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WELCOME MESSAGE FROM THE EDITOR-IN-CHIEF

Welcome to the Borneo Epidemiology Journal

I am pleased to welcome you to our new "*Borneo Epidemiology Journal*" which provides a forum for publication of original research articles, reviews, short communications, perspectives, case studies, and editorials directed at the cutting edge of the fields of Epidemiology and Public Health. The journal assures you that the review processes are timely maintaining the quality of the manuscripts and provide the wide range of opportunity to the authors and readers to contribute as well as gain significant knowledge in this specialized field. There are no borders in the online era, and we invite the authors across the globe to take this opportunity to submit your research manuscripts to *Borneo Epidemiology Journal*. The editorial team consists of members with vast experiences in the related fields, which ensures the manuscript review process goes smoothly and with quality. The editorial board looks forward to receiving the manuscripts from different regions of the globe in the field of Epidemiology and Public Health.

Assoc. Prof Dr Pasupuleti Visweswara Rao, PhD, FAPAS, FMSA
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EDITORIAL **Open Access**

COVID-19: Need of the hour to revisit asymptomatic prevalence of coronavirus pandemic

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Since the Coronavirus disease 2019 (COVID-19) pandemic unfolded in China (Huang et al., 2020) back in December 2019, thus far, more than five million people were infected with the virus and 333,401 death were recorded worldwide (WHO, 2020b). The exponential increase in number shows that COVID-19 spreads faster compared to Severe Acute Respiratory Syndrome (SARS) or Middle East Respiratory Syndrome (MERS). A study (Zou et al., 2020) has shown that high viral loads of Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) are detected in symptomatic patients soon after the onset of symptoms, wherein the load content is higher in their nose than in their throat. Furthermore, the same study has revealed similar viral loads between symptomatic and asymptomatic patients. Therefore, these findings may suggest the possibility of COVID-19 transmission earlier before the onset of symptoms itself. In the early stages of the pandemic, the control measures carried out have focused on screening of symptomatic person; at the time, the whole world thought that the spread of SARS-Cov-2 would only occur through symptomatic person-to-person transmission. In comparison, transmission in SARS would happen after the onset of illness, whereby the viral loads in the respiratory tract peaked around ten days after the development of symptoms by patients (Peiris et al., 2003). However, case detection for SARS (i.e. screening of symptomatic persons) will be grossly inadequate for the current COVID-19 pandemic, thus requiring different strategies to detect those infected with SARS-CoV-2 before they develop the symptoms.

With the current knowledge, the World Health Organization (WHO) describes three routes of COVID-19 transmission (WHO, 2020c) namely symptomatic, pre-symptomatic, and asymptomatic individuals infected with the virus. In particular, symptomatic transmission refers to the transmission from a person while they are experiencing the signs and symptoms compatible with COVID-19 virus infection. Meanwhile, pre-symptomatic transmission

describes the transmission occurring from a person with a laboratory-confirmed COVID-19 infection before they develop any symptoms, wherein they will eventually display the associated symptoms accordingly. Finally, asymptomatic transmission denotes transmission of the virus from a person who does not develop symptoms throughout the entire course of illness.

Data from different countries show that people are tested positive for SARS-CoV-2 infection a few days before they develop any symptoms. Based on a study of COVID-19 clusters in Singapore, it is shown that transmission can occur 1–3 days before the source patient develops the symptoms (Wei et al., 2020). Similarly, the report (WHO, 2020a) generated by WHO-China Joint Mission on COVID-19 has yielded evidence revealing cases that are asymptomatic on the date of identification have later went on to develop symptoms. Moreover, the investigation by Zhen et al. on two clusters of COVID-19 in Zhejiang Province, China has clearly detailed the evidence of pre-symptomatic transmission could occurring among family members (Tong et al., 2020). Additionally, some studies (Lavezzo et al., 2020; Pan et al., 2020) have revealed that the COVID-19 transmission can occur from persons infected with SARS-CoV-2 who remained asymptomatic.

In general, data detailing the evidence of COVID-19 transmission from pre-symptomatic or asymptomatic persons with SARS-CoV-2 infection are increasing; however, those describing the actual proportion of persons with COVID-19 who are asymptomatic and pre-symptomatic are still lacking. This information is essential to estimate the total number of infections in the population through mathematical modelling. Studies showed that 17.9% of COVID-19 infections were completely asymptomatic on the Diamond Princess Cruise Ship (Mizumoto et al., 2020), while a 33.3% rate was recorded in Japanese people who were evacuated from Wuhan (Nishiura et al., 2020).

In Malaysia, a total of 12,384 students, teachers, and staff of Madrasah Tahfiz schools were screened for SARS-CoV-2 infection using reverse transcription polymerase chain reaction (RT-PCR), wherein 635 people were found positive (MOH, 2020). Of this amount of confirmed cases, 539 (84.5%) patients had no symptoms at diagnosis. However, no details are available on the clinical progression of the cases. Similarly, a high proportion of about 85% COVID-19 cases reported in the state of Sabah, Malaysia, was also asymptomatic at diagnosis (JKNS, 2020). These figures are alarming as this can lead to higher transmission of COVID-19 infection among their respective family members, the local community, and general population. Regardless, the approach implemented by the Ministry of Health (MOH) Malaysia consisting of targeted screening for early detection, isolation for confirmed cases, and quarantine for those who have been exposed to confirmed or suspected COVID-19 cases has seemingly prevented its spread from increasing exponentially. Besides, the timely decision made by the Government of Malaysia to implement the movement control order since March 18, 2020 has also contributed significantly towards slowing down the spread of the disease.

Henceforth, the availability of rapid antibody testing for COVID-19 cases offering high sensitivity and specificity and a well-designed study to estimate the total number of infections inclusive of both pre-symptomatic and asymptomatic cases are necessary to help and re-strategise the control measures. For instance, when a study reports on a large proportion of the population having already been infected with COVID-19, the ability of asymptomatic cases to

spread the disease will be limited and thus allowing physical distancing to be lifted. If it shows otherwise, then the practices of good personal hygiene, avoiding crowded places and mass gatherings, and social distancing should be continued. Additionally, more widespread testing for COVID-19 should be considered on top of highly effective contact tracing strategies.

Therefore, it is important to further explore the impact of asymptomatic and pre-symptomatic transmission on the control measures of COVID-19 infection as the current data is still inadequate.

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REVIEW ARTICLE Open Access

Complications of Melioidosis: A Systematic Review

Marilyn Charlene Montini Maluda[1,2], Michelle May D. Goroh[1,2], Eric Tan Chee How[1,2], Syed Sharizman Syed Abdul Rahim[1*], Richard Avoi[1], Mohammad Saffree Jeffree[1], Zahir Izuan Azhar[3] and Azizan Omar[1,4]

Abstract

Introduction: Melioidosis, also known as Whitmore disease, is caused by the gram-negative bacillus, *Burkholderia pseudomallei* and remains a public health concern in Southeast Asia and northern parts of Australia. This study attempts to identify all possible complications of melioidosis and its outcomes.

Methods: Literature search was conducted from databases such as PubMed, Science Direct and Scopus from 1st January 2000 to 31st August 2019. Medical Subject Headings (MeSH) search strategy was used with the terms 'Melioidosis' or '*Burkholderia pseudomallei*' and 'Complications'.

Results: A total of 162 titles were identified and 22 articles were included in the review. Findings showed that among the 22 articles, the ratio of male to female melioidosis incidence was 2.3 to 1, with most cases (86.4%) aged older than 14 years old and showed a mean age of 46 years old. A third (7/22) of the papers reported the involvement of the nervous system as a complication of melioidosis followed by cardiovascular complications. Among the 23 cases reported, 13 had underlying medical conditions with most of them (84.6%) having diabetes mellitus or newly diagnosed with diabetes mellitus. Overall, only one case (4.3%) had resulted in mortality, while 17.4% developed complications and 78.3% managed a full recovery after undergoing treatment for melioidosis.

Conclusion: The most commonly found complication of melioidosis involved the nervous system but patient outcomes were favourable. Rare complications included mycotic aneurysm that can be fatal. Melioidosis can affect almost any organ leading to various complications.

Keywords: Melioidosis, *Burkholderia pseudomallei*, complications, encephalitis, brain

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Introduction

Melioidosis also known as Whitmore disease is caused by the gram-negative bacillus, *Burkholderia pseudomallei*. The disease is endemic in Southeast Asia, Papua New Guinea, most of the Indian subcontinent, Southern China, Hong Kong, and Taiwan. It is observed to be highly endemic in northeast Thailand, Malaysia, Singapore and northern Australia. Sporadic cases have also been reported in parts of South America, West and East (Birnie et al., 2019; Currie, Dance, & Cheng, 2008). Person to person contact is rare but potentially may occur through direct contact (Currie, Ward, & Cheng, 2010).

The incubation period for melioidosis is generally 1-21 days however with a high inoculum, symptoms may develop after a few hours. Although melioidosis may remain latent from months to years before symptoms develop (Currie et al., 2000). The disease generally occurs in individuals with impaired immunocompetence whose non-intact skin has had contact with contaminated soil or surface water. Among the known clinical risk factors associated with melioidosis are diabetes mellitus, pre-existing liver and renal diseases, chronic lung diseases, thalassemia, malignancies and hazardous alcohol consumption (Chaowagul et al., 1989; Currie et al., 2010; Suputtamongkol et al., 1999).

The clinical manifestation is broad spectrum, ranging from acute fulminant sepsis to chronic infection mimicking tuberculosis. The lungs are the primary organ affected where patients are presented with acute or subacute pneumonia (Currie et al., 2010; Meumann, Cheng, Ward, & Currie, 2012). In children, the disease may present as acute febrile illness or in less virulent forms ranging from chronic localised skin infection to the formation of abscess in organs where the most common organs being affected are the lung, spleen, and liver (Sanderson & Currie, 2014).

In some regions, for instance in Thailand and Cambodia , one third of children with melioidosis develop complications such as parotid abscess or acute suppurative parotitis which is in contrast to Australian children who rarely develop such complications (Sanderson & Currie, 2014; White, 2003). A previously published case report found that melioidosis could lead to uncommon complications such as mycotic aneurysm despite undergoing aggressive antibiotic therapy (Anunnatsiri, Chetchotisakd, and Kularbkaew, 2008). In Sri Lanka, Guillain-Barre syndrome was found to be a rare complication of melioidosis and should be suspected in patients who develop lower limb weakness (Wijekoon, Bandara, Kailainathan, Chandrasiri, and Hapuarachchi, 2016).

Although melioidosis is endemic in Southeast Asia and northern parts of Australia, it is still considered uncommon and exotic in most parts of the world. Currently, there is a gap in knowledge on the specific melioidosis complications found in the human body. This review attempts to provide a comprehensive overview of all complications, and outcomes of melioidosis among children and adults from the available literature and case reports seen globally.

Methodology

Literature Search Strategy

Extensive search of literature was obtained from electronic databases such as PubMed, Science Direct and Scopus from 1st January 2000 to 31st August 2019. For PubMed, Medical Subject Headings (MeSH) and the title terms 'Melioidosis' 'or' '*Burkholderia pseudomallei'* 'and' in combination with the term 'Complications' were used. Similar literature search strategy with the other electronic databases were used as well. Two investigators (MG and MM) conducted the systematic review of the literature independently by assessing the study eligibility from the extracted data. A third investigator (ET) was consulted in case of disagreements or discrepancies so that a final decision could be made based on mutual consensus.

Study selection and eligibility criteria

Titles and abstracts were extracted from the extensive search via electronic databases. Duplicate research papers were then removed, and the relevant papers were screened based on the titles and abstracts. Research papers that were irrelevant were excluded. Full texts of the selected research papers were then retrieved and assessed for eligibility. Inclusion criteria for the eligibility study comprised articles that reported complication of melioidosis while excluding systematic reviews and editorial reviews. The studies selected also had to be in the English language. Studies in which the full article was not accessible were excluded. Among the results, 114 articles were excluded since their title and abstract did not match the criteria, 19 articles were excluded after they were found to be irrelevant based on a full text review or if researchers were unable to retrieve the full text. Irrelevant here means that the article did not provide in depth explanation of melioidosis complications.

Data extraction

This review extracted information regarding the first author's name, country, year of publication, age of studied participants, complication(s), system affected and outcome(s).

Study selection process

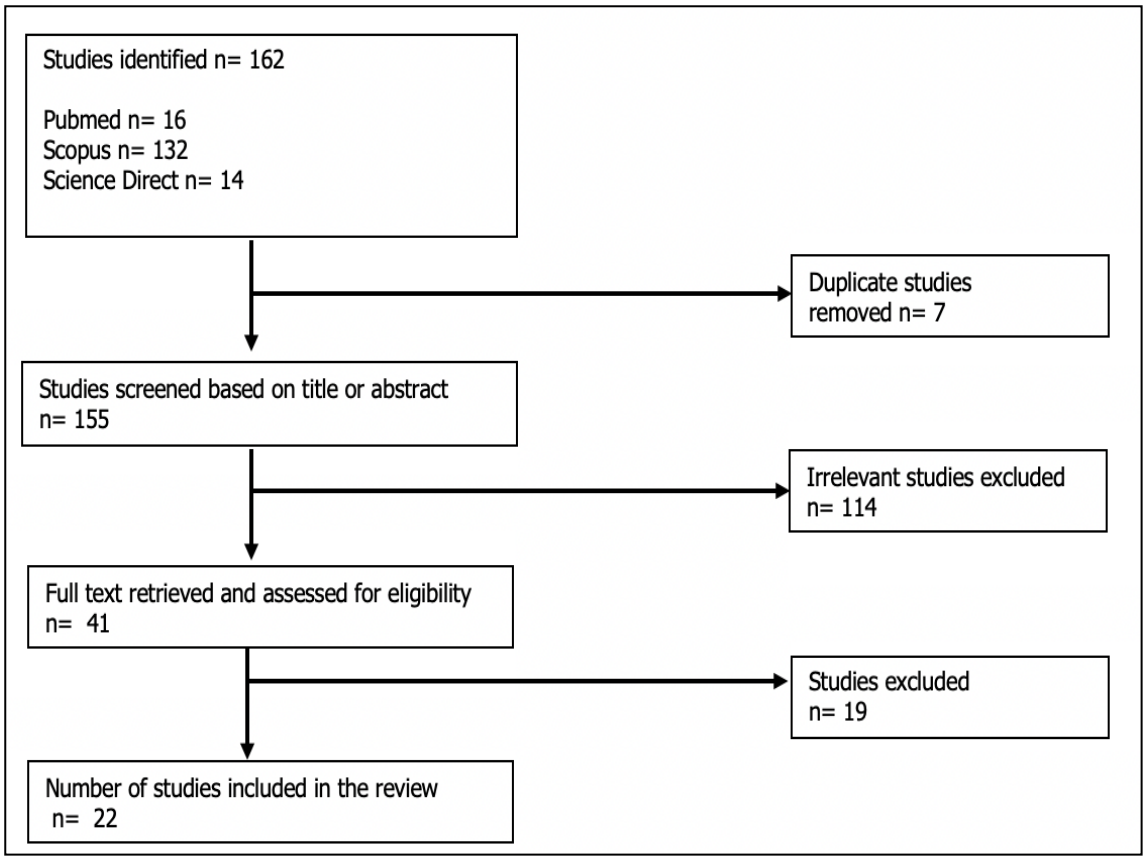

Figure 1: Flow chart of the study selection process

Results

Study selection and characteristics of the published studies

Figure 1 demonstrates the flowchart for the conducted systematic review following the PRISMA-P guidelines. A total of 162 titles were identified through the search. A total of 22 articles were deemed appropriate for inclusion.

This systematic review showed that the ratio of male to female melioidosis incidence is 2.3 to 1 (Table 1), with most cases (86.4%) aged older than 14 years old (adults). The mean age of cases in this review is 46 years old. Only 4.3% (1 case) resulted in mortality, while 17.4% developed complication and 78.3% had full recovery after undergoing treatment for melioidosis.

