ORIGINAL ARTICLE

Predictors of Pain During Nasopharyngeal Swab among Covid-19 Suspected Cases in Central Malacca, Malaysia

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ABSTRACT

Introduction: Nasopharyngeal swab (NPS) is the screening tool for Coronavirus Disease 2019 (COVID-19). It is a painful procedure that leads people to refuse it. Since there was no pain evaluation conducted, this study is to examine the pain prevalence and its predictors during NPS among COVID-19 suspected cases at Central Malacca drive-through screening centre. **Materials and methods:** A cross-sectional study was conducted among 365 screened respondents, selected through simple random sampling in May 2021. The pain category was divided into clinically significant pain (CSP) and Non-CSP using the Ministry of Health Pain Scale. Independent variables were the socio-demographic factors, frequency of NPS, operators' experience score and swab tip type. Data was collected using validated, self-administered Google form questionnaire, blasted via WhatsApp and the analysis was done using IBM SPSS software version 26. **Results:** The response rate was 86.4% with 53.5% reported having CSP. Binary Logistic Regression revealed frequent NPS procedures (OR= 1.18, 95% CI 1.01-1.38, p=0.040) and the nylon-flocked swab tip (OR= 2.08, 95% CI 1.24-3.49, p=0.006) have higher odds of CSP. Operator with more experience score is less likely to cause CSP to respondents (OR = 0.94, 95% CI 0.89-0.99, p <0.048). The predictors of CSP during NPS among COVID-19 suspected cases are of higher frequency of NPS and nylon-flocked swab tip. Increase operators' experience score is the protective factor for CSP. **Conclusion:** The painless saliva self-testing modality screening for COVID-19 is highly recommended.
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Keywords: Predictors of pain, COVID-19, Nasopharyngeal swab, Screening centre, ENT procedure

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INTRODUCTION

Coronavirus disease 2019 (COVID-19) is an emerging global disease resulting from SARS-COV-2. The Centre for Disease Control (CDC) recommends nasopharyngeal swab (NPS) sampling as the screening tool for COVID-19 which the viral load is highest at the nasopharynx (1-3). NPS is easy to perform, cost-effective, and yields accurate results with proper techniques. The people who should do the screening test are those who have symptoms, close contact with COVID-19 patients within six feet for at least 15 minutes or more, visited closed, confined, and crowded places with confirmed COVID-19 patients, and those who are instructed to do the screening by healthcare providers (3). However, NPS is an invasive procedure which results in pain and discomfort to patients, making them reluctant to do the screening test. According to the International Association for the Study of Pain (IASP), pain is a stressful experience that may cause actual or potential tissues damage in terms of sensory, emotional, cognitive, and social aspects. Pain is a personal experience, and it is always 'what the patient says hurt' and can be a protective mechanism (4).

There are not many published studies on the prevalence of pain during NPS or ENT procedures. At the moment, there were two published studies on the NPS procedures. Gupta et al. (2021) showed the adverse effects of NPS procedure and the swab type. In a commercial and 3D printed nasopharyngeal swab testing, the rate of nasal discomfort was 4.2% and 7.5%, respectively (5). Another study conducted by Clark et al. (2021) investigated the adverse effects of NPS procedure that having ENT complications. The study summarized few case reports of surgical intervention to treat the complications of NPS procedure. The authors discussed that the complications could be avoided by having a fundamental understanding of nasal anatomy and discontinuing the procedure in the event of pain or increasing resistance. Although the test

could feel uncomfortable, neither the operator nor the patient should expect it to be severely painful (6).

The studies conducted by Sommer et al. (2009), and Nagaya et al. (2009) showed that 43% to 50% of the patients who underwent ENT procedures had high pain score post-procedures (6,7). There were 30% of patients who had gone through the endoscopic procedure, and 20% of patients had the ear and nose surgery from day one to day four post-operation indicating a higher rating pain score (8). Moreover, Nagaya et al. concluded that 43% of the patients who underwent trans nasal endoscopy reported pain, the most intolerable complaint. Apart from that, Kinloch et al. (2020) showed that Asians have a higher pain intensity than Caucasians (Whites) due to the difference in nasal shapes and contours. Most Asians have lower nasal volumes, lower mean cross-sectional nasal areas, and having greater distances to the minimum cross-sectional area (9).

