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Association between contact with a general practitioner and depressive symptoms during the COVID-19 pandemic and lockdown: a large community-based study in Hangzhou, China

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ABSTRACT

Objectives To determine the association of general practitioner (GP) contact with depressive symptoms during the COVID-19 pandemic and lockdown in China.

Design In April 2020, a follow-up survey was conducted on the basis of a baseline survey conducted between October 2018 and May 2019.

Setting The survey was embedded in the Stanford Wellness Living Laboratory-China (WELL China) study, an ongoing prospective community-based cohort study during 2018–2019.

Participants The survey was conducted by telephone interview among 4144 adult urban residents participating in the WELL China study at baseline. We collected information on sociodemographic characteristics, depressive symptoms and GP contact during the lockdown period (February to March 2020).

Primary and secondary outcome measures Depressive symptoms were measured using the WHO-Five Well-being Index, comprising five questionnaire items that briefly indicate psychological well-being. Logistic regression models were applied to assess the association between GP contact and depressive symptoms.

Results In total, 3356 participants responded to the survey; 203 were excluded owing to missing data on depressive symptoms, leaving 3153 participants in the present study. During lockdown, 449 participants had GP contact. GP contact was significantly negatively associated with prevalent depressive symptoms (OR, 0.67; 95% CI 0.51 to 0.89; p<0.01) and incident depressive symptoms (OR 0.68; 95% CI 0.51 to 0.93; p<0.05). Stratified analysis showed a significant negative association between depressive symptoms and GP contact in individuals who were 45–64 years old (p<0.01), had a middle or high education (p<0.01) and had self-reported non-communicable diseases (p<0.05).

Conclusions Contact with GPs during the COVID-19 pandemic and lockdowns may have a negative association with depressive symptoms in community-dwelling populations. Given the possibility of further surges in COVID-19 infections, GPs' contact in the community should be enhanced.

Strengths and limitations of this study

- This was a longitudinal study using the WHO-Five Well-being Index, health assessment and sociodemographic characteristics at both baseline and during the lockdown period.
- The sample size of our study was large, which provided sufficient statistical power.
- Most respondents to the baseline survey responded to the follow-up survey.
- Selection bias may exist owing to the use of telephone interviews.
- Causation cannot be established owing to the cross-sectional study design.

INTRODUCTION

The outbreak of COVID-19 has had negative health impacts around the world. According to the WHO, there were 134 508 532 confirmed cases of COVID-19, causing 2 914 774 deaths by 9 April 2021.[1] COVID-19 is not only threatening to physical health but also has impacts on short-term and long-term mental health. According to reports, the rate of depressive symptoms in the general population was 14.6%–48.3% during the COVID-19 epidemics in China, Spain, Italy, Iran, the USA, Turkey, Nepal and Denmark, using different measurement tools.[2] Furthermore, physical symptoms similar to COVID-19 infection can increase people's perceived risk and lead to adverse mental health outcomes, including depressive symptoms.[3]

The COVID-19 pandemic has changed people's lifestyles owing to restricted movements; temporary unemployment; new realities of working from home; lack of physical contact with family members, friends and colleagues and homeschooling of children, among other factors.[4] Added to these changes is fear of contracting the disease. Psychological impacts during lockdowns have been reported.[5–8] Stressful life events, pessimism, home quarantine, social distancing, wearing face masks and increased exposure to social media have been reported to influence mental health during lockdown, exacerbating various mental health conditions, including depression, anxiety and grief-related symptoms.[9–12] Good mental health is fundamental to overall health and well-being.[4] Thus, it is important to properly manage mental health problems both in the short and long term during the COVID-19 pandemic.

In China, mental health during the COVID-19 pandemic has attracted attention. Wang *et al* found that during the initial stages of the outbreak in China, 16.5% of respondents to an online survey reported moderate to severe depressive symptoms.[13] A longitudinal study in a Chinese community-dwelling population showed that 4 weeks after the pandemic peak, depressive symptoms were similar to those at the initial stage, using the Depression, Anxiety and Stress Scale (DASS) depression subscale.[14] Additionally, some surveys have focused on depression in a specific population, such as patients with COVID-19, psychiatric patients and workers returning to the workplace after lockdown. Results from these studies suggest that patients with COVID-19 and psychiatric patients are more vulnerable to and have relatively high levels of depression.[15–17] Studies have shown that personal precautionary measures, confidence in doctors and satisfaction with health education may relieve depression and anxiety.[13 14 18] Chinese general practitioners (GPs) may play an essential role during the pandemic by giving professional support to people at risk of impaired mental health.

