Supplementary Material

Data Sources

Australia

This research used de-identified patient data from the Patron primary care-data repository (extracted from consenting-general practices-www.gp.unimelb.edu.au/datafordecisions), that has been created and is operated by the Department of General Practice, The University of Melbourne. The repository contains data from electronic patient medical records from 103 general practices mainly based in Victoria, Australia. There are approximately 3.5 million de-identified individuals and 80 million patient visits represented in the dataset. Around 38% of practices are located in regional or rural locations. Records included in the current analysis included records from patients with a valid date of birth, sex recorded, and an associated Medical Benefit Service (MBS) item number, that aligns with the general practice service provided. The Patron Responsivity is governed by an independent Data Governance Committee that provides advice and oversight to data custodians and researchers to ensure that the program of research is transparent and ethical, and the research, researchers and data technical team comply with all relevant Australian laws and regulatory requirements.

Canada

Canadian data were drawn from the University of Toronto Practice-Based Research Network (UTOPIAN) Data Safe Haven (https://www.dfcm.utoronto.ca/utopian-data-safe-haven), a primary care electronic medical record (EMR) database containing records from 392 primary care physicians working in 95 family medicine clinics in Ontario, Canada. Over 70% of physicians contributing to the UTOPIAN database work in the Greater Toronto Area. Records included in the current analysis were required to meet minimum data quality standards for contributing physicians and included only patients with a valid date of birth and sex recorded. Primary care physicians contributing to the UTOPIAN database use their EMR system to bill the Ontario Health Insurance Plan for the services they provide such that at least one billing code is recorded for all visits documented in the EMR database. A subset of these billing codes was used to identify family practice visits, and these were further classified as in-person or virtual. A maximum of one in-person and one virtual visit was counted per patient per day.

China

Claims data from “The Family Medicine General Practice Clinic” at The University of Hong Kong Shen Zhen Hospital (HKUSZH) were used for this project. The Family Medicine General Practice Clinic was the first in the nation in providing general practice in a general hospital. The clinic is currently run by 13 family physicians and 3 psychotherapists. The Family Medicine General Practice Clinic divides the clinics into several sub clinics that offer a variety of comprehensive packages with varying fees such as chronic disease management, general practice, prenatal and postnatal management, mental health, and vaccination. The package includes the cost of the consultation, certain investigations, and medications. The majority of the patients use social insurance to pay for their visits. Amongst the 13 doctors, several are also posted to run a general practice clinic at Huawei headquarters in Shenzhen as well as the International Medical Center at HKUSZH for those paying private rates. During the latter half of 2020, Hong Kong residents living in Shenzhen were funded by the Hong Kong government to attend HKUSZH if they were unable to travel to Hong Kong to receive medical care. The Huawei, International Medical Clinic and Hong Kong patients are not included in the dataset. In addition, the 3-psychotherapists working in the department offer psychotherapy and these are also not included in the data set. In this hospital, although referrals from GP to specialists are encouraged, patients may also directly book appointments directly to specialty clinics. In person consultations were calculated by counting the number of visits in each of the sub clinics from the EMR database. As virtual visits were not billable, these were not recorded in the EMR. Each general practitioner in the clinic recorded virtual consultations on their own and the sum of the virtual consultations per day were calculated.

Norway

Claims data for the whole population of Norway (5,385 million people) for 2019 and 2020 came from the Norwegian Health Economics Administration (HELFO). This includes records of payment for services from the national health insurance based on submitted claims from all

consultations and other contacts in general practice and out-of-hours services. The reimbursement claims include information about the doctor (ID-number) and patient (unique personal identifier and sex), daytime general practice or out-of-hours service, date and time for the contact, and diagnoses (that are coded using the International Classification of Primary Care, 2nd edition (ICPC-2) for each contact. The claims also include billing codes that indicate form of contact (consultation, letter/phone-call, e-consultation, home visit), and billing codes for certain procedures like point-of-care CRP testing and issuing of sickness certificate as part of the individual consultations.

Singapore
Data from Singapore came from the National University Polyclinics, a network of 6 publicly funded polyclinics — Bukit Batok Polyclinic, Choa Chu Kang Polyclinic, Clementi Polyclinic, Jurong Polyclinic, Pioneer Polyclinic and Queenstown Polyclinic. These public polyclinics are subsidized up to 75% with different charges based on residency status. This network provides subsidized primary care treatment for acute illnesses, management of chronic diseases, women and children health services, and dental care. Polyclinics also have in-house facilities for basic tests, radiology, and physiotherapy as well as nursing / allied health counseling and support. Medication is dispensed on-site after the consult. Approximately 250,000 unique patients are seen annually across all types of services provided through the National University Polyclinics. Although many virtual visits occurred in the hospitals, most polyclinic patients had their appointments deferred during COVID and were followed up by phone without physician remuneration and hence not captured in the data available here.

South Korea
Korean data were drawn from the electronic medical record (EMR) of the department of Family Medicine, Asan Medical Center. Asan Medical Center is the largest hospital in Korea, and more than 60,000 patients visit the outpatient clinic of the department of Family Medicine annually. The data includes patients visiting 5 professors, 3 fellows, and 15 residents in the Department of Family Medicine. Prior to pandemic, virtual consultation was illegal in Korea. From February 24, 2020, telephone consultation and prescription by fax were temporarily allowed by the Ministry of Health and Welfare.

Sweden
Region Uppsala in Sweden contributed with data on its 400,000 patients in the data set. Swedish regional data for 2019 and 2020 came from the electronic patient records. The data includes billing codes that indicate form of contact (visits, letter/phone-call, e-consultation, home visits) For the current study we used data on form of contact for all 150 primary care physicians in the region. Virtual consultations included electronic video-consultation.

UK
Data were drawn from the Oxford - Royal College of General Practitioners (RCGP) Research and Surveillance Centre (RSC) Workload Observatory. (https://orchid.phc.ox.ac.uk/index.php/rcgprscworkloadobservatory/). The Workload Observatory was developed with funding from NHS England, the ORCHID (Oxford-Royal College of General Practitioners Clinical Informatics Digital Hub) principal funder is Public Health England. Data used to estimate in-person and virtual visit volume are extracted and reported weekly. Because the number of practices contributing data increased substantially during 2019-2020, weekly visit counts in this database were reported as rates per 10,000 patients. Weekly rates are published for GP consultations by type under the following categories: clinical administration, e-consultation, face to face, telephone consultation, visit, and unspecified. In-person visit volume was based on face-to-face consultation rates. Virtual visit volume was based on the sum of telephone and e-consultation rates.

US
Data for the United States came from the DARTNet Institute. The DARTNet Institute Practice Performance Registry includes almost 550 healthcare organizations, including 13 academic medical centers, more than 7000 clinicians, extensive IT professionals and electronic health record repositories. It was not possible to distinguish between virtual and in-person visits at all organizations, therefore 3 large healthcare organizations with high quality data available regarding format of care delivery were selected for inclusion in the current study. The included sites had 236 PCPs amongst 1030 clinicians and were located in California, Texas, and Colorado. Electronic health record data was used to determine type of visit by procedure codes,

Current Procedural Terminology (CPT) modifier codes, and text indicating a virtual or telehealth visit.