In addition, pain causes suboptimal sampling in which the patients may not be cooperative, overreacting to the procedure, and improper sampling techniques by healthcare workers themselves (1). These problems can lead to more severe complications that require ENT intervention, such as rupture of the ethmoidal artery, nasal septum abscess, and swab stuck at the nasopharynx (10) and suboptimal sampling, which later may produce false-negative results (11). In addition, pain causes psychological and physical disturbance (11,12). Psychological disturbances influence the psychological processes that increase the pain intensity, thus leading to additional stress, anxiety, and fear, resulting in avoidance behaviour and further disabling pain (14).

The prevalence of asymptomatic carriers is 40% to 45% of SARS-CoV-2 infection. They have a higher potential to be the silent spreader of the virus, even more than the average 14 days incubation period (15). Despite the symptomatic screening, public health surveillance must expand the screening scope to these asymptomatic carriers as they will not voluntarily turn up to medical facilities. However, due to the possible enduring pain that they may experience, the screening rate may be low, leading to suboptimal sampling and false-negative results (11). Consequently, the containment of the virus spread will be very much difficult. Thus, there is an imperative need to increase the screening rate for suspected COVID-19 patients. The implications of pain lead to major impediments in encouraging people to do the screening, thus hampering the early detection of COVID-19. Eventually, this problem will cause a higher prevalence of the disease and higher mortality. Therefore, it is crucial to understand the pain and to address it effectively.

In Malaysia, people are encouraged to undergo COVID-19 screening if they fulfill the clinical and epidemiological criteria. However, there is no specific information on the NPS procedure and its complications as a reference to the community. The current health education provided is more towards the importance of screening for early detection of COVID-19, as it is the preventive and control measures to be taken immediately to break the chain of transmission. Therefore, a specific health education program on the NPS procedure and its complications, especially pain, will empower the people to undergo the screening test and prepare for any complications. Although there are many saliva test kits for COVID-19 that are available over-the counter, PCR test remains the gold standard for diagnostic confirmation.

This study offers benefits to respondents, healthcare providers, and research as a whole. Patient feedback from screening activities is crucial for improving surveillance efforts. The study aims to provide recommendations for enhancing sampling techniques, swab types, and addressing the psychological aspects of pain during nasopharyngeal swab procedures. The results can serve as a reference for organizations such as the Melaka State Health Department, the Malaysia Ministry of Health (MOH), the Centre for Disease Control (CDC), and the World Health Organization (WHO to inform the development of policies and health interventions for nasopharyngeal swab procedures, particularly by addressing pain factors. Targeted health education and intervention programs can reduce screening-related fear, leading to early virus detection, treatment, and a decrease in disease complications. This, in turn, can lower healthcare costs by reducing ICU admissions and ventilator support, enabling resources to be redirected towards screening and laboratory expenses.

MATERIALS AND METHODS

Study area

The study was conducted in Central Malacca, Malacca, Malaysia. Malacca is one of the 14 states in Malaysia and Central Malacca is one of the three districts in Malacca. Healthcare facilities in each district consist of government and private health facilities. Population in Central Malacca was estimated at 932, 700 people in 2021. The highest incidence of COVID-19 was in Central Malacca for 2021. The estimated swab tests conducted from March 2020 till May 2021 were equal to or more than 50,000. The COVID-19 screening was actively conducted by the government and private healthcare facilities.

Sample size and study population

The Central Malacca drive-through screening centre conducted NPS for 365 adults aged 18 and above. The sample size was calculated by Elashoff and Lemeshow (2005) formula (16). The exclusion criteria included being illiterate, not understanding Malay or English, and having known contraindications for the procedure, such as bleeding tendency, cleft palate, and nasopharyngeal

carcinoma.