Table 1: Summary of reviewed articles

Author, Year, Country	Age (years), Sex	Complication	Systems Affected	Treatment	Outcome
Maytapa et al., 2018, Thailand	52, Male	Gastrosplenic fistula	Gastrointestinal	IV Ceftazidime, splenectomy with gastrosplenic fistula repair, oral Trimethoprim/ Sulfamethoxazole	Recovery
Wijekoon et al., 2016, Sri Lanka	46, Female	Guillaine-Barre Syndrome	Nervous	IV Meropenem, plasmaphoresis, IV Cotrimoxazole, IV Co-amoxyclav	Recovery
Lu et al., 2018, Malaysia	38, Male	Constrictive Pericarditis	Cardiovascular	IV Ceftazidime, IV meropenem, oral Bactrim, IV Ciprofloxacin	Complication
Direksunthorn, 2017, Thailand	54, Male	Portal Vein Thrombosis	Cardiovascular	IV Ceftazidime, IV Metronidazole, oral Amoxicillin-Clavulanic acid	Recovery
Morelli et al., 2015, Netherlands	63, Male	Acute Renal Failure	Renal	IV Ceftazidime, oral Trimethoprim/Sulfamethoxazole, oral doxycycline	Complication
Li et al., 2015, Hong Kong	82, Male	Mycotic Aneurysm of aortic arch/left subclavian artery	Cardiovascular	IV Amoxicillin-clavulanate and Azithromycin, IV Ceftazidime, oral Amoxicillin-clavulanate and Doxycycline, IV Meropenem and Doxycycline, IV Minocyclin and Moxifloxacin	Mortality
Ng et al., 2015, Malaysia	62, Male	Acute Parkinsonism	Nervous	IV Imipenem, Levodopa/Benserazide, oral Co-trimoxazole and Doxycycline	Recovery
Abidin et al., 2007, Malaysia	65, Male	Pacemaker infection	Others	IV Ampicillin-sulbactam, IV Meropenem, IV Ceftazidime, Oral TMP-SMX and Doxycycline	Recovery
Chen et al., 2007, Taiwan	51, Male	Endophthalmitis	Ophthalmic	IV Cefazolin and Gentamicin, IV Ceftazidime, oral Trimethoprim/Sulfamethoxazole, Intravitreal	Complication

				Vancomycin and Ceftazidime, Topical Vancomycin, Ceftazidime and 1% prednisolone acetate	
Wang et al., 2003, Singapore	61, Male	Necrotising Fasciitis	Integumentary	Wound debridement and split thickness skin grafting, IV Ceftazidime and Doxycycline, IV Imipenem, oral Amoxicillin-clavulanate and Doxycycline	Recovery
Kumar et al., 2016, India	10 months, Female	Brainstem microabscesses	Nervous	IV Amoxicillin-clavulanic acid, IV Meropenem and Cotrimoxazole	Recovery
Porter et al., 2018, Australia	35, Female	Chorioamnionitis	Reproductive	IV Meropenem, IV Ceftazidime, oral amoxicillin-clavulanic acid	Recovery
Saravu et al., 2015, India	39, Male	Encephalitis and empyema	Nervous	IV Ceftazidime, oral Cotrimoxazole and Doxycycline	Recovery
Saravu et al.,2015, India	45, Male	Encephalitis and Transverse Myelitis	Nervous	IV Meropenem and Cotrimoxazole, oral Cotrimoxazole and Doxycycline	Complication
Wijewickrama and Weerakoon, 2017, Sri Lanka	33, Female	Thrombotic thrombocytopenic purpura	Hematopoietic	IV Ceftriaxone and Clarythromycin, plasmapheresis, IV Meropenem, oral Cotrimoxazole	Recovery
Chen et al., 2018, China	55, Male	Splenic abscess	Lymphatic	Laparoscopic exploration and splenectomy, IV Cefmenoxime and Pieracillin-Tazobactam, IV Ceftazidime, oral Trimethoprim/Sulfamethoxazole,	Recovery
Nernsai et al., 2018, Thailand	31, Female	Left Tubo-ovarian abscess	Reproductive	IV Gentamicin and Clindamycin, exploratory laparotomy, left salpingo-oophorectomy and pus drainage, IV Ceftazidime and oral Cotrimoxazole	Recovery
Kogilavaani et al., 2014, Malaysia	11, Female	Bilateral orbital abscesses with subdural empyema	Ophthalmic and Nervous	IV Cloxacillin, Cefepime, and Metronidazole, IV Ceftazidime and Ceftriaxone, IV Meropemen and	Recovery

		and cavernous sinus thrombosis		Metronidazole, oral Trimethoprim/Sulfamethoxazole	
Mohammad and Ghazali, 2017, Malaysia	64, Male	Venous thrombo-embolism and cavitary pneumonia	Cardiovascular and Respiratory	IV Ceftazidime and IV Heparin	Recovery
Pelerito et al., 2016, Portugal	62, Female	Gluteal abscesses and left ileum osteomyelitis	Musculoskeletal	IV Meropenem, oral Amoxicillin-clavulanic acid	Recovery
Schindler et al., 2002, United Stated of America	58, Male	Infected intrathoracic subclavian artery pseudoaneurysm	Cardiovascular	Coronary artery bypass grafting procedure and pseudoaneurysm repair, femofemoral bypass graft, IV Ceftazidime, oral Doxycycline and Amoxicillin clavulanic acid	Recovery
Andersen et al.,2016, Australia	4, Male	Acute flaccid paralysis	Nervous	IV Meropenem and Cotrimoxazole, oral Cotrimoxazole	Recovery
Martin et al., 2016, Philippines	44, Male	Liver abscess	Hepatobilliary	IV Ceftazidime, oral Trimethoprim/Sulfamethoxazole	Recovery

Discussion

This review attempt to identify all the various complications of melioidosis to further improve the management of patients with melioidosis. Since all the reviews were obtained via case reports the inclusion of novelties or rare complications are included in this systematic review. The results of the systematic review revealed that the incidence of melioidosis is approximately two times higher in males than females, which is similar to the global burden of melioidosis in 2015, showing cases twice as high for men as for women (Birnie et al., 2019).

Melioidosis is known to cause sepsis in adults with underlying conditions that impair immune function, such as diabetes, chronic renal failure, alcoholism and prolonged steroid use (Cheng & Currie, 2005). In this current review 84.6% of the cases had diabetes mellitus. This corresponds with the findings reported by Birnie et al. (2019), where diabetes or newly diagnosed hyperglycaemia were among the top four risk factors for melioidosis globally.

One third of the papers (7/22) reported the involvement of the nervous system as a complication of melioidosis despite the rare occurrences of neurological melioidosis. It is notable that in this current systematic review, encephalitis is the most common neurological manifestation which correlates with a 20-year prospective study of melioidosis conducted in Northern Australia. Therefore, melioidosis should always be suspected in a patient with superficial or deep seated abscess formation with neurological presentation that presents as clinical features of meningo-encephalitis (Wijekoon et al., 2016) .This is crucial as previous studies have reported that patients with neurological melioidosis have a mortality rate of 25% (Andersen, Mackay, & Ryan, 2016).

In adults, cardiac complications due to melioidosis is usually rare compared to other more common outcomes such as pneumonia and intra-abdominal abscess. Among the papers reviewed, five cases (22%) showed a breakdown of the cardiovascular system as a complication of melioidosis. The case of melioidosis reported from Hong Kong showed relapsing melioidosis which was further complicated by mycotic aneurysm. The report disclosed that the patient had succumbed to the disease despite treatment (Li, Chau, & Wong, 2015). Melioidosis presenting as mycotic aneurysm is very uncommon and has been found to be associated with high morbidity, high mortality and relapse rates (Low, Quek, Sin, & Ang, 2005). Therefore, physicians should be attentive to the development of mycotic aneurysm especially when treating for persistent or recurrent melioidosis and should consider early surgical intervention (Li et al., 2015).

Apart from that, most of the cases reported favourable outcomes (survival) which have resulted in full recovery of the patients after treatment (78.3%) as opposed to the survival outcomes reported by the global burden of melioidosis in 2015, which revealed 93.6% of melioidosis survivors ended up with some sort of complication such as post-sepsis, ongoing CNS or musculoskeletal impairment, while only 6.4% include consolidated treatment (Birnie et al., 2019).

In terms of public health intervention, even when the current risk factors are well known, active public health intervention is still lacking. Even though protective footwear is frequently suggested for individuals at risk of melioidosis, the practicality and effectiveness of this advice is unknown (Cheng & Currie, 2005).

Conclusion

Melioidosis, a known opportunistic pathogen, is a disease that needs to be understood by public health authorities especially in Southeast Asia and parts of Australia since it has the potential to spread to other parts of the world. From this systematic review, it was revealed that the most common complication involved the nervous system, however outcomes were favourable for a majority of patients. Despite advancement in antibiotic therapy, there are patients that can succumb to this emerging disease due to rare and severe complications such as mycotic aneurysm. Melioidosis can involve almost any organ and can cause the human body to deteriorate rapidly. Therefore, strengthening surveillance and medical diagnostics are crucial especially in countries endemic with the disease.

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REVIEW ARTICLE **Open Access**

A Scoping Review of the Effectiveness of Control Interventions of Human and Canine Rabies in an Effort to Rationalise the One Health Approach

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Abstract

According to the World Health Organization (WHO), rabies is one of the 18 neglected tropical diseases, together with dengue, leprosy, and trachoma, among others. Despite being a vaccine-preventable disease, the latest estimate of annual human rabies mortality from a 2015 study is as high as 59,000 throughout 150 countries. In human rabies, more than 95% of the cases are due to dog bites, making the elimination of canine rabies a global priority by fighting the disease at its animal source. World Health Organization (WHO), World Organization for Animal Health (OIE), Food and Agriculture Organization (FAO) of the United Nations, and the Global Alliance for Rabies Control (GARC) have warranted the One Health framework with the objective of complete eradication of dog-related human rabies by the year 2030. In an effort to rationalise the One Health approach, this scoping review found 17 studies on assessing the effectiveness of control interventions of human and canine rabies. Different strategies were implemented based on the endemicity of rabies in a particular country. Overall, the combined strategies using the One Health approach, which allows effective participation and communication between different agencies, have shown promising results in reducing rabies cases. These strategies will hopefully realise the goal in the Global Strategic Plan to achieve zero canine-mediated human rabies death by the year 2030.

Keywords: Rabies, Effectiveness, One health, Control and Intervention

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Introduction

According to the World Health Organization (WHO), rabies is one of the 18 neglected tropical diseases, together with dengue, leprosy, and trachoma, among others (World Health Organization (WHO), 2020a). Despite being an ancient vaccine-preventable zoonotic disease, the latest estimate of annual human rabies mortality could still be as high as 59,000 across 150 countries around the globe (Hampson et al., 2015), (World Health Organization (WHO), 2020c). Although a preventable disease, it is generally fatal following the development of clinical signs of rabies (Centers for Disease Control and Prevention (CDC), 2019). In human rabies, more than 99% of the cases are due to dog bites (World Health Organization (WHO), 2020c), making the elimination of canine rabies a global priority by fighting the disease at its animal source.

In view of this, a quadripartite anti-rabies alliance between World Health Organization (WHO), World Organization for Animal Health (OIE), Food and Agriculture Organization (FAO) of the United Nations, and the Global Alliance for Rabies Control (GARC) have warranted the One Health framework with the principal goal of complete eradication of dog-related human rabies by the year 2030 (Lavan et al., 2017). The One Health initiatives acknowledge that the health of humans and animals together with the environment are highly interrelated. Built on five pillars, the action plan involves a collaborative strategy that combines sociocultural, technical, organisational, political, and resource-oriented aspects. It notably calls for three key actions; (1) to make human vaccination and immunoglobulin affordable, (2) to ensure timely treatment for bite victims, and (3) to implement mass vaccination campaigns for dogs in at-risk areas.

In this paper, we designed a scoping review of literature to examine the published evidence available on the effectiveness of human and canine rabies interventions in an effort to rationalise the One Health approach. The focus questions include the following:

1) What are the rabies control and prevention strategies being implemented globally?
2) What is the best practice for rabies control and intervention strategy?
3) Which of these has been shown to be effective, for different levels of rabies-risk setting?

Methods

Our review methodology adopts the 2005 framework as developed by Arksey and O'Malley (Arksey & Malley, 2005) constituting the following five essential components: (1) developing research questions, (2) identifying the relevant studies, (3) selecting the studies, (4) charting the data, and (5) gathering, summarising, and reporting the results.

Search strategy

A comprehensive electronic search through Medline and Centre for Review and Dissemination (CRD) databases was done to identify the relevant studies in the past five years. For the Medline database, we set the search-field descriptor in the PubMed search as MeSH and Text Word and we assigned search terms including "rabies [MeSH]" AND "vaccination [MeSH]" AND "cost-benefit [Text Word]". For the CRD database, the search term included "rabies" AND "effectiveness" OR "vaccination". Additional key studies were identified via other sources like the reference lists and hand searched using the Google Scholar search engine.

Study selection

Only peer-reviewed articles published in academic journals from 2015 to 2020 were considered. The identified studies were then selected for review only if they fulfilled the following set of eligibility criteria:

1) The study population must be dogs or humans or both.
2) The interventions considered include canine immunisation or post-exposure prophylaxis (PEP) treatment or pre-exposure prophylaxis (PrEP) for humans.
3) The result of study includes the effectiveness or cost-effectiveness of the control strategies considered.

Rabies studies on other wildlife species such as skunks, racoons, and foxes were not included in the review. Non-English articles, guidelines, blueprints, systemic reviews, anecdotal reports, pre-prints as well as other grey literature were excluded. Effectiveness and efficacy studies that solely focused on improving intervention performance, such as immune response, vaccine quality, and potency regarding clinical trials, as well as studies that only addressed surveillance and monitoring type interventions, were also excluded in the review.

Data charting

Two authors (NA and RS) independently extracted and analysed the data in all the studies selected for the final review. Descriptive data on the study country and population, aim and methods, types of intervention and control strategies, as well as the key findings for each study were collated and recorded. All discrepancies were resolved by consensus.

Results

Initial search across the two databases identified a total number of 36 studies, with 33 studies from the MEDLINE database, and the remaining three were from the Centre for Reviews and Dissemination (CRD) database. Two studies were removed due to duplication, leaving 34 studies subjected to the record screening of titles. From the title screening, eight studies did not target the dog or human population, while another two studies did not address rabies prevention and controls directly and were therefore excluded. Six additional articles were included via hand-search of the key terms in the Google Scholar search engine or chosen from the reference lists. A total of 30 studies were then further screened in our full-text eligibility assessment,

whereby 13 articles did not meet our inclusion criteria. Two studies were in French and Chinese languages, another two publications were clinical trials, and the remaining did not have the outcomes of interest. As a result, 17 studies have met our inclusion criteria and so included in our final review, as seen in the flowchart in Figure 1 detailing the study selection. Table 1 presents the descriptive data of the studies extracted for our review.

Study characteristics

Around 47% of the studies(Borse et al., 2018; Hudson et al., 2019; Jeon et al., 2019; Laager et al., 2018; S. Musaili & Chepkwony, 2020; Taib et al., 2019; Wei et al., 2018; Yoder et al., 2019) included in our review were publications from the past three years while the remaining percentage (Bilinski et al., 2016; Dumas et al., 2015; Ferguson et al., 2015; Fitzpatrick et al., 2016; Mindekem et al., 2017; Muthiani et al., 2015; Velasco-Villa et al., 2017; E Wera et al., 2017; Ewaldus Wera et al., 2017) were published from the year 2015 to year 2017. Six studies (35%) were concerned on rabies in the continent of Africa; two in Chad (Mindekem et al., 2017; Yoder et al., 2019) one in Mali (Muthiani et al., 2015), one in Kenya (S. Musaili & Chepkwony, 2020), one in Tanzania (Bilinski et al., 2016) and one study in East Africa (Borse et al., 2018). Another four studies (23%) considered rabies in South East Asia; two in Indonesia (E Wera et al., 2017; Ewaldus Wera et al., 2017) one in Philippines (Ferguson et al., 2015) and one in Malaysia (Taib et al., 2019). In one study, the focus was on rabies in the Western Hemisphere region (Velasco-Villa et al., 2017) including North America, Central and South America and the Caribbean. A single study was conducted each for rabies in Australia (Wei et al., 2018), China (Laager et al., 2018), India (Fitzpatrick et al., 2016), France (Dumas et al., 2015) and in Latin America (Jeon et al., 2019). However, one study (Hudson et al., 2019) did not specify its study country as the researchers only simulated hypothetical scenarios.