Community-based prevention and control of mental diseases (or mental health) are important for controlling the COVID-19 pandemic.[19] In response to the outbreak of COVID-19 in China during late January 2020, GPs acted as frontline health workers in the community healthcare response to the epidemic,[20 21] undertaking responsibilities including the dissemination of up-to-date information regarding prevention methods, monitoring of patients' health status, guidance for appropriate responses and provision of prompt treatment for diseases among local residents. Normally, GPs are involved in health improvement and the control of non-communicable diseases (NCDs).[21 22] During the COVID-19 epidemic in China, GPs have contacted residents with or without NCDs via telephone. However, there is no evidence regarding the impact of such contact with a GP on mental health.

Given the possibility of further surges in COVID-19 infections,[23 24] it is important to understand the role of GPs in community-based prevention and control of COVID-19 epidemics, including the impact of contact with a GP on mental health. Therefore, in the present study, we investigated the association between having contact with a GP by telephone (GP contact) and depressive symptoms among community residents before and during the COVID-19 lockdown period in Hangzhou, China. These findings may inform new healthcare initiatives to meet future challenges.

METHODS

Study design and participants

Telephone interviews were conducted in April 2020 among 4144 urban residents who participated in the baseline survey of the Stanford Wellness Living Laboratory-China (WELL China) study between October 2018 and May 2019 in Gongshu District, Hangzhou City in Zhejiang, China, which is an urban area.[25] Of the 4144 baseline participants, 3356 responded to the survey, with a response rate of 81%. We excluded 203 participants owing to missing data regarding educational attainment (n=29), WHO-Five Well-being Index (WHO-5) values at baseline (n=3), WHO-5 values during lockdown in response to the COVID-19 outbreak (n=45), or GP contact (n=126). In total, 3153 participants were included in the final analysis.

Data collection and variable definitions

At the baseline survey between October 2018 and May 2019, face-to-face interviews were performed to collect demographic characteristics, WHO-5 data and history of clinical diagnoses. In the follow-up survey in April 2020, we collected WHO-5 data and information about GP contact with residents via telephone during lockdown in response to the COVID-19 outbreak between February and March in 2020.

In the present study, we used the WHO-5 to indirectly assess depressive symptoms. The WHO-5 is a short questionnaire comprising five simple, non-invasive questions reflecting well-being, which includes the following five items[26]: (1) 'I have felt cheerful and in good spirits', (2) 'I have felt calm and relaxed', (3) 'I have felt active and vigorous', (4) 'I woke up feeling fresh and rested' and (5) 'My daily life has been filled with things that interest me'. Participants reported their feelings (WHO-5 index) during lockdown on a 6-point scale ranging from 'all of the time' (5 points) to 'at no time' (0 points). A summed score less than 13 or scores of 0 or 1 for any item are considered to indicate depressive symptoms.[27] Although the WHO-5 is not considered the gold standard for defining depression, it has relatively good psychometric performance in terms of reliability and validity, and it has a strong correlation with depressive symptoms.[26] The WHO-5 can be used as a sensitive and specific screening tool for depression in epidemiological studies. Considering the time limit of telephone interviews, we chose to use the WHO-5 as an indicator of depressive symptoms in this large population health survey.

GP contact was defined as a GP providing health guidance, including advice regarding health improvement, the management of NCDs and prevention of infectious diseases, to residents with or without NCDs via telephone during the COVID-19 pandemic and lockdown.

NCDs included a history of hypertension, diabetes, clinically diagnosed cardiovascular disease, cancer, endocrine and metabolic diseases, osteoarthritis, respiratory system diseases, digestive system diseases, mental diseases, nervous system diseases, urinary system diseases, immune diseases and allergies at baseline.

Statistical analysis

We used t-tests and χ^2 tests to analyse participants' characteristics according to GP contact status. Logistic regression analysis was performed to test the association between GP contact (yes/no) and prevalent and incident depressive symptoms; baseline depressive symptoms were excluded to test for incident symptoms. Results are presented as ORs and 95% CIs. Model 1 was adjusted for age, sex, educational attainment and marital status. Model 2 was additionally adjusted for NCDs. Model 3 was additionally adjusted for depressive symptoms at baseline.

