluster of 'atypical viral pneumonia' cases were diagnosed in Wuhan City, China in December 2019 [1]. By 9 January 2020, Chinese authorities found the cause of the outbreak was a novel coronavirus [2] – later named COVID-19. The WHO declared an international public health emergency [3] and by the end of February 2020, Ireland had its first case. National lockdown measures commenced in March 2020 and recommended that general practitioners (GPs) observe physical distancing, wear personal protective equipment (PPE), and use telephone triage and appointments to reduce face-to-face contact [4]. Epidemiologists globally have been monitoring the progression of this infection while governments have been developing and deploying emergency pandemic responses. The need to have global and national emergency management plans has been well-documented [3] since the outbreak of SARS in 2003. Previous outbreaks have proven that contagious diseases can put intense pressure on health systems, especially on general practice, as it is the frontline of the medical response [5]. GPs have expressed their past uncertainty about how to respond to a pandemic [5]. Indeed, in response to the H1N1 pandemic, primary care staff struggled with implementing new workflows [6]. In Ireland, comprehensive preparedness plans are in place for handling public health emergencies. These plans follow WHO [7] and ECDC [8] guidance and are coordinated by the National Public Health Emergency Team [9].

General practitioners in Ireland operate as private professionals charging patients not covered under the public system a fee per visit. The State pays GPs on a capitation basis for patients covered under the public system. Around 43% of Irish people qualify for free healthcare access either through the public system known as the General Medical Services (GMS) card (32.4%) or a GP-visit only card (10.4%); the remainder pay privately for GP visits [10]. GPs are critical to managing the increasing amount of chronic illnesses such as heart diseases, diabetes, and asthma – 80% of all visits to the GP are for chronic care management [11]. In 2015, the first step towards universal healthcare in Ireland was taken when children under 6 years old and adults over 70 years old became eligible for free GP care [11]. Patients in the latter group accounted for 25% of GP consultations and 31% of practice nurse visits in 2016 [12]. Before the start of this pandemic, general practitioners faced a heavy workload managing the majority of care needs [11], completing more than 25 consultations daily, and additional time spent on administration led to GPs working nearly 10 hours in a day [13]. The need to move more care into the community is the central point of the current healthcare strategy in Ireland [14]. Another key point in the reform strategy is to achieve universal healthcare by expanding current entitlements and moving to a preventative care model [11].

With the onset of COVID-19, the face of general practice in Ireland, as in many countries, drastically changed, with developing clinical models [15] and new consultation strategies having an impact on primary care [16]. GPs quickly noticed a decrease in the number of appointments scheduled by patients, while practice costs increased and income decreased [17]. Continuity of routine care might be at risk because of the pandemic, and the general health of the population is a key concern for primary care [16]. This paper reports on the changes experienced, particularly those in consultation delivery methods, in Irish general practice during the COVID-19 pandemic. At the beginning of February 2020, the Irish College of General Practitioners (ICGP) surveyed its membership before the global pandemic reached Irish shores. In June 2020, the ICGP again surveyed its membership regarding the impact of COVID-19 on general practice.

Methods

In early 2020, the ICGP – the professional body for GPs in Ireland - designed an online survey to capture practice activities, stressors, and demographic details regarding general practices in Ireland. The survey was developed in order to measure general practice activity, as this information is not yet routinely collected in Ireland. It was the intention to periodically repeat the survey with ICGP members to build a dataset to enable better resource planning in primary care; however, because of the COVID-19 pandemic, a decision was taken to adjust the survey accordingly.

It was distributed to 3,378 members both before (February 2020) and during (June 2020) the coronavirus pandemic. It was not sent to trainees, retired GPs, or Irish GPs working abroad. The second survey was updated to include additional questions and response categories that specifically related to the pandemic. Before each survey was sent out, eight GPs piloted the survey. A population survey approach was taken; therefore, no additional sampling techniques were used. The responding sample was self-selecting, with the survey open for a two-week period to maximise the number of responses received.

The questionnaire was developed specifically for use in the survey. The questionnaire before the pandemic had 14 items, which covered the number of GPs and practice nurses, consultation activity and hours worked, stressors and practice demographic information. The questionnaire conducted during the pandemic had 25 items, as it gained new items pertaining to changes introduced because of COVID-19. The surveys have been included as supplemental materials (supplementary file 1 and 2 respectively). Questions regarding stress, hours worked, appointment availability and pandemic response were included to obtain a better understanding of the state of general practice.

There were no eligibility criteria to complete the survey. Only one survey for each practice was requested in order to obtain cross-sectional data from Irish general practice. Ethical approval from the ICGP Research Ethics Committee for both surveys was obtained and consent from practices for participation and data processing was confirmed at the start of each survey. The online survey was fully anonymous and no IP addresses were collected.

All data is based on survey responses. Consultation rates include face-to-face consultations, telephone and video consultations (referred to as telemedicine), home visits and visits to nursing homes reported by practices who responded to the survey. Data was returned regarding the most recent working day. Out of hours services in Ireland are provided and recorded separately and hence are not included in these figures. The definitions for city, town and village are based on Central Statistics Office [18] definitions - rural is an area where less than 1,500 people live, a town has a population between 1,500 and 49,999, and cities have a population 50,000 or more.

We conducted the analysis using SPSS V25 software, using descriptive analysis. For numerical data, means and medians were used to describe and compare the data as appropriate. A p-value of <0.05 was used to indicate statistical significance. Mann-Whitney U tests were used to compare the number of consultations per GP or practice nurse per day; interquartile range (IQR) of the median number of consultations are given to show variance within the numbers at each time point; and chi-square tests were used for categorical variables.

Results

Survey Population

There were 526 responses to the pre-COVID-19 survey - 32% of all 1,635 practices in Ireland [19]. Five hundred twenty-three practices responded regarding the number of full time equivalent (FTE) GPs employed at the practice, stating that 1,504.5 FTE GPs are employed at these practices. In terms

of the number of FTE GPs working on the day on which consultation data is based, 526 practices reported a total of 1,253.9 FTE GPs (82.8%) on duty on the day. In this sample, approximately one fifth (19.4%) of the practices had 1.0 FTE GP or less employed - these are considered single-handed practices. The average number of FTE GPs at group practices was 3.3. At least one part-time practice nurse was employed across 483 practices, 93.8% of the 515 practices who responded to this question. A total of 629.5 FTE practice nurses were employed by these practices. On average, practices employed 1.2 FTE practice nurses – although 161 practices employed between 0.20 and 0.90 FTE practice nurses. In terms of nurses on duty on the day relevant to consultation data, 514 practices reported that 535.8 FTE practice nurses were working across 447 practices. There was an average of 1.0 FTE practice nurse working at each practice; 67 practices stated they had no practice nurses working on the day in question.