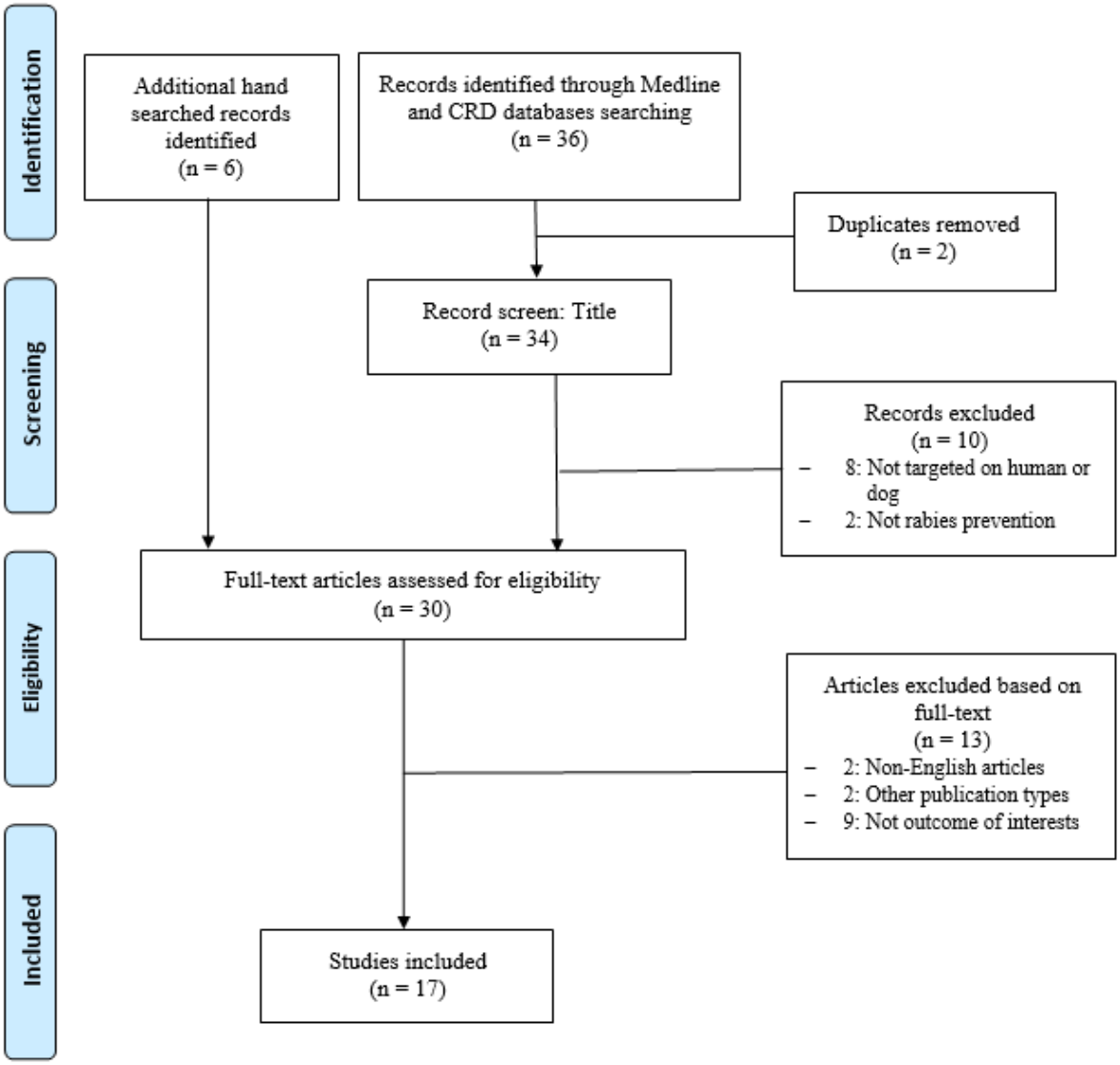

Figure 1: Flowchart of the study selection

In regards to the study objectives, ten studies (70%) aimed at evaluating or reviewing the effectiveness of different control and intervention strategies in human and canine rabies while the other 30% (Bilinski et al., 2016; Borse et al., 2018; Dumas et al., 2015; Fitzpatrick et al., 2016; Mindekem et al., 2017; E Wera et al., 2017; Ewaldus Wera et al., 2017) aimed at estimating the cost-effectiveness of rabies interventions. Almost all of the studies examined dog vaccination but other rabies control strategies such as public education, the combined use of dog vaccination and contraceptives, dog culling, human post-exposure prophylaxis (PEP), oral rabies vaccine (ORV), and surgical sterilization of dogs were considered as well.

Effectiveness evaluation

The evaluation of rabies intervention effectiveness was considered at different levels of rabies-risk (endemic, epidemic, and rabies-free). Although the endemic setting was the focal point in most literatures, three studies (Dumas et al., 2015; Hudson et al., 2019; Wei et al., 2018) have analysed the effectiveness of rabies prevention and control strategies in a rabies-free scenario. There were 13 studies utilising mathematical models to simulate disease transmission; nine

(Bilinski et al., 2016; Fitzpatrick et al., 2016; Hudson et al., 2019; Mindekem et al., 2017; S. Musaili & Chepkwony, 2020; E Wera et al., 2017; Ewaldus Wera et al., 2017; Yoder et al., 2019) of which used a compartmental, deterministic model, one (Dumas et al., 2015) used decision-tree model, while another two(Taib et al., 2019; Wei et al., 2018) used individual- and agent-based models. The remaining studies (Ferguson et al., 2015; Jeon et al., 2019; Laager et al., 2018; Muthiani et al., 2015; Velasco-Villa et al., 2017) primarily used statistical analysis on available data in evaluating the intervention effectiveness.

Six studies (Bilinski et al., 2016; Ferguson et al., 2015; Fitzpatrick et al., 2016; Muthiani et al., 2015; Wei et al., 2018; E Wera et al., 2017) examined dog vaccination alone including small and large scale mass dog vaccination campaigns, one study (Dumas et al., 2015) focused solely on human PEP as the prevention and control strategy, whereas other studies have addressed the use of alternative interventions such as oral rabies vaccine (ORV) together with mass parenteral vaccination, or the combination of dog vaccination and human PEP, culling or surgical sterilization as well as public health education.

Table 1: Description of selected studies included in the review. (n = 17)

No.	Author/ Year	Study country/ population	Rabies-risk level	Aim and methods	Interventions considered	Key findings
1	Musaili JS et al. (2020) (Musaili & Chepkwony, 2020)	Country: Makueni county, Kenya. Study population: Dogs.	Endemic	Aim: To study the influence of public health education as one of the control measures of canine rabies elimination in Makueni. Methods: Numerical simulation using a deterministic, compartmental model that captures the rabies transmission dynamics among dogs in Makueni.	Public health education on the importance of canine pre- and post-exposure prophylaxis with emphasis on the concept of responsible ownership.	Public health education on the importance of canine pre- and post-exposure prophylaxis with emphasize on the concept of responsible ownership produced a significant decrease in the number of rabid dogs in Makueni.
2	Hudson EG et al. (2019) (Hudson, et al., 2019)	Country: Northern Peninsula Area (NPA), Queensland	Rabies-Free.	Aim: To assess the effectiveness of several vaccination programs in	Dog vaccination	In a rabies-free NPA, a random vaccination strategy is favourable as opposed to a non-vaccination strategy.

		, Australia. Study population: Dogs.		terms of different dog roaming patterns in NPA, Queensland. Methods: An agent-based, stochastic model is developed which simulates outbreaks among the population of free-roaming domestic dog in NPA.		A random non-targeted vaccination coverage of 40% is the most efficient in the context of NPA. However, as compared to a random vaccination strategy with the same percentage of coverage, a 40% vaccination coverage targeting more on roaming dogs was more effective in decreasing the size and period of epidemic.
3	Jeon S et al. (2019) (Jeon et al., 2019)	Country: Hypothetical scenario. Study population: Dogs, humans.	Rabies-Free.	Aim: To evaluate the level of vaccination needed to prevent the re-establishment of dog rabies in a post-elimination setting. Methods: A modified version of RabiesEcon, which is a deterministic mathematical model to simulate different rabies reintroduction scenarios.	Dog vaccination, human PEP	To prevent the reintroduction of dog rabies in a post-elimination setting, it is crucial to vaccinate the free-roaming dog group with coverage of at least 38% to 56%. Rabies-free countries are at risk of reintroduction if dog movement control and surveillance system are not fortified post-elimination.
4	Yoder J et al. (2019) (Yoder et al., 2019)	Country: Latin America. Study	Endemic.	Aim: To study the influence of dog rabies vaccination on the aspects of	Dog vaccination, human PEP.	As the usage of human PEP increases by 10%, human rabies deaths decrease by 7%, but

		population: Dogs, humans.		human deaths due to rabies, bites reporting, and human PEP. Methods: A multivariate regression analysis is performed over annual rabies-related data from 1995 to 2005 across seven different Latin American countries.		when canine vaccination is increased by 10%, the usage of PEP can be reduced by 2.8%. Emphasis is on the importance of mass dog vaccination, public education, treatment accessibility, and clinical algorithms to avoid wastage of human PEP.
5	Abdul Taib NA et al. (2019) (Taib et al., 2019)	Country: Sarawak State, Malaysia. Study population: Dogs, humans.	Epidemic.	Aim: To determine the parameter with the most impact on Sarawak rabies transmission dynamics. Methods: Model simulation using a deterministic model to simulate rabies transmission among dogs and dog-to-human in Sarawak.	Dog vaccination, dog population management.	The ongoing outbreak can be managed effectively by increasing dog vaccination coverage and reducing the number of newborn puppies while culling is ineffective for long-term rabies elimination. Culling is an ineffective method for population control.
6	Laager M et al. (2018) (Laager et al., 2018)	Country: N'Djamena, Chad Study population: Dogs	Endemic	Aim: To evaluate the effects of dog heterogeneity at individual levels and examine the risk of re-establishment over different	Dog vaccination, Oral Rabies Vaccine (ORV).	70% coverage of dog vaccination would prevent major outbreaks. Targeted vaccination on the population of highly connected roaming dogs would be a

				vaccination coverage. Methods: An individual-based contact network model of dog rabies transmission in N'Djamena is developed.		more effective vaccination strategy as compared to a random vaccination strategy. Oral vaccination would be an effective method to immunise these highly connected roaming dogs.
7	Wei XK et al. (2018) (Wei et al., 2018)	Country: Guangxi Province, China Study population: Dogs, humans	Endemic	Aim: To advocate the vaccination of domestic dogs in rural China in order to reduce the number of human rabies cases significantly. Methods: A vaccination program model, applicable to rural China is developed and assessed.	Mass dog vaccination, dog surveillance, vaccinated dog monitoring, human rabies surveillance.	To control rabies in Guangxi, a rabies vaccination program has been successful demonstrated which involves several control strategies such as dog vaccination, dog surveillance and monitoring, as well as compiling and reporting statistics of human rabies cases.
8	Borse RH et al. (2018) (Borse et al., 2018)	Country: East Africa. Study population: Dogs, humans.	Endemic.	Aim: To estimate the cost-effectiveness of East African dog rabies vaccination programs. Methods: Model simulation using a spreadsheet tool, RabiesEcon, which incorporates a deterministic	Mass dog vaccination, human PEP and RIG, dog population management.	In a low disease transmission setting, mass vaccinating 20% (biennial) or 50% (annually) of the East African dog population is the most cost-effective. However, in a high transmission scenario, a 70% vaccination coverage is required to control the spread of rabies for a minimum of 20 years.

				model of dog-to-dog and dog-to-human rabies transmission.		
9	Velasco-Villa A et al. (2017) (Velasco-villa et al., 2017)	Country: Western Hemisphere. Study population: Dogs, humans .	Varies.	Aim: To review the available control strategies for canine rabies eradication within the Western Hemisphere. Methods: The necessary available information on the progress of canine rabies elimination from the Western Hemisphere is collated and extensively reviewed.	Mass dog parenteral vaccination, oral rabies vaccine (ORV), culling, immunocontraception, dog population management and surveillance.	In order to increase vaccination coverage, oral rabies vaccine (ORV) should be utilised to vaccinate free-roaming dog populations. Immunocontraception can be used as fertility control to manage free-roaming dog populations in Latin American countries. Canine rabies can be eradicated when dog herd immunity is maintained at above 70%, along with laboratory-based surveillance of rabies in dogs, domestic animals and wildlife, as well as heightened public awareness. Culling only when the number of human rabies exposures is high.
10	Mindekem R et al. (2017) (Mindekem et al., 2017)	Country: N'Djamena, Chad. Study population: Dogs, humans.	Endemic.	Aim: To evaluate the cost-effectiveness, defined as the cost per human exposure averted, of different intervention strategies in N'Djamena,	Dog mass vaccination, human PEP, and paramount One Health communication i.e. communication between human health and veterinary professionals.	The combined strategies of dog vaccination, human PEP and paramount One Health communication is more cost-effective as compared to the strategy of using PEP alone. In a resource poor setting, the cost of

				Chad. Method: Numerical simulation using a deterministic model capturing the dynamics of N'Djamena rabies transmission among dogs and dog-to-human and economic evaluation of the mass vaccination campaigns in N'Djamena.		PEP use will be significantly lowered when the One Health concept is efficiently applied.
11	Wera E et al. (2017) (Ewaldus Wera et al., 2017)	Country: Flores Island, Indonesia. Study population: Dogs, humans.	Endemic.	Aim: To conduct an economic evaluation when different mass vaccination strategies is applied in Flores Island. Methods: Numerical simulation using a deterministic model representing the dynamics of rabies transmission among dogs and dog-to-human in Flores Island to estimate the cost-effectiveness ratio of the alternative	Mass dog vaccination, human PEP.	The combined strategies of annual vaccination using a long-acting vaccine at 70% coverage together with human PEP could eliminate all human rabies deaths completely although at a slightly higher cost-effectiveness ratio.

				strategies for mass vaccination.		
12	Fitzpatrick MC (2016) (Fitzpatrick et al., 2016)	Country: Tamil Nadu, India. Study population: Owned dogs, stray dogs.	Endemic.	Aim: To assess the cost-effectiveness for different control strategies of rabies in Tamil Nadu. Methods: Numerical simulation using a deterministic model of rabies transmission utilising data on human rabies and canine demography in Tamil Nadu.	Dog vaccination (owned dog, stray dog).	Focus should be more on vaccinating at least 13% of the stray dog population in Tamil Nadu as it would be more cost-effective in lowering the number of human rabies cases by up to 90%.
13	Bilinski AM et al. (2016) (Bilinski et al., 2016)	Country: Ngorongoro and Serengeti, Tanzania. Study population: Dogs, wildlife, and humans.	Endemic.	Aim: To evaluate the cost-effectiveness of several rabies canine vaccination campaigns with different coverage and frequency. Methods: Numerical simulation using a deterministic model that incorporates the dynamics of dog, wildlife and human populations.	Mass dog vaccination campaign.	The study emphasises on campaign frequency, rather than coverage. When risk of rabies reintroduction is low, semi-annual vaccination campaigns are the most cost-effective to control the disease spread.