Study design
This cross-sectional study was conducted between April 29 and May 30, 2021.

Sampling technique
A simple random sampling was conducted by using the table of random numbers by selecting patients from the list of COVID-19 suspected cases of nasopharyngeal swab screening at Central Malacca Drive-through Screening Centre. The selected respondents were listed in a new list with a code number assigned to each name. After that, the list was given to the person in charge to contact them for the nasopharyngeal swab procedure according to the respective dates given.

Study instrument
A validated and reliable self-administered questionnaire was prepared in Malay and English It consisted of five sections; Section A was on sociodemographic characteristics, Section B was on the history of nasal diseases, Section C was on the Malaysia Ministry of Health (MOH) Pain Scale, Section D was on Respondents' Psychological Criteria and Section D was on procedure-related factors. The content validity ratio (CVR) ranged from 0.33 to 1 and content validity index (CVI) was 1.0.

Variables
The outcome of this study was the pain category during the NPS measured using the MOH pain scale. It is a scale that combines Numeric Rating Scale (NRS), the Visual Analogue Scale (VAS) and the faces scale. The pain score is between 0 (no pain) to 10 (most severe pain). Pain is divided into 3 categories, mild (0-3), moderate (4-6) and severe (7-10) (17). In this study, we divided the pain into two categories, which are clinically significant pain (NRS score ≥4) and clinically not significant pain (NRS score 0-3) (8). This is because of the treatment and management of the pain. In the community mass testing setup, we can treat the clinically not significant pain by giving reassurances and non-opioid analgesics such as T. Paracetamol. However, for clinically significant pain, we need to refer the patient to a health clinic or hospital for further assessment and management. Other data gathered in this study were the sociodemographic characteristics (age, gender, race, BMI, education level, current occupation, and smoking status), respondents' psychological criteria (pain anxiety, pain catastrophizing and sleep quality), procedure-related factors (sampling techniques, operator's experience, swab tip type and frequency of NPS), and nasal occlusion.

Data management
Three variables were collected by direct observation: the sampling techniques, the operator's experience, and the swab tip type. The researcher observed the sampling technique used by the doctor in charge of the NPS procedure and subsequently verified it. The doctor's experience was obtained regarding how long they had been performing the nasopharyngeal swab from March 2020 until May 2021. The swab tip type depended on the availability of the swab type on the day of data collection. Thus, all respondents who underwent NPS on the same date had a similar swab tip type. After completing the NPS procedure, the respondents were given the Google form questionnaire link with a code number via WhatsApp. The researchers followed up with the respondents three days after the link was distributed, which reminded them to answer the questionnaire.

Each respondent was asked for implied consent before answering the questionnaire. The form is in English and the Malay language, uploaded on the first page of the questionnaire link. The questionnaire contains 42 questions. It took an average time of 10 to 15 minutes to answer one complete questionnaire. The questionnaire's content validity ratio (CVR) ranged from 0.33 to 1, and the content validity index (CVI) was 1.0. The Cronbach's alpha of the questionnaire for the subscale pain anxiety, pain catastrophizing and sleep quality were 0.971, 0.928, and 0.834, respectively, which were considered high in terms of reliability (Hinton et al., 2004).

Statistical analysis
To ensure accuracy, two people entered the data using the double-entry approach in Excel. A computer software of SPSS version 26 was used for the data analysis. Normality tests were conducted on continuous variables such as pain score, age, frequency of NPS and operator's experience. Based on Kolmogorov-Smirnov and Shapiro-Wilk tests, the significant values were <0.001. Thus, all variables were not normally distributed. Descriptive statistics of variables were presented as frequency and percentage for categorical data types, whereas the median and interquartile range for the continuous data. The associations between the pain category and categorical independent variables were tested using the Chi-Square test and simple logistic regression. The variables with $p<0.25$ were further tested using the multiple logistic regression to determine clinically significant pain predictors during the NPS procedure. This study's significance level was set at an alpha value of 0.05 or significant at 95% CI.

