Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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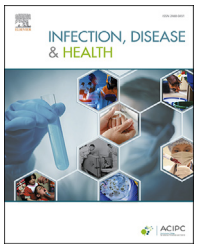

Research paper

Primary healthcare physicians' satisfaction towards work safety and personal protective equipment during the COVID-19 pandemic in Qatar: A cross-sectional study

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Abstract *Background:* During COVID-19 pandemic, healthcare workers are experiencing unprecedented pressure from stressors including enormous workload, virus exposure, and inadequate PPE. This study aimed to assess primary healthcare physicians' satisfaction towards work safety and personal protective equipment and their predictors during early stages of COVID-19 pandemic in Qatar.
Methods: A cross-sectional web-based survey was conducted in 27 primary healthcare centers in Qatar from 1st June to 30 July 2020. Descriptive and analytical statistics were used when appropriate. A multivariable linear regression analysis was done to identify predictors of satisfaction among participants.
Results: A total of 262 participants completed the questionnaire with a response rate of 58.2%. 51.9% were males and 68.3% were family physicians. Only 14.9% and 17.2% of respondents were satisfied or highly satisfied about the overall safety of work and the clinical guidelines on the use of PPE in the context of COVID-19 respectively. Participants who were general practitioners were significantly more likely to be satisfied with maintaining work safety and local PPE guidelines compared to family physicians by 2.93 scores (95% CI 1.43, 4,43 p -value $<$0.001), and 2.82 scores (95% CI 1.19, 4,44 p -value 0.001) respectively. Also, physicians who had more than ten years of experience in practice were significantly more likely to be

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satisfied with the PPE use guidelines compared to those who had fewer years of experience by 1.93 scores (95% CI 0.45, 3.41 p -value 0.011).
Conclusion: Overall satisfaction of participants with the safety of work and PPE clinical practice guidelines was low.

Highlights

- Primary care is the foundation for public emergency response plan.
- Healthcare worker safety is the cornerstone for patient safety.
- Clinical guidelines should be clear, applicable and delivered in a timely manner.
- Availability and quality of PPE provided extend beyond physical protection.
- Family physicians were less satisfied with work safety and PPE regulations.

Introduction

The world has comprehensively changed once the World Health Organization (WHO) announced the Novel Coronavirus SARS-CoV-2 (COVID-19) as a pandemic outbreak on the 11th of March, 2020 [1], which have had continuously affecting the economy, governments, and healthcare systems. COVID-19 virus is transmitted between people through close contact, droplets and through airborne transmission. Healthcare workers who are in close contact with a COVID-19 patient or who care for COVID-19 patients are at significant risk of getting the infection [2]. Consequently, it is mandatory to protect them and prevent transmission in the work setting by using appropriate personal protective equipment (PPE).

Multiple global, international, and local health authorities issued recommendations on safety protocols for healthcare workers [3—5]. Universally, as the Novel Coronavirus (SARS-CoV-2) pandemic has evolved, there has been a shortage of PPE availability to the healthcare workforce [6,7]. Meanwhile, since the WHO has warned about the beginning of the pandemic in March, basic protective equipment and safety protocols have not been always available in many medical institutions dealing with COVID-19 patients. Lack of PPE has left frontline healthcare workers unprotected while caring for their patients [8].

Since the start of the pandemic, guidance on the usage of such equipment has continued to evolve and has emphasized the conservation of resources rather than optimizing the protection of workers [9]. One of the biggest physical and psychological challenges for physicians while responding to COVID-19 was PPE, including repeated donning and doffing of equipment and prolonged hours wearing an uncomfortable, unsuitable PPE, challenges communicating with the health team and patients while wearing PPE [10]. Healthcare workers, who have been trained on how to don and doff PPE to maximize protection from infection, have had to make ad hoc adjustments on what piece of equipment to use and when that are not reflected in any training they have received because of PPE shortage [11].

During the COVID-19 pandemic, healthcare workers are experiencing unprecedented pressure from stressors including but not limited to enormous workload, virus exposure, and inadequate PPE [12,13]. Statistics from countries with the highest mortality rates indicate that healthcare workers are considered at greater risk of being infected with COVID-19, ranging from 15% to 20% of the infected population, and are therefore at a disproportionate risk to the rest of the population [14,15].