14	Wera E et al. (2016) (E Wera et al., 2016)	Country: Flores Island, Indonesia Study population: Dogs.	Endemic.	Aim: To evaluate the cost-effectiveness of alternative mass vaccination strategies for rabies control in Flores Island. Methods: Numerical simulation using a deterministic model that incorporates the dynamics of rabies transmission in Flores Island.	Mass dog vaccination campaign.	The implementation of an annual mass dog vaccination campaign with 70% coverage using a long-acting vaccine can reduce the duration of outbreaks thus the strategy would be the most cost-effective in the context of Flores Island.
15	Dumas FR et al. (2015) (Dumas et al., 2015)	Country: France. Study population: Humans.	Rabies-free.	Aim: To conduct an economic evaluation of PEP strategies following dog bite exposure in very low rabies risk settings. Methods: A decision-tree model is developed simulating the trajectory of bite victims in French cities seeking PEP treatment following dog bite exposure.	Human PEP and RIG.	Regardless of the category of exposure, the administration of human PEP is not the most cost-effective method and thus not preferable in a setting with very low risk of rabies.
16	Muthiani Y et al. (2015) (Muthiani et al.,	Country: Bamako, Mali. Study	Endemic.	Aim: To estimate the achieved coverage of a small-scale	Small-scale central-point dog vaccination campaign.	The achieved coverage of fixed-point vaccination campaign in Bamako was low

	2015)	population: Dogs, humans.		dog mass vaccination campaign in Bamako and to determine weak key parameters for intervention effectiveness. Methods: Following the vaccination campaign, household survey and a transect survey within the vaccination zone were conducted simultaneously. The household and transect-survey data were fitted to a Bayesian model in order to estimate the overall vaccination coverage. An effectiveness-model framework was developed to estimate effectiveness parameters of interventions.		(only 17%) which could be due to low engagement by dog owners. Lack of information and dog aggressiveness affect intervention effectiveness. To increase the knowledge within the society, a stakeholder approach should be taken in which the community itself is proactive in every step of the process from the initial planning up to implementation stage of the campaign. A vaccination campaign combining both fixed point and house-to-house vaccination strategy could mitigate the problem of handling aggressive dogs.
17	Ferguson EA et al. (2015) (Ferguson et al., 2015)	Country: Region VI (Western Visayas), Philippines. Study population: Dogs.	Endemic, rabies-free.	Aim: To study the impact of spatial heterogeneity in vaccination coverage and human-mediated dog movements for the	Mass dog vaccination campaign.	The effectiveness of mass vaccination campaigns could be reduced significantly due to spatial heterogeneity in vaccination coverage even when the overall coverage

				elimination of endemic canine rabies by mass dog vaccination in Region VI of the Philippines (Western Visayas). Methods: A spatially-explicit canine rabies transmission model is developed which incorporates dog movement and vaccination coverage scenarios in Region VI.		is high. The problem of heterogeneity can be mitigated through vaccine redistribution. Long-distance dog movement will increase the risk of rabies reintroduction into a rabies-free area. Thus, an effective surveillance and dog movement regulations will be critical at this post-elimination setting.

Discussion

The World Health Organization (WHO) has asserted that annual mass canine vaccination with an optimal threshold of 70% coverage would be the most cost-effective rabies control strategy (WHO, 2020b). Five studies (Borse et al., 2018; Muthiani et al., 2015; Taib et al., 2019; Velasco-Villa et al., 2017; Ewaldus Wera et al., 2017) have also highlighted the importance in sustaining a minimum of 70% dog vaccination coverage to induce herd immunity, which aligns with WHO's recommended guideline for canine rabies control. Furthermore, in an effort to manage the stray dog population with zero rabies immunity, two studies (Laager et al., 2018; Velasco-Villa et al., 2017) considered the use of baits laced with oral rabies vaccines (ORV). Laager (Laager et al., 2018) suggested a targeted vaccination strategy on a highly-connected roaming dogs with 70% coverage to eliminate endemic rabies.

Five studies (CDC, 2019; Jeon et al., 2019; Laager et al., 2018; S. Musaili & Chepkwony, 2020; WHO, 2020c) considered shifting the focus on vaccinating free-roaming stray dogs as the most effective means to control rabies both in a endemic setting or in a rabies-free area as a preventive measure. However, in a very low rabies risk setting, researchers (Hudson et al., 2019; Jeon et al., 2019) have found that a vaccination coverage of less than the WHO-recommended 70% is sufficient to maintain a rabies-free status. As compared to a random vaccination strategy, a vaccination strategy of 40% coverage in NPA, Queensland

targeting more on free-roaming dogs rather than the easily accessible non-roaming dogs would be more effective in preventing rabies incursion into the area (Hudson et al., 2019). These findings were also supported by another study (Jeon et al., 2019) which considered a simulated rabies-free post-elimination scenario in which a vaccination coverage of 38% to 56% of free-roaming dogs was found to be the most effective prevention measure.

Two studies (Ferguson et al., 2015; Jeon et al., 2019) have stressed the importance of dog surveillance in a post-elimination setting in order to prevent rabies re-establishment. An economic evaluation conducted by Dumas (Dumas et al., 2015) showed that, in terms of the rabies-free France, the human PEP treatment administered to bite victims indeed accumulated significant unnecessary costs, and is therefore not preferable regardless of the category of exposure.

In eradicate canine rabies in an endemic setting, Yoder (Yoder et al., 2019) emphasized on the combined strategy of mass dog vaccination and increasing public awareness and treatment accessibility, as well as having a better clinical algorithm to reduce the wastage of the costly, unnecessary PEP use. One study in Sarawak has found that the more effective strategy to manage the ongoing rabies outbreak would be to increase the dog vaccination coverage and to lower the dog birth rate (Taib et al., 2019) while culling is an ineffective method to stop the spread of rabies according to two studies (Taib et al., 2019; Velasco-Villa et al., 2017).

Additionally, two studies (Bilinski et al., 2016; Borse et al., 2018) have indicated that in a low-risk of rabies reintroduction, conducting a semi-annual vaccination campaign would be the most cost-effective to control the disease spread. According to Borse (Borse et al., 2018), dog vaccination coverage of 70% or above to halt the spread of rabies for at least 20 years in a high disease transmission scenario. However, in a low transmission scenario, vaccinating 20% semi-annually or 50% annually of the East African dog population will be most cost-effective.

Velasco-Villa (Velasco-Villa et al., 2017) suggested the use of ORV to immunise the free-roaming dogs especially in hard-to-reach places during mass parenteral vaccination campaigns and the use of immunocontraception to control the population of free-roaming dogs. Furthermore, the feasibility of canine rabies elimination can only be achieved when dog herd immunity is maintained at above 70%, along with sustained laboratory-based animal surveillance, as well as heightened public awareness on rabies education and the practice of responsible pet ownership.

Wei et al., 2018 stated that a control strategy involving mass dog vaccination, dog surveillance and monitoring, as well as human rabies case reporting can effectively reduce the spread of rabies from dogs to humans and successfully control endemic rabies in Guangxi. A study done by Fitzpatrick (Fitzpatrick et al., 2016) recommended vaccinating more of the stray dog population to control human rabies death while Musaili (S. Musaili & Chepkwony, 2020) emphasized the importance of public health education regarding both pre- and post-exposure prophylaxis for dogs as well as the practice of responsible dog ownership. According to

Muthiani (Muthiani et al., 2015), to increase the public awareness on mass dog vaccination, a stakeholder approach concerning a proactive participation of the community along every step of the process from the initial planning up to the implementation stage of the vaccination campaign should be integrated.

Two studies (Fitzpatrick et al., 2016), (E Wera et al., 2017) have highlighted the effectiveness of using long-acting vaccines for dog immunisation as compared to short-acting vaccines. Based on Wera (E Wera et al., 2017), implementing mass dog vaccination campaign annually with a 70% vaccination coverage using a long-acting vaccine produced shorter outbreak duration. A follow-up study in 2017 found that human rabies in Flores Island, Indonesia can only be eradicated with the use of combined strategies involving the long-acting vaccine at 70% coverage together with human PEP (Ewaldus Wera et al., 2017). Bilinski (Bilinski et al., 2016) also stated that less frequent vaccination campaigns would be optimal when risk of rabies reintroduction is low.

The estimated cost-effectiveness by Mindekem (Mindekem et al., 2017) is significantly higher for the control strategy involving combination of canine vaccination, human PEP and One Health communication as compared to the strategy of using PEP alone. Furthermore, reducing spatial heterogeneity by closing the gaps in vaccination coverage via vaccine redistribution could be a more effective mass vaccination campaign strategy as stated by Ferguson (Ferguson et al., 2015) while in a post-elimination setting, effective dog movement surveillance is important to prevent rabies reintroduction.

Conclusion

In an effort to rationalize the One Health approach, this scoping review found 17 studies on assessing the effectiveness of rabies interventions and control strategies. Different strategies were implemented based on the endemicity of rabies in that particular country. Among the successful strategies were public education, the practice of responsible dog ownership, human-animal surveillance system, targeted dog vaccination, control of free roaming population, as well as a decentralised network for animal control, surveillance and vaccination. Furthermore, the stakeholder approach needs to be strengthened which involves community-level collaboration when planning and implementing intervention programs. Overall, the combined strategies using One Health approach which allows effective participation and communication between different agencies including human health and veterinary professionals, among others have showed promising results in reducing rabies cases. The strategies will hopefully able to realize the goal in the Global Strategic Plan to achieve zero canine-mediated human rabies death by the year 2030.

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Ten-year Cardiovascular Disease Risk Amongst Workers in a Tertiary Healthcare Institution in Kuala Lumpur

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Abstract

Strategising, which is an effective workplace intervention to curb cardiovascular disease (CVD), requires understanding of the CVD risk related to a specific working population. The Framingham Risk Score (FRS) is widely used in predicting the ten-year CVD risk of various working populations. This study aimed to use FRS to determine the ten-year CVD risk amongst workers in a tertiary healthcare setting and its associated factors. A cross-sectional study was conducted on workers who participated in the special health check programme at the staff clinic of a tertiary healthcare institution in Kuala Lumpur, Malaysia. A set of data sheets was used to retrieve the workers' sociodemographic and CVD risk information. The prevalence of high, moderate and low ten-year CVD risk was 12.8%, 20.0% and 67.2%, respectively. Workers in the high-risk group were older [mean age: 54.81 (standard deviation, 5.72) years], male (44%), smokers (72.7%) and having hyperglycaemia (46.7%) and hypertriglyceridemia [median triglycerides: 1.75 (interquartile range, 1.45) mmol/L]. Diastolic blood pressure (aOR 1.07, 95% CI: 1.01,1.14), hyperglycaemia (aOR 8.80, 95% CI: 1.92,40.36) and hypertriglyceridemia (aOR 4.45, 95% CI: 1.78,11.09) were significantly associated with high ten-year CVD risk. Diastolic blood pressure (aOR 1.08, 95% CI: 1.03,1.13) and hypertriglyceridemia (aOR 2.51, 95% CI: 1.12-5.61) were significantly associated with moderate ten-year CVD risk. The prevalence of high and moderate ten-year CVD risk was relatively high. Amongst the workers in the high-risk group, they were older, male, smokers and with high fasting blood sugar and triglyceride. Understanding the ten-year CVD risk and its associated factors could be used to plan periodic workplace health assessment and monitor to prevent CVD.

Keywords: Framingham, Cardiovascular diseases, Workers, Healthcare

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Introduction

Cardiovascular diseases (CVDs) are the leading global mortality cause with the prevalence of premature deaths from CVDs that ranges from 4% in high-income population (WHO, 2011). Mortality rate related to circulatory disease in Malaysian public hospitals was 21.7% (Ministry of Health, Malaysia, 2018). Framingham Risk Score (FRS) is widely used as a risk assessment tool to predict the ten-year CVD risk in various populations (Cezar-Vaz et al., 2018; Nakhaie et al.,2018; Yadav et al., 2017). Local studies have used FRS to stratify CVD risk amongst the general population (Borhanuddin et al., 2018), rural community (Chia Yook & Pengal, 2009; Zabadi et al., 2011), urban community (Su et al., 2015) and patients attending primary care clinics (Chia et al., 2015).

The working population comprises approximately 65% of young and middle-aged adults in Malaysia (Department of Statistics, Malaysia, 2019). Workplace intervention was recommended to prevent CVD by promoting healthy lifestyles, such as balanced diet, stop smoking and regular physical exercises (Piepoli et al., 2016). Strategising an effective workplace intervention to curb CVD requires an understanding about the CVD risk related to certain working populations (Veronesi et al., 2018). Several local studies were conducted to assess the CVD risk factors amongst various working populations, such as healthcare workers (HCWs) (Helmy Hazmi et al., 2015) and security guards (Moy et al., 2008). However, only the latter research had applied the use of FRS. A score-based formula introduced by D'Agostino et al. (2008) was introduced for an easier adoption in the field for public health use.

The opportunistic serial health checks provided to the workers are potentially useful to detect CVD risk factors in early stages. Workers in a tertiary healthcare setting include HCWs and non-HCWs. These workers play a vital role in delivering care and services to the sick and ailing, either directly or indirectly. Healthcare industry, including tertiary setting, is one of the risky environments to work in (Joseph & Joseph, 2016). Workers in this setting are constantly exposed to a variety of health and safety risk to both communicable and non-communicable disease, including CVD. Furthermore, local information on the ten-year CVD risk by using FRS among workers in this setting is scarce. The objective of this study is to determine the ten-year CVD risk group by using FRS amongst workers in a tertiary healthcare institution and its associated factors.

Materials and methods

A cross sectional study was conducted amongst workers who undergo health checks under a special programme at the staff clinic in at tertiary healthcare institution in Kuala Lumpur, Malaysia. The programme recruited 186 workers from 2013 to 2015, but only 125 workers were included in this study. Sample size was calculated by using a formula by Naing & Rusli (2006), with reference to a previous local study (Moy et al., 2008). The inclusion criteria were all permanent workers in the institution while the exclusion criteria were participants who were pregnant and with incomplete data. Study approval was obtained from the Universiti

Kebangsaan Malaysia Medical Centre (UKMMC) Research Ethic Committee (REC) (project code: FF-2015-253).

A set of data sheet was used to retrieve data from the programme records, medical records, online medical system and online pharmacy record. The data collected consisted of four sections, (1) Section A: sociodemographic characteristics (age, sex, occupation, underlying comorbidity and family history); (ii) Section B: lifestyle (smoking, alcohol consumption and physical activity) (iii) Section C: biophysical measurement [body mass index (BMI), systolic and diastolic blood pressure (SBP and DBP)] and biochemical measurement [fasting blood sugar (FBS), total cholesterol (TCHOL), triglyceride (TG), high-density lipoprotein (HDL) and low-density lipoprotein (LDL)], and (iv) Section D: treatment history (untreated or treated high BP).

For sociodemographic characteristics, occupations were classified into (i) occupational skill level and (ii) job category. Occupational skill level was categorised into (i) first skill level (major group was with elementary occupations), (ii) second skills level (major groups included clerical support workers, service workers and machine-operators), (iii) third skill level (major groups included technicians and associate professionals) and (iv)fourth skill level (major group was with professionals). Job category was divided into (i) academic staff and (ii) support staff. For lifestyle, smokers are defined as they currently or had smoked in the past. Workers who consumed alcohol is defined as alcohol consumption of ≥ 4 or more drinks per day or ≥ 14 drinks per week. Physical activity was recorded according to the frequency of regular physical activity with moderate intensity. For the biophysical measurement, BMI were categorised into obese ($\geq$30kg/m^2) and non-obese ($<$30kg/m^2) (Ministry of Health, Malaysia, 2004), For the biochemical measurement, FBS was categorised into hyperglycaemia (≥7.0 mmol/L) and normoglycaemia (<7.0mmol/L) (Ministry of Health, Malaysia, 2015).

The FRS was used to assess the general CVD risk which stratifies the workers into a high-, moderate-, or low-risk group and calculates their ten-year risk of developing CVD based on CVD risk factors (D'Agostino et al., 2008). It involves summation of FRS scores derived from each worker's factors and categorising the total FRS scores into ten-year CVD risk: (i) > 20% (high-risk), (ii) 7% -20% (moderate-risk) and (iii) ≤ 6% (low-risk).

Statistical Analyses

All statistical analyses were performed by using the statistical package for social sciences (SPSS Version 20.0). Descriptive statistic which use frequency (*n*) and percentage (%) were used for the categorical data. Mean and standard deviations (SD) were calculated for normally distributed continuous data while median and interquartile range (IQR) was used for non-normally distributed continuous data. Univariable analyses were conducted by using Pearson Chi-square, one-way ANOVA and Kruskal Wallis tests for categorical, normally distributed and non-normally distributed continuous data, respectively. Multivariable analysis i.e. ordinal logistic regression was used to identify factors associated with ten-year CVD risk.

