ORIGINAL ARTICLE

Evaluation Of Sexual Dysfunction in Associations with Physical Activity, Psychological Health, and Other Factors Among Female Healthcare Workers During the Pandemic Novel Coronavirus Disease (COVID-19)

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ABSTRACT

Introduction: Female sexual function may be affected during the COVID-19 pandemic. Factors including spousal factors, physical and psychological health, and physical activity could contribute to female sexual dysfunction but were not much explored. Understanding this is important to address the often neglected but vital aspect of human functioning. **Methods:** This cross-sectional study examined the prevalence and determinants of female sexual dysfunction (FSD) among female healthcare workers in an urban teaching hospital. Participants completed baseline characteristics, the validated Malay version of the Female Sexual Function Index (MVFSFI), International Physical Activity Questionnaire-Short Form (IPAQ-SF), Depression Anxiety and Stress Scale 21 (DASS-21), and International Index of Erectile Dysfunction (IIEF). FSD predictors were determined by using multiple logistic regression. **Results:** Large missing IIEF data were overcome by the multiple imputation method. Among 229 participants, FSD prevalence was 6.1%. Lack of lubrication was significantly associated with moderate-to-vigorous physical activity (p=0.043). The variables with a p-value of less than 0.200 from the univariable analysis were included in the multiple regression model. The significant association for FSD was the spouse's erectile function (adjusted OR [AOR] = 0.76 95% CI: 0.59 to 0.98, p= 0.033). In comparison, a positive COVID-19 history was related to a lower odds of FSD (adjusted OR [AOR] = 0.19 95% CI 0.05 to 0.74, p= 0.017). **Conclusion:** Although the prevalence of female sexual dysfunction (FSD) was low among healthcare workers, it was significantly associated with spousal erectile function. In addition, a history of COVID-19 infection was associated with lower odds of FSD.
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Keywords: COVID-19, Physical activity, Mental health, Health personnel, Sexual dysfunction,Physiological

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INTRODUCTION

The novel coronavirus disease (COVID-19) that sparked a global health scare has significantly influenced population life beyond one's physical health symptoms years after the endemic of the disease. Global unpreparedness for this unprecedented challenge has resulted in occupational and emotional burden on healthcare workers (HCWs), rendering them a vulnerable population. The third wave of the epidemic occurred throughout this study period, and by April 2022, the virus had progressed from recovery to endemic status. HCWs had to cope with their responsibilities in adapting to this new normal while effectively responding to the needs of the communities with optimum care despite the limited resources available to treat and reduce this contagion. As a result, HCWs are susceptible to psychological and physical stressors, which impact their psychological well-being, physical activity, and sexual health, which could be interrelated [1–4]. The COVID-19 lockdown measure also influenced their physical inactivity during the COVID-19 outbreak.

While psychological and physical health received robust and widespread research during the COVID-19

pandemic, studies on sexual functioning remain scarce. Nevertheless, the impact of COVID-19 on female sexual health has been implicated, including a decline in sexual behaviour, frequency, and quality of life [3]. Contradictorily, a study on female sexual behaviour in Turkey reported an increase in the frequency of sexual intercourse during COVID-19, but with a significant reduction in the desire to get pregnant and an impairment in sexual quality of life [5].

The FSD has resulted from multifactorial causes, which include biological, psychological, or environmental factors that may influence. Sociodemographic characteristics, psychiatric disorders, and medical history have been shown to have a significant relation with sexual function during the COVID-19 pandemic [6]. Similarly, sexual quality of life was also affected following the lockdown period [7].

Psychological distress is known to have an impact on sexual health. FSD was significantly increased in participants with high psychological distress, including during the COVID-19 pandemic. Vulnerability to stress has exposed 22% of healthcare workers to have sexual dysfunction [7,8]. Another contributing factor is possibly due to their ambiguity about having sex and sustained physical contact with their partners.

The evidence of the benefits of physical activity in sexual dysfunction, psychological disorders, and chronic medical illness was extensively reviewed [4]. Meanwhile, a population-based meta-analysis discovered a significant association between physical inactivity and female sexual problems [9]. Maseroli et al. (2021) identified an important relationship between higher physical activity and lower levels of desire, arousal, pleasure, and lubrication of the sexual domain parameters. Similarly, studies highlighted that physical activity had a significant association with sexual desire, orgasm, and lubrication dysfunction [10,11]. Physical activity could improve genital blood flow, which was found to be correlated with high genital lubrication.