The Ministry of Public Health in Qatar has developed an emergency action plan in response to the outbreak of COVID-19 in March 2020, including access to PPE, alongside strict infection control guidelines and measures for healthcare facilities, staff, patients, and visitors. As a result, infection rates for healthcare staff were contained at 6.5%, which allowed maintenance of sufficient healthcare workforce [16]. Primary Health Care Corporation (PHCC) is publicly run and serves a population of 2.8 million throughout a network of 27 primary health care centers covering all of Qatar [17]. PHCC responded rapidly to the pandemic by assessing suspected COVID-19 cases and by tracing the contacts of positive patients. They suspended nonessential services, implemented telemedicine, and maintained urgent services and walk-in clinics. Laboratory services, pharmacy, and diagnostics were all operated to support the walk-in patients [18].

Workforce satisfaction is the cornerstone of well-functioning health systems. Prior to the pandemic, studies showed that physicians' professional satisfaction is associated with achieving higher quality of care, greater patients' satisfaction, and better levels of treatment adherence [19]. Moreover, during this critical time of the pandemic, physicians' satisfaction proved to be an essential motivational source to reduce physicians' burnout and to retain the medical workforce [13]. Therefore, healthcare policy makers need to identify primary healthcare physicians perception toward their safety at work and their satisfaction on PPE supply and regulations.

This study aimed to assess the satisfaction towards work safety and personal protective equipment and their

predictors among primary healthcare physicians during COVID-19 pandemic management in Qatar.

Methods

Study design and setting

A cross-sectional web-based survey was conducted from June 1st to July 30th, 2020 in PHCC. The study was reviewed and approved by the Institutional Review Board at Primary Health Care Corporation in Qatar with a reference number PHCC/DCR/2020/04/036. All Primary healthcare physicians (PCPs) were invited through email to participate in the study with a link containing anonymous, self-administered questionnaires using *SurveyMonkey* software. The email also provided information about the aim of the study, a confidentiality agreement, and consent for voluntary participation. An updated list of working PCPs was obtained from the PHCC operation office which provided a total of 450 PCPs who were mainly general practitioners (medical doctors with no specialty certification or post-graduate training) and family physicians (certified in family medicine), in addition to a few PCPs specialized in internal medicine, pediatrics, ophthalmology, and Ear, Nose, and Throat physicians (ENT). PCPs who were only providing administrative work or were on leave during the data collection period were excluded from the study.

Data collection

The questionnaire was developed based on expert opinion of primary care physicians currently working in PHCC and a review of the relevant literature. It was pretested with a convenient sample of the study population. Respondents who were included in pretesting were excluded from the final data analysis. Some questions were modified based on the feedback and the questionnaire was reviewed by three senior consultant researchers. The questionnaire contained the following sections: (1) participants' background characteristics including; age, gender, years of clinical experience, and qualifications, (2) PCPs' satisfaction with maintaining their safety at the workplace using the question "How satisfied or unsatisfied are you with the followings aspects of work environment safety in your health center", and (3) PCPs' satisfaction with PHCC clinical practice guidelines on the use of PPE using this question: "Regarding PHCC clinical practice guidelines on the use of PPE in the context of COVID-19, how satisfied or unsatisfied are you on the following aspects". The response to each question in the questionnaire was devised using a Likert scale that provides 5-options for respondents (1 = highly unsatisfied; 2 = unsatisfied; 3 = neutral; 4 = satisfied; 5 = highly unsatisfied) [20]. Likert scale was considered in this study to avoid nonresponse to the questions.

Statistical analysis

The data were analyzed using the *IBM SPSS Statistics for Windows* (version 23, IBM Corp., Armonk, N.Y., USA). Both descriptive and analytical statistics were applied. For descriptive statistics, frequency distribution tables and percentages were used for categorical variables, while mean and standard deviation (SD) were used for numeric variables. For analytical statistics, univariable and multivariable linear regression analyses were performed to identify the predictors of overall satisfaction with maintaining the safety of work at PHC centers as well towards PPE guidelines. Statistical significance was considered at $p \leq 0.05$.