Results

Table 1 shows that the mean age of the workers was 46.73 (8.50) years old with the majority being 45 years old and above (64.8%). More than two-thirds of workers were female (78.4%), had almost equal distribution of workers, which were from second to forth occupational level skill. Most workers were amongst the support staffs (78.4%) and the majority workers have hypertension (19.2%). A small percentage was smokers and consumed alcohol (8.8% and 0.8%, respectively). However, most workers did not engage in physical activity (72%), and either being overweight (29.6%) or obese (56.8%). Up to 12% of workers were with hyperglycaemic condition.

Table 1: Characteristics of the Workers in a Tertiary Healthcare Institution (*n*=125)

Factors		Median (IQR)	Mean (SD)	*n* (%)
Age (years)			46.73 (8.50)	
	30-34			10 (8.0)
	35-39			19 (15.2)
	40-44			15 (12.0)
	45-49			34 (27.2)
	50-54			23 (18.4)
	55-59			14 (11.2)
	60-64			9 (7.2)
	65-69			1 (0.8)
Sex				
	Female			98 (78.4)
	Male			27 (21.6)
Occupation skill level				
	First			3 (2.4)
	Second			39 (31.2)
	Third			38 (30.4)
	Fourth			45 (36.0)
Job category				
	Academic staff			27 (21.6)
	Support staff			98 (78.4)
Underlying comorbidity[a] (Yes)				
	Hyperlipidaemia			36 (28.8)
	Heart disease			1 (0.8)
	Type 2 diabetes mellitus			22 (17.6)
	Hypertension			24 (19.2)
Family history[a] (Yes)				
	Hyperlipidaemia			10 (8.0)
	Heart disease			22 (17.6)
	Type 2 diabetes mellitus			68 (54.4)
	Stroke			9 (7.2)

	Hypertension		75 (60.0)
Smoking			
	Yes		11 (8.8)
	No		114 (91.2)
Alcohol			
	Yes		1 (0.8)
	No		124 (99.2)
Physical activity			
	Yes		35 (28.0)
	No		90 (72.0)
Blood pressure			
	Systolic	125.78 (15.90)	
	Diastolic	76.33 (11.02)	
Body mass index (kg/m^2)		29.13 (6.11)	
	Underweight		2 (1.6)
	Normal		15 (12.0)
	Overweight		37 (29.6)
	Obese		71 (56.8)
Fasting blood sugar (mmol/L)	5.88 (2.24)		
	Hyperglycaemia		15 (12.0)
	Normoglycaemia		110 (88.0)
Fasting lipid profile (mmol/L)			
	Total cholesterol	5.50 (1.11)	
	Triglycerides	1.26 (0.73)	
	High-density lipoprotein	1.38 (0.34)	
	Low-density lipoprotein	3.50 (1.35)	

Abbreviation: IQR: interquartile range; SD: standard deviation
[a]response to Yes in *n* (%)

The FRS indicated that 12.8% (*n*=16), 20.0% (*n*=25) and 67.2% (*n*=84) of workers were at high, moderate and low ten-year CVD risks, respectively. Table 2 shows that the mean age of workers in the high-risk group was significantly higher as compared to moderate and low risk-risk groups. A total of 44.4% of male, 72.7% of smokers and 46.7% of hyperglycaemic workers were in the high-risk group. The level of TG for workers in the high-risk group was higher than the upper limit of normal value and significantly different as compared to moderate and low-risk groups. Further univariable analysis showed that 12 factors had p value < 0.05 (Table II). All these factors were included in the ordinal logistic regression. The multivariable analysis showed three factors, namely DBP, TG and FBS were significantly associated with ten-year CVD risk, as depicted by Table 3. Workers with an increase of 5 mmHg of DBP had 47 % higher odds for high ten-year CVD risk [(1.08^5= 1.47), (aOR= 1.08, 95% CI: 1.03, 1.13)] and 40.0% higher odds for moderate ten-year CVD risk [(1.07^5= 1.40), (aOR=1.07, 95% CI: 1.00, 1.14)] as compared to low ten-year CVD risk group. Increasing 1 unit of TG put the workers four times more odds for high (aOR=4.45, 95% CI: 1.78, 11.10) and almost three times

more odds for moderate (aOR= 2.51, 95% CI: 1.12, 5.61) ten-year CVD risk. Workers with hyperglycaemia had nine times higher odds for high (aOR=8.80, 95% CI: 1.92, 40.36) as compared to normoglycaemic participants.

Table 2: The 10-years CVD risk Distribution of Workers in a Tertiary Healthcare Institution (*n*=125)

Factors	10-years CVD risk			Test[c]	*p* value
	High (*n*=16)	Moderate (*n*=25)	Low (*n*=84)		
	n (%)	*n* (%)	*n* (%)		
Sex				31.64	**<0.001**
Male	12 (44.4)	5 (18.5)	10 (37)		
Female	4 (4.1)	20 (20.4)	74 (75.5)		
Occupational skill				10.65[d]	0.169
First	0 (0)	0 (0)	3 (100)		
Second	3 (7.7)	8 (20.5)	28 (71.8)		
Third	9 (23.7)	4 (10.5)	25 (65.8)		
Fourth	45 (8.9)	13 (28.9)	28 (62.2)		
Job category				0.78	0.676
Academic staff	3 (11.1)	4 (14.8)	20 (74.1)		
Support staff	13 (13.3)	21 (21.4)	64 (65.3)		
Body mass index				6.50	**0.039**
Obese	5 (11.6)	14 (32.6)	24 (73.2)		
Non-obese	11 (13.4)	11 (25)	60 (55.8)		
Underlying comorbidity[a]				21.11	**<0.001**
Yes	12 (21.8)	18 (32.7)	25 (45.5)		
No	4 (5.7)	7 (10)	59 (84.3)		
Family history of disease[b]				2.37	0.306
Yes	13 (14)	21 (22.6)	59 (63.4)		
No	3 (9.4)	4 (12.5)	25 (78.1)		
Smoking				38.87	**<0.001**
Yes	8 (72.7)	1 (9.1)	2 (18.2)		
No	8 (7)	24 (21.1)	82 (71.9)		
Alcohol consumption				6.87	**0.032**
Yes	1 (100)	0 (0)	0 (0)		
No	15 (12.1)	25 (20.2)	84 (67.7)		
Physical activity				1.01	0.604
Yes	5 (14.3)	5 (14.3)	25 (71.4)		
No	11 (12.2)	20 (22.2)	59 (65.6)		
Fasting blood sugar				18.13	**<0.001**
Hyperglycaemia	7 (46.7)	3 (20)	5 (33.3)		
Normoglycaemia	9 (8.2)	22 (20)	79 (71.8)		

	mean (SD)	mean (SD)	mean (SD)	Test[e]	*p* value
Age (years)	54.81 (5.72)	50.80(7.53)	43.98(7.77)	18.64	**<0.001**[g]
Blood pressure (mmHg)					
Systolic	131.50 (13.50)	137.32 (15.00)	121.25 (14.58)	13.19	**<0.001**[g]
Diastolic	80.69 (12.02)	82.48 (11.57)	73.67 (9.71)	8.52	**<0.001**[g]
Fasting lipid profile (mmol/L)					
Total cholesterol	5.90 (1.44)	5.96 (0.91)	5.29 (1.04)	4.88	**0.009**[h]
High-density Lipoprotein	1.16 (0.34)	1.43 (0.37)	1.41 (0.35)	4.05	**0.020**[g]
	Median (IQR)	**Median (IQR)**	**Median (IQR)**	**Test[f]**	***p* value**
Fasting lipid profile (mmol/L)					
Triglycerides	1.75 (1.45)	1.39 (0.60)	1.55 (0.70)	20.11	**<0.001**
Low-density lipoprotein	3.83 (1.76)	3.69 (1.44)	3.44 (1.27)	4.63	0.099

Abbreviation: CVD: cardiovascular disease; IQR: interquartile range; SD: standard deviation
[a]Workers' underlying comorbidity include hyperlipidaemia, heart disease, Type 2 diabetes mellitus or hypertension. [b]Workers' family history including hyperlipidaemia, heart disease Type 2 diabetes mellitus, stroke or hypertension. [c]Pearson χ^2. [d]Fisher Exact test. [e]One-way ANOVA. [f]Kruskal-Wallis Test. [g]significant difference between high-moderate and high-low risk groups. [h]significant difference between moderate-low risk groups.

Table 3. Factors associated with High and Moderate 10-years CVD risk (*n*=125)

		10-years CVD risk		
Factors	**χ^2 (df)**	**High[a]**	**Moderate[a]**	***p* value**
		aOR (95% CI)	**aOR (95% CI)**	
Diastolic blood pressure (mmHg)	13.07 (2)	1.07 (1.01,1.14)	1.08 (1.03,1.13)	0.001
Triglyceride (mmol/L)	12.78 (2)	4.45 (1.78,11.09)	2.51 (1.12-5.61)	0.002
Fasting blood sugar				
Normoglycaemia		1		
Hyperglycaemia	8.10 (2)	8.80 (1.92,40.36)		0.017

Abbreviation: aOR: adjusted odds ratio; CVD: cardiovascular disease
[a]reference group (low CVD risk)

Discussion

CVD risk prediction is crucial in the prevention and management of CVD. The widely used FRS could identify the high-risk group in Malaysian population (Selvarajah et al. 2014). The prevalence of high and moderate ten-year CVD risks amongst the local population is inconclusive, depending on the study population. The prevalence of high and moderate ten-year CVD risks from this current study was almost the same as a previous local study conducted amongst a rural (Zabadi et al., 2011) and an urban community (Su et al., 2015). However, the prevalence of high-risk ten-year CVD risk amongst the worker population was higher (12.8%) as compared to locals (4.8%) (Moy et al., 2008) non-local working populations (Park & Hwang, 2015). This difference could be due to the difference in work sector and these previous studies were conducted amongst male workers only.

This study showed that our workers in the high-risk group had older age. Previous local community studies (Chia Yook & Pengal, 2009; Su et al., 2015; Zabadi et al., 2011) approved these findings but notably, the mean age of local workers was very much lower as compared to these previous studies. The mean age of workers in the high-risk was almost comparable to a study amongst small industrial workers in Korea (Park & Hwang, 2015). These findings supported the suggestion that CVD risk increased with age (Benjamin et al., 2017).

This study showed that almost half of male workers were in the high-risk group. Previous local community studies also showed that the proportion of males in the high-risk group was higher as compared to females, which varied from 35% (Su et al., 2015) to 91.2% (Zabadi et al., 2011). Similar male predominance in the high-risk group was also shown in other non-local studies among workers (Cezar-Vaz et al., 2018; Nakhaie et al., 2018). It is widely perceived that CVD is a man's disease and partly could be explained by the role of sex hormones (Vitale et al., 2010).

This present study indicated that almost three-quarter of smokers and half of hyperglycaemic workers were in the high-risk group. The association of smoking leading to vascular dysfunction and cardiovascular was widely reported (Messner & Bernhard, 2014; Mons et al., 2015). Chronic hyperglycaemia resulting from defective insulin sensitivity and secretion may exert long-lasting negative effects on the cardiovascular system (Paneni et al., 2013). There is substantial evidence from epidemiological and pathophysiological studies that hyperglycaemia is an individual risk factor for CVD (Einarson et al., 2018). A study amongst rural workers in Brazil showed that 63.4% of smokers were in the high-risk group (Cezar-Vaz et al., 2018). However, a study amongst office workers in Iran did not show any different of FRS score and ten-year CVD risk between smokers and non-smokers (Nakhaie et al., 2018). The prevalence of smoking by different industrial and occupation group in the United States of America ranged between approximately 10%-30% and was projected to be greater than its reduction goal by 2020 (Syamlal et al.,2015). The prevalence of diabetes mellitus amongst the general population in Malaysia has doubled to 17.5% in 2015 since 1996 (IPH 2015). Previous study conducted amongst working populations showed the prevalence of diabetes mellitus varies between 7% and 14% (Abou-Gamel et al., 2014; Coetzee et al., 2019; Uehara et al., 2014). In view of the high prevalence of smoking and diabetes mellitus among workers, the smoking cessation initiatives, good glycaemic control and prevention programmes need to be enhanced.

The median level of TG was significantly higher in local high-risk group, which was approved by a study amongst small industry workers in Korea (Park & Hwang, 2015). Several reviews were actively discussing about the role of TG in increased CVD risk (Nordestgaard & Varbo, 2014; Reiner, 2017). A study amongst Spanish working populations indicated that the CVD risk gradually increased from among workers with normal, mild, moderate and severe hypertriglyceridaemia (1.7%, 6.6%, 14% and 37%, respectively) (Valdivielso et al., 2009).

In this study, three factors (DBP, TG and hyperglycaemia) and two factors (DBP and TG) were significantly associated with high and moderate ten-year CVD risks, respectively. Meanwhile, studies study among male workers showed that obesity indices (BMI, waist circumference and waist-hip ratio) were significantly correlated with FRS score (Moy et al., 2008) and another study found seven predictors for the high ten-year CVD risk which include age, occupation, TG, obesity, no physical activity, heavy alcohol consumption and presence of co-morbidity (Park & Hwang, 2015). Despite the differences in the factors associated with high or moderate ten-year CVD risk found in these studies, the findings gave additional information in identifying individuals at increased CVD risks.

There are several limitations in this study. First, the data collected were from workers in tertiary healthcare setting. Therefore, any generalisations of the results to the other working and general populations need to be done cautiously. Second, there is bias information because the data was collected from their medical reports, which may not be updated to workers' well-being. Some of the data were incomplete due to defaulted follow-up or properly documented. Third, patients' lifestyle report such as physical inactivity was obtained from their medical record which may not represent their current lifestyle. This study could include scientific information to the body of knowledge and can serve as a baseline data for future cohort study among these workers.

Conclusion

The prevalence of high and moderate ten-year CVD risk in our working population was relatively high. Amongst the workers in the high-risk group, they were older, male, smokers and with high fasting FBS and TG. Understanding the ten-year CVD risk and its associated factors could be used to plan periodic workplace health assessments and monitoring to prevent CVD.

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ORIGINAL ARTICLE **Open Access**

Geographic accessibility of healthcare services and health seeking behaviours of rural communities in Kudat and Pitas areas of Sabah

Naing Oo Tha*, Wendy Diana Shoesmith, Chrystalle B. Y. Tan, Mohd Yusof Ibrahim, Syed Shajee Hussein

Abstract

Introduction: One of the aims outlined in Malaysia's Health Vision 2020 is to be a nation of healthy individuals, families, and communities through an equitable, affordable, efficient, environmentally adaptable, and consumer friendly healthcare system. Sabah faces tremendous challenges to provide the best care for patients. For example, Sabah's unique geographical location and landscape, such as steep hills and rivers, is one of the challenges that health staff faces. Objectives of this study aimed to examine the prevalence of geographical accessibility, types of healthcare services, and the types of health seeking behaviour in 2 northern rural areas of Sabah to assess the geographic accessibility and availability of healthcare services.

Materials and Methods: A community-based cross-sectional study was conducted in two rural areas in Sabah—Kudat and Pitas. Data collection was done by using questionnaire and face–to-face interviews.

Results: It was found that 48% of the study population sought healthcare and they mainly chose healthcare services from hospitals and health clinics.

Conclusion: Half of the population in the areas studied used healthcare in the last year. The choice of using a public hospital or community health clinics was determined by distance from residence.