In terms of practice location, city practices comprised 37.5% of the total, with 43.9% of practices located in towns and 18.6% in villages. There was at least one practice recorded in every county of Ireland.

In the survey issued during the COVID-19 response, 783 practices responded, however, 240 participants only answered the first four items and five respondents did not consent for their responses to be used – ergo 538 valid responses were received. Hence, 32.9% of all practices in Ireland were represented in the during COVID-19 survey.

With regards to the total number of FTE GPs and practices nurses employed, 537 practices responded to the GP part of the question reporting 1276.5 FTE GPs employed overall and 526 practices responded to the practice nurse part of the question, reporting a total of 607.2 FTE nurses. Just 56 practices had no practice nurse employed, and 12 did not respond to this question. With respect to the number of FTE GPs and practice nurses working on the day when consultation numbers were recorded, 534 practices reported that 1,104.9 FTE GPs were working with an average of 2.1 FTE GPs at working each practice and 513 practices reported 509.0 FTE practice nurses were available, with an average of 1.0 FTE nurse working per practice.

There were slightly more single-handed practices in this responding sample at just over a quarter (29.0%). Group practices employed an average of 2.9 FTE GPs.

A total of 537 practices provided location information. City practices comprised 34.4 % (185) of the total, with 46.0% (247) of practices located in towns and 19.5% (105) in villages and at least one practice responding in every county. Practice characteristics from both surveys are shown in Table 1.

Table 1: Practice Characteristics

	Pre-COVID-19	During COVID-19
Total Number of practices	526	538
Number of Single-Handed Practices: Percent of Total:	101 19.4%	156 29.0%
Number of Group Practices: Percent of Total:	422 80.2%	382 71.0%
Number of FTE GPs Overall: Number of Respondents:	1,504.5 523	1,276.5 537
Mean GPs Overall:	2.9	2.4

Number of FTE GPs on the Day: Number of Respondents:	1,253.9 526	1,104.9 534
Mean GPs on day:	2.40	2.1
Practices with a PN employed: Percent of Total: Number of Respondents:	483 93.8% 515	463 88.0% 526
Number of FTE PNs Overall: Number of Respondents:	629.5 515	607.2 526
Mean PNs Overall:	1.2	1.2
Number of FTE PNs on the day: Number of Respondents:	535.8 514	509.0 513
Mean PNs on day:	1.0	1.0
Practices located in a City: Percent of Total:	197 37.6%	185 34.4%
Practices located in a Town: Percent of Total:	231 43.9%	247 46.0%
Practices Located in a Village: Percent of Total:	98 18.6%	105 19.5%

FTE = Full Time Equivalent, GP = General Practitioner, PN = Practice Nurse

In both surveys, practices received the questionnaire via email with one additional reminder email. The number of practices that provided valid responses, defined as providing information for overall and on the day data, was comparable. The geographic spread of the practices was similar, though there was a small increase in single-handed practices responding to the during COVID-19 survey; however, this did not have a significant impact when comparing consultation methods.

In the pre-COVID-19 survey, the proportion of missing responses ranged from 0.6% to 10.5%, the questions that had more missing responses were the number of consultations completed by practice nurses, with 6.8% and 10.5% of practices skipping these questions.

The proportion of missing answers ranged from 1.1% to 56.7% in the during COVID-19 survey. The questions that had missing answers were the financial questions, items 8 to 11, with a range of 4.5% to 56.7% practices not answering these questions.

Consultations

In the survey pre-COVID-19, items 5, 7, and 8 on the questionnaire (see supplementary file 1) asked the number of consultations GPs and practice nurses completed in person, using telemedicine, and in visits to homes and nursing homes. Overall, 36,821 GP consultations were recorded by 523 practices; 87.3% of appointments occurred face-to-face, 10.5% were telemedicine and the remainder were visits to homes and nursing homes.

During COVID-19, items 21, 22, 23, and 24 on the questionnaire (see supplementary file 2) asked practices to report the number of GP and practice nurse consultations completed in person, using telemedicine, and in visits to homes and nursing homes. The main mode of consultation changed significantly. This time, 530 practices reported 25,596 consultations. Over half of the GP consultations occurred via telemedicine (57.0%) and 41.0% occurred face-to-face with the remaining visits to homes or nursing homes. Table 2 shows the proportion of consultations by each consultation method for GPs and practice nurses at each time point.

Table 2: Summary of Consultations

Consultation Method	Pre COVID-19 Consultations	During COVID-19 Consultations
GP Face-to-Face		
Total consultations:	32,160	10,484
Proportion of GP consultations	87.3%	41.0%
Number of Respondents:	523	530
GP Telemedicine*		
Total consultations:	3,895	14,588
Proportion of GP consultations:	10.5%	57.0%
Number of Respondents:	508	523
GP home visits		
Total consultations:	483	299
Proportion of GP consultations:	1.3%	1.2%
Number of Respondents:	510	517
GP nursing home visits	322	225
Total consultations:		
Proportion of GP consultations:	0.9%	0.9%
Number of Respondents:	496	503
PN Face-to-Face		
Total consultations:	11,417	5,908
Proportion of PN consultations:	82.4%	67.6%
Number of Respondents:	490	489
PN Telemedicine*		
Total consultations:	2,436	2,828
Proportion of PN consultations:	17.6%	32.4
Number of Respondents:	471	469

****Telemedicine consultations include video, telephone and other remote technology used. GP = General Practitioner, PN=Practice Nurse***

Face-to-face appointments decreased from 87.3% to 41.0% of all GP consultations and consultations by telemedicine increased from 10.5% to 57.0% of reported consultations. Before the start of the pandemic, 12.5% of all consultations (by GPs and practice nurses) were conducted via telemedicine compared to 51.0% after the pandemic began.

Pre-COVID-19, 490 practices reported that practice nurses completed 13,853 consultations. Just under one fifth, 17.6%, of practice nurse consultations were via telemedicine and 82.4% were face-to-face. During the pandemic, 489 practices reported 8,736 practice nurse consultations. The consultations via telemedicine made up 32.4%, with the remainder conducted face to face (67.6%).