Results

Among the 450 PCPs who were invited to participate in this survey, 262 PCPs completed the questionnaire with a response rate of 58.2%. As shown in Table 1, around half of the respondents were males (56.5%) and aged between 41 and 50 years old (51.9%). Most of the respondents (77.9%) had more than ten years of experience in general practice, and more than two-thirds were specialized in family medicine (68.3%).

Only 14.9% of PCPs who responded to our survey were satisfied or highly satisfied about the overall safety of work in their respective health centers. However, looking closely at the components of the questionnaire, we found that two-thirds of the respondents were satisfied or highly satisfied with their training on PPE, donning, and doffing, whereas around half of them were satisfied or highly satisfied with their accessibility for significant incidence reporting as well as the safety of the physical environment of the health center (56.8% and 53.5% respectively). 45.6% and 42.7% of the respondents were satisfied or highly

Table 1 Background characteristics of study participants (N = 262).

Variable	Frequency (%)
Age (years)	
≤40	63 (24.0)
41-50	136 (51.9)
≥51	63 (24.0)
Gender	
Female	114 (43.5)
Male	148 (56.5)
Specialty	
Family medicine	179 (68.3)
General practitioner	45 (17.2)
Internal medicine	12 (4.6)
Pediatrics	13 (5.0)
Others[a]	13 (5.0)
Job degree at PHCC	
General practitioner	65 (24.8)
Specialist	47 (17.9)
Consultant	129 (49.2)
Senior consultant	21 (8.0)
Years of experience	
≤10 years	58 (22.1)
>10 years	204 (77.9)

PHCC: Primary Health Care Corporation.
[a] Others: include: otolaryngologists, ophthalmologists, dermatologists.

Table 2 Physicians' satisfaction with maintaining the safety of work in their respective primary healthcare centers (N = 262).

Satisfaction toward maintaining work safety at the primary health center	Highly unsatisfied N (%)	Unsatisfied N (%)	Neutral N (%)	Satisfied N (%)	Highly satisfied N (%)
Accessibility to report and investigate arising incidents	8 (3.3)	18 (7.5)	78 (32.4)	110 (45.6)	27 (11.2)
Safety of the physical environment at your health center	14 (5.8)	19 (7.9)	79 (32.8)	102 (42.3)	27 (11.2)
Availability of PPE equipment at your health center	16 (6.6)	33 (13.7)	65 (27.0)	96 (39.8)	31 (12.9)
Quality of PPE equipment available in your health center	25 (10.4)	29 (12.0)	77 (32.0)	90 (37.3)	20 (8.3)
Training you on PPE use	10 (4.1)	15 (6.2)	55 (22.8)	132 (54.8)	29 (12.0)
Your overall satisfaction toward your health center safety of work	33 (13.7)	94 (39.0)	78 (32.4)	26 (10.8)	10 (4.1)

PPE: Personal protective equipment.

satisfied with the quality and availability of PPE provided (Table 2).

Similarly, 17.2% of respondents were overall satisfied or highly satisfied with PHCC-Infection Prevention and Control (IPAC) guidance on the use of PPE. Nevertheless, around half of the respondents were satisfied or highly satisfied with the scientific background and clarity of these guidelines (54% and 51.2% respectively), and the recommended type of PPE used by patients and staff (48.9% and 47% respectively). 38.6% and 38.1% were satisfied or highly satisfied about PCPs' contribution to the development or modification of PPE guidelines, respectively (Table 3).

Predictors of overall satisfaction with maintaining safety of work

The univariate analysis showed that age, medical specialty, and years of experience were significantly associated with overall satisfaction toward maintaining the safety of work among PCPs. After full adjustment, only medical specialty was significantly associated with overall satisfaction with maintaining the safety of work. Participants who were general practitioners and others (i.e., otolaryngologists, ophthalmologists, dermatologists) were significantly more likely to be satisfied with maintaining work safety at PHC centers compared to family physicians by 2.93 scores (95% CI 1.43, 4,43 $p < 0.001$) and 2.73 scores (95% CI 0.22, 5.25, $p = 0.033$), respectively (Table 4).

