Introduction. COVID-19 pandemic has placed the entire world, including Malaysia in a state of fear. The rising burden on healthcare facilities has put healthcare workers consistently at risk of healthcare-associated infection. We sought to identify determinants of preventive practice against COVID-19 at work among primary healthcare professionals in Sabah, Malaysia.

Method. This was a cross-sectional study involving healthcare workers of the Penampang and Putatan districts of Sabah, Malaysia. A total of 167 health professionals from primary healthcare settings took part in this study via a self-administered questionnaire from November 2020 until January 2021. Independent t-test and Analysis of Variance were used to determine differences in preventive practice for categorical independent variables. Pearson product-moment correlation was applied to assess the relationship between Job Satisfaction, burnout, and preventive practice. Subsequently, predictors of preventive practice at work among healthcare workers in Sabah were identified through Binomial Logistic Regression.

Results. The prevalence of good preventive practice among health professionals at work was 71.3%. There was no difference in preventive practice between professions. Almost all participants reported having good personal protective equipment compliance and hand hygiene practice at work. Marital status (AOR = 4.170, 95% CI = 1.787, 9.733; p = 0.001), average sleep hours (AOR = 1.775, 95% CI = 1.144, 2.754; p = 0.01), and pandemic-related burnout (AOR = 0.905, 95% CI = 0.847, 0.967; p = 0.003) were identified as significant predictors of preventive practice at primary healthcare facilities.

Conclusions. The outcome of this study is beneficial to the healthcare organization. It can serve as a useful guide to tackle issues related to poor preventive practice against COVID-19 at work for health professionals.
organization. To date, there is no research to study the determinants of good compliance on preventive practice among the health workforce in the state of Sabah, in both primary healthcare and hospital settings.

International borders were closed with movement restrictions on state and district borders has affected healthcare workers and their families as well, causing excessive negative psychological effects [11]. Case overload could threaten the well-being of our health workforce. In this scenario, understanding factors that could influence healthcare workers’ compliance towards the preventive practice of COVID-19 at work is vital to provide the necessary interventions. Therefore, the main objective of this study is to identify the determinants of preventive practice at work among primary healthcare workers in Sabah during the COVID-19 pandemic.

Methods

**STUDY SETTING, DESIGN AND SAMPLING**

Sabah is the second largest state in Malaysia and it is located in Borneo Island alongside Sarawak and neighboring countries namely Brunei and Indonesia [12]. Penampang is located on the west coast of Sabah, Malaysia with a size of 424.73 square kilometers. It is located approximately 9 km from the capital city of Sabah, Kota Kinabalu and about two-thirds of its area is highland and natural forest. Public primary healthcare facilities in Penampang are District Health Office, Penampang Health Clinics, Terian Health Clinic, two community clinics (Cyber Square and Bundusan), and four Rural Clinics (Nosoob, Limbanak, Moyog, and Babagon). The district of Putatan is also located at the west coast region of Sabah. Primary healthcare facilities in Putatan are the District Health Office, Putatan Health Clinic, Putatan Jaya Community Clinic, and Petagas Rural Clinic. Primary healthcare services comprise detection, prevention, and control activities of COVID-19.

This was a health facility-based cross-sectional study involving governmental primary healthcare workers of Penampang and Putatan Sabah. It was carried out from December 2020 until February 2021. Doctors, Nurses, Assistant Medical Officers, Assistant Environmental Health Officers, Pharmacists, Science Officers, Occupational/Physiotherapists were recruited via convenience sampling. All primary healthcare workers of Penampang and Putatan districts were eligible to participate (n = 409). After participants were briefed on the research objective, self-administered questionnaires were given via online google form. Their daily tasks were not interrupted by this project. Out of 409 healthcare workers, a total of 167 took part in this study (response rate = 40.8%). Those who consented were briefed on this study. Then self-administered questionnaires (google form) were given to them.