Keywords: geographic accessibility, health seeking behaviour, Sabah, Malaysia

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Introduction

A resolution to improve accessibility of healthcare and provide universal coverage defined as 'access for all to appropriate promotive, preventive, curative and rehabilitative services at an affordable cost' was endorsed by World Health Organisation (WHO) member states in 2005 (Jacobs B, 2012). Malaysia has a population of 30.5 million, of which 44% reside in rural areas. The Ministry of Health is the main healthcare provider for rural communities with private general practitioners playing a complimentary role (Ariff KM & Teng CL, 2002). Since the 1970s, the Ministry of Health Malaysia has emphasised accessibility to healthcare and built a network of primary healthcare clinics around the country. 92% of the Malaysian population now have access to health services within 3km (Safurah, 2013) of where they live and in East Malaysia, more than 50% of the rural population have access to health services within a 5 km radius from their residence (Inche Zainal Abidin S, 2014). However, differences in health status continue to exist between urban and rural populations. Sabah faces tremendous challenges to provide the best care to patients. For example, Sabah's unique geographical location and landscape, such as steep hills and rivers, are some of the challenges that health staff face (Inche Zainal Abidin S, 2014). One of the aims outlined in Malaysia's Health Vision 2020 is to be a nation of healthy individuals, families, and communities through an equitable, affordable, efficient, environmentally adaptable, and consumer friendly healthcare system with emphasis on quality, innovation, health promotion and community participation. Health or care seeking behaviour has been defined as any action undertaken by individuals who perceive themselves to have a health problem or to be ill for the purpose of finding an appropriate remedy (Ward H, 1997). Health seeking behaviour is determined by a decision-making process which is further governed by individuals or household behaviour, community norms, expectations as well as provider-related characteristics and behaviour (J. Olenja, 2003). According to the sociology literature, healthcare seeking behaviour is influenced by the individual self, disease, and the availability and accessibility of health services (Dos Anjos Luis A, Cabral P, 2016). There are four types of accessibility to healthcare services: 1. Geographical accessibility which is based on distance between services and service users; 2. Organisational accessibility, for example due to clinic opening times and waiting times; 3. Social accessibility, which includes the compatibility between the services offered and the cultural and social characteristics of the people that they serve; 4. Economic accessibility which includes the costs of care (Ngugi AK, 2017).

This study aimed to examine the prevalence of utilisation of healthcare services and the types of health seeking behaviour in two northern rural areas of Sabah to explore and improve the geographical accessibility of healthcare services and enhance quality of life. The study explored the prevalence of health seeking in a one-year period and compared the types of health seeking behaviour in two rural communities as well as the reasons of different types of healthcare services chosen and hence exploring the geographic accessibility of healthcare services in these two areas of Sabah.

Materials and Methods

A community-based cross-sectional analytical study was conducted. Study population is the rural communities in Kudat area and Pitas area in northern Sabah. The study period was two years, from May 2015 to Aug 2017.

A brainstorming session was conducted among public health specialists to create the questionnaire items. After the development of the questionnaire, it was translated into Malay and back translated into English. Face validity was tested by giving the questionnaire to three other public health specialists. A pilot study was conducted in a village in Kudat to check the understanding. The researchers were responsible for developing the questionnaire, framing the research methodology, monitoring and coordinating the project progress, planning for statistical analysis and providing administrative support and logistic arrangements. The field team was responsible for the management of data collection as well as quality control. Training of research assistants for data collection was done. Ethical clearance was obtained from the ethical committee of UMS.

The Kudat and Pitas areas of Sabah were selected due to logistic convenience since a rural medical education centre is located there. A multistage sampling method was used for the selection of villages from two areas. Three remote rural villages from the Pitas area and two remote rural villages in the Kudat area were randomly selected. The required sample size was 197, assuming the utilisation rate of healthcare services was around 50%, giving an 80% power to detect a difference from a reference value of 40%, with α=0.05. We used systematic sampling methods to select households and participants in households. A random starting point for each pair of interviewers was selected and households were selected systematically, at every second house along a street. A household form was filled in for each household member who stayed in the house for more than one night per week. Research assistants filled in the Kish category column, according to the Kish Table. Data was then collected by face-to-face interview.

Data was analysed using SPSS IBM 23, while data checking and data cleaning were done for possible errors. The range was checked, and outliers were identified using histograms. Possible errors were checked against original records and questionnaires. Descriptive analysis was conducted to meet the objectives of the study and characteristics of the study population by using frequencies, graphs and diagrams and Chi-square test analysis was done for comparisons between the areas. The final analysis was checked to make sure that conclusions were not affected unduly by extreme values.

Results

A total of 200 households were approached and each household had at least one respondent. A total of 200 people was interviewed, giving a response rate of 100%. The demographics of both areas are shown in Table 1.

Forty-eight percent of the study population had sought healthcare in the last year. Health seeking practice according to gender, religion, ethnic group and area were almost the same and there was no significant difference. It was found that the health clinics and the hospital are the main healthcare facilities for the study population. Private clinics, pharmacies, other villagers and Klinik 1Malaysia (Table 2) were also used.

It was found that people in the Pitas area were significantly more likely to attend the hospital, rather than the health clinic ($p<0.001$) (Table 3). The villages selected in Kudat are 38km or 39min drive away from Kudat hospital and health clinics are nearer with an average 5 km away. The villages selected in Pitas are closer to the Pitas hospital which is 12 km and 11 min drive away but far from the health clinic at 48 km and 46 min drive away. Common problems in respondents were fever (20% of people that sought help), flu (11%), high blood pressure (8%) and cough (6%). From the respondents that sought help, 54% of them thought that their illness was due to weather followed by diet (6%) and age (5%). Of the respondents that sought help, 17% discussed their problem with someone else first and only 2% looked for information about their problem first, for example on the internet. The main reasons for choosing the healthcare service that they had attended was proximity to their residence (cited by 63.83% of respondents), speed of service (4%) and reliability (4%).

Positive experiences of healthcare services are shown in (Table 4), with the most common positive experience in Kudat as being “more informative” whereas for Pitas, the most common positive experience was “getting better” ($p=0.002$). Few negative experiences were described, with three patients describing slow service and one describing slow healing (Table 5). The majority of the respondents felt better after their healthcare service visit in both areas, with 83% describing their condition as ‘better’ or ‘controlled’ after seeking healthcare services.

Discussion

The prevalence of utilisation of healthcare services within the last year is 48% in the study population in rural Sabah. This is less than the prevalence of health seeking in a study done in 2017 (Lim K. K. & Sivasampu, 2017) on the west coast of Peninsula Malaysia, which showed that 67.7% had visited a doctor in the past 6 months. The types of healthcare service utilised are public community health clinics and public hospitals. Health clinic K1, Pitas hospital and Health clinic K2 are the main healthcare facilities for the study population. People from the villages studied in the Kudat area usually utilise the respective health clinics (health clinics K1 and K2) rather than the hospital in Kudat, whereas those residing in the three villages studied in the Pitas area usually go to Pitas hospital than the health clinics of Pitas. Because of the location being nearer to primary care services in Kudat villages, the people choose to go to the

community health clinics which are nearest to them. The three villages in Pitas are nearer to the hospital and their choice is mostly the hospital.

The World Health Organisation (WHO) suggests the use of travel time, instead of distance, to assess healthcare services because this method takes into consideration the conditions of the roads and the means of transport (Huerta Munoz U, 2012). There is no universally accepted range of time for allowing people to travel for medical care. Some studies state that more than 30 min is considered reduced access (Rooväli L, 2006). Others state that people living at more than 45 min away from healthcare facilities are more likely to be marginalised (Kara F, Egresi I, 2013). Consideration also needs to be given to whether people are walking or driving. A study in Mozambique showed that many areas are considered underserved if this is measured by walking time to the nearest clinic but are not considered underserved if this is measured by driving time (Dos Anjos Luis A , 2016). In our study areas in the north of Sabah, the majority of rural villages have road access to healthcare facilities with at least a gravel road. The driving distances to the nearest healthcare facility are relatively short, but walking distance is several hours. Some rural populations may not have their own transport and the distance and geographic as well as economic accessibility to healthcare services are their main problems.

Conclusion

Half of the population in the areas studied used healthcare in the last year. The choice of using a public hospital or community health clinics was determined by distance from residence.

Conflict of Interest

There is no conflict of interest in this study.

Recommendation

Sabah Healthcare services should be more accessible and available with innovative ways of engaging with communities and making healthcare more accessible and available to achieve quality healthcare for rural communities living in rural areas of Sabah with the following suggestions:

1. Geographical accessibility- Developing telemedicine and mobile clinic services.
2. Organisational accessibility – Strengthening primary healthcare services next to the hospital services.
3. Social accessibility –Strengthening culturally appropriate services.
4. Economic accessibility –Considering financial plans and mechanism for transportation cost in rural healthcare.

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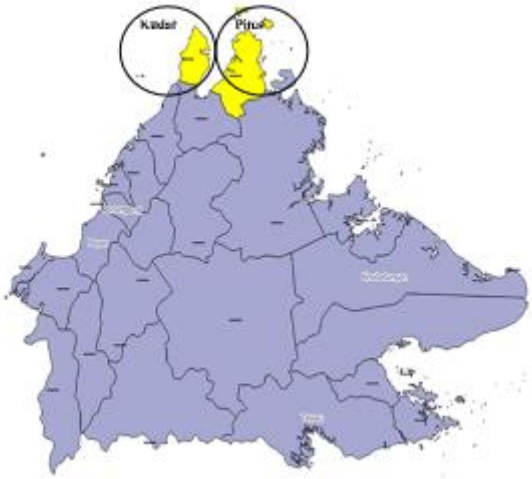

Figure 1: Study areas (Kudat and Pitas) in northern area of Sabah

Table 1: Demography of study population

		n	%
Gender	Male	109	54.5
	Female	91	45.5
Ethnic group	Bajau	25	12.5
	China	2	1.0
	Dusun	3	1.5
	Melayu	2	1.0
	Rungus	106	53.0
	Sungai	55	27.5
	Suluk	1	0.5
	Others	6	3.0
Religion	Christian	101	50.5
	Islam	98	49.0
	Buddha	1	0.5
Marital	Married	143	71.5
	Single	46	23.0
	Divorced	2	1.0
	Widow	9	4.5
Occupation	Self employed	80	40.0
	Salaried	31	15.5

	Unemployed	23	11.5
	Housewife	48	24.0
	Student	18	9.0
Education	None	29	14.5
	Primary	47	23.5
	Secondary	115	57.5
	University	9	4.5
Seek health care within one year	No	104	52.0
	Yes	96	48.0

Table 2: Types of health care services using in study population

Types of health care	n	%
Health clinic	39	19.5
1 Malaysia	11	5.5
Pharmacy	6	3
Private	12	6
Hospital	36	18
Herbalist	4	2
Ahli	0	0
Bombo	0	0
Orapandai	0	0
Bidan	0	0
Ketua Kg	0	0

Table 3: Different types of health seeking to health services in 2 areas($p<0.001$)

Health care location	n	%
Health Clinic K1	11	5.5
Health Clinic K2	30	15.0
Klinik 1 Malaysia	2	1.0
Km Pharmacy	1	0.5
Kota Kinabalu	1	0.5
Health Clinic P1	6	3.0
Kudat Hospital	6	3.0
Health Clinic P2	6	3.0
Pitas Hospital	29	14.5
Pitas Village	1	0.5
Pitas Private Clinic	3	1.5
Villager	1	0.5

Table 4: Patient experiences on their chosen health care services in different villages (p=0.002)

	Pitas			Kudat		
	Village P1	**Village P2**	**Village P3**	**Village K1**	**Village K2**	**Total**
Fast	1(9.1%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)	1(1.5%)
Getting better	7(63.6%)	14(87.5%)	2(15.4%)	5(100.0%)	0(0.0%)	28(41.2%)
Good medicine	0(0.0%)	1(6.3%)	0(0.0%)	0(0.0%)	0(0.0%)	1(1.5%)
Helpful	0(0.0%)	0(0.0%)	1(7.7%)	0(0.0%)	0(0.0%)	1(1.5%)
More info	3(27.3%)	1(6.3%)	8(61.5%)	0(0.0%)	23(100.0%)	35(51.5%)
Not really	0(0.0%)	0(0.0%)	1(7.7%)	0(0.0%)	0(0.0%)	1(1.5%)
Reliable	0(0.0%)	0(0.0%)	1(7.7%)	0(0.0%)	0(0.0%)	1(1.5%)
Total	11(100%)	16(100%)	13(100%)	5(100%)	23(100%)	68(100%)

Table 5: Reasons of health care choices among respondents comparing in 2 areas

Reasons	**Kudat**	**Pitas**	**Total**
Appointment	3(6.0%)	4(9.1%)	7(7.4%)
Easy & can ask info	0(0.0%)	2(4.5%)	2(2.1%)
Fast service	0(0.0%)	1(2.3%)	1(1.1%)
Faster	3(6.0%)	1(2.3%)	4(4.3%)
Follow up	4(8.0%)	1(2.3%)	5(5.3%)
Free	0(0.0%)	1(2.3%)	1(1.1%)
Good	0(0.0%)	1(2.3%)	1(1.1%)
Location	1(2.0%)	0(0.0%)	1(1.1%)
More reliable	0(0.0%)	2(4.5%)	2(2.1%)
No choice on public holiday	0(0.0%)	1(2.3%)	1(1.1%)
No choice on sat	0(0.0%)	1(2.3%)	1(1.1%)
Not serious	0(0.0%)	1(2.3%)	1(1.1%)
Prefer private	0(0.0%)	2(4.5%)	2(2.1%)
Reliable	4(8.0%)	0(0.0%)	4(4.3%)
The closest	35(70.0%)	25(56.8%)	60(63.8%)
The medicine is effective	0(0.0%)	1(2.3%)	1(1.1%)

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ORIGINAL ARTICLE **Open Access**

Knowledge, Attitude, and Practice of Dengue Hemorrhagic Fever Prevention Among Mothers in Endemic and Non-Endemic Locations of Pekanbaru City, Riau Province, Indonesia

Tyagita Widya Sari[*], Martha Saptariza Yuliea, Novita Meqimiana Siregar and Raudhatul Muttaqin

Abstract

Dengue hemorrhagic fever (DHF) is an infectious disease caused by dengue virus, which is one of the serious public health problems in Indonesia, particularly Pekanbaru City, Riau Province, Indonesia. One of the DHF endemic locations in Pekanbaru City is Payung Sekaki Health Centre, where 52 DHF cases and no deaths were reported in 2018. The number of DHF cases has increased to 53 and caused 1 death in January-August 2019 period (CFR=1.89%). Karya Wanita Rumbai Health Centre is one of the DHF non-endemic areas in Pekanbaru City, where only 10 DHF cases and no deaths were reported in January-August 2019 period. The purpose of this study was to compare the knowledge, attitude, and practice of DHF prevention between mothers in endemic and non-endemic areas of Pekanbaru City, Riau Province, Indonesia. The design of this study was observational, with a cross-sectional approach. The sampling technique used in this study was accidental sampling, which included 100 respondents from each region. The data source of this study consisted of primary and secondary data. Data analysis was performed using bivariate analysis with Mann Whitney statistical test because the data were not normally distributed. The results of the study showed that there were no differences in knowledge (*p*-value = 0.912) and attitude (*p*-value = 0.065) of DHF prevention between mothers living in the endemic and non-endemic areas of Pekanbaru City, Riau Province, Indonesia. However, there were differences in practice of DHF prevention between mothers (*p*-value = 0.002) living in the endemic and non-endemic areas of Pekanbaru City, Riau Province, Indonesia. The conclusion of this study is that there is no difference in knowledge and attitude of DHF prevention between mothers living in the endemic and non-endemic areas, but there are differences in DHF prevention practice between mothers living in the endemic and non-endemic areas of Pekanbaru City, Riau Province, Indonesia.

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Introduction

Dengue hemorrhagic fever (DHF) is an infectious disease caused by dengue virus in which the virus is transmitted by *Aedes Spp*. *Aedes Spp.* is the fastest growing mosquito and has caused around 390 people in the world to suffer from DHF every year. DHF has symptoms similar to dengue fever, but DHF has other symptoms in the form of pain or constant pain in the solar plexus, bleeding in the nose, mouth, gums, or bruises on the skin (Indonesian Ministry of Health, 2018).

DHF is one of the serious public health problems in Indonesia, where the number of patients is increasing and the distribution is getting wider. The number of DHF cases has spread in 33 provinces and 436 districts or cities (88%) from the total of 497 districts or cities in Indonesia. DHF is an infectious disease that generally attack children of the age group of less than 15 years, but can also attack adults. According to the World Health Organisation (WHO) data in 2010, Indonesia was reported as the second country with the largest DHF cases among 30 countries with dengue endemic regions (Indonesian Ministry of Health, 2014, 2018).