Ethical approval
This study has been granted ethical approval by the Medical Research and Ethics Committee (MREC), Malaysian Ministry of Health and registered under the National Medical Research Registry (NMRR-21-347-58728).

RESULTS

The total response rate was 86.6%. The median (IQR) pain score during NPS was 4.0 (4.0). The prevalence of pain category was 46.5% for clinically not significant pain and 53.5% for clinically significant pain.

Characteristics of respondents

The median (IQR) age of the respondents was 32 (11.0) years old. Most of the respondents were female (57.0%), Malays (80.4%), non-smoker (81.6%), had tertiary education (75.6%), government servants (52.8%), obese (39.6%) and did not have any nasal occlusion (71.8%). Almost half of them had a 48.0% moderate pain anxiety level, 37.0% had mild, and only 15.2% had severe pain anxiety. Furthermore, 63.3% of them had high pain catastrophizing level however, most of the respondents had good sleep quality at 66.1%.

The median (IQR) number of operator's experience in performing NPS procedure was 6 (7.0) months, and for the frequency of NPS that the respondents had was 2 (2.0). There were 57.0% of operators that performed a rotation for 10 second technique and 66.1% respondents who went through the sampling using the nylon-flocked swab tip for the NPS procedure.

Sociodemographic characteristics, anatomical factor and pain category

The association between pain category during the NPS procedure with sociodemographic and anatomical factors only showed the age factor had a significant association with pain. The result shows that the younger people had more significant pain from the NPS procedure (OR:0.96, 95% CI 0.94-0.99, p=0.005).

Respondents' psychological criteria and pain category

Table I showed the respondents with severe pain anxiety level had 4.59 times higher odds to get clinically significant pain (OR:4.59, 95% CI 2.09-10.07, p<0.001). Also, the higher the catastrophizing pain level of respondents, the more clinically significant pain they experienced (OR:1.64, 95% CI 1.04-2.60, p=0.035). Poor sleep quality was 1.86 higher odds to get clinically significant pain during the NPS procedure (OR:1.86, 95% CI 1.16-3.00, p=0.011).

Table I: Association between pain category during NPS and respondents' psychological factor

Variables	Pain category		Simple Logistic Regression			
	Clinically significant, n (%)	**Clinically not significant, n (%)**	**B**	**Crude OR**	**p-value**	**95% CI**
Pain anxiety						
Mild	53 (45.3)	64 (54.7)	**Ref**			
Moderate	78 (51.7)	73 (48.3)	0.26	1.29	0.302	0.80-2.09
Severe	38 (79.2)	10 (20.8)	1.52	4.59	**<0.001***	2.09-10.07
Pain catastrophizing						
Low	53 (45.7)	63 (54.3)	**Ref**			
High	116 (58.0)	84 (42.0)	0.50	1.64	**0.035***	1.04-2.60
Sleep quality						
Good	101 (48.3)	108 (51.7)	**Ref**			
Poor	68 (63.6)	39 (36.4)	0.62	1.86	**0.011***	1.16-3.00

(*) – significant at p ≤0.05
B- Regression coefficient

Procedure-related factors and pain category

For the procedure-related factors, Table II showed the more experienced operators caused less significant pain to the respondents (OR:0.94, 95% CI 0.89-0.99, p=0.028). The more NPS that the respondents experienced, they have 1.18 times higher odds of having clinically significant pain (OR:1.18, 95% CI 1.01-1.39, p=0.044). In addition, the respondents significantly reported 2.26 higher odds of clinically significant pain with the nylon-flocked tip as compared with the rayon tip (OR:2.26, 95% CI 1.40-3.64, p=0.001). Next, the rotation of the swab for 10 second at the nasopharynx significantly causing 2.16 higher odds of clinically significant pain to the respondents (OR:2.16, 95% CI 1.37-3.41, p=0.001).