While the association between FSD and COVID-19 was commonly examined through the perspective of psychosocial influence, the biological connection between COVID-19 and female sexual function has been given little attention, which differs from males. Even though the exact pathophysiological cause was not established, several studies found a significant association between COVID-19 infection and sexual activity, including FSD [12–14]. Meanwhile, vaginal discharge was found to be significantly associated with long COVID-19.

On the other hand, previous studies discovered that FSD among females was reflected by male factor conditions, which were males' medical and sexual dysfunction [15,16]. The relationship between male sexual dysfunction and FSD was revealed in a meta-analytic review, and each factor may contribute to the other's problems [17].

In Malaysia, former studies revealed the prevalence of female sexual dysfunction (FSD) as 29.6% in the primary care population [18], while 5.5% among the healthcare personnel [16]. However, considering the potential impact of COVID-19 on FSD and the current state of HCWs, they have a higher risk of developing sexual dysfunction [8]. Moreover, this relationship was not broadly investigated and is still understudied, especially among local female healthcare workers during the pandemic due to its taboo nature. As an important health aspect that contributes vitally to preserving human overall well-being, FSD and its modifiable factors resemble a potential area for exploration to aid in understanding female HCWs' sexual functioning, particularly during the pandemic as well as mitigating the detrimental effects of COVID-19 on FSD. Preliminary evidence is necessary before further intervention can be offered to the population. Therefore, this research aimed to determine the prevalence of FSD among female healthcare workers and its association with sociodemographic factors, physical activity, psychological health, spousal health factors (medical and sexual health), and history of COVID-19 infection.

MATERIALS AND METHODS

A cross-sectional study was conducted in an urban teaching hospital in Kuala Lumpur, involving all female healthcare workers. The hospital is a tertiary referral center that provides multidisciplinary, general outpatient, and inpatient care to the population of Kuala Lumpur. During the surge of COVID-19 cases in March 2020, this hospital was announced to be one of the dedicated COVID-19 hospitals. The data collection was performed for 12 months, from November 2021 to November 2022. The third wave of the COVID-19 outbreak occurred in Malaysia around this time, with the outbreak moving from its recovery phase into its endemic phase in April 2022. The study surveyed female workers in the teaching hospital. 16 out of over 30 departments have given their approval for data collection consisting of clinical work, clinical support, and administrative work, which represent the healthcare workers in the hospital. The study included individuals aged 18 to 60 who were married, sexually active, able to comprehend, read, and write in Malay or English, and who consented to participate. They were excluded from the study if any of the following conditions were present: established diagnosis of sexual dysfunction requiring treatment, suffering from an acute or severe medical/psychiatry disorder, pregnant, lactating woman, menopause, refusal to give consent, and were positive for COVID-19 or under quarantine within the past one month. The participants who were positive for COVID-19 or under quarantine within

the past one month were excluded from the study as it was considered within the acute phase of infection [19]. Before recruitment, informed consent was sought from all participants, including their spouses. The data confidentiality and anonymity were also reassured to all of them. The sample size was calculated by using the formula by Daniel and Cross (2018), whereby a total of 243 respondents were targeted based on the previous prevalence rate of sexual dysfunction of 29.6% [20], assuming a 95% confidence level, with a precision (d) of 0.05. The participants and spouses were asked to answer a set of self-reported questionnaires.

Instruments

A baseline demographic characteristics questionnaire, the International Physical Activity Questionnaire-Short Form (IPAQ-SF) [21], the Depression Anxiety and Stress Scale (DASS-21) [22], and the Malay Version Female Sexual Functioning Index (MVFSFI) were distributed to the female healthcare workers [20]. The spouse who agreed to participate has been required to complete the 5-item Malay version of the International Index of Erectile Function (IIEF-5).

Baseline Characteristic Questionnaire

The baseline characteristic questionnaire is a pre-designed questionnaire comprised of the participants' sociodemographic, marital background, substance use, and contraceptive methods. The clinical data on participants' height, weight, body mass index (BMI), status on medical and psychiatry illness, and COVID-19 infection were based on self-reports. For the male participants (spouses), age and presence of medical problems were also recorded.