Predictors of overall satisfaction towards PPE guidelines

As in Table 5, the univariate analysis showed that age, medical specialty, and years of experience were significantly associated with overall satisfaction towards PPE guidelines. The fully adjusted regression model showed that participants who were general practitioners, internal medicine physicians, and others (i.e., otolaryngologists, ophthalmologists, dermatologists) were significantly more likely to be satisfied with the local PPE guidelines compared to family physicians by 2.82 scores (95% CI 1.19, 4,44 $p = 0.001$), 3.69 scores (95% CI 0.98, 6.41 $p = 0.008$), and

Table 3 Physicians' satisfaction with PHCC clinical practice guidelines on the use of PPE in the context of COVID-19 (N = 262).

Satisfaction toward PHCC clinical practice guidelines on the use of PPE	Highly unsatisfied N (%)	Unsatisfied N (%)	Neutral N (%)	Satisfied N (%)	Highly satisfied N (%)
Scientific background of the guidelines	14 (5.3)	25 (9.5)	80 (30.5)	122 (46.6)	21 (8.0)
Recommended type of PPE to be used by patients in the context of COVID-19	9 (3.4)	28 (10.7)	97 (37.0)	106 (40.5)	22 (8.4)
Recommended type of PPE to be used by staff in the context of COVID-19	22 (8.4)	42 (16.0)	75 (28.6)	99 (37.8)	24 (9.2)
The applicability of guidelines in your health center	12 (4.6)	22 (8.4)	94 (35.9)	110 (42.0)	24 (9.2)
Contribution of PHC physicians to the development of guidelines	14 (5.3)	45 (17.2)	102 (38.9)	84 (32.1)	17 (6.5)
Modifying the guideline according to family physicians' feedback	16 (6.1)	45 (17.2)	101 (38.5)	85 (32.4)	15 (5.7)
Your overall satisfaction toward PHCC-IPAC guidance on the use of PPE	26 (9.9)	95 (36.3)	96 (36.6)	26 (9.9)	19 (7.3)

PPE: Personal protective equipment. PHC: Primary health care. PHCC: Primary Health Care Corporation. IPAC: Infection Prevention and Control.

Table 4 Predictors of overall satisfaction with maintaining work safety among PCPs in Qatar (linear regression) (N = 262).

Variable	Univariable linear analysis			Multivariable linear analysis	
	Mean[a] (SD)	Unadjusted difference in mean (95% CI)	*p*-value	Adjusted difference in mean (95% CI)	*p*-value
Age (years)					
≤40	22.4 (4.4)	Reference		Reference	
41-50	22.7 (4.3)	0.29 (−1.03, 1.60)	0.667	−0.16 (−1.53, 1,21)	0.819
≥51	25.1 (3.7)	2.62 (1.06, 4.17)	0.001[b]	0.94 (−0.85, 2.74)	0.302
Gender					
Female	23.0 (3.9)	Reference		Reference	
Male	23.4 (4.6)	0.36 (−0.75, 1.47)	0.526	0.29 (−0.78, 1.37)	0.592
Medical specialty					
Family medicine	22.2 (4.3)	Reference		Reference	
General practitioner	25.6 (3.3)	3.36 (1.95, 4,78)	<0.001[b]	2.93 (1.43, 4,43)	<0.001[b]
Internal medicine	24.6 (4.8)	2.35 (−0.06, 4.75)	0.056	2.12 (−0.30, 4.53)	0.086
Pediatrics	25.4 (2.6)	3.15 (0.83, 5.47)	0.008[b]	2.22 (−0.30, 4.74)	0.084
Others[c]	24.8 (3.8)	2.58 (0.80, 5.10)	0.044[b]	2.73 (0.22, 5.25)	0.033[b]
Years of experience					
≤10 years	22.1 (4.3)	Reference		Reference	
>10 years	23.5 (4.3)	1.42 (0.11, 2.72)	0.034[b]	1.10 (−0.26, 2.45)	0.112

Dependent variable: overall awareness mean score. Enter multiple linear regression applied. The model assumption is fulfilled. No interactions and no multicollinearity were detected. R^2 = 14.0%.

[a] Score ranged from 10 to 31.

[b] Statistically significant at $p \leq 0.05$.

[c] Include: otolaryngologists, ophthalmologists, dermatologist.