**INSTRUMENT**

A structured questionnaire was generated from literature review and validated questionnaires. It consist of 6 constructs: sociodemographic characteristics, working environment, Risk assessment and information on Personal Protective Equipment, Copenhagen Burnout Inventory, Job Satisfaction, and preventive practice against COVID-19. Copenhagen Burnout Inventory contains 3 domains with a total question of 22; personal burnout (5 questions), work-related burnout (7 questions), and pandemic-related burnout (10 questions). The first and second domains were adopted from the Malay Version of the Copenhagen Burnout Inventory by Andrew Chin and Colleagues [13]. Simultaneously, Pandemic related burnout component was adopted from a study by Khasne R. and Colleagues on healthcare workers in India [14]. Job Satisfaction was a 5-point Likert scale measurement (strongly disagree, disagree, unsure, agree and strongly agree) questionnaire with a total of 7 questions and was adopted from Leggat, S., and Colleagues [15]. Questions on Preventive practice at work were adopted from the study by Asemahagn, M.’s study in Ethiopia which consists of 9 questions [6]. For every question, the respondents were required to choose one answer out of 3 options (never, occasionally, and always). The overall preventive practice score was computed from 9 questions with a possible maximum score of 27 and a minimum score of 0. Participants who scored less than the mean value were classified as having poor preventive practice. The higher the score, the better the preventive practice.

**STATISTICAL ANALYSIS**

First, data were coded and analyzed using Statistical Package for Social Science (SPSS) version 23. All the data were carefully checked and cleaned in Microsoft Excel before analysis in SPSS. Descriptive analysis was performed to determine frequency, percentage, mean, median, and standard deviation. It was used to describe the basic features of the data in this study. Descriptive statistics provided a simple summary of the sample and its measures. Before logistic regression, bivariate analysis was performed and all the independent variables with a p-value of less than 0.2 were selected to be analyzed in multivariate analysis. For categorical data, the Chi-square test was used to assess the relationship between the independent variables and preventive practice. Pearson correlation coefficient was applied to measure the linear association between two continuous variables. Subsequently, Binomial logistics regression was used to determine the predictors of preventive practice at the workplace. The dependent variable consists of two categories: good and poor preventive practice. Outliers, assumptions, multicollinearity, and interactions were checked. An odd ratio of more than one indicates an increased odd that affects preventive practice at work among health professionals an odds ratio of less than one indicates the opposite result. A p-value of less than 0.05 was considered statistically significant.

**ETHICAL CONSIDERATION**

Medical Research and Ethics Committee of the Ministry of Health Malaysia granted approval to conduct this research [NMRR-20-2554-57340 (IIR)]. Participation
in this research was voluntary and confidentiality of information was assured.

**Results**

A total of 167 respondents took part in this study and all of them were Malaysians. Sociodemographic characteristics were presented in Table I alongside the difference in preventive practice. All our respondents were healthcare workers, aged between 21 to 56 years old with an interval of 35 years. The mean age of respondents was 35.2 (7.36) years. Approximately half of the respondents (43.1%) were from the age group of 31 to 40 years old. A majority of respondents were married (70.1%) and more than half of them (65.3%) obtained cert/diploma/secondary education. Based on the profession, the majority of them were nurses (35.9%), followed by doctors (20.4%) and Assistant Medical Officers (17.4%). Other support staff such as Assistant Environmental Health Officer, Public Health Assistant comprised 26.3%.

Most of them (43.5%) have working experience of more than 10 years, average weekly working hours of 41-60 hours (53.3%), and average sleep of 6 hours or less daily (67.1%). A total of 40.7% of the respondents lived more than 10 km from their workplace.