We conducted stratified analysis according to: (1) age group (young, 18–44 years old; middle aged, 45–64 years old and older ≥65 years old), (2) educational attainment groups (illiterate or primary school, middle school or high school and college or above) and (3) groups with or without NCDs.

Data analysis was performed using R software V.4.0.2 (The R Project for Statistical Computing, Vienna, Austria). The threshold for statistical significance was set at p<0.05 (two sided).

Patient and public involvement

No patients or the public were involved in the study design, setting the research questions, interpretation or writing up of the results or reporting of the research.

RESULTS

Of 3153 participants, 449 participants had contact with a GP and 2704 had no contact with a GP during the COVID-19 lockdown. Sociodemographic characteristics and NCDs at baseline among participants with and without GP contact via telephone (GP contact) during lockdown are shown in table 1. The results revealed significant differences in age, educational attainment, marital status and NCDs between participants with and without GP contact (p<0.05). Participants with and without GP contact did not differ according to sex (p>0.05).

Table 2 shows the ORs and 95% CIs of depressive symptoms at baseline and during lockdown for participants who had GP contact during the COVID-19 lockdown. In our telephone interview study of 3153 individuals, depressive symptoms among residents at baseline were analysed according to GP contact during lockdown, revealing no differences in prevalent depressive symptoms at baseline

Table 1 Sociodemographic characteristics, NCDS, and GP contact among participants

Variables	Total (n=3153)	GP contact		P
		No (n=2704)	Yes (n=449)	
Age, years (mean±SD)	55.5±12.9	55.0±12.9	59.0±12.0	<0.001
Age stratification, n (%)				<0.001
18–44	613 (100)	557 (90.9)	56 (9.1)	
45–64	1698 (100)	1474 (86.8)	224 (13.2)	
≥65	842 (100)	673 (79.9)	169 (20.1)	
Gender, n (%)				0.14
Male	1186 (100)	1003 (84.6)	183 (15.4)	
Female	1967 (100)	1701 (86.5)	266 (13.5)	
Educational attainment, n (%)				<0.001
Illiterate or primary school	672 (100)	563 (83.8)	109 (16.2)	
Middle school or high school	1795 (100)	1518 (84.6)	277 (15.4)	
College or above	686 (100)	623 (90.8)	63 (9.2)	
Marital status, n (%)				0.04
Married/remarried	2915 (100)	2489 (85.4)	426 (14.6)	
Unmarried/divorced/separate	238 (100)	215 (90.3)	23 (9.7)	
NCDs, n (%)				<0.001
Without	1168 (100)	1047 (89.6)	121 (10.4)	
With	1985 (100)	1657 (83.5)	328 (16.5)	

Data of sociodemographic characteristics and NCDs among residents are from the baseline survey.
Data of GP contact with residents are from the follow-up survey during COVID-19 lockdown.
GP, general practitioner; NCD, non-communicable disease.

Table 2 Association of GP contact with depressive symptoms among residents

Variables Depressive symptom prevalent	Total n (%)	GP contact No n (%)	 Yes n (%)
Baseline (before lockdown)	n=3153	n=2704	n=449
No	2722 (86.3)	2329 (86.1)	393 (87.5)
Yes	431 (13.7)	375 (13.9)	56 (12.5)
Model 1 OR (95% CI), P		Ref	0.96 (0.70 to 1.29), 0.77
Model 2 OR (95% CI), P		Ref	0.94 (0.70 to 1.28), 0.71
Prevalent lockdown	n=3153	n=2704	n=449
No	2517 (79.8)	2135 (79.0)	382 (85.1)
Yes	636 (20.2)	569 (21.0)	67 (14.9)
Model 1 OR (95% CI), P		Ref	0.68 (0.52 to 0.90), 0.007
Model 2 OR (95% CI), P		Ref	0.67 (0.51 to 0.88), 0.004
Model 3 OR (95% CI), P		Ref	0.67 (0.51 to 0.89), 0.005
Incident*	n=2722	n=2329	n=393
No	2210 (81.2)	1873 (80.4)	337 (85.8)
Yes	512 (18.8)	456 (19.6)	56 (14.2)
Model 1 OR (95% CI), P		Ref	0.70 (0.52 to 0.95), 0.02
Model 2 OR (95% CI), P		Ref	0.68 (0.51 to 0.93), 0.02