Before the pandemic began, practice nurses had a higher proportion of telemedicine appointments than GPs – 17.6% of practice nurse appointments in February 2020 compared to only 10.5% of GP appointments. During COVID-19, 57.0% of GP appointments occurred via telemedicine compared to 32.4% of practice nurse appointments. The Mann Whitney U test was used to compare GP consultations per day for each consultation method pre-COVID-19 and during COVID-19; all of the tests showed the difference was statistically significant ($p<0.001$). The same technique was used to

compare the number of consultations by practice nurses per day; this also found that the difference between pre-COVID-19 and during COVID-19 nurse consultations was statistically significant ($p<0.001$). For GPs, the median number of face-to-face consultations went from 26 (IQR 21.3, 30) to a median of 8 (IQR 6, 13) during – which was a significant decline ($p<0.001$). Similarly, GP consultations via telemedicine increased from a median of 2.4 (IQR 0, 5.33) to a median of 11.33 (IQR 6, 19) – again this was a significant change ($p<0.001$). Furthermore, the differences pre-COVID-19 and during the initial COVID-19 response for other consultation methods were all highly significant ($p<0.001$).

Practices were asked in the during COVID-19 survey if they had noticed a decline in certain high traffic patient groups. Overall, there was a reported decline in non-COVID-19 related consultations. Five hundred twenty-six practices answered this question, the question was in tick-box format and practices could select any number of the options. Almost all practices – 484 practices – noticed a decline for children under six years old and 418 saw a decline for patients over 70 years (two patient groups with free GP care nationally).

Practice income impact

When practices were asked whether there had been a change in profitability since the pandemic started, 536 practices responded and 80.0% of these practices reported a decrease in profitability. This was reported by 124 single-handed practices and 305 group practices. These practices estimated they would have a 35.1% decrease in profitability on average. However, only 257 practices said they had completed a formal assessment of their profits.

More group practices completed formal account reviews assessing the change in practice income and profit - out of the 257 who had completed a formal assessment, 210 were group practices compared to just 47 single-handed practices. Single-handed practices estimated an average loss of 41.5%, compared to the average estimate of 32.6% for group practices. The lower number of formal assessments by single-handed practices could explain part of this difference, through overestimates by GPs when completing the survey.

When asked what, if any, assistance measures to help the business manage the financial impact of COVID-19, had been put in place, 308 (57.9%) practices implemented one or more of the changes listed to accommodate for any lost profit. The most popular cost saving measure used was asking staff to take their annual leave early, with 27.1% of practices implementing this measure.

There were no significant relationships between practice size and implementing the listed measures.

Overall 233 practices (43.3%) indicated they had staff that were by reduced hours, salary, or redundancy. The most affected staff has been receptionists with 103 (19.1%) practices recording that this group had been affected in their practice. Following that, were nurses and salaried GP with 83 practices (15.4%) noting each of these staff groups had been affected. Forty-six GP respondents left comments as well, most highlighting that they had been the one to reduce their personal salary for the sake of keeping their staff. Table 3 shows the proportion of practices that used the following methods to protect income during the pandemic.

Table 3: Measures introduced to help the business manage the financial effects of COVID-19

	Single-Handed Practices (n=156)	Group Practices (n=382)
Have informed staff to take annual leave early	Total: 22 Proportion: 14.1%	Total: 124 Proportion: 32.4%
Have asked staff to reduce their hours and work them back up later in the year	Total: 12 Proportion: 7.7%	Total: 56 Proportion: 14.7%
Have formally reduced staff hours and payment until profitability improves	Total: 16 Proportion: 10.3%	Total: 76 Proportion:19.9%
Have made staff redundant	Total: 15 Proportion: 9.6%	Total: 37 Proportion: 9.7%
Have applied for the employer wage subsidy scheme	Total: 15 Proportion:9.6%	Total: 63 Proportion: 16.5%

Discussion

Principal Findings

A shift to telemedicine was observed from 10.5% of all GP consultations and 17.6% of practice nurse consultations pre-COVID-19 to 57.0% and 32.4% respectively during the COVID-19 response.

More than half of practices saw decreases in non-COVID-19 related consultations from vulnerable patient groups. Particularly, non-COVID-19 related visits from patients under 6 and over 70 – who receive free GP care – decreased despite usually being frequent users of health services.

Finally, practices' finances have been impacted, with 80.0% reporting reduced profit. Moreover, two-fifths of practices had staff affected by redundancy, reduced hours or reduced salary as a measure to offset the financial impact of the pandemic.

Strengths and weaknesses of the study

Our surveys are based on a self-selecting sample, which comes with inherent bias. We cannot undertake a direct practice-based pre and post comparison; however, key comparisons indicated that the responding samples were generally comparable. As the study design used a cross-sectional survey approach, a key limitation was the inability to determine causal relationships between the surveys. Due to the changing atmosphere caused by COVID-19, the survey questions were updated and the second iteration was longer – this difference may have caused response bias. Furthermore, we did not collect information that would allow for meaningful geographical analyses, and therefore could not account for regional and socioeconomic differences, which could affect consultation methods. Data is based on reported data and not from data extracted from general practice systems and hence may lead to under- or over-reporting. The survey was completed by one GP per practice, which could have reduced the accuracy of practice nurse consultation figures, although practice management systems allow identification of these. Additionally, we did not collect patient population information so adjustment for disability or other patient factors could not be undertaken

or compared nationally. Finally, the results assume that the national picture corresponds with that of this sample of GP practices.

However, a strength of these surveys is the number of practices and FTE GPs represented. In the pre-COVID-19 survey, there were 1,504.5 FTE GPs represented, employed by the 526 responding practices. In the post-COVID-19 survey, 1,276.5 (n=537) FTE GPs from the 538 responding practices were represented. This means an estimated 32% and 33% respectively of all practices in Ireland were captured in each survey. While this is a reasonable response rate, it is not a majority of practices; therefore, the proportion of each consultation method is an estimate and should be considered as such in a national context.

Another strength is that the representation of both single-handed and group practices was similar to national figures [20] making the response more generalizable. And, while detailed geographical information was not collected, both samples included at least one practice in all parts of the country with more in cities such as Dublin and Cork, which is consistent with the geographical spread of practices previously reported [21].