| Variables                | Frequency (%) | Mean (SD)/median | Preventive practice at work | P-value |
|--------------------------|---------------|------------------|----------------------------|---------|
| **Age**                  |               |                  |                            |         |
| Below 30                 | 54 (32.3)     | 35.2 (7.36)      | 17 (31.5)                  | 0.747   |
| 31 to 40                 | 72 (43.1)     |                  | 21 (29.2)                  |         |
| Above 40                 | 41 (24.6)     | Median 34.0      | 10 (24.4)                  |         |
| **Gender**               |               |                  |                            |         |
| Male                     | 54 (32.3)     |                  | 21 (38.9)                  | 0.045*  |
| Female                   | 113 (67.7)    | 27 (23.9)        | 33 (61.1)                  |         |
| **Marital status**       |               |                  |                            |         |
| Married                  | 117 (70.1)    | 25 (21.4)        | 92 (78.6)                  | 0.001*  |
| Unmarried                | 50 (29.9)     | 25 (46.0)        | 27 (54.0)                  |         |
| **Education**            |               |                  |                            |         |
| Cert/diploma and below   | 109 (65.3)    | 31 (28.4)        | 78 (71.6)                  | 0.906   |
| Tertiary education       | 58 (34.7)     | 17 (29.3)        | 41 (70.7)                  |         |
| **Designation**          |               |                  |                            |         |
| Doctor                   | 34 (20.4)     | 11 (32.4)        | 23 (67.6)                  | 0.070   |
| Nurse                    | 60 (35.9)     | 10 (16.7)        | 50 (83.3)                  |         |
| Medical Assistant        | 29 (17.4)     | 10 (34.5)        | 19 (65.5)                  |         |
| Others                   | 44 (26.5)     | 17 (38.6)        | 27 (61.4)                  |         |
| **Working experience**   |               |                  |                            |         |
| Less than 5 years        | 30 (17.9)     | 10.8 (7.03)      | 21 (70.0)                  | 0.652   |
| 5 to 10 years            | 65 (38.7)     | Median 9.0       | 44 (67.7)                  |         |
| More than 10 years       | 72 (43.5)     | 18 (25.0)        | 54 (75.0)                  |         |
| **Comorbs**              |               |                  |                            |         |
| Yes                      | 33 (19.8)     | 8 (24.2)         | 25 (75.8)                  | 0.524   |
| No                       | 134 (80.2)    | 40 (29.9)        | 94 (70.1)                  |         |
| **Average sleep hour**   |               |                  |                            |         |
| 6 hours and less         | 112 (67.1)    | 6.1 (1.07)       | 75 (67.0)                  | 0.080   |
| More than 6 hours        | 55 (32.9)     | Median 6.0       | 44 (80.0)                  |         |
| **Working duration (weekly)** |           |                  |                            |         |
| 40 hours and below       | 38 (22.8)     | 54.1 (14.46)     | 31 (81.6)                  | 0.230   |
| 41-60 hours              | 89 (53.5)     | Median 50.0      | 66 (74.2)                  |         |
| More than 60 hours       | 40 (24.0)     | 18 (45.0)        | 22 (55.0)                  |         |
| **Elderly family members at home** |     |                  |                            |         |
| Yes                      | 46 (27.5)     | 9 (19.6)         | 37 (80.4)                  | 0.106   |
| No                       | 121 (72.5)    | 39 (32.2)        | 82 (67.8)                  |         |
| **PPE discomfort**       |               |                  |                            |         |
| Yes                      | 88 (52.7)     | 32 (36.4)        | 56 (63.6)                  | 0.022*  |
| No                       | 79 (47.3)     | 16 (20.3)        | 65 (79.7)                  |         |
| **House distance**       |               |                  |                            |         |
| Less than 5 km           | 45 (26.9)     | 10 (22.2)        | 35 (77.8)                  | 0.162   |
| 5-10 km                  | 54 (32.3)     | 13 (24.1)        | 41 (75.9)                  |         |
| More than 10 km          | 68 (40.7)     | 25 (36.5)        | 43 (63.2)                  |         |
| **Treated as PUI**       |               |                  |                            |         |
| Yes                      | 90 (53.9)     | 28 (31.1)        | 62 (68.9)                  | 0.465   |
| No                       | 77 (46.1)     | 20 (26.0)        | 57 (74.0)                  |         |

PUI: Person Under Investigation, * P < 0.05 is considered significant.
respondents have no comorbid (80.2%) and not staying with an elderly family member (72.5%). Half of the respondents claimed to have discomfort when wearing Personal Protective equipment at work (52.7%). Since the beginning of this pandemic (up to the end of the data collection phase), a total of 90 respondents (53.9%) had a history of quarantine due to contact with positive cases or interstate traveling.