Model 1: Adjusted for age, sex, educational attainment, marital status.
Model 2: Further adjusted for NCDs.
Model 3: Further adjusted for depressive symptoms at baseline.
Data of sociodemographic characteristics and NCDs among residents are from the baseline survey.
Data of GP contact with residents are from the follow-up survey during COVID-19 lockdown.
Data of depressive symptoms from baseline and follow-up surveys.
*Individuals who reported no depressive symptoms at baseline but reported depressive symptoms at the follow-up interview in April 2020.
GP, general practitioner; NCD, non-communicable disease.

between those who were or were not contacted by a GP (p>0.05) (table 2, top panel). In the analysis of prevalent depressive symptoms during lockdown, GP contact was associated with a lower risk of depressive symptoms among respondents (OR=0.67, p=0.005), after adjusting for age, sex, educational attainment, marital status and NCDs and depressive symptoms at baseline (table 2, middle panel). In the analysis of new cases of depressive symptoms occurring after baseline (incident depressive symptoms) assessed using WHO-5 scores, we further excluded 431 individuals with depressive symptoms at baseline (prevalent cases of depressive symptoms) assessed using WHO-5 scores, leaving 2722 individuals in the analysis. The associations between incident depressive symptoms among residents and GP contact during the COVID-19 lockdown are shown in table 2 (bottom panel). After adjusting for age, sex, educational attainment, marital status and NCDs at baseline, individuals who had contact with a GP were less likely to develop incident depressive symptoms (OR=0.68, p=0.02)

Associations between prevalent depressive symptoms and GP contact during lockdown among individuals with and without NCDs are shown in table 3. After adjusting for age, sex, educational attainment, marital status and depressive symptoms at baseline, depressive symptoms were negatively associated with GP contact during the

Table 3 Association between GP contact and prevalent depressive symptoms among residents stratified by NCD groups

	Without NCDs n=1168			With NCDs n=1985		
		With contact			With contact	
	Without contact	OR (95% CI)	P	Without contact	OR (95% CI)	P
Model 1	Ref	0.69 (0.40 to 1.20)	0.19	Ref	0.66 (0.48 to 0.92)	0.01
Model 3	Ref	0.69 (0.40 to 1.20)	0.19	Ref	0.67 (0.48 to 0.92)	0.01

Model 1: Adjusted for age, sex, educational attainment, marital status.
Model 3: Further adjusted for depressive symptoms at baseline.
Data of sociodemographic characteristics and NCDs among residents are from the baseline survey.
Data of GP contact with residents are from the follow-up survey during COVID-19 lockdown.
Data of depressive symptoms are from baseline and follow-up surveys.
GP, general practitioner; NCD, non-communicable disease.

COVID-19 lockdown (OR=0.67, p=0.01) among individuals with NCDs. In individuals without NCDs, no significant associations were found between depressive symptoms and GP contact during lockdown (p>0.05).

We further assessed the associations between prevalent depressive symptoms among residents and GP contact, by age group (table 4). After adjusting for sex, educational attainment, marital status, NCDs and depressive symptoms at baseline, GP contact was associated with a lower risk of depressive symptoms during lockdown in the middle-aged group (OR=0.53, p=0.005). In the young and older groups, no significant differences were found between depressive symptoms among residents and GP contact during lockdown (p>0.05).

Table 5 shows the associations between prevalent depressive symptoms and GP contact during lockdown according to educational attainment. After adjusting for age, sex, marital status, NCDs and depressive symptoms at baseline, GP contact was associated with a lower risk of depressive symptoms during the COVID-19 lockdown among individuals in the groups with middle school or high school educational attainment (OR=0.60, p=0.007). In the illiterate or primary school groups and the college or above group, no significant relationships were found between depressive symptoms and GP contact during lockdown (p>0.05).

DISCUSSION

In the present study, GP contact was negatively associated with prevalent depressive symptoms and new depressive symptoms among residents of Gongshu District, Hangzhou, China during the COVID-19 pandemic and lockdown between February and March 2020. There was no difference in baseline depressive symptoms (from October 2018 to May 2019) between residents with and without GP contact.