International Physical Activity Questionnaire-Short Form (IPAQ-SF)

The International Physical Activity Questionnaire was developed to assess the physical activity patterns in the population. Long and short-form questionnaires have been widely studied for their reliability and validity nationwide [23]. The Malay version of the IPAQ (IPAQ-M) demonstrated good reliability and validity for assessing physical activity within the Malay population [21]. The self-reported, validated short form of the International Physical Activity Questionnaire-Short Form (IPAQ-SF) was utilized in the present study to assess respondents' physical activity levels over the preceding seven days [24]. The continuous score was expressed by metabolic equivalent (MET) minutes per week and categorized as inactive (<600 MET-min/week), minimally active (600-2999 MET-min/week), and (>3000 MET-min/week) health-enhancing physical activity; a high active category (HEPA active) [25]. The IPAQ-SF instrument was considered brief enough and suitable for physical activity surveillance.

Depression Anxiety and Stress Scale 21 (DASS-21)

To determine the level of psychological distress among healthcare workers, the Depression Anxiety and Stress Scale 21 (DASS-21) has been utilized. This instrument uses 21 items to assess depression, anxiety, and stress (7 items per domain). A cut-off score of 10 was used to identify the existence of depressive symptoms, while 8 and 15 for anxiety and stress, respectively [22,26]. Attendees were considered to be dealing with psychological distress if they scored more points than the cut-off values for depression, anxiety, stress, or a combination. The Malay version of the DASS-21 (M-DASS-21) was validated in the Malaysian population. Internal consistency values for depression, anxiety, and stress were 0.84, 0.74, and 0.79, respectively [27].

Malay Version Female Sexual Functioning Index (MVFSFI)

The Female Sexual Functioning Index (FSFI) is a self-reported questionnaire validated for use in the Malaysian population for assessing female sexual dysfunction. It measures the changes in sexual function over the prior month [20]. It comprises a total of 19 questions, which measure sexual dysfunction across six domains. A score of 55 and lower was taken as the cut-off score to determine sexual dysfunction (99% sensitivity and 97% specificity) [20]. For each domain, the respective cut-off score with sensitivity and specificity are as the following; (i) desire; ≤5 for sexual desire disorder (sensitivity = 95%, specificity = 89%); (ii) arousal; ≤9 for sexual arousal disorder (sensitivity = 77%, specificity = 95%); (iii) lubrication; ≤10 for a disorder of lubrication (sensitivity = 79%, specificity = 87%); (iv) orgasm; ≤4 for the orgasmic disorder (sensitivity = 83%, specificity = 85%); (v) satisfaction; ≤11 for sexual dissatisfaction (sensitivity = 83%, specificity = 85%); and (vi) pain; ≤7 for sexual pain disorder (sensitivity = 86%, specificity = 95%).

Malay version International Index of Erectile Function (IIEF-5) for spouses of the female healthcare workers

The International Index of Erectile Function (IIEF-5), a simplified version of the International Index of Erectile Function 15 (IIEF-15), was utilized to assess male erectile dysfunction. IIEF-5 comprises items 2,4,5,7,15 of IIEF-15. The Malay version of IIEF-5 is a validated questionnaire with an acceptable area under the receiver operating characteristic (ROC) curve of 0.86 [28]. The IIEF-5 score ranges from 5 to 25, with an optimal cut-off score of 17 for erectile dysfunction (85% sensitivity and 75 % specificity). The scores are classified based on the following: no significant erectile dysfunction (22-25), mild (17-21), mild-to-moderate erectile dysfunction (12-16), moderate erectile dysfunction (8-11), and severe erectile dysfunction (5-7).

Study Procedures

Written informed consent was obtained from research respondents before their enrollment. The confidentiality of data was assured. The participants have been informed of the right to decline or withdraw at any time during the

study. Those who were identified to be in severe sexual dysfunction, depression, or anxiety were offered further intervention.

Statistical Analysis

IBM SPSS Statistics (Version 29) was used to analyze the data. The characteristics of the subjects were described using descriptive statistics. Skewness, kurtosis, histogram, Kolmogorov-Smirnov, and Shapiro-Wilk tests were used to examine the distribution of continuous variables. No missing data apart from IIEF data. To address the problem of large missing data for the IIEF score, multiple imputation techniques were used. A binary variable that separated the sample into two groups: with IIEF score and without IIEF score was generated to see if the missing data occurred randomly or was connected to particular respondent characteristics. Comparison between observed and imputed values confirmed the plausibility of the imputation results. The pooling of analyses performed on each was done per Rubin's rules [29]. Factors associated with sexual dysfunction were explored using logistic regression analysis. Univariable analysis simple logistic regression was first used for exploration, and variables with a p-value of less than 0.200 were included in the multivariable model [30–32]. All the tests were two-sided and statistical significance was denoted as p-value < 0.05.