2.95 scores (95% CI 0.32, 5.58 $p = 0.028$), respectively. Furthermore, physicians who had more than ten years of experience in practice were significantly more likely to be satisfied with the PPE use guidelines compared to those who had fewer years of experience by 1.93 scores (95% CI 0.45, 3.41 $p = 0.011$).

Discussion

This is a retrospective cross-sectional study on 262 primary healthcare physicians working in Qatar that aimed to reflect their satisfaction toward safety of work and PPE use in the context of COVID-19 pandemic management at the primary healthcare level.

Our study indicates that respondents had a low level of overall satisfaction toward maintaining work safety and PPE use guidelines in PHCC in Qatar despite having a better level of satisfaction on each component of these two domains. PCPs who were specialized in family medicine were the least likely to be satisfied in comparison to other specialties. Whereas having more than 10 years of clinical experience doubled the likelihood of satisfaction with PPE use guidelines.

Empowering frontline healthcare workers by maintaining a safe working environment and providing adequate and quality-compliant PPE help in reducing psychological distress associated with this pandemic as well as maintaining healthcare workforce. An observational study by Cai et al. on 534 frontline medical staff in Hubei, China, showed that although participants believed that they had social and professional obligations to continue working long hours, provision of adequate PPE and strict infection control measures were considered the most important motivational factors to encourage continuation of work in any future outbreaks [21]. Another study in Iran during the height of the COVID-19 pandemic in April 2020 concluded that the effect of PPE accessibility extended beyond physical protection, as it was not only associated with better physical health but was also correlated with improved job satisfaction and less distress [13].

Physicians' satisfaction toward work safety, PPE use and regulations were variable among different health systems and settings. In Italy, a web-based survey on 516 physicians with comparable age and clinical experience to the participants in the current study, found that PPE was 'always' available for 13% and 'sometimes' for 50% of respondents, and that the place of work affected PPE accessibility where adult PCPs had half the odds of getting PPE when they needed it (OR = 0.5, 95% C.I. 0.3–0.9). Moreover, around half of the respondents found the information they received on PPE use was clear (47%) or complete (54%), and only 25% were satisfied with this information. Likewise, adult PCPs had half the odds (OR = 0.5, 95% C.I. 0.3–0.9) of receiving such information compared to physicians working in a different setting [22]. In comparison to the current study, our results indicate that PCPs in Qatar had higher level of satisfaction with their training on PPE use, the availability and quality of PPE provided, as well as the scientific background and applicability of PPE use clinical practice guidelines.

Regarding physicians' perception toward physical environment and safety policies, our results were similar to studies conducted in other countries. For example, a cross-sectional study in Latin America on the realities and perspectives of healthcare workers on personal safety during the COVID-19 pandemic found that participants' perception

Table 5 Predictors of overall satisfaction towards PPEs guidelines among physicians in primary care in Qatar (linear regression) (N = 262).

Variable	Univariable linear analysis			Multivariable linear analysis	
	Mean[a] (SD)	Unadjusted difference in mean (95% CI)	*p*-value	Adjusted difference in mean (95% CI)	*p*-value
Age (years)					
≤40	24.9 (5.2)	Reference		Reference	
41-50	25.3 (4.7)	0.36 (−1.10, 1.79)	0.622	−0.41 (−1.91, 1,10)	0.594
≥51	28.2 (4.5)	3.24 (1.57, 4.91)	<0.001[b]	1.30 (−0.64, 3.24)	0.188
Gender					
Female	25.6 (4.6)	Reference		Reference	
Male	26.2 (5.1)	0.57 (−0.64, 1.78)	0.353	0.55 (−0.61, 1.72)	0.349
Medical specialty					
Family medicine	24.9 (4.8)	Reference		Reference	
General practitioner	28.4 (4.3)	3.55 (2.01, 5,09)	<0.001[b]	2.82 (1.19, 4,44)	0.001[b]
Internal medicine	28.9 (4.6)	4.06 (1.31, 6.82)	0.004[b]	3.69 (0.98, 6.41)	0.008[b]
Pediatrics	27.2 (4.1)	2.30 (−0.35, 4.95)	0.089	0.85 (−1.96, 3.67)	0.551
Others[c]	27.6 (5.1)	2.76 (0.11, 5.41)	0.041[b]	2.95 (0.32, 5.58)	0.028[b]
Years of experience					
≤10 years	24.1 (5.1)	Reference		Reference	
>10 years	26.4 (4.8)	2.26 (0.85, 3.68)	0.002[b]	1.93 (0.45, 3.41)	0.011[b]

Dependent variable: overall awareness mean score. Enter multiple linear regression applied. The model assumption is fulfilled. No interactions and no multicollinearity were detected. R^2 = 15.0%.