Interpretation in terms of international literature/Strengths and weaknesses compared to other literature

Since the beginning of the COVID-19 pandemic, there have been many changes rapidly implemented in healthcare across the world and they are having an impact on clinicians [16, 17]. Our study showed a decrease overall in general practice GP appointments (GPs and practice nurses) in the early days of the pandemic. This is similar to reports in the UK [22], where the NHS has noticed a 30% decrease in the number of GP appointments compared to the same time in 2019.

Our study showed a substantial shift from 12.5% to 51.0% of GP and practice nurse consultations in Ireland delivered via telemedicine. The UK reports are varied; however, they show a similar shift to telemedicine consultations. With an overall 30% drop in all consultations, GPs reported consultations changing from 90-95% face-to-face to 85% remote [22, 23]. The current UK estimates are higher than ours; however, their telemedicine rate pre-COVID-19 was also higher [22]. Spain also reports an increase in the use of virtual consultations, at 68.3% during the pandemic [24]. The proportion of face-to-face GP consultations decreased from 87.3% to 41.0% in our study, showing a similar reduction to England where proportions changed from 70% to 23% [25].

The majority (80.2%) of our practices reported reduced practice profit, and this has been seen elsewhere with GPs in the United States of America turning to crowdfunding to help their practices, and GPs in Belgium and Australia also feeling the effects of changing remuneration during COVID-19 [16, 17, 26].

Similar studies comparing the impact of COVID-19 on practice consultations are rare. Much of the literature to date on delivery type changes are based on commentaries and not actual measurements [24, 27]. However, there are a handful of recent publications about the use of healthcare during the pandemic. A recent German study with 1,095 GPs and patients aged 65 or older found that there was a 14% decrease in consultations in May 2020 compared to the same time in 2019, and the rate of diabetes, dementia, depression, cancer and stroke diagnoses decreased during this period (between -17% and -26%) [28]. In a survey of Australian GPs, 73% of practices had a reduction in bookings and 77% had a decrease in practice income; meanwhile, telephone calls (93%) and practice costs (81%) increased [17]. These results support our survey's findings that these challenges have also been experienced by GPs in Ireland. A key strength of this paper is that it adds

to the knowledge base in terms of the potential impact of the COVID-19 pandemic on general practice in the current void of such literature.

Implications for practice

GPs are motivated by altruism to work during pandemics despite the high personal risk, and they are enthusiastic about further training and information [5]. However, despite preparedness planning, implementing pandemic policies faces multiple obstacles [5]. GPs are facing rapidly changing patient flows, clinical algorithms, new care pathways, and the need for new ways of delivering high-quality care [16, 17, 24, 27, 28, 29]. Irish GPs have implemented many changes during the COVID-19 pandemic. The RACGP recommends 'a planned and coordinated approach' when implementing a telehealth service [30]; however, due to the urgent nature of the current situation, this has not been possible. Maintaining the quality of healthcare is important in sustaining a healthy workforce, which is essential to support a healthy economy during and after the pandemic.

Ireland, like many other countries, has taken massive steps towards the regular use of remote consultations, seemingly overnight, with previous trepidation regarding continuity of care and safety falling away out of necessity [16, 29]. The rapid national adoption of telemedicine consultations as well as electronic prescribing has presented opportunity; however, GPs are concerned that without as much face-to-face contact, critical non-verbal communication is missing from consultations and in some cases, telephone consults are insufficient to address patient concerns [16].

Ireland has two health strategies promoting the use of technology to enable patient-centred care nationally. Sláintecare, the current healthcare strategy in Ireland, aims to establish a national health fund that will help deliver universal healthcare and introduce comprehensive eHealth infrastructure [11]. This strategy supported the 2013 eHealth strategy, which had an objective of more affordable and more personalised care for all by capitalising on technology [31]. During the pandemic, practices across the country have swiftly transitioned to using technology such as a secure email facility between health care providers (Healthmail), e-prescribing, and telemedicine (video and telephone) consultations. Before the COVID-19 pandemic began, clinicians in primary care had used telemedicine interventions [29], but not extensively. Changes adopted during this pandemic accelerated the digitalisation of healthcare [29]. This could lead the way to the lasting adoption of technology such as e-prescribing and telephone and video consultations after the pandemic.

Telemedicine has been viewed as a way to lower costs and see more patients [32, 33, 34] but was rare in Irish general practice up to now, and here, as elsewhere, there was some resistance and concern [16]. However, the current COVID-19 pandemic has resulted in telemedicine consultations being recommended for all GPs [4]. Patients, like health care workers, have adapted to telemedicine consultations being the standard method of consultation; previous studies found that patients found video consultations acceptable [32] but age (over 60) and computer proficiency were found to negatively impact a patient's view of acceptability [33, 34]. Telemedicine has been invaluable during the outbreak of COVID-19, as it has enabled routine care to continue to some degree; however, patients who are digitally disadvantaged are often from populations already experiencing greater health risks - such as older people and those in lower socioeconomic classes [32, 34]. Going forward, special attention must be given to reducing health inequalities exacerbated by recent changes in care.

Furthermore, a noted decrease in consultations for non-COVID related symptoms has been observed in our survey. Patients who are most vulnerable, such as people over 65, have also been avoiding

seeking care in other countries [16, 26, 28]. This could have serious impacts on health outcomes and patient safety with calls on patients not to self-diagnose or delay seeking treatment [16, 26, 28]. Patients are also changing the way they use health services, with more emphasis on self-care [16, 24, 28]. However, not all patients will have the same capacity for caring for their health without the level of support a GP or practice nurse can provide with face-to-face consultations. More research on patient and physician satisfaction and whether health outcomes are impacted by consultation types is needed to develop guidelines and policies on how frequently remote consultations can be used. Patient feedback will be invaluable for maintaining lasting benefits.

The COVID-19 pandemic has the potential to change general practice forever, and this does not only apply in Ireland but has been noted elsewhere [15, 16, 17, 22, 24, 28]. The adoption of 'total triage' systems has been seen during this pandemic whereby GPs can decide the mode of follow-up consultation, whether that is face-to-face, video call or telephone. As we look to a post-COVID landscape, there is a case for general practice retaining this to allow more flexibility in how consultations are delivered according to the needs and preferences of patients. However, telephone triage does not reduce GP workload, so we need to evaluate the impacts on workload and patient-centred care [16, 32, 33, 34]. While it is unlikely that we will maintain this level of telemedicine consultations, it is expected that how general practice functions will not return to as it was before [29, 35].