ETHICAL CLEARANCE

This research was approved by the Research Ethics Committee of Universiti Kebangsaan Malaysia (RECUKM) (UKM PPI/111/8/JEP-2021-372).

RESULTS

A total of 243 female healthcare workers were recruited in this study. Fourteen participants were excluded due to incomplete responses and refused participation. The response rate was 94.2%. Only 65% (n=149) of the respective spouses agreed to take part in the study and answered the IIEF-5 questionnaire. The sociodemographic information of the respondents was shown in Table I. A total of 229 participants were recruited into the study with mean age and BMI of 39 years old (SD±6.82) and 27.26 kg/m2 (SD±5.45), respectively. Most were Malay (97.8%) working as permanent staff (98.3%). The majority of them had education up to a diploma (35.3%) and degree (30.6%) level. 64 (27.9%) participants reported having medical history, 3 (1.3%) reported having psychiatry history, and 198 (86.5%) reported having history of COVID-19. The most common medical illnesses were hypertension and asthma, both of which contributed 13 (5.7%), and Diabetes Mellitus, which contributed 10 (4.4%). Nearly two-thirds of the participants had a family income between 1105– 2500 United States dollars (USD); equivalent to the M40 salary group in Malaysia (70.3%). The mean number of children was 3 (SD± 1.54). Hypertension, Diabetes, and Coronary Heart Disease were the most frequent medical illnesses among spouses, accounting for 18(7.9%), 13 (5.7%), and 5 (2.25), respectively. For the spouse particulars, the spouse's mean age was 42 years old (SD± 8.17), and 39 (17.0%) of them reported having a medical history.

Table I Characteristic of the participants

Characteristics		Frequency (%) *
Age in years, mean ± SD		39.35 ± 6.82
Age in category	<30	16 (7.0)
	30-39	96 (41.9)
	40-49	101 (44.1)
	≥50	16 (7.0)
Race	Malay	224 (97.8)
	Chinese	4 (1.7)
	Indian	1 (0.4)
Marital period in years, mean ± SD		14.00 ± 8.41
Education level	Secondary and below	54(23.6)
	Diploma/Certificate	81 (35.3)
	Undergraduate	70 (30.6)
	Postgraduate	24 (10.5)
Job status	Contract	4 (1.7)
	Permanent	225 (98.3)
Height in cm, mean ± SD		156.01 ± 5.54
Weight in kg, mean ± SD		66.39 ± 14.06
BMI in kg/m^2, mean ± SD		27.26 ± 5.45
BMI in category	Underweight	4 (1.7)
	Normal	45 (19.7)
	Pre-obese	84 (36.7)
	Obese I	74 (32.3)
	Obese II	18 (7.9)
	Obese III	4 (1.7)
Medical history	No	165 (72.1)
	Yes	64 (27.9)
Types of Medical History	Diabetes Mellitus	10 (4.4)
	Hypertension	13 (5.7)
	Hyperlipidemia	7 (3.1)
	Cardiovascular Accident	1 (0.4)
	Asthma	13 (5.7)
	Cancer	1 (0.4)
	Polycystic Ovarian Syndrome	6 (2.6)
	Others	35(15.3)
Psychiatry history	No	226 (98.7)
	Yes	3 (1.3)
Contraceptive method	No	154 (67.2)
	Sterilisation	16 (7.0)
	Barrier method	10 (4.4)
	Hormonal	49 (21.4)
Family income	<RM4850(B40)	40 (17.5)
	RM4850-RM10970 (M40)	161 (70.3)
	>RM10970 (T20)	28 (12.2)
Number of children, mean ± SD		2.72 ± 1.54
Number of children in category	<2	54 (23.6)
	2-5	169 (73.8)
	>5	6 (2.6)
Spouse age in years, mean ± SD		41.53 ± 8.17

CONTINUE

Table I Characteristic of the participants (cont.)