Table II: Association between pain category during NPS and procedure-related factors

Variables	Pain Category		Simple Logistic Regression			
	Clinically significantn (%)	Not Clinically significant, n (%)	B	Crude OR	p-value	95% CI
Operator's experience			-0.06	0.94	**0.028***	0.89-0.99
Frequency of NPS			0.17	1.18	**0.044***	1.01-1.39
Swab tip type						
Rayon Nylon flocked	43 (40.2) 126 (60.3)	64 (59.8) 83 (39.7)	**Ref** 0.82	2.26	**0.001***	1.40-3.64
Sampling technique						
In-out method Rotation for 10s	58 (42.6) 111 (61.7)	78 (57.4) 69 (38.3)	**Ref** 0.77	2.16	**0.001***	1.37-3.41

(*) – significant at p ≤0.05
B- Regression coefficient

Predictors of clinically significant pain during NPS

After the multivariable analysis, only five variables became the predictors of clinically significant pain during the NPS procedure. The results in Table III showed that the older people had less likely to experience clinically significant pain as compared to the younger people (aOR= 0.97, 95% CI 0.94-0.99, p=0.013). Respondents who experienced many NPS procedures had 1.18 times higher odds to get clinically significant pain than those who had less frequent NPS (aOR= 1.18, 95% CI 1.01-1.38, p=0.040). Respondents with severe pain anxiety levels have five times higher odds of getting clinically significant pain as compared to moderate and mild groups (aOR= 5.00, 95% CI 2.21-11.3, p<0.001). The more experienced operators had a lower probability of causing clinically significant pain to the respondents during the NPS procedure (aOR= 0.94, 95% CI 0.89-1.00, p<0.048). The nylon-flocked tip had two times higher odds to cause clinically significant pain than the rayon tip (aOR= 2.08, 95% CI 1.24-3.49, p=0.006).

Therefore, this study concludes that the younger age, the high frequency of NPS done, severe pain anxiety level, less experienced operators and the nylon-flocked swab tip were the predictors of clinically significant pain during the NPS procedure among COVID-19 suspected cases at Central Malacca drive-through screening centre.

Table III: The predictors of clinically significant pain during NPS procedure among COVID-19 suspected cases

MULTIPLE LOGISTIC REGRESSION					
Variables	Coefficient	Adjusted OR	p- value	95% CI	
				Lower	Upper
Intercept	0.54				
Age (year)	-0.03	0.97	**0.013***	0.94	0.99
Frequency of NPS	0.17	1.18	**0.040***	1.01	1.38
Pain anxiety					
Mild	**Ref**				
Moderate	0.2	1.22	0.460	0.72	2.04
Severe	1.61	5.00	**<0.001***	2.21	11.31

CONTINUE

Table III: The predictors of clinically significant pain during NPS procedure among COVID-19 suspected cases (CONT.)

MULTIPLE LOGISTIC REGRESSION					
Variables	Coefficient	Adjusted OR	p- value	95% CI	
				Lower	Upper
Operator's experience	-0.06	0.94	**0.048***	0.89	0.99
Swab tip type					
Rayon	**Ref**				
Nylon flocked	0.73	2.08	**0.006***	1.24	3.49

(*) – significant at p ≤0.05
Forward Stepwise (Conditional) was applied.
Multicollinearity and interaction terms were checked.
Hosmer and Lemeshow test (p=0.631), classification table (overall percentage 65.8%), Cox and Snell R squared (0.140), Nagelkerke R squared (0.188), ROC=0.736.

DISCUSSION

The objective of this study was to determine the associated factors and the predictors of the clinically significant pain during the NPS procedure among COVID-19 suspected cases. Three hundred sixteen respondents took part in this study. To our knowledge, this is the first study to evaluate the pain status during the NPS procedure among COVID-19 suspected cases. We have divided the pain status into two categories based on a study by Sommer et al. (2009). The categories are (1) clinically significant pain (pain score ≥4) and (2) not clinically significant pain (pain score <4) (8).