However, we should not lose sight of the relationship between the GP and patient and the importance of good communication and trust [16, 26, 27, 29, 32, 33]. Telemedicine does not work for all patients or health problems, and there is a need to establish what works best for different patients [16, 27, 32, 33, 34]. We need to evaluate the impact on patient experience, health inequalities and patient-centred care [33, 36].

Since the beginning of June 2020, renewed efforts have been made to reassure and encourage the public to continue seeking medical advice from their GPs by making an appointment [36].

Unanswered questions and future research

How general practice is delivered will not return to as before; increased telemedicine is likely. It is necessary to assess the impact of this shift on patient health and to assess healthcare provider and patient experience to ensure continued high-quality care and patient safety. Furthermore, we need to understand the impact of changing work requirements and evolving consultation techniques on general practice workload and practice income and viability.

DECLARATIONS

Abbreviations

ECDC – European Centre for Disease Prevention and Control

ESRI – Economic and Social Research Institute

FTE – Full time equivalent

GP - General Practitioner

HSE - Health Service Executive

ICGP - Irish College of General Practitioners

NHS – National Health Service (UK)

PN - Practice Nurse

PPE – Personal protective equipment

RACGP – Royal Australian College of General Practitioners

WHO - World Health Organisation

Competing interests

All authors have completed the *Unified Competing Interest form* (available on request from the corresponding author) and declare: no financial relationships with any organisations that might have an interest in the submitted work in the previous three years, no other relationships or activities that could appear to have influenced the submitted work.

Ethics approval and consent to participate

Ethical approval was obtained for the study from the Irish College of General Practitioners Research Ethics Committee.

Public and patient involvement

Patents and members of the public were not involved in this research because it was not relevant to the study questions. The study focused on changes experienced by general practitioners. General practitioners were involved in the study design as members of the ICGP Board who approved and oversaw the project.

Consent for publication

Not applicable.

Availability of data and materials

The data is available on reasonable request to the corresponding author.

Funding

The project was in part supported via a Quality Improvement Grant from Pfizer under its Global Medical Grants (reference #6216072). The funder had no role in project design, data collection, analysis, interpretation or reporting.

Authors' contributions

CC was the project principal investigator. She conceived the project idea, designed the questionnaire, undertook the data collection, obtained the funding, supervised the data analysis and contributed to the paper.

RH was the project research assistant. She analysed the data, undertook the analysis and contributed to the paper.

Both authors have read and approved the final paper.

Name of guarantor: Claire Collins.

Transparency declaration

The authors affirm that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

Acknowledgements

The authors wish to acknowledge the valuable contribution and time given by all participants. Dr. Jean Saunders, affiliated with CSCS Ireland, statistical advice on the paper is noted and appreciated.

References

1. WHO Newsroom. *Timeline of WHO's response to COVID-19.* [Internet] Geneva: World Health Organisation; 29 June 2020 [updated 30 July 2020]. Available from: https://www.who.int/china/news/detail/09-01-2020-who-statement-regarding-cluster-of-pneumonia-cases-in-wuhan-china [Accessed 24th August 2020]
2. WHO. *WHO Statement regarding cluster of pneumonia cases in Wuhan, China.* [Internet] Geneva: World Health Organisation; 9 January 2020. Available from: https://www.who.int/china/news/detail/09-01-2020-who-statement-regarding-cluster-of-pneumonia-cases-in-wuhan-china [Accessed 24th August 2020]
3. WHO. *WHO Director-General's statement on IHR Emergency Committee on Novel Coronavirus (2019-nCoV).* [Internet] Geneva: World Health Organisation; 30 January 2020. Available from: https://www.who.int/dg/speeches/detail/who-director-general-s-statement-on-ihr-emergency-committee-on-novel-coronavirus-(2019-ncov) [Accessed 24th August 2020]
4. HSE/HPSC. *Guiding principles for Infection Prevention and Control when returning to routine General Practice during pandemic v2.1.* [Internet] Dublin: Health Protection Surveillance Centre; 10 July 2020. Available from: https://www.hpsc.ie/a-z/respiratory/coronavirus/novelcoronavirus/guidance/primarycareguidance/adviceriskassessmentandmanagementofpatients/Guiding%20principles%20IPC%20GP.pdf [Accessed 24th August 2020]