Bivariate analysis reported several factors associated with good COVID-19 preventive practice at the workplace. Female respondents have better preventive practice compared to male respondents. Married participants were reported to have better preventive practice than the unmarried participants. Respondents with discomfort when wearing PPE reported to have poorer preventive practice than those without discomfort when wearing PPE. Pearson product-moment correlation was run to determine the relationship between preventive practice against COVID-19 and Job Satisfaction, personal burnout, work burnout and pandemic burnout. There was a correlation between Job Satisfaction and preventive practice against COVID-19 which was statistically significant (r = 0.235, n = 167, p = 0.002). Burnout was also found to have effect on preventive practice against COVID-19. Personal burnout (r = -0.242, n = 167, p = 0.002), work burnout (r = -0.306, n = 167, p < 0.001) and pandemic burnout (r = -0.305, n = 167, p < 0.001) has negative correlation towards preventive practice against COVID-19 and were statistically significant.

A vast majority of healthcare workers, 163 (97%) regularly throw used tissue into the dustbin when they were at work (Tab. II). Almost all respondents (98.2%) frequently wash their hands, regularly wear face masks/face shields (98.8%) at work, and no longer practice handshaking (91.7%). More than half of the respondents (60.7%) still occasionally practice table sharing during lunch break with their colleagues. A total of 71 (42.3%) participants claimed that their workplace/room/cubicle was occasionally crowded. Half of the respondents [89 (53.0%)] occasionally touch their eyes, nose, or mouth when they are at work and a total of 126 (75.0%) respondents always practice social distancing as recommended by World Health Organization. A total of 117 (69.9%) respondents always disinfect their belongings, table, and working room.

Binomial logistic regression was used to determine the predictors of good preventive practice among healthcare workers in Sabah (Tab. III). The logistic regression model

**Tab. II.** Preventive practice among healthcare workers.

| Variables                                      | Never n (%) | Occasionally n (%) | Always n (%) |
|-----------------------------------------------|-------------|--------------------|--------------|
| Do you throw used tissue safely in a dustbin?  | 3 (1.8)     | 2 (1.2)            | 163 (97.0)   |
| Do you use frequent handwashing with water and soap /or alcohol-based bund rub sterilizer as per recommended? | 0 (0.0)     | 3 (1.8)            | 165 (98.2)   |
| Do you routinely wear a facemask / face shields at work? | 0 (0.0)     | 2 (1.2)            | 166 (98.8)   |
| Do you and your colleague eat together at workplace (same table)? | 33 (19.6)   | 102 (60.7)         | 33 (19.6)    |
| Is your workplace/room/cubicle crowded?       | 57 (33.9)   | 71 (42.3)          | 40 (23.8)    |
| Do you practice handshaking?                  | 154 (91.7)  | 11 (6.5)           | 5 (1.8)      |
| Do you touch your eyes, nose or mouth when you are at work? | 71 (42.3)   | 89 (53.0)          | 8 (4.8)      |
| Do you practice social distancing recommended by the WHO? | 7 (4.2)     | 35 (20.8)          | 126 (75.0)   |
| Do routinely disinfect your own belongings, surfaces table and working room? | 10 (6.0)    | 41 (24.4)          | 117 (69.9)   |

**Tab. III.** Predictors of prevention practice against COVID-19 among healthcare workers at work.

| Variables                                      | Crude OR (95% CI) | Adjusted OR (95% CI) | P value |
|-----------------------------------------------|-------------------|----------------------|---------|
| Gender                                        | 1.253 (1.410-3.856) | 0.692                |         |
| Marital status                                | 5.788 (1.871-17.906) | 4.170 (1.787-9.733) | 0.001   |
| Designation                                   |                   |                      |         |
| Doctor                                        |                   |                      |         |
| AMO*                                          | 0.900             | 0.058                |         |
| Nurse                                         | 1.504             | 0.886                |         |
| Others                                        | 0.232             | 0.616                |         |
| Average sleep hours                           | 1.671 (1.011-2.763) | 1.775(1.144-2.754) | 0.010   |
| Working duration                              | 0.986 (0.956-1.017) | 0.365                |         |
| Elderly at home                               | 3.108 (1.032-9.355) | 0.059                |         |
| PPE discomfort                                | 0.787 (0.314-1.974) | 0.610                |         |
| House distance                                | 1.600 (0.661-3.871) | 0.297                |         |
| Treated as PUI                                | 1.385 (0.553-3.587) | 0.503                |         |
| Job satisfaction                              | 1.207 (1.076-1.355) | 1.145(1.050-1.248) | 0.002   |
| Personal burnout                              | 1.018 (0.834-1.242) | 0.864                |         |
| Work related burnout                          | 1.019(0.865-1.199)  | 0.825                |         |
| Pandemic related burnout                       | 0.882(0.781-0.996)  | 0.905(0.847-0.967)  | 0.003   |