The results indicate that the prevalence of clinically significant pain was higher than clinically not significant pain status. Only five variables remained significant after adjusting other factors in the multivariate analysis. Therefore, the younger age group, severe pain anxiety, high frequency of NPS, less experienced operators, and the nylon-flocked tip were the predictors of clinically significant pain for the NPS in our study.

The prevalence of pain category was almost equal between the two groups. The prevalence was at 53.5% for clinically significant pain, higher than the not clinically significant pain status of 46.5%. This study was a community-based study. The results show that the

prevalence is higher than a cohort study at a hospital-based surgical ENT procedure conducted by Sommer et al. (2009) among 217 adults in the Netherland. The study resulted in a 50% prevalence of clinically significant pain at day one post-operation. The difference between hospital-based and community-based settings is attributed to the patient population. Hospital-based patients typically have pre-existing ENT problems, resulting in higher pain tolerance, while community-based respondents, usually from the general population, provided a more accurate assessment of pain (Harris et al., 2013).

The prevalence of clinically significant pain for this study was 53.5%, and it was higher than the overall prevalence of pain of 43% for nasal pain after trans nasal endoscopy conducted by Nagaya et al. (2009) in a hospital setting in Japan (7). In a hospital-setting study, the procedure was carried out under an established set-up environment. As a result, the patients and the doctors were comfortable and well-equipped. In contrast, the setting for this study was at a drive-through centre, where the set-up for a procedure might be not optimum and comfortable for both patients and operators.

The median (IQR) age of the respondents was 32(11.0) years old. Only five respondents aged 60 years old and above participated in the study and the eldest was 65 years old. This is because older people were not proficient in using the Google form link to answer the questionnaire. Some of them did not even have an internet connection; thus, they were not exposed to WhatsApp application as a medium of communication. Even the contact number given was usually their children's or guardians' number. Therefore, the older people's participation was lesser in this study.

From the literature review, older people were usually reported more pain in the clinical setting. In addition, studies by Mat et al. (2019) and Guido et al. (2020) proved that older age was a predictor of chronic pain (15,16). It is believed that older people are usually related to some co- morbidities. Thus, they have a poor quality of life and some disabilities, which later causing more pain (19). However, the relationship between age and pain research is inconsistent in the experimental or laboratory setting. For example, Gupta et al. (2009) found out that younger participants had a lower pain threshold to both painful stimuli as compared to the older participants (20).

Therefore, the younger respondents became the predictor of clinically significant pain during the NPS procedure. This result may be explained that the older people underrated their pain intensity as less painful, and they retained their sensitivity to the tolerance of painful stimuli (21). Also, various life experiences made them more tolerance to pain as compared to the younger people.

Most respondents experienced moderate pain anxiety level at 47.8%, mild pain anxiety at 37.0% and severe pain anxiety level at 15.2%. Thus, the respondents had mild to moderate worries about the negative consequences of pain during the NPS procedure. It was expected to be the normal behavioural response of human for a certain procedure (22). This study also proved the highly significant association between severe pain anxiety and clinically significant pain, in line with the hypothesis and the previous research (21-23). The respondents with severe pain anxiety were noted to have five times higher odds of experiencing clinically significant pain. Higher pain anxiety causes more physical and psychological distress as well as more pain intensity. The respondents may have anticipated or had an idea of their pain tolerance since it was inevitable for them to experience pain (25). Besides the procedural pain, the main cause of the procedure may contribute to the triggering factor of the pain. In other words, the pain experienced during the procedure may not solely be due to the procedure's physical aspects but can also be influenced by an underlying cause or factor related to the procedure. This suggests that the procedure's main cause or underlying issue might be connected to the pain experienced by the individual.

The population of this study was all on the COVID-19 suspected cases. Thus, the respondents might have some anxiety about the expected result of the test, fear of the complications and the procedure itself. Therefore, it can be concluded that procedure-related, psychological and environmental factors influenced the acute pain experience to a higher degree (22).