Characteristics		Frequency (%) *
Spouse age in category	<30	12 (5.2)
	30-39	79 (34.5)
	40-49	107 (46.7)
	≥50	31 (13.5)
Spouse medical history	No	190 (83.0)
	Yes	39(17.0)
Type of spouse medical history	Diabetes	13 (5.7)
	Hypertension	18 (7.9)
	Coronary Heart Disease	5 (2.2)
	Renal disease	1 (0.4)
	Others	21 (9.2)
Husband's consent	No	80 (35.0)
	Yes	149 (65.0)
History of COVID-19	No	31 (13.5)
	Yes	198 (86.5)

*Unless otherwise indicated, HEPA active (health-enhancing physical activity; a high active category), SD = standard deviation, USD = United Stated Dollar

The physical activity, psychological health, and sexual function characteristics of the participants were presented in Table II. The result was presented as median rather than mean scores after normality testing was done, as data were not normally distributed. The median IPAQ score was 1062 (Interquartile range, IQR: 479-2586), with 63 (27.5%) being inactive, 84 (36.7%) being minimally active, and 82 (35.8%) being HEPA active. For the DASS-21, the reported median (IQR) for stress, anxiety, and depression was 3 (1-6), 2 (0-4), and 1 (0-3), respectively. The majority of them reported having normal stress (98.3%), anxiety (91.7%), and depression (96.1%) levels. While for the sexual functioning index, it was observed that the number of participants reported to have desire disorder, arousal disorder, lubrication disorder, orgasm disorder, satisfaction disorder, and pain disorder were 48 (21.0%), 21 (9.2%), 19 (8.3%), 6 (2.6%), 10 (4.4%), and 11 (4.8%) respectively. The median interquartile range (IQR) overall score was 79 (69-87), which was normal with 6.1% (95% CI: 3.5-9.2%) reported to have sexual dysfunction. The IIEF for spouses was reported, and over half of them had no significant erectile dysfunction (56.4%). 50 (33.6%) of the spouses had mild erectile dysfunction, and 15 (10.1%) reported having mild-to-moderate erectile dysfunction.

Table II Physical activity, psychological health, and sexual function characteristics of the participant

Characteristics		Frequency (%) *
International Physical Activity Questionnaire (IPAQ), n=229		
IPAQ total score, median (IQR)		1062 (479-2586)
IPAQ in category	Inactive	63 (27.5)
	Minimal active	84 (36.7)
	HEPA active	82 (35.8)

CONTINUE

Table II Physical activity, psychological health, and sexual function characteristics of the participant (cont.)

Characteristics		Frequency (%) *
Depression Anxiety Stress (DASS-21), n= 229		
Stress score, median (IQR)		3 (1-6)
Stress	Normal	225 (98.3)
	Mild	3 (1.3)
	Extremely severe	1 (0.4)
Anxiety score, median (IQR)		2 (0-4)
Anxiety	Normal	210 (91.7)
	Mild	11 (4.8)
	Moderate	4 (1.7)
	Severe	3 (1.3)
	Extremely severe	1 (0.4)
Depression score, median (IQR)		1 (0-3)
Depression	Normal	220 (96.1)
	Mild	6 (2.6)
	Moderate	2 (0.9)
	Extremely severe	1 (0.4)
Malay Version Female Sexual Functioning Index (MVFSFI), n=229		
Desire	Normal	181 (79.0)
	Sexual disorder (≤5)	48 (21.0)
Arousal	Normal	208 (90.8)
	Sexual disorder (≤9)	21 (9.2)
Lubrication	Normal	210 (91.7)
	Sexual disorder (≤10)	19 (8.3)
Orgasm	Normal	223 (97.4)
	Sexual disorder (≤4)	6 (2.6)
Satisfaction	Normal	219 (95.6)
	Sexual disorder (≤11)	10 (4.4)
Pain	Normal	218 (95.2)
	Sexual disorder (≤7)	11 (4.8)
Total score, median (IQR)		79 (69- 87)
Total score in category	Normal	215 (93.9)
	Sexual disorder (≤55)	14 (6.1)
Malay version International Index of Erectile Function (IIEF-5) for spouse, n=149		
IIEF score, median (IQR)		22 (20-24)
IIEF in category	No significant erectile dysfunction	84 (56.4)
	Mild erectile dysfunction	50 (33.6)
	Mild to moderate erectile dysfunction	15 (10.1)

MVFSI = Malay version of Female Sexual Function Index; IIEF = The International Index of Erectile Function

The comparisons of sexual dysfunction rates in subjects with and without moderate-to-vigorous physical activity were presented in Table III. The outcome demonstrated a statistically significant association between the lubrication dysfunction domain and moderate-to-

vigorous physical activity, with a p-value of 0.043. Otherwise, no significant associations were found for the dysfunction domains of desire (p=0.941), arousal (p=0.690), orgasm (p=1.000), satisfaction (p=0.731), and pain (p=0.500).