Some strategies have been proposed for managing mental health during the pandemic. Although patients with or survivors of COVID-19,[28] patients with severe mental illness[29] and healthcare workers[30] require mental healthcare, the general public also requires mental health attention during the COVID-19 pandemic and lockdown periods. Online-based cognitive behavioural therapy may be one effective solution.[31–33] It is also important to promote communication of up-to-date information on the prevention and control of COVID-19 in consideration of mental health content.[34 35] Improving management of community-based primary mental healthcare is an important goal.[36]

GPs are the foundation of community health services, including prevention, health education, basic clinical services, women and children's care, elder care, immunisation and physical rehabilitation.[37] In China, GPs are also known as family doctors or family physicians. In 2015, these contract services were implemented throughout Zhejiang Province.[38] A previous study reported that services for mental health management had improved

Table 4 Association between GP contact and prevalent depressive symptoms among residents stratified by age group

	18–44 years n=613			45–64 years n=1698			≥65 years n=842		
	Without contact	With contact		Without contact	With contact		Without contact	With contact	
		OR (95% CI)	P		OR (95% CI)	P		OR (95% CI)	P
Model 1	Ref	0.78 (0.40 to 1.53)	0.48	Ref	0.55 (0.35 to 0.85)	0.007	Ref	0.81 (0.52 to 1.25)	0.35
Model 2	Ref	0.77 (0.40 to 1.52)	0.46	Ref	0.53 (0.34 to 0.82)	0.004	Ref	0.81 (0.52 to 1.25)	0.34
Model 3	Ref	0.76 (0.38 to 1.48)	0.42	Ref	0.53 (0.34 to 0.82)	0.005	Ref	0.81 (0.52 to 1.25)	0.34

Model 1: Adjusted for sex, educational attainment, marital status.
Model 2: Further adjusted for NCDs.
Model 3: Further adjusted for depressive symptoms at baseline.
Data of sociodemographic characteristics and NCDs among residents are from the baseline survey.
Data of GP contact with residents are from the follow-up survey during COVID-19 lockdown.
Data of depressive symptoms are from baseline and follow-up surveys.
GP, general practitioner; NCD, non-communicable disease.

Table 5 Association between GP contact and prevalent depressive symptoms among residents stratified by educational attainment

	Illiterate or primary school n=672			Middle school or high school n=1795			College or above n=686		
	Without contact	With contact		Without contact	With contact		Without contact	With contact	
		OR (95% CI)	P		OR (95% CI)	P		OR (95% CI)	P
Model 1	Ref	0.79 (0.46 to 1.39)	0.41	Ref	0.62 (0.43 to 0.89)	0.01	Ref	0.75 (0.39 to 1.46)	0.40
Model 2	Ref	0.78 (0.45 to 1.37)	0.39	Ref	0.60 (0.42 to 0.87)	0.007	Ref	0.75 (0.38 to 1.45)	0.39
Model 3	Ref	0.78 (0.44 to 1.37)	0.39	Ref	0.60 (0.42 to 0.87)	0.007	Ref	0.75 (0.39 to 1.46)	0.40

Model 1: Adjusted for age, sex, marital status.
Model 2: Further adjusted for NCDs.
Model 3: Further adjusted for depressive symptoms at baseline.
Data of sociodemographic characteristics and NCDs among residents are from the baseline survey.
GP, general practitioner; NCD, non-communicable disease.

depressive symptoms among local residents via health education and organisational interventions.[39]

To the best of our knowledge, this is the first study to report the association of GP contact with the mental health of individuals during COVID-19 lockdown periods. Previous studies have reported the negative psychological impacts of quarantine[9 40 41] related to overwhelming stress levels owing to unemployment, deaths and isolation caused by the COVID-19 pandemic.[42] For this reason, relieving fear and anxiety in the community is considered an important task.[43] In the battle against COVID-19, GPs have been involved in all aspects of the pandemic response. GPs with good communication skills work with local community staff to perform daily health monitoring and provide psychological support to help relieve fear and panic, such as through psychological counselling via telephone-based and internet-based communication. Local residents may have greater reliance on GPs during an emergency, enabling these health professionals to have an intervening role in residents' mental health during lockdown periods.