The outcome of this study is consistent with earlier studies and the study's hypothesis, which found that the more trained operators cause less pain during post-procedure. It was seen among breast biopsy (26), liver biopsy (27) and bedside percutaneous liver biopsy (28) patients who reported less pain score when the procedures were conducted by highly trained operators. Also, the training effects of the experienced operators had reduced the postprocedural pain score and the time delay for the procedure among vertebroplasty patients in New York (29).

In our study, the drive-through set-up was different from the health clinic set-up for the sampling exercise. The estimated number of patients that need to be sampled per day was about 500-600 in four hours. In contrast, only three to five patients in the health clinic had to be sampled per week. Therefore, the skills and experience of the operators and their team members are very important. This is because, a highly trained operator achieved the skills required in performing a safe NPS procedure thus, reducing the respondents' pain experience (30). In addition, they will reduce the time delay for the actual procedure (29), thus, improving the screening capacity of the centre.

In Melaka Tengah District Health Office (DHO), two nasopharyngeal swab tips available for adult patients: (i) nylon- flocked tip and (ii) rayon tip. The tips were assigned based on the availability. The nylon-flocked tip caused two times higher clinically significant pain as compared to the rayon tip. This result is because the nasal cavity is a very delicate and a sensate organ. Also, the nasal passage is very narrow; thus, physical contact between the swab tip and the nasal mucosa is more likely to happen. Thus, the physical property of the flocked swab caused it to lead to more pain, especially when combining with the swab rotation technique.

The study finding was different from a study done by Daley et al. (2006) among Canadians with upper respiratory tract infection, where the association between the swab tip type and pain score was insignificant. However, their study rated a higher pain score with nylon-flocked swab as compared to rayon tip, even though the association was insignificant. They focused on the epithelial cells' uptake among the asymptomatic and symptomatic patients, where the flocked swab was preferred for diagnostic purposes because it increases the cells yield (31). Additionally, Apoola et al. (2012) found that rayon swab was more painful than Dacron swab for urethral sampling in the UK (32). However, they had a different study design and different study population from this research.

The higher the number of NPS that the respondents experienced, the higher the probability of experiencing clinically significant pain. This explained the psychological impact that the previous pain experience that causes more disabling pain to them (14). The physical impact from the previous procedure might harm the nasopharynx and causing minor trauma at the anatomical site. Therefore, recurrent procedure worsens the pain experience because the nasal cavity is very sensitive, and it is a highly vascular organ.

A study among children in Israel with a higher number of endoscopic gastrointestinal biopsies was associated with a higher post-procedural pain score (33). However, the relationship was indirect. In fact, the researchers established a correlation between the results and the longer duration of the procedure, where a greater quantity of breathed air was necessary to maintain the luminal visualization (33). In contrast, a study among men with sexually transmitted infection who went through the urethral sampling in a clinic setting found that the patients who had previous urethral swab rated lesser pain score (32). However, their study population was only men, and the method of data collection was different.

This study provides new information to the body of knowledge on pain. It used the probability sampling method to sample respondents who underwent NPS sampling at Melaka Tengah drive-through screening centre. It achieved a high response rate of 86.6% despite the current lockdown period due to the worsening pandemic situation in Malaysia, thus, providing a broader view of the issue. The probability sampling method ensures the representativeness of the population of interest, while a high response rate minimizes the non-response bias. Finally, this study assessed both patients and operators' factors that contributed to the pain during the NPS, providing a complete assessment of the problem.

The contribution of this study to the respondents is in identifying the high-risk group who is deemed to be experiencing clinically significant pain. Specific and targeted health education will be conducted to stress on the importance of early detection of the disease. In addition, this study contributes to the organisation's surveillance activity, subsequently improving our healthcare services for future pandemic control and screening activities. Healthcare providers should capitalize and improvise techniques and pain management in every procedure conducted in the community. Moreover, the recommended approach for development of policy and health intervention must focus on the factors identified which are associated with pain. Thus, it leads to a positive outcome such as early detection of the virus, early treatment starts, and reduced complications and subsequently reducing the burden of high healthcare costs. More occasional Intensive Care Unit (ICU) admissions and less utilization of ventilators will extensively contribute to overcoming financial issues and constraints. Thus, we can shift or transfer any surplus fund to screening activities and laboratory costs.