The number of DHF cases in Riau Province was 1928 and caused 15 deaths in 2017 (Case Fatality Rate/CFR = 0.78%). Furthermore, DHF cases in Riau Province decreased to 918 cases and caused 8 deaths in 2018 (CFR = 0.87%) (Indonesian Ministry of Health, 2018, 2019). In 2018, Riau Provincial Health Office reported as many as 358 cases and 2 deaths in DHF (CFR = 0.56%) in Pekanbaru City in. The number of DHF cases reported in the first semester of 2019 was as many as 274 of which the most were in the working area of Payung Sekaki Health Centre, with 52 cases (Pekanbaru City Health Department, 2019a, 2019b). The number of DHF cases in the working area of Payung Sekaki Health Centre increased to 53 and 1 death (CFR = 1.89%) in January-August 2019 period. The number of DHF cases reported in Karya Wanita Rumbai Health Centre in January-August 2019 period were 10 and no death (Payung Sekaki Health Centre, 2019; Pekanbaru City Health Department, 2019b).

The amount of a particular disease that is usually present in a community is referred to as the endemic level of the disease. This level is not necessarily the desired level, which may in fact be zero, but rather is the observed level. In the absence of intervention and assuming that the level is not high enough to deplete the pool of susceptible persons, the disease may continue to occur at this level indefinitely. Therefore, the baseline level is often regarded as the expected level of the disease (CDC, 2012). The working area of Payung Sekaki Health Centre is a DHF endemic area, where the incidence of DHF often occurs and is increasing every year. However, DHF seldom occur in the working area of Karya Wanita Rumbai Health Centre, thus it is categorised as a non-endemic DHF area.

Figure 1. Basemap Pekanbaru City, Riau Province
Source : (Indonesian National Disaster Management Agency, 2014)

Based on Figure 1, it can be seen that Pekanbaru city in Riau province is located in Sumatra island. Sumatra island is located at the west side of Indonesia territory and it is bordered by Malaysia, where the two countries are separated by Malacca Strait.

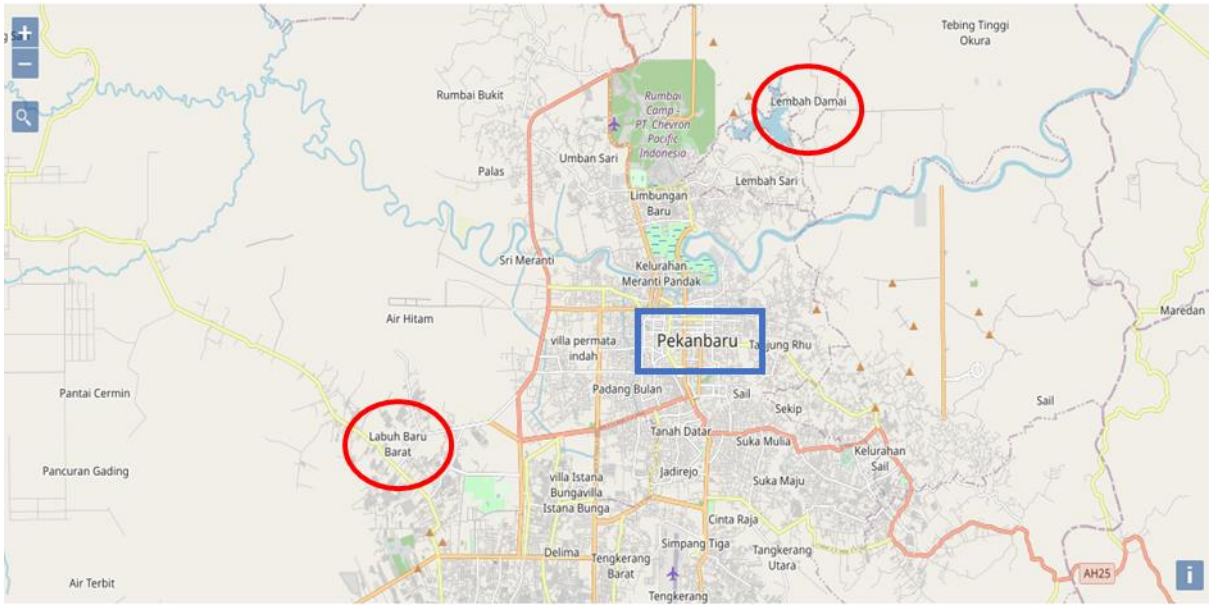

Figure 2. The research location map, which is Labuh Baru Barat sub-district (endemic) and Lembah Damai sub-district (non-endemic)
Source : (Peta.Web.Id, 2020)

Based on Figure 2, it can be explained that Payung Sekaki Health Centre is located in Labuh Baru Barat sub-district of Payung Sekaki district, while Karya Wanita Rumbai Health Centre is located in Lembah Damao sub-district of Rumbai Pesisir district. Both health centre locations are in Pekanbaru City, Riau Province, Indonesia. They have a distance and travel time of approximately 7 kilometres and 30 minutes, respectively.

DHF prevention practice is related to the knowledge and attitude of the community about DHF, especially mothers, who play an important role in maintaining family health and keeping the house clean. In the context of preventing DHF, mothers will eradicate the breeding place of mosquitos if they are aware of the purpose and benefits of doing it for their family's health, and the danger or risk if it is not carried out (Notoatmodjo, 2012). The purpose of this study is to compare the knowledge, attitude, and practice of DHF prevention among mothers in endemic and non-endemic areas of Pekanbaru City.

Materials and Methods

This study used an analytic observational study design with a cross-sectional method. This study was conducted in the working areas of Payung Sekaki Health Centre and Karya Wanita Rumbai Health Centre, Pekanbaru City from July to August 2019. The research data consisted of primary and secondary data. The primary data collected was knowledge, attitude, and practice of DHF prevention of mothers. The secondary data collected was the number of female residents who were mothers living in the working area of Payung Sekaki Health Centre and Karya Wanita Rumbai Health Centre, Pekanbaru City.

The samples of this study were the mothers living in the working area of Payung Sekaki Health Centre and Karya Wanita Health Centre, Pekanbaru City, who met the study inclusion and exclusion criteria. The sampling technique used was accidental sampling, which is a sampling technique based on coincidence of which anyone can be used as a sample, if the person deems appropriate as a data source (Notoatmodjo, 2011).

The questionnaire covered domains, namely demographic information of respondents (i.e. age, address, education, and occupation) and knowledge, attitude, and practice of DHF prevention. The questionnaire comprised of close-ended questions in which the respondents could select a 'Yes' or 'No' answer and open-ended questions. Each questionnaire domain consisted of 10 questions, bringing a total of 30 questions. The questionnaire was first tested for validity and reliability before being used in the research.

The validity test of the DHF prevention behaviour questionnaire was conducted on 30 mothers who were living in the working area of Payung Sekaki Health Centre. Scale validity test was calculated by correlating each question score with the total score (the total correlation of correlated item). A question is considered valid if r arithmetic ≥ r tables (Widi, 2011). A significance level of 0.05 can be seen in table r with the equation N-2 = 30-2 = 28 = 0.361. Out of the 10 questions on mother's knowledge of DHF prevention, 1 question was invalid, and thus was excluded from the questionnaire, while out of the 10 questions on mother's attitude of DHF prevention, 5 questions were invalid, and thus were excluded from the questionnaire. In addition, out of the 10 questions on mother's DHF prevention practice, 5 question items were invalid, and thus were excluded from the questionnaire. Furthermore, the reliability test results on the fixed DHF prevention knowledge, attitude, and practice questionnaire showed Cronbach's alpha value > 0.60, and thus were considered reliable (Widi, 2011).

The respondents were given an explanation on the procedures for filling out the questionnaire by one of the researchers of the study. During the session, respondents were accompanied by researchers. After completing the questionnaire, respondents were given a leaflet that contained a summary of DHF prevention. The study was conducted for 7 days, which consisted of research preparations in the form of focus group discussion (FGD) between the research team and enumerators for 1 day, and retrieval of research data for 6 days. The main researcher was assisted by 12 enumerators in collecting research data from the respondents, where the enumerators had been given training and simulations about the research in advance.

The data analysis consisted of univariate and bivariate analyses. Before statistical test is performed, a normality test is performed to determine whether the data is normal or vice versa. The test used was Kolmogorov Smirnov because the sample was large (more than 50). The hypothesis was tested using Mann Whitney test because the data were not normally distributed, of which the test results were in the form of *p*-values (Notoatmodjo, 2015).

Although the research data of this study was in ratio scale, the knowledge, attitude, and practice variables were classified as follows for univariate analysis (Arikunto, 2006):

a. Good, if the respondents were able to answer 76% to 100% of all the questions correctly
b. Moderate, if the respondents were able to answer 56% to 75% of all the questions correctly
c. Poor, if the respondents were able to answer <56% of all the questions correctly

Results

Data Normality Test

Before using the hypothesis test, it is necessary to do a data normality test to find out whether the data of a study are normally distributed or not. A data can be considered normally distributed if the *p*-value > 0.05. Conversely, if the *p*-value < 0.05, then the data are not normally distributed. The Kolmogrov Smirnov normality test was used in testing data normality because the study sample was > 50. The normality test results of the research variables tested showed that the knowledge, attitude, and practice of DHF prevention questionnaire was not normally distributed (*p*-value < 0.05), thus the Mann Whitney test was used.

Respondent Characteristics

Table 1. Frequency Distribution of Respondent Characteristics

No	Respondent Characteristics	Endemic		Non-Endemic	
		N	%	N	%
1.	Age (years)				
	20-29	13	13.0	15	15.0
	30-39	40	40.0	36	36.0
	40-49	29	29.0	30	30.0
	50-59	13	13.0	13	13.0
	60-69	3	3.0	5	5.0
	70-79	2	2.0	1	1.0
2.	Education				
	Uneducate	3	3.0	1	1.0
	Primary School	9	9.0	11	11.0
	Junior High School	11	11.0	12	12.0
	Senior High School	57	57.0	55	55.0
	Academy / University	20	20.0	21	21.0
3.	Occupation				
	Labour	0	0.0	1	1.0

	Civil servant	1	1.0	0	0.0
	Private employee	5	5.0	7	7.0
	Enterpreneur	5	5.0	8	8.0
	Other job	5	5.0	5	5.0
	Housewive	84	84.0	79	79.0
4	DHF Prevention Knowledge				
	Poor	26	26.0	26	26.0
	Moderate	48	48.0	54	54.0
	Good	26	26.0	20	20.0
5	DHF Prevention Attitude				
	Poor	2	2.0	7	7.0
	Moderate	4	4.0	5	5.0
	Good	94	94.0	88	88.0
6	DHF Prevention Practice				
	Poor	27	27.0	25	25.0
	Moderate	29	29.0	18	18.0
	Good	44	44.0	57	57.0
	TOTAL	100	100.0	100	100.0

Based on Table 1, it can be seen that the majority of respondents in the endemic and non-endemic areas were in the 30–39 age range, with 40 mothers (40%) and 36 mothers (36%), respectively. In addition, the majority of respondents in the endemic and non-endemic areas had high school education, with 57 mothers (57%) and 55 mothers (55%), respectively. In addition, the majority of respondents in the endemic and non endemic areas were housewives, with 84 mothers (84%) and 79 mothers (79%), respectively.

For the knowledge of DHF prevention, both respondents from the endemic and non-endemic areas were in the category of moderate knowledge, with 48 mothers (48%) and 54 mothers (54%), respectively. For the attitude of DHF prevention, both respondents from the endemic and non-endemic areas were in the good attitude category, with 94 mothers (94%) and 88 mothers (88%), respectively. For the DHF prevention practice variable, both respondents from the endemic and non-endemic areas were mostly in the good practice category, with 44 mothers (44%) and 57 mothers (57%), respectively.

Central Tendency and Dispersion

Table 2. Central Tendency and Dispersion

Variable	Endemicity	Mean	Median	Min	Max	N
DHF Prevention Knowledge	Endemic	57,48	59	18	86	100
	Non-Endemic	56,60	60	8	82	100
DHF Prevention Attitude	Endemic	46,90	50	10	50	100
	Non-Endemic	44,50	50	10	50	100
DHF Prevention Practice	Endemic	22,60	20	0	40	100
	Non-Endemic	28,60	30	0	50	100

Based on Table 2, it can be seen that the mean value of DHF prevention knowledge of respondents in the endemic area (57.48) was higher than the non-endemic area (56.60), the mean value of DHF prevention attitude of respondents in the endemic area (46.90) was higher than the non-endemic area (44.50), and the mean value of DHF prevention practice of respondents in the endemic area (22.60) was lower than the non-endemic area (28.60).

Mann Whitney Test

Table 3. Knowledge, Attitude, and Practice of DHF Prevention among Mother

Variable	Mann Whitney Test	
DHF Prevention Knowledge	N	100
	p-value	0.912
DHF Prevention Attitude	N	100
	p-value	0.065
DHF Prevention Practice	N	100
	p-value	0.002

Based on the results of the Mann Whitney test in Table 3, it can be seen that the respondents' DHF prevention knowledge and attitude have *p*-value > 0.05, thus it can be considered that there was no difference in the knowledge and attitude of DHF prevention between mothers living in the endemic and non-endemic areas. However, the respondents' DHF prevention practice has a *p*-value < 0.05, thus it can be considered that there were differences in DHF prevention practice between mothers living in the endemic and non-endemic areas.

Discussion

Based on the research conducted on 100 mothers in the Payung Sekaki Health Centre area and 100 mothers in the Karya Wanita Rumbai area from July to August 2019, the significance value obtained showed that there was no significance in the knowledge and attitude of DHF prevention between mothers living in the endemic and non-endemic areas, with *p*-values 0.912 and 0.065 (*p*-values > 0.05), respectively. Therefore, it can be concluded that there is no difference in the knowledge of DHF prevention between mothers living in the endemic and non-endemic areas of Pekanbaru City. However, a significant value was obtained in the DHF prevention practice of mothers living in the endemic and non-endemic areas, with *p*-value 0.002 (*p*-value < 0.05). Therefore, it can be concluded that there are differences in the DHF prevention practice between mothers living in the endemic and non-endemic areas of Pekanbaru City.

Knowledge is the result of knowing which occurs after a person senses a certain object. Sensing occurs through the five human senses, namely sight, hearing, smell, taste, and touch. Most of the human knowledge is obtained through eyes and ears. Knowledge or cognitive domain is a very important domain in shaping one's actions. Attitude is not yet an action or activity, but it is a predisposition to the action of a behaviour. Therefore, attitude is still a

closed reaction, not an open reaction or open behaviour. Attitude is a readiness to react to objects in a particular environment as an appreciation of the objects (Notoatmodjo, 2012). The formation of new behaviours (adoption of behaviour) in a person starts from knowing the meaning and benefits of the behaviour for himself or his family in advance. In the process of adopting new behaviours, a person's successive processes occur as follows (Notoatmodjo, 2012):

1) Awareness; that someone is aware of the sense of knowing the stimulus (object) first
2) Interest; is when someone starts to be attracted to the stimulus
3) Evaluation; is when someone considers whether or not the stimulus is good for him. This means that someone's attitude is better than before.
4) Trial; where the subject has begun to try to do something in accordance with what is desired by the stimulus
5) Adoption; where the subject has recently behaved and practiced in accordance with his knowledge, awareness, and attitude to the stimulus

Based on the results of this study, the majority of respondents in the endemic and non-endemic areas were in the 30–39 age range, with 40 mothers (40%) and 36 mothers (36%), respectively. Age group had no association with respondents' DHF prevention knowledge (Harapan et al., 2018). The majority of respondents in the endemic and non-endemic areas had high school education, with 57 mothers (57%) and 55 mothers (55%), respectively. Respondents with a higher education level were more knowledgeable and showed appropriate attitudes and good practices. Furthermore, that explains the importance of education in changing the attitude and level of practice of DHF prevention (Gong et al., 2019). In addition, the majority of respondents in the endemic and non endemic areas were housewives, with 84 mothers (84%) and 79 mothers (79%), respectively. Mothers as housewives play a major role in domestic works, which are directly connected to DHF prevention practice. They are the ones who collect and store water for domestic use, take care of ill members in their family, and clean up the breeding places of mosquitoes (Dhimal et al., 2014).