5. Patel MS, Phillips CB, Pearce C, Kljakovic M, Dugdale P, Glasgow N. General practice and pandemic influenza: a framework for planning and comparison of plans in five countries. *PLoS One* 2008 May 28;3(5):e2269.
6. Kunin M, Engelhard D, Thomas S, Ashworth M, Piterman L. Challenges of the Pandemic Response in Primary Care during Pre-Vaccination Period: A Qualitative Study. *Isr.J.Health.Policy.Res.* 2015 Oct 15;4:32-015-0028-5. eCollection 2015.
7. WHO. *2019 Novel Coronavirus (2019-nCoV): Strategic Preparedness and Response Plan.* [Internet] Geneva: World Health Organisation; 2020 [Draft as of 3 February 2020]. Available from: https://www.who.int/docs/default-source/coronaviruse/srp-04022020.pdf?ua=1 [Accessed 24th August 2020]
8. European Centre for Disease Prevention and Control. *Infection prevention and control for COVID-19 in healthcare settings – Fourth update.* [Internet] 3 July 2020. ECDC: Stockholm; 2020. Available from: https://www.ecdc.europa.eu/en/publications-data/infection-prevention-and-control-and-preparedness-covid-19-healthcare-settings [Accessed 25th August 2020]
9. NPHET. *National Public Health Emergency Team (NPHET) COVID-19 Subgroup : Guidance and Evidence Synthesis.* [Internet] Dublin: Department of Health; 6 May 2020 [Last updated 4 August 2020]. Available from: https://www.gov.ie/en/collection/07d750-nphet-covid-19-subgroup-guidance-and-evidence-synthesis/ [Accessed 25th August 2020]
10. HSE. *Primary Care Reimbursement Service Statistical Analysis of Claims and Payments 2019.* [Internet] Dublin: Health Care Executive Primary Reimbursement Service; 2020. Available from: https://www.hse.ie/eng/staff/pcrs/pcrs-publications/annual-report-2019.pdf [Accessed 25th August 2020]
11. Committee on the Future of Healthcare. *Sláintecare Report.* [Internet] Dublin: Houses of the Oireachtas; May 2017. Available from: https://www.gov.ie/pdf/?file=https://assets.gov.ie/165/270718095030-1134389-Slaintecare-Report-May-2017.pdf#page=1 [Accessed 25th August 2020]
12. Department of Health. *Sláintecare Action Plan 2019.* [Internet] Dublin: Department of Health; 2019. Available from: https://assets.gov.ie/22606/4e13c790cf31463491c2e878212e3c29.pdf [Accessed 28th August 2020]
13. Crosbie B, O'Callaghan ME, O'Flanagan S, Brennan D, Keane G, Behan W. A real-time measurement of general practice workload in the Republic of Ireland: a prospective study. *Br.J.Gen.Pract.* 2020 Jun 25;70(696):e489-e496.
14. Department of Health. *Health Service Capacity Review 2018 Executive Report: Review of Health Demand and Capacity Requirement in Ireland to 2031 – Findings and Recommendations.* London: PA Knowledge Limited; 2018. Available from: https://assets.gov.ie/10131/5bb5ff12463345bbac465aaf02a2333d.pdf [Accessed 25th August 2020]
15. Liu Y, Wang Z, Ren J, Tian Y, Zhou M, Zhou T, et al. A COVID-19 Risk Assessment Decision Support System for General Practitioners: Design and Development Study. *J.Med.Internet Res.* 2020 Jun 29;22(6):e19786.
16. Verhoeven V, Tsakitzidis G, Philips H, Van Royen P. Impact of the COVID-19 pandemic on the core functions of primary care: will the cure be worse than the disease? A qualitative interview study in Flemish GPs. *BMJ Open* 2020 Jun 17;10(6):e039674-2020-039674.

17. Kippen R, O'Sullivan B, Hickson H, Leach M, Wallace G. A national survey of COVID-19 challenges, responses and effects in Australian general practice. *Aust J Gen Pract.* 2020 Nov;49(11):745-751. doi: 10.31128/AJGP-06-20-5465.
18. CSO. *CSO Statistical Release: Population and Migration Estimates.* [Internet] Cork: Central Statistics Office; April 2019. Available from: https://www.cso.ie/en/releasesandpublications/er/pme/populationandmigrationestimatesapril2019/ [Accessed 25th August 2020]
19. HSE. *Medical Workforce Planning: Future Demand for General Practitoners 2015-2025.* [Internet] Dublin: National Doctor Training and Planning, HR Directorate, Health Service Executive; September 2015. Available from: https://www.hse.ie/eng/staff/leadership-education-development/met/plan/gp-medical-workforce-planning-report-sept-2015.pdf [Accessed 25th August 2020]
20. O'Kelly M, Teljeur C, O'Kelly F, Ni Shulleabhain A, O'Dowd T. *Structure of General Practice in Ireland 1982 – 2015.* [Internet] Dublin: Trinity College Dublin/Irish College of General Practitioners; 2016. Available from: https://www.tcd.ie/medicine/public_health_primary_care/assets/pdf/structure-of-general-practice-2016.pdf [Accessed 28th August 2020]
21. Smith S, Walsh B, Wren M, Barron S, Morgenroth E, Eighan J, et al. *Geographic profile of healthcare needs and non-acute healthcare supply in Ireland.* ESRI Research Series: 90. [Internet] Dublin: The Economic and Social Research Institute; July 22 2019. Available from: https://www.esri.ie/system/files/publications/RS90_0.pdf [Accessed 28th August 2020]
22. The Health Foundation. *How might COVID-19 affected people's ability to see their GP? COVID-19 Chart Series.* [Internet] London: The Health Foundation; 1 May 2020. Available from: https://www.health.org.uk/news-and-comment/charts-and-infographics/how-might-covid-19-have-affected-peoples-ability-to-see-GP [Accessed 25th August 2020]
23. NHS. Letter to: Chief executives of all NHS trusts and foundation trusts; CCG Accountable Officers; GP practices and Primary Care Networks; Providers of community health services; NHS 111 providers. *IMPORTANT - FOR ACTION - SECOND PHASE OF NHS RESPONSE TO COVID19.* From the Chief Executive Sir Simon Stevens & Chief Operating Officer Amanda Pritchard. [Internet] London: NHS; 29 April 2020. Available from: https://www.england.nhs.uk/coronavirus/wp-content/uploads/sites/52/2020/04/second-phase-of-nhs-response-to-covid-19-letter-to-chief-execs-29-april-2020.pdf [Accessed 25th August 2020]
24. Munoz MA, Lopez-Grau M. Lessons learned from the approach to the COVID-19 pandemic in urban primary health care centres in Barcelona, Spain. *Eur.J.Gen.Pract.* 2020 Dec;26(1):106-107.
25. RCGP. *General practice in the post Covid world: Challenges and opportunities for general practice.* [Internet] London: Royal College of General Practitioners; 2020. Available from: https://www.rcgp.org.uk/-/media/Files/News/2020/general-practice-post-covid-rcgp.ashx?la=en [Accessed 25th August 2020]
26. Rubin R. COVID-19's Crushing Effects on Medical Practices, Some of Which Might Not Survive. *JAMA* 2020 Jun 18.
27. de Sutter A, Llor C, Maier M, Mallen C, Tatsioni A, van Weert H, et al. Family medicine in times of 'COVID-19': A generalists' voice. *Eur.J.Gen.Pract.* 2020 Dec;26(1):58-60.