Table III Comparisons of the rates of sexual dysfunction between subjects with and without reported moderate-to-vigorous physical activity.

Dysfunction	Moderate-to-vigorous physical activity		p-value
	Yes, n (%)	No, n (%)	
Desire	35 (21.1)	13 (20.6)	0.941a
Arousal	16 (9.6)	5 (7.9)	0.690a
Lubrication	10 (6.0)	9 (14.3)	0.043a*
Orgasm	5 (3.0)	1 (1.6)	1.000b
Satisfaction	8 (4.8)	2 (3.2)	0.731b
Pain	7 (4.2)	4 (6.3)	0.500b

a Chi-square test; b Fisher's exact test; * statistically significant

The IIEF score had a 34.9% missing rate due to non-response, while other variables had complete data. The listwise deletion method reduced the sample for analysis to 149 spouses. To assess whether missing data were random, we compared categorical and continuous variables between those with and without IIEF scores using chi-square and Mann-Whitney U tests, finding no significant differences. Multiple imputation techniques were applied, and comparisons between observed and imputed values confirmed their plausibility. The pooled results from multiple imputations closely matched those from listwise deletion, and thus, imputed results are presented [33].

The regression analysis results were presented in Table IV. The variables significant in the univariable analysis included medical history (odds ratio, OR: 2.80, 95%CI: 1.01 to 7.83, p= 0.049), spouses' medical history (OR: 3.27, 95% CI: 1.11 to 9.62, p= 0.031), history of COVID-19 infection (OR 0.22 95% CI: 0.07 to 0.66, p= 0.007, stress (OR 1.16 95% CI: 1.02 to 1.32, p= 0.021, anxiety (OR 1.15 95% 1.02 to 1.30, p = 0.025), depression (OR 1.16 95% 1.03 to 1.31, p = 0.017), and erectile dysfunction (OR 0.74, 95%CI 0.62 to 0.88, p=0.001).

Factors associated with female sexual dysfunction were further explored using logistic regression. Variables with p-value <0.200 were included in the multivariable model, and the factors significantly associated with sexual dysfunction in the final multivariable model eliminating the confounding effects were history of COVID-19 infection, adjusted OR [AOR] = 0.19 95% CI 0.05 to 0.74, p= 0.017 and erectile functioning, by

Table IV Regression Analyses Results

	Simple Logistic Regression			Multiple Logistic Regression		
	OR	**95% CI**	**P value**	**Adj OR**	**95% CI**	**P value**
Age	1.05	0.98, 1.13	0.181	0.97	0.83, 1.14	0.726
Education level						
Secondary and below	Ref			Ref		
Diploma/ Certificate	0.53	0.15, 1.82	0.311	0.79	0.16, 3.96	0.791
Undergraduate	0.36	0.09, 1.50	0.161	0.96	0.17, 5.54	0.957
Postgraduate	0.73	0.14, 3.89	0.710	3.09	0.36, 26.44	3.085
BMI	1.00	0.91, 1.10	0.976			
Medical history						
No	Ref			Ref		
Yes	2.80	1.01, 7.83	0.049*	1.50	0.42, 5.43	0.534
Psychiatry history						
No	Ref					
Yes	2.65 x10^{10}	0, -	>0.950			
Contraceptive						
No	Ref					
Yes	1.25	0.44, 3.59	0.675			
Marital period	0.99	0.93, 1.05	0.735			
Family income						
<1105 USD(B40)	Ref					
1105-2500USD (M40)	0.60	0.18, 2.01	0.404			
>2500 USD (T20)	0.69	0.12, 4.07	0.684			
Number of children	1.01	0.73, 1.41	0.937			
Spouse age	1.05	1.00, 1.11	0.071	1.04	0.91, 1.20	0.565
Spouse medical history						
No	Ref			Ref		
Yes	3.27	1.11, 9.62	0.031*	2.01	0.50, 8.01	0.323
History of covid						
No	Ref			Ref		
Yes	0.22	0.07, 0.66	0.007*	0.19	0.05, 0.74	0.017*
IPAQ						
Inactive	Ref					
Minimal active	0.50 1.19	0.15, 1.69	0.262			
HEPA active		0.34, 4.16	0.781			