AMO: Assistant Medical Officer; Model of chi square (df): 47.99 (4) p-value < 0.001; n = 167; Hosmer and Lemeshow Test p-value = 2.568 > 0.05; CI: Confidence Interval; OR: Odd Ratio; * Logistic Regression (no multicollinearity, assumptions were all met); Dependant variables: preventive practice against COVID-19 at work (poor vs good).
was statistically significant, $\chi^2(4) = 47.99, p < 0.001$. The model explained 35.7% (Nagelkerke $R^2$) of the variance in preventive practice and correctly classified 71.3% of cases. The outcome variable was dichotomous and selected independent variables from socio-demographic characteristics, working environment, risk assessment, and information of Personal Protective Equipment including continuous variables: Copenhagen Burnout Inventory and Job Satisfaction. Married respondents were 4.170 times more likely to have better preventive practice than unmarried respondents (95% CI: 1.787, 9.733; p = 0.001). Every unit of adequate sleep will increase preventive practice by 1.775 times (95% CI: 1.144, 2.754; p = 0.01). Every unit increase in burnout (pandemic related) score, there was a 10% decrease in odds of having good preventive practice (95% CI: 0.847, 0.967; p = 0.003). With every unit of increment in Job Satisfaction, preventive practice improves by 1.15 times with AOR: 1.145 (95% CI: 1.050-1.248). However, the 95% CI of the OR was reported to be 1.050 times (pandemic related) score, there was a 10% decrease in odds of having good preventive practice (95% CI: 0.847, 0.967; p = 0.003). With every unit of increment in Job Satisfaction, preventive practice improves by 1.15 times with AOR: 1.145 (95% CI: 1.050-1.248). However, the 95% CI of the OR was reported to be 1.050 times and 1.24 times. Therefore, Job Satisfaction was not a significant predictor for the preventive practice among primary healthcare workers in Sabah because the lowest point of 95% CI was near 1.0.

Discussion

To the best of our knowledge, this study was one of the first to assess the level of preventive practice at the workplace among primary healthcare workers in Malaysia. Compliance with good occupational safety and health protocols among healthcare workers is vital to reduce the risk of contracting COVID-19. Healthcare workers are the most important resources in the war against this devastating pandemic. Good workplace health and safety practice against infection is important to prevent health professionals from contracting Healthcare-Associated Infection (HAI) such as COVID-19. Our analysis discovered substantial determinants of preventive practice against COVID-19 among healthcare workers at the workplace. In this study, the prevalence of good overall preventive practice against COVID-19 in healthcare settings was 71.3%. However, it is vital to acknowledge that almost all health professionals who took part in this study constantly wear personal protective equipment such as face mask/face shield at work and regularly practice good hand hygiene. Similar findings were reported in other developing countries namely Ethiopia, Nepal, and China [16-18]. Good hand hygiene practice and adherence to personal protective equipment were two of the most important preventive measure to repel nosocomial infection. Even though gloves were worn during certain clinical procedures and disease control activities in the field, it is not a substitute for handwashing. The World Health Organisation (2009) reported that a simple procedure such as hand hygiene can reduce the global burden of Healthcare-Associated Infection [19]. Furthermore, supplies of alcohol-based sanitizers and personal protective equipment in healthcare settings have been consistently sufficient throughout this pandemic.

Chi-square analysis reported that there was a significant difference in preventive practice at work between males and females. Female respondents have better preventive practices than male respondents. Similar findings were reported among healthcare workers in Saudi Arabia whereby female nurses practice better infection control practice compared to male nurses [20]. Nevertheless, logistic regression indicated that gender was not a predictor of preventive practice among healthcare workers in Sabah. A similar finding was reported among healthcare workers in Lebanon and Pakistan [21, 22]. It is not surprising that the education level of healthcare workers did not influence COVID-19 preventive practice as studies in other developing countries reported similar findings [16, 20]. The preventive practice among healthcare was also not influenced by their profession. Furthermore, it is worth noting that respondents with higher educational backgrounds such as tertiary education are in the management and professional group. Thus, an intervention can be focused on healthcare workers in general regardless of their rank and position. Marital status significantly affects preventive behaviours in our study. Married healthcare workers have better preventive practices than unmarried healthcare workers. A study in Saudi Arabia reported a similar finding [20]. Al-Dossary and colleagues conducted studies among nurses in Saudi Arabia and postulated that married healthcare workers have better preventive practice than unmarried healthcare workers. This might be attributed to one’s responsibility to prevent infecting family members.