28. Michalowsky B, Hoffmann W, Bohlken J, Kostev K. Effect of the COVID-19 Lockdown on Disease Recognition and Utilization of Healthcare Services in the Older Population in German: A Cross-sectional Study. Age and Ageing. 2020.
29. Marshall M, Howe A, Howsam G, Mulholland M, Leach J. COVID-19: a danger and an opportunity for the future of general practice. *Br.J.Gen.Pract.* 2020 May 28;70(695):270-271.
30. RACGP. *Implementation guidelines for video consultations in general practice: A telehealth initiative.* 3rd Edition. [Internet] East Melbourne Victoria: The Royal Australian College of General Practitioners; September 2012. Available from: https://www.racgp.org.au/download/Documents/Telehealth/videoconsultguidelinesv3.pdf [Accessed 25th August 2020]
31. HSE/Department of Health. *eHealth Strategy for Ireland.* [Internet] Dublin: Department of Health; 2013. Available from: https://www.gov.ie/en/publication/6b7909-ehealth-strategy-for-ireland/ [Accessed 25th August 2020]
32. Thiyagarajan A, Grant C, Griffiths F, Atherton H. Exploring patients' and clinicians' experiences of video consultations in primary care: a systematic scoping review. BJGP open. 2020;4(1).
33. Johnston S, MacDougall M, McKinstry B. The use of video consulting in general practice: semi-structured interviews examining acceptability to patients. BMJ Health & Care Informatics 2016;23:doi: 10.14236/jhi.v23i2.141
34. Gilligan P, Bennett A, Houlihan A, Padki A, Owen N, Morris D, et al. The Doctor Can See You Now: A Key Stakeholder Study Into The Acceptability Of Ambulance Based Telemedicine. *Ir.Med.J.* 2018 Jun 7;111(6):769.
35. Thornton J. Covid-19: how coronavirus will change the face of general practice forever. *BMJ* 2020 Mar 30;368:m1279.
36. HSE. *Coronavirus: Get urgent medical help for non-coronavirus symptoms.* [Internet] 5 June 2020. Available from: https://www2.hse.ie/conditions/coronavirus/get-urgent-medical-help-for-non-coronavirus-symptoms.html [Accessed 25th August 2020]

Practice Activity January 2020

Practice Activity

There has been a lot of media discussion regarding general practice and the ICGP would be grateful for your assistance in providing strong evidence so that we can inform this discussion and advocate on your behalf.

We fully appreciate that you are all very busy and we have kept the information requested to a minimum. We are asking for only one reply per practice - and this could be completed by any staff member. We have not made any questions mandatory. Of course, we hope you will complete as many as possible with the key questions relating to the number of consultations in the practice and the number of GPs and PNs on duty on the chosen day in the practice.

You can choose any typical working day - this could be yesterday or tomorrow - on which to provide data.

This survey should take about 5 minutes to complete. Thank you for taking time out of your already busy schedule to contribute data to inform this discussion and ensure accurate information is available directly from general practice.

Dr. Tony Cox, ICGP Medical Director

* 1. I confirm that I have read the introductory information and email invitation for this survey.
I consent to my data being used as part of this survey and any publications as a result of the findings.
I understand that my data will be retained on a secure server and for a short period will be held on a server located outside the E.U.
Data will only be held until the research is completed and it will then be deleted.

- ○ Yes I consent to the above
- ○ No I do not consent to the above, click DONE at end of survey to exit.

2. Please complete this survey in respect of any day in the surgery this week. Which day are you including data for:

- Monday
- Tuesday
- Wednesday
- Thursday
- Friday

3. How many staff (GPs and Practice Nurses) were on duty on the day you are completing this survey?Please note we are asking for full time equivalents here so if someone worked half a day that is 0.5 FTE. Please enter number in deciamal format.

FTE GPs

FTE Practice Nurses

4. How many FTEs in the practice overall? Please note we are asking for full time equivalents here so if a PN usually works three days per week that is 0.6 FTE. Please enter in decimal format.

FTE GPs

FTE Practice Nurses

5. How many face to face consultations were seen in the surgery in total on the day in question: please enter in whole number format.

By GPs

By PNs

6. Do you usually leave some appointments free to accommodate urgent/same day appointments?

Yes No

7. How many telemedicine consultations were seen on the day in question: please enter in whole number format.

By GPs

By PNs

8. How many visits by GPs were made on the day in question? Please enter in whole number format.

To homes

To nursing homes

9. On the day in question: how many hours in total did you personally work in the practice (clinical and non-clinical hours)? If you are not a GP and are completing it on behalf of the practice, please leave this question blank. Please enter in decimal format e.g. 0.5 or 2.0

10. What is the average waiting time to get a NON-URGENT appointment in your practice? Please enter in whole number format e.g. 0 or 4 etc.

For adults _____ days

For children _____ days

11. Is your practice closed to taking new patients?

	Yes	No
GMS	○	○
Private	○	○

12. Is your practice located in

- ○ A City
- ○ A Town
- ○ A Village

13. Please indicate where your practice is located:

14. What is **the most significant** stressor for GPs at the moment? Please tick only one answer.

- ○ Income
- ○ Locums
- ○ Workload
- ○ Work/Life balance
- ○ Regulations
- ○ Litigation risk
- ○ Other (please specify)

Practice Survey on COVID-19 Changes May/June 2020

Practice Survey on COVID-19 Changes May/June 2020

The ICGP would be grateful for your assistance in providing strong evidence so that we can inform discussions around practice changes during COVID-19 and the supports needed going forward for general practice.
We are asking for only one reply per practice - and this could be completed by any staff member.

We have tried to keep the information requested to a minimum but also to cover all areas so as a result the survey here will take you less than 10 minutes. We have not made any questions mandatory except the Q1 re consent. Of course, we hope you will complete as many as possible.

Thank you for taking the time to contribute data to inform this discussion and ensure accurate information is available from general practice.

* 1. I confirm that I have read the introductory information and email invitation for this survey.
I consent to my data being used as part of this survey and any publications as a result of the findings.
I understand that my data will be retained on a secure server and for a short period will be held on a server located outside the E.U.
Data will only be held until the research is completed and it will then be deleted.

- ○ Yes I consent to the above (ticking this is a requirement to proceed)
- ○ No I do not consent to the above, click DONE at end of survey to exit.

Practice Survey on COVID-19 Changes May/June 2020

2. Is your practice located in

- ○ A City
- ○ A Town
- ○ A Village

3. Please indicate where your practice is located:

4. How many FTEs GPs and Practice Nurses currently work in the practice overall? Please note we are asking for full time equivalents here so if a PN usually works three days per week that is 0.6 FTE. Please enter in DECIMAL format.

FTE GPs	
FTE Practice Nurses	

Practice Survey on COVID-19 Changes May/June 2020

Practice Changes

5. How has teamwork in the practice changed compared to before the COVID-19 changes?

- Very increased teamwork amongst the practice team
- Increased teamwork amongst the practice team
- Remained the same
- Decreased teamwork amongst the practice team
- Very decreased teamwork amongst the practice team

6. How has connectivity with other service providers (Consultants/Pharmacists) in general changed compared to before COVID-19?