Table IV Regression Analyses Results

	Simple Logistic Regression			Multiple Logistic Regression		
	OR	**95% CI**	**P value**	**Adj OR**	**95% CI**	**P value**
Stress	1.16	1.02, 1.32	0.021*	1.01	0.75, 1.38	0.928
Anxiety	1.15	1.02, 1.30	0.025*	1.13	0.86, 1.47	0.380
Depression	1.16	1.03, 1.31	0.017*	1.04	0.78, 1.38	0.802
IIEF	0.74	0.62, 0.88	0.001*	0.76	0.59, 0.98	0.033*

IPAQ= International Physical Activity Questionnaire, IIEF = The International Index of Erectile Function
USD = United States Dollar
*statistically significant

IIEF score (AOR = 0.76 95% CI: 0.59 to 0.98, p= 0.033). A unit increase in the IIEF score was found to decrease the likelihood of sexual dysfunction (adjusted OR [AOR] = 0.76 95% CI: 0.59 to 0.98, p= 0.033). Furthermore, those with a positive COVID history were related to a lower odds of FSD (adjusted OR[AOR] 0.19 95% CI 0.05 to 0.74, p= 0.017).

DISCUSSION

The current study presents the findings on the prevalence of FSD and determines the related factors among female healthcare workers during the COVID-19 outbreak. The prevalence of FSD among healthcare workers was low in our study, contradicting the majority of previously published global or even local studies, either from pre or during the pandemic, which ranged from 13% to 79% [8,18,34]. However, our prevalence finding was consistent to a local pre-pandemic study conducted in a similar cohort, which reported a 5.5% prevalence of FSD among female healthcare workers [16]. The prevalence of FSD during COVID-19 was hypothesized to be high; however, our study found a lower prevalence, likely due to data collection occurring post-recovery as Malaysia transitioned into the endemic phase. With lifted social restrictions, individuals resumed routines, leading to potential psychological, sexual, and physical health recovery. Reduced psychological distress among healthcare staff during this timeframe may have contributed to this trend [35]. Our participants' characteristics, by being relatively young and healthy, might partly explain the findings by reducing the risk for FSD, which were consistent with local evidence indicating that age above 45 years is a significant factor associated with FSD [16]. On the other hand, the marked discrepancy between the prevalence observed in this study and global estimates may be attributed to underreporting. As the majority of participants were Malay, the findings may have been influenced by cultural sensitivities, as sexual dysfunction remains a sensitive and often taboo topic within Malay culture. Moreover, it had been shown that reliance on self-reported sexual behaviors introduces the possibility of social desirability bias, which may result in inaccurate reporting [36].

This study found no association between psychiatric illnesses and FSD, potentially due to a small number of our participants having a history of psychiatric illness. The risk factors associated with FSD in this present study were medical history, a history of COVID-19 infection, stress, depression, anxiety level, spousal medical history, and erectile dysfunction. This study found that participants with medical comorbidities were significantly more inclined to develop FSD. The most frequent medical conditions among these participants were diabetes mellitus and hypertension, both of which have been linked to the development of FSD in previous research [37]. However, we did not find any significant association between BMI and FSD, even though several studies have reported a significant negative correlation [38].

Among all the sexual domains, decreased sexual desire was the most common disorder, generally affecting about 20-30% of the population across countries, which is consistent with our findings of about 21% [34,39]. However, our rate was not amplified during the COVID-19 outbreak, which contrasted with what was discovered in healthcare workers during the initial COVID-19 outbreak in Italy [6]. Yet, being female, working in health care, having children at home, and living with a spouse were among the found associations with low sexual desire, which primarily reflected the risk among our participants [6].

Psychological distress is known to influence sexual health. Similarly, during COVID-19, females who scored higher on psychological distress parameters significantly reported a low total FSFI score with decreased scores in all domains [40]. These findings were consistent with our results, which observed depression, anxiety, and stress levels as significant associations with FSD.

Our analysis demonstrated a significant association between lubrication and physical activity levels, consistent with existing literature. Maseroli et al. (2021) found that high physical activity was linked to lower desire, arousal, pleasure, and lubrication, supporting our findings. Conversely, the improvement in vaginal blood flow due to physical activity may explain its positive correlation with enhanced genital lubrication [2,41]. Several studies have explored the relationship between physical inactivity and female sexual dysfunction, revealing that physically active women tend to have higher sexual desire, while orgasm dysfunction is more prevalent among inactive individuals [9]. Additionally,

a study on perimenopausal women found a strong correlation between physical activity and all FSFI domains, while another study linked physical inactivity to greater lubrication impairment [10].