The study result on knowledge variable of DHF prevention showed that both respondents in the endemic and non-endemic areas were in the moderate category, with 48 mothers (48%) and 54 mothers (54%), respectively. The respondent's knowledge needs to improve because knowledge will influence attitude and practice regarding DHF. For the attitude variable of DHF prevention, both respondents in the endemic and non-endemic areas were mostly in the good category, with 94 mothers (94%) and 88 mothers (88%), respectively. This result shows that the majority of respondents had a less perceived risk of DHF and support towards DHF control. It might also be partially influenced by characteristic individuals who did not perceive the benefit of DHF prevention. Furthermore, it needs attention for the modification of health promotion- related DHF prevention. For the DHF prevention practice variable, both respondents in the endemic and non-endemic areas were mostly in the good category, with 44 mothers (44%) and 57 mothers (57%), respectively. One of the reasons for the good category attained in this study was because many questions on the level of practice were related to daily practices of DHF prevention. On the other hand, the

previous study reported that most people who had a good attitude towards DHF prevention by monitoring mosquito larvae found half of the people said the obstacle was no time to monitor mosquito larvae. Therefore, awareness programme is urgently needed to raise the respondents' knowledge regarding DHF (Martina, Bratajaya, & Ernawati, 2018).

In this study, the researchers found that mothers who live in the endemic area have a better knowledge and attitude of DHF prevention, but they have a lower practice of DHF prevention than mothers who live in the non-endemic area. This is similar to the previous study in Vietnam where people who reported a high density of mosquitoes were found more likely to have good knowledge and attitude. However, the result is not similar to the previous study which found that people who reported a high density of mosquitoes were found more likely to have good practice of DHF prevention. It can be explained by the fact that people who live in high-risk or endemic areas have more serious perceptions of mosquito-borne diseases, such as DHF and dengue fever (DF), though the perceptions of mosquito-borne diseases were not always in line with the practice of DHF prevention (Nguyen et al., 2019). The results of this study were also dissimilar to a study conducted in Selangor, Malaysia in which communities that lived in the non-endemic areas of dengue outbreaks had better knowledge and attitude of dengue than communities that lived in the endemic areas, but no significant difference was found in the practice category between communities in both areas (Ghani et al., 2019). Another research on residents of Wardha Districts, Maharashtra State, India indicated that there was a significant relation between knowledge and attitude towards Aedes control. A wide gap that can be seen between prevention knowledge and practice was most likely due to the respondent's financial condition (Taksande & Lakhkar, 2013).

DHF is still a major health problem around the world, especially in South-East Asia. In the absence of vaccine, the only effective strategy to control DHF outbreak is to eliminate Aedes mosquitoes and their larval habitats. Further efforts should be directed at addressing the barriers to behavioural change, correcting misconception on the spread of dengue through social and close contacts and educating the illiterate on measures to prevent dengue. Aedes larval breeding sites in the domestic and peri-domestic environment could increase due to poor hygiene and failure in checking the breeding places of aedes mosquitoes as well as reluctance to have their homes fogged with insecticides. The key to success in controlling dengue vector is active participation of the government, local organisation, and the public (Kaushik, Singh, & Srivastava, 2019).

DHF prevention practice includes eradicating mosquito breeding places related to the incidence of DHF in an area. Mosquito breeding places eradication is an example of healthy living behaviour because it is related to efforts in preventing DF by breaking the chain of dengue transmission. Mosquito breeding places eradication should be carried out simultaneously and continuously by all levels of society (Indonesian Ministry of Health, 2016). The results of the study by Jata et al. (2016) found that there was a relation between community practice in mosquito breeding places eradication and the incidence of DHF in the area of Puskesmas I in South Denpasar and Puskesmas I in Denpasar Timur Bali (Jata, Adi Putra, & Pujaastawa, 2016). According to the results of other study, there was a significant

relation between practice of mosquito breeding places eradication and incidence of DHF in Andalas Village, Padang (*p*-value = 0.001) (Priesley, Reza, & Rusjdi, 2018).

The results of this study must be interpreted with caution because the study design was cross-sectional, which assessed the comparison of mothers' DHF prevention knowledge attitude, and practice at one point in time. It is possible that some respondents might have provided socially desirable responses to some questions, especially in the attitude and practice domains since the survey was conducted by an interviewer based on the use of structured questionnaire and many questions on practice domain were related to daily practices of the mosquito-borne diseases control. The other limitations of this study were inadequate sampling size and sampling method. However, this study provides baseline information on relevant comparison of DHF prevention knowledge, attitude, and practice between mothers living in endemic and non-endemic areas in Pekanbaru City, Riau Province, Indonesia.

Conclusion

In conclusion, there is no difference in the knowledge and attitude of mothers on DHF prevention, while there are differences in the practice of DHF prevention between mothers living in the endemic and non-endemic areas of Pekanbaru City, Riau Province, Indonesia. Health workers should increase the level of public knowledge on effective and efficient DHF prevention, namely mosquito breeding places eradication. Moreover, mosquito breeding places eradication should be carried out simultaneously and continuously at all levels of society. The mobilisation of female community health volunteers will be very important, as they have very good networks at the household level, especially mothers' group, and represent the largest work force of the health sector in Indonesia. Adequate DHF prevention knowledge of mothers can lead to appropriate DHF prevention attitude, thus resulting in good DHF prevention practice of mothers.

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ORIGINAL ARTICLE **Open Access**

Validity and Reliability of Knowledge, Attitude and Practice (KAP) Scale for Dog Bite Prevention in Children

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Abstract

Introduction: Rabies is a highly fatal disease that is mostly caused by a dog bite. The Dog Bite Prevention KAP scale is a 30-item scale that is designed to measure children's level of safety knowledge on dog's behaviour, precautionary behaviour around dogs, perceived vulnerability towards dogs and help-seeking behaviour following a dog bite. Therefore, this study aimed to determine the test-retest reliability and validity of outcome measures.

Methods: This questionnaire was administered to samples of school student aged from 13 years to 14 years at a secondary school located in Bau District, Sarawak. They were purposively selected for a baseline interview (Time 1) and a ten-day follow-up (Time 2). This study was conducted within four months, which were from 10 April to 31 August 2018. Descriptive analysis, content analysis, Cronbach's alpha, intra-class correlation and exploratory factor analysis were performed in this study.

Results: A total of 64 boys and 114 girls were involved in the study, whereby 79.2%, 10.1%, 7.9%, 2.2% and 0.6% of them were of Bidayuh ethnic, Chinese, Iban, Malays and other ethnic, respectively. The Cronbach's alpha was 0.796. The test-retest intra-class correlation was adequate, with 0.84 for perceived vulnerability towards dogs and 0.81 for precautionary behaviour around dogs. Principal components analysis with varimax rotation resulted in two factors, which explained 39% of the variance (perceived vulnerability towards dogs) and 49% of the variance (precautionary behaviour around dogs).

Conclusion: The questionnaire is a valid and reliable tool for a dog-bite prevention survey.

Keywords: *Knowledge, Precautionary, Vulnerability, Help-seeking*

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Introduction

Dog bite remains a major public health (Ogundare et al., 2017) and clinical problem worldwide. It is not only associated with high morbidity and mortality as a consequence from the severity of a dog bite injury, but the victims are also at high risk of contracting rabies from an attacking rabid dog. Rabies often results in a fatal outcome once it is progressed to the symptomatic stage and it occurs in all continents, except Antarctica (World Health Organisation, 2017). Dog-mediated rabies were reported to cause more than 99% of human infections (World Health Organisation, 2019) and more than 95% of human mortalities in Asia and Africa (Hampson et al., 2015) as compared to other animals.

The majority of dog bite victims are among children (Abubakar & Bakari, 2012), mainly males aged below 15 years (Ghosh et al., 2016). Younger children also tend to be bitten by their family pet dog, which is familiar to them (Davis et al., 2012; Reisner et al., 2011). In addition, a study by Seligsohn (2014) discovered that family pet dogs were responsible for the majority of dog bite incidences as compared to stray and unfamiliar dogs**.** Regrettably, the majority of dog bite victims do not seek treatment despite of being aware that asymptomatic rabies is 100% vaccine-preventable disease (Shah et al., 2012). Adversely, poor access to appropriate post-exposure prophylaxis treatment following a dog's bite and inadequate availability of medical resource may also be inferior and expensive or that does not exist in a certain locality had also contributed to the high number of mortality rate (Zaidi et al., 2013).

Besides community participation and access to post bite treatment, the World Health Organisation (WHO) had emphasised on the importance of educational intervention, public awareness and access to mass vaccination of dogs as the main components delineated in the three pillars of a successful rabies control programme (World Health Organisation, 2017). The component of the pillar, such as health educational intervention on rabies-related knowledge, is beneficial for the improvement of knowledge attitude and people's practice towards rabies (Wu et al., 2016). In fact, it should encompass the awareness on the dog's behaviour to prevent dog bite as well as the appropriate response and good health seeking behaviour following a dog bite. As in the paediatric dog bite point of view, children should be competently educated on the dog's behaviour (Asghar et al., 2017) and safe behaviour around dogs (Dwyer et al., 2007) to prevent future dog bites amongst them, besides ensuring the animal control, environmental modifications and optimising the adult supervision (Schwebel et al., 2016).

Rabies outbreak that occurred in Sarawak, Malaysia resulted in 12 mortalities out of 13 cases, as reported from 30 June 2017 to 21 August 2018 (Abdullah, 2018). A total of 16,070 dog bite cases were reported cumulatively from 1 April 2017 to 1 November 2018 (*Jawatankuasa Pengurusan Bencana Negeri Sarawak*, 2018). This indicated the number of dog bite cases in Sarawak, which is gradually increasing over time, despite the intensive health campaign programmes. This could be due to the ineffective use of information, education and communication (IEC) materials in preventing dog bite. Therefore, to address this problem the study had applied a novel and theoretical-based IEC intervention in developing a mobile game application to prevent dog bites amongst school children. It is highly relevant in this modern

sophisticated era whereby computer, web, portable or console games are played by 97% of teenagers aged from 12 years to 17 years, with 48% of them playing games by using a cell phone or handheld organisers (Lenhart et al., 2008).

In this study, a pilot test was conducted to determine the test-retest reliability and validity of outcome measures, which were knowledge on dog's behaviour, precautionary behaviour around dogs, perceived vulnerability towards dogs and help seeking behaviour following dog bites, as well as to explore game preferences for gamification purposes.

Materials and Methods

Study design and sampling procedure

This was a cross-sectional quantitative study to explore the validity and reliability of a questionnaire. This study was conducted within four months, which was from 10 April 2018 to 31 August 2018. To answer the questionnaires, a total of 178 Grade 7 and Grade 8 students aged between 13 years and 14 years were purposively selected from a secondary school in a rabies infected area. The sample size was decided based on the number of items in the questionnaire, which was 5 respondents per item (Hair et al., 2010). The attrition rate was 19% with a total of 178 respondents included in the final analysis.

Data collection instruments and data collection procedure

A questionnaire was developed based on a questionnaire framework (Launiala, 2009). The questions for assessing knowledge on dog were created based on other information sources (Coren & Hodgson, 2007; the United States Department of Homeland Security, 2016). The items to measure perceived vulnerability towards dogs, precautionary behaviour around dogs and help-seeking behaviour in Section C, Section D, and Section E were adapted based on a questionnaire from another study (Shen et al., 2016) to match with the cognitive level of respondents. The English language version was translated into Malay language by a researcher version. Meanwhile, another researcher translated the Malay language version back to English language. Finally, both researchers compared their English language version for field operation.

During data collection, all respondents were gathered in an allocated school hall with assistance from the school principal in both test and re-test sessions with a ten-day gap in between. The respondents were briefed and guided on the questions in the questionnaire through presentation slides to improve their understanding and projected some clearer pictorial items in the questionnaire on a big white screen. This is important to prevent the respondents from any misleading or misunderstanding of the question and reduce the risk of having questions left unanswered due to uncertainty. All data were verified by the research team leader. The content validation was performed by Professor Dr. Razitasham Binti Safii (Public Health Physician) and Dr. Rosalia Saimon (Preventive Scientist).

Data entry and analysis

The data collected were coded, manually checked for any inconsistencies, duplications or missing values and analysed by using the statistical package for social science (SPSS), Version 21.0. Data distribution normality and outliers were examined prior to the descriptive analysis on all five questionnaire sections. Quantitative data were presented in mean, median, minimum, maximum and standard deviation, whereby the qualitative data were presented in frequency and percentage. The reliability of Likert Scale items, namely Section C and Section D, were analysed by using Cronbach's alpha values, and followed by factor analysis by using varimax rotation method for questionnaire validation. The expected Cronbach's alpha to establish reliability was at least 0.70 (University of California Los Angeles, 2020). The intra-class correlation coefficient analysis was also performed to determine the reliability from test-retest and the expected value, which was at least 0.75 to indicate a good or excellent reliability (Koo & Li, 2016). However, in this study Section B and Section E only had content analysis performed.

Ethical considerations

This study was approved by the Ethical Committee of Universiti Malaysia Sarawak (UNIMAS) [UNIMAS/NC-21.02/03-02 Jld.2 (122)]. Furthermore, permission to perform this study by involving the secondary school students was obtained from the Malaysian Ministry of Education [KPM.600-3/23-eras (466)] and Sarawak State Educational Department [JPNSW.SKPP.LAT.600-1/1/1 (89)]. The participants were briefed about the purpose of data collection and their voluntary participation was sought. They were also assured of data confidentiality. A written informed consent was taken before the interview.

Results

Sociodemographic Data

There were 55.6% and 44.4% of respondents aged between 13 years and 14 years, respectively, in which 36% were males and 64% were females. Most of them were Bidayuh ethnic (79.2%), followed by Chinese (10.1%), Iban (7.9%), Malays (2.2%) and other ethnics (0.6%).

Content Analysis

Content Analysis was performed based on the feedback from an expert and the respondents. The choice of answer for question on respondents' ethnic should be rephrased by allowing the respondent who chose "other ethnic" to specify their ethnic. Furthermore, questions on informing parents about dog bite incidence and seeking treatment from a clinic or hospital following a dog bite incidence, which involve the respondent and/or their other family members, should be rephrased by adding the phrase of "or any other adults" instead of mentioning the respondent only. This is important to reduce confusion amongst respondents.

Table 1: Summary of Content Validation

Section	Name of section	Item Removed / Added / Rephrased						Item accepted
		Removed answer	**Removed question**	**Added answer**	**Added question**	**Rephrase answer**	**Rephrase question**	No changes
A	Respondents Information	0	0	0	0	1	2	11
B	Safety Knowledge On Dogs' Behaviour	0	0	0	0	0	0	6
C	Perceived Vulnerability Towards Dogs	0	0	0	0	0	0	11
D	Precautionary Behaviour Around Dogs	0	0	0	0	0	0	8
E	Help-seeking Behaviour Following Dog Bite	0	0	0	0	0	0	5

Reliability Analysis

The overall Cronbach's alpha was 0.796, which showed a good reliability. The individual reliability of both Section C and Section D were also good with Cronbach's alpha of 0.732 and 0.724, respectively. Therefore, no question was removed in view of the good Cronbach's alpha.

Table 2: Reliability Analysis of Likert Scale Items in Questionnaire

Section	**No. of questions**	**Likert Scale**	**Cronbach's alpha**	**Interpretation of Cronbach's alpha**
C	11	5	0.732	Good
D	8	5	0.724	Good
Overall	19		0.796	Good

Test-retest reliability

The intra-class correlation coefficient (95% confidence interval) for questions on perceived vulnerability towards dogs and precautionary behaviour around dogs were 0.842 (0.804 – 0.875) and 0.812 (0.766 – 0.852), respectively. Table 3 summarises