This study's limitation where it was a cross-sectional study, thus caution should be exercised to conclude as there was no temporal relationship between independent and dependent variables that can be established. Second, there was limited literature or previous study on pain during the NPS procedure among adults. The study uses general pain for all procedures as in the ENT procedure, to find a comprehensive review of the factors causing pain. Third, the questionnaire used in this study did not go through the test-retest process. Due to a poor response by the respondents for the retest questionnaire, the Cohen's Kappa value and intraclass correlation coefficient were not able to be calculated. Fourth, the results of this study are limited to COVID-19 suspected cases at Melaka Tengah drive-through screening centre. The research is unable to generalize to other population. Fifth, exclusion of the illiterate and respondents who do not understand Malay or English language may have systematically excluded non-citizens, including foreign workers. It is important to gauge their perception of the NPS procedure because they have the higher risks of having COVID-19 virus (due to various factors), thus they are more likely to undergo multiple NPS procedures. Recommendations are also more solid if at-risk groups' perceptions or input are considered. Finally,

the misinformation or recall bias can occur because data such as BMI were self-reported by respondents. They might provide wrong estimate of their current weight and height.

CONCLUSION

This research aims to identify the prevalence of pain during NPS procedure and its associated factors among COVID-19 suspected cases at Melaka Tengah drive-through screening centre. Based on quantitative analysis, the prevalence of clinically significant pain is 53.5%. The variables in this study are sociodemographic characteristics, nasal occlusion, psychological factors and procedure-related factors and pain category. The three main variables are found to have significant association with pain category which are age, respondents' psychological factors and procedure-related factors. Finally, the predictors of clinically significant pain are from the younger respondents, severe pain anxiety level, the nylon-flocked tip, less experienced operators, and high frequency of NPS.

The operators should be trained frequently as to prepare themselves in performing the NPS at a mass screening. More skillful operators cause lesser pain and save time (29). The researcher recommends the 'in- out' method in a mass-screening setting as it causes less pain and saves time (9). Thus, a centre can cater a greater number of patients in the daily screening exercise. Finally, the Melaka Tengah DHO or MOH should consider using the rayon tip swab for the improvement of the patients' pain experience (31). Indirectly, the screening cost will be reduced as the rayon tip is cheaper as compared to the nylon-flocked swab (34). In an ideal condition such as in a well-equipped environment is recommended for the high-risk group such as children or people who might experience clinically significant pain with high possibility of having severe pain anxiety. The researcher also would like to recommend the NPS procedure to be conducted by a highly experienced operator using the 'in-out' method and the rayon tip swab.

In addition, due to high prevalence of clinically significant pain in this study, the researcher recommends a different testing modality that causes no pain to the people. The SARS-CoV-2 viral load was the highest at nasopharynx, but it was also relatively higher in the saliva than in oropharynx at the early stage of COVID-19 infection. This finding suggested that the virus might be secreted from salivary glands as compared to the nasopharynx (2). Thus, a saliva-based sample may allow self-testing at home environment which does not require a trained staff, personal protective equipment, swab, time and potential crowding at the sampling site (35).

In addition, the cost for saliva testing is two times lower than nasopharyngeal swab sampling (2). Thus, it is useful in a mass screening context because it is painless, safer and effective. However, its disadvantage is the viral load decreases during the late stage of COVID-19 infection. For a severe stage of the disease that requires oxygen support and intubation, providing a saliva sample for diagnostic purpose is not practical. Also, the saliva testing is insensitive for asymptomatic individuals and those who are at the later stage of infection (35).

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