A comprehensive review identified a significant relationship between sexual dysfunction in men and women with FSD, notably erectile and ejaculatory dysfunction [17]. FSD among our female healthcare workers was reflected by male factor conditions, as in concordance proposed by the former existing studies [15,16]. Conversely, Maseroli et al. (2016) found a perceived decline in the partner's desire contributes to female FSD rather than the spouse's erectile dysfunction. After adjusting the confounding factors, our current analysis demonstrated erectile functioning as a significant factor associated with FSD, a finding that aligns with evidence reported in previous studies [15,16,42,43]. It is recognizable that male sexual dysfunction and FSD are interrelated, as one factor may lead to the other's problems. This bidirectional relationship has been supported by a systematic review demonstrating a link between male sexual dysfunction and FSD, particularly in the context of erectile and ejaculatory function [17]. The association between spousal erectile dysfunction and FSD underscores the dyadic nature of sexual health, with evidence showing reciprocal effects between partners and supporting couple-based interventions to improve both sexual and relational outcomes [43–45]. Interestingly, our study found that a history of COVID-19 infection has lower odds for FSD, which differs from several reported findings [14,46]. Kaya et al. (2021) examined hospitalized women and stated a low FSFI total score with a significant reduction in sexual intercourse and satisfaction following the COVID-19 infection. Despite the evidence, the exact pathophysiology of COVID-19 infection to female sexual dysfunction was unclear due to little research investigating the mechanism, unlike in males [47,48]. Our study population may have included a higher proportion of post-COVID-19 cases, but only fully recovered individuals with infections over a month prior were included. Additionally, participants with prior COVID-19 infections may have reflected resilience or psychological adaptation by HCWs, which further reduced FSD risk. This aligns with findings among Malaysian healthcare workers, where cautious attitudes and perceived high infection risk were significantly associated with greater health anxiety [49].

This study's key strength lies in its use of validated questionnaires across the Malaysian population, ensuring reliable data collection. Additionally, it identified significant factors related to FSD among healthcare workers, highlighting an important issue within this population. However, several limitations should be acknowledged. Although this study included healthcare professionals from several departments, it may not be representative of the overall population, due to convenience sampling, and certain departments could not be recruited due to disapproval and time constraints. Furthermore, the generalization of our findings was also limited due to different methodologies and a wide variation in the global and local prevalence of FSD. The study relied solely on self-reported measures to demonstrate FSD, psychological distress, physical activity, and spousal erectile dysfunction, without formal diagnostic assessments. We acknowledged that the baseline sexual activity before COVID-19 was not measured, making it difficult to determine actual changes in sexual function. However, existing literature on FSFI scores in a similar cohort provided context, showing a comparable prevalence of 5.1% [16]. Furthermore, the binary classification of post-COVID-19 infection prevented an in-depth analysis of its severity and duration. Our findings may also be subject to potential survivor bias, as only participants deemed sufficiently stable were eligible for inclusion. Given that only 14 participants were categorized as having FSD, the statistical power to detect associations may also have been limited. We believed that the association between post-COVID-19 infection and FSD required additional investigation because we were unable to draw the biological association between COVID-19 infection and FSD. Additionally, 35% of spousal IIEF data was missing due to non-response, though multiple imputation was used to minimize bias. Lastly, the observational study design prevents causal inferences. Future longitudinal studies with larger, randomized samples are needed to establish definitive causal relationships between FSD and its associated factors.

CONCLUSION

Our study demonstrated that the prevalence of FSD among female healthcare workers was 6.1% during the COVID-19 pandemic. Low sexual desire was the most prevalent female sexual dysfunction in the FSFI domain, involving 21% of the women, with lubrication dysfunction being the only significant factor associated with moderate-to-vigorous physical activity. The spousal erectile dysfunction was significantly associated with FSD, while post-COVID-19 infection was associated with a lower odds of FSD in this study. The involvement of the spouse in the treatment of FSD is imperative to alleviate the female sexual quality of life. This emphasizes how crucial it is to incorporate partner characteristics into FSD research in the future, particularly in Malaysia, as sexual problems were not commonly shared due to taboo topics. As a result, the problems remained unrecognized, leading to failure in addressing these issues clinically.

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