[a] Score ranged from 12 to 36

[b] Statistically significant at $p \leq 0.05$.

[c] Includes otolaryngologists, ophthalmologists, dermatologists.

toward the role of their medical institution and public health authorities in protecting physical integrity in the workplace was around 5 (in a 1 to 10 Likert scale) [23] which is comparable to our results. In the current study, around half of the respondents were satisfied with the health centres' physical environment safety and their accessibility to report and investigate significant incidents using PHCC risk management system.

In regards to physicians characteristics, our study showed no correlation between age and gender of PCPs and the level of satisfaction towards work safety and PPE uses clinical practice guidelines. However, the previously cited study in China found that older medical staff had more worries about their own safety than younger staff and were more stressed by lack of protective clothing, whereas measures like correct guidance and effective safeguards for the prevention of disease transmission eased more female staff anxiety than in male staff with a small difference [21]. Regarding physicians' professional characteristics, having more than 10 years of clinical experience correlated positively with satisfaction with the PPE guidelines, whereas PCPs who were specialized in family medicine were the least likely to be satisfied with work safety and PPE guidelines.

Based on the available evidence, several recommendations can be drawn in order to maintain primary healthcare physicians' satisfaction toward safety of work during this unprecedented time. First, healthcare policy makers should incorporate PCPs feedback and provide timely, evidence-based, and clear clinical practice guidelines. Second, PCPs training needs on PPE use should be identified and continuously reassessed to ensure their safety and satisfaction. Third, adequate and quality-compliant supplies of PPE should be maintained in primary healthcare settings to sustain physical and psychological support. Fourth, PCPs with shorter duration of clinical experience need to be empowered and involved in infection control and prevention decision making. Finally, family medicine training programs should integrate emergency preparedness strategies as integral parts of their curriculum.

This study has several limitations. Due to the challenges of data collection during the COVID-19 era, the response rate was lower than desired. Furthermore, due to the complex nature of assessing work safety in a healthcare setting for PCPs, it is possible that the questionnaire used was limited in scope which could be better assessed with a follow up mixed qualitative and quantitative methods study. Also, the self-reported response in this questionnaire might not represent actual or genuine answers.

Despite these limitations, our results present some of the first evidence on how PCPs in Qatar felt about their safety at work and local clinical practice regulations on PPE use. The complex nature of this global pandemic has certainly influenced the sense of safety physicians might have felt. Given the unique circumstances faced both globally and locally, and when these results are put into perspective, it appears that PCPs in Qatar were reasonably satisfied with the current availability of PPE and work safety regulations. However, knowledge gaps are still existing on how to improve overall perception of family physicians in Qatar toward work safety during these unaccustomed circumstances. The current study has underlined some areas that need improvement in preparation for recurrent waves of the COVID-19 disease and any potential future pandemics or epidemics.

Conclusion

The overall satisfaction of PCPs in Qatar on the safety of work and PPE use guidelines were low despite having reasonable satisfaction rates with the availability and quality of PPE, the physical environment of the health center as well as clarity and applicability of PPE use clinical practice guidelines.

Ethical considerations

The Institutional Review Board at Primary Health Care Corporation in Qatar approved this study (Reference number PHCC/DCR/2020/04/036). Consent was taken from the participant electronically through the survey link.

Authorship statement

Conception and design of the study: MI, AJ, NS.
Data acquisition: MI, AJ, MN.
Data Analysis: AA, NS.
Data interpretation: MI, AJ, AA, FE, NS.
All the authors contributed to drafting the work or revising it critically, agreed to be accountable for all aspects of the work, and approved the final version submitted to Infection, Disease & Health.

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Declaration of competing interest

None declared.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.idh.2021.12.002.

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