Job Satisfaction improves preventive practice at work for healthcare providers. Our study reported that healthcare workers with good Job Satisfaction practice better COVID-19 preventive behaviour. It was not surprising to discover that burnout affects the preventive practice of health professionals other than their work performance. This was supported by the findings of Appleton K and Colleagues in their study on the general practitioners in Leeds, England [23]. Job Satisfaction can be influenced by the level of motivation. One study in Indonesia demonstrated that Infection Prevention Control Practice among healthcare workers improves with better motivation levels [24]. Good sleeping habit promotes better preventive behaviours, job performance and quality of service [25, 26]. Sleeping disorders can also cause metabolic disturbances. Our study reported that lack of sleep leads to the poor preventive practice of health professionals at the workplace. Sleep deprivation leads to error which lead to poor infection control practice among healthcare workers. It is interesting to note that certain demographic variables like age and working experience do not significantly affect one’s preventive behaviour.

Our study suggested that pandemic-related burnout negatively influenced preventive practice among healthcare workers. Burnout can seriously affect the physical and mental health of health professionals which can lead to low productivity, absenteeism, and accident
The main strength of the study was it serves as baseline data of preventive behaviours among healthcare workers to formulate intervention strategies. Further study is needed to include health professionals from the hospital setting. Additionally, mental health and the risk of metabolic diseases among healthcare workers also require appropriate attention. A qualitative study on job satisfaction among healthcare workers could serve as a good method to explore its determinants. Good job satisfaction will optimize the health system service delivery. It will be interesting to assess preventive behaviours at the workplace which include other communicable diseases such as tuberculosis. Sedentary lifestyle habits among healthcare workers which resulted from overwork should be assessed as well to address non-communicable diseases.

Several limitations of this study should be acknowledged. First, a cross-sectional study only allows us to obtain independent and dependent variables concurrently. Hence only association can be identified but causality could not be inferred. Secondly, since the study was carried out in District Health Office and Health Clinics, the generalizability of research findings is limited to governmental primary healthcare facilities. Another limitation that warrants an explanation was in a self-reported questionnaire, respondents might be biased in expressing their opinion.

**Conclusions**

The current study revealed that the prevention practice among health professionals still requires optimization to prevent Healthcare-Associated infection. Marital status, average hours of sleep daily, job satisfaction, and burnout were significant predictors of preventive practice against COVID-19 among healthcare workers. The outcome of this study is beneficial to the policymakers of healthcare. It can serve as a guide to tackle issues related to poor preventive practice against COVID-19 at work. Focused intervention can be delivered according to the significant findings by aiming at specific target groups. This will be more cost-effective and at the same time able to provide an efficient service.

**Acknowledgements**

Funding sources: this research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. We gratefully appreciate all respondents of this research. Special thanks to all who were involved in the recruitment of participants. We would also like to thank the Director-General of Health Malaysia for the permission to publish this paper.

**Conflict of interest statement**

The authors declare no conflict of interest.
Authors’ contributions

SFJ designed and directed the project. AJ helped to supervise the study. AFM and MEE were involved in data collection. SFJ performed the analysis, results interpretation and wrote the manuscript with the support of AJ, AFM, and MEE. All authors reviewed and approved the final version of the manuscript.

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Received on February 18, 2021. Accepted on July 14, 2021.

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How to cite this article: Jiee SF, Jantim A, Mohamed AF, Emiral ME. COVID-19 pandemic: determinants of workplace preventive practice among primary healthcare workers in Sabah, Malaysia. J Prev Med Hyg 2021;62:E605-E612. https://doi.org/10.15167/2421-4248/jpmh2021.62.3.2031

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