NCDs, including diabetes mellitus, endocrine dysfunction, cardiovascular diseases, inflammation and asthma, may occur concomitantly with diagnosed or undiagnosed depression.[36 44] Under normal circumstances, GPs provide health guidance to their patients, with a particular focus on those with NCDs, via home visits, telephone contact or face-to-face consultations at community hospitals. Because patients with NCDs receive more attention from and have closer relationships with GPs, they may rely more on GPs during lockdown periods, in comparison with local residents who do not have NCDs. Therefore, the mental health of residents with NCDs might be more strongly influenced by GPs.

In our study, we found that young (age 18–44 years old) and older (≥65 years old) residents had a higher proportion of depressive symptoms than middle-aged residents (age 45–64 years) during lockdown, with 26.6% of young people, 17.7% of middle-aged people and 20.4% of older people indicating depressive symptoms. These results suggest that young and older people are more likely to be affected by the COVID-19 epidemic, leading to depressive symptoms. Although in our study, the rates of GP contact increased from young to older age groups, only middle-aged residents who had contact with a GP showed a significant decrease in depressive symptoms. We speculated that middle-aged residents may be more capable of resisting the various pressures that can result in depression, making it easier for GPs to intervene positively in these patients' mental health.

In the present study, we found a significant negative association of GP contact with a risk of having depressive symptoms only among local residents with middle or high school educational attainment. To understand why middle or high school education levels were an advantage in the association between depressive symptoms and GP contact, we additionally analysed the age distribution in these groups (n=1795). We found that individuals in the middle-aged

group (n=1134) constituted 63.2% of the total residents with middle or high school educational attainment, those in the young group (n=189) constituted 10.5% of the total and those in the older group (n=472) constituted 26.3%. We speculated that the negative association between depressive symptoms and GP contact among people with middle or high school educational attainment was likely owing to most of these individuals being middle aged.

The study has several strengths. First, the present study consisted of surveys of residents at baseline and during lockdown; which enabled comparisons of such points as mental health, health assessment, socioeconomic status, lifestyle and disease condition among the residents between the baseline and lockdown periods. Additionally, the seasonal characteristics of the baseline and lockdown periods were similar because the baseline survey was conducted approximately 1 year ahead of lockdown. Second, the response rate in our follow-up survey was 81%, and we have built strong relationships with communities and residents. These relationships enabled us to conduct follow-up surveys to examine the situations of the residents during lockdown in this extremely difficult time. Third, we performed the stratified analysis of the relationship between depressive symptoms from different characteristics of the population and GP contact. The results would be helpful for proposing targeted strategy.

The study had several limitations that should be addressed. First, causation could not be established owing to the cross-sectional design of this study. Second, selection bias may exist. During the COVID-19 epidemic, telephone interviewing was used, which may have introduced volunteer bias. To identify the potential influence of selection bias, we conducted a non-response analysis by comparing the general characteristics between the study population (n=3153) and the population excluded from the study (n=991). The results showed that the study population had higher educational levels ($p<0.05$) and had more NCDs ($p<0.05$) than individuals who were excluded from the study (see online supplemental table 1). A potential explanation is that people with higher education levels and more health conditions may pay greater attention to their own health and would, thus, be more likely to participate in health-related research projects. Third, we defined depressive symptoms using the WHO-5, whose psychometric performance is not the same as that of traditional measures of depression, such as Zung's Self-Rating Depression Scale[45] and the 21-item DASS.[18] We recommend that future studies apply multiple approaches to precisely measure depression, including short-version screening tools, gold standard instruments and clinical diagnosis, such as structured clinical interviews and functional neuroimaging.[46–48] Additionally, we did not record the reasons for contact with a GP.

In response to the high prevalence of common mental disorders, including depression and anxiety disorders, the WHO has proposed that primary care includes mental health services.[49] As the foundation of primary care in community health services and frontline workers in the prevention and control of infectious diseases in the community,[37] GPs play an important role in mental healthcare in the community.[50] The present study further supports the notion that GPs have an important role in improving mental health, including depressive symptoms, particularly during public health emergencies. Although the system of health provision by GPs is continually developing, when overwhelming numbers of patients require care, the quality and quantity of GP care are often insufficient.[37 51] Thus, systems of healthcare provision by GPs in the community should be enhanced, particularly given the risk of further epidemic waves of COVID-19. Additionally, with the advancement of COVID-19 vaccine development together with the existing problem of vaccine hesitancy,[52] it is necessary to explore the impact of GPs on COVID-19 vaccine uptake in future studies.

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Patient consent for publication Not required.

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terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

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