	Very increased connectivity	Increased connectivity	Remained the same	Decreased connectivity	Very decreased conectivity
Consultants					
Pharmacists					

Other (please specify)

7. How is the COVID-19 pandemic affecting the practice you work in terms of profitability?

- Practice profit has improved
- No change in practice profit
- Practice profit has decreased
- I don't know if the practice profit has changed

8. If change noted, have you or someone else in your practice had the opportunity to do a formal comparison between your current business performance now compared to the first 2 months of 2020 or this time last year or is the above based on anecdotal evidence?

- ○ Yes, we have conducted a formal assessment
- ○ No, based on anecdotal or informal evidence

9. If change noted, what percentage increase or decrease do you anticipate?

0% Overall percentage change I00%

10. Has the practice you work in introduced any of the following measures to help the business manage the financial effects of COVID-19? Please tick all that apply.

- ☐ Have informed staff to take annual leave early
- ☐ Have asked staff to reduce their hours and work them back up later in the year
- ☐ Have formally reduced staff hours and payment until profitability improves
- ☐ Have made staff redundant
- ☐ Have applied for the employer wage subsidy scheme

11. If the practice you work in has made redundancies or reduced salaries/hours which of the following possible staff groups have been affected? Please tick all that apply.

- ☐ Cleaners
- ☐ Healthcare assistants
- ☐ Practice nurses
- ☐ Advanced nurse practitioners
- ☐ Practice managers
- ☐ Receptionists
- ☐ Salaried GPs
- ☐ Other (please specify)

12. What physical/consulting changes have been noticed in your practice? Please tick all that apply.

- [ ] Patients waiting outside/in car
- [ ] Triage before entering
- [ ] Limiting number of patients in waiting room
- [ ] No longer use waiting room
- [ ] Increased infection control practices
- [ ] Structural changes to reception and waiting area
- [ ] Telephone triage
- [ ] Completely managing 1st presentation fo new problem by phone
- [ ] Video consultations
- [ ] Increased use of healthmail
- [ ] Repeat prescription approach in terms of patient attending practice
- [ ] Using e-script
- [ ] Using healthmail for prescriptions
- [ ] Other (please specify)

13. Are you currently providing the following services for your patients?

	Yes	No
Face-to-face assessment for patients with symptoms who may have COVID	○	○
Face-to-face assessment for urgent medical conditions non-COVID related	○	○
Face-to-face consultations for bloods only for those with chronic conditions	○	○
Face-to-face consultations for full consult for those with chronic conditions	○	○
Childhood immunisations	○	○
Face-to-face antenatal care	○	○
Video consultations	○	○
Safety bloods for those on long-term medication if these are recommended e.g. lithium, methotrexate	○	○

14. Are you able to access the following in your area without referral to emergency department?

	Yes, similar to before	Yes, increased access	Yes, reduced access	No access	Don't Know
Chest x-ray	○	○	○	○	○
Ultrasound	○	○	○	○	○
Hospital phlebotomy	○	○	○	○	○

15. Has your local hospital service provided you with pathways to access the following services?

	Yes	No	Don't Know
Early cancer referral for suspected breast cancer	○	○	○
Early cancer referral for suspected lung cancer	○	○	○
Early referral for suspected prostate cancer	○	○	○
Urgent gynaecology access without referral to the emergency department	○	○	○
Urgent cardiac services without referral to the emergency department	○	○	○
Urgent TIA assessment service without referral to the emergency department	○	○	○

16. Has your local hospital service provided you with out-patient pathways for those with chronic conditions at the more severe end of the disease who require combined GP and consultant led care?

	Yes	No	Don't Know
Diabetes	○	○	○
Heart failure	○	○	○
Ischaemic heart disease	○	○	○
COPD	○	○	○
Asthma	○	○	○

17. Has your local hospital service provided you with access to paediatric assessment in terms of any of the following?

	Yes	No	Don't Know
Access to assessment for acute paediatric non-COVID medical conditions without the need to go to ED	◯	◯	◯
Pathways for paediatric outpatient referral for those who require consultant input for new diagnoses	◯	◯	◯
Pathways for paediatric outpatient for those with existing chronic medical conditions that require combined GP and consultant led care e.g. cystic fibrosis, diabetes	◯	◯	◯

18. Would you support the development of clearly defined care pathway between GP/community and acute services using an electronic/online system?

◯ Yes ◯ No ◯ Don't Know

19. How busy is your practice overall now compared to pre-COVID-19?

◯ Less busy ◯ The same ◯ Busier

20. Thinking about the last day of work this week in the practice - How many staff (GPs and Practice Nurses) were on duty on the day? Please note we are asking for full-time equivalents here so if someone worked half a day that is 0.5 FTE. Please enter answer in DECIMAL format.

FTE GPs

FTE Practice Nurses

21. How many face-to-face consultations were there on the last day in the practice? Please enter in WHOLE number format.

By GPs

By PNs

22. How many video consultations were there on the day in question? Please enter in WHOLE number format.

By GPs

By PNs

23. How many telemedicine consultations were there on the day in question? Please enter in WHOLE number format.

By GPs

By PNs

24. How many visits by GPs were made on the day in question? Please enter in WHOLE number format.

To homes

To nursing homes

25. Overall, have you seen a decline in non-COVID-19 related consultations from any of the following? Please tick all that apply.

- [ ] Under 6's
- [ ] Over 70's
- [ ] Patients with chronic conditions
- [ ] Patients with mental health concerns

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	5
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*5*
Bias	9	Describe any efforts to address potential sources of bias	5
Study size	10	Explain how the study size was arrived at	5-6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	5
		(*b*) Describe any methods used to examine subgroups and interactions	5
		(*c*) Explain how missing data were addressed	5
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	5
		(*e*) Describe any sensitivity analyses	5

Continued on next page

Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6
		(b) Give reasons for non-participation at each stage	n/a
		(c) Consider use of a flow diagram	n/a
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	5-7
		(b) Indicate number of participants with missing data for each variable of interest	5-10
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	7
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	*4-9*
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	5-10
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	5-9
Discussion			
Key results	18	Summarise key results with reference to study objectives	10
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	10
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	10-11
Generalisability	21	Discuss the generalisability (external validity) of the study results	11-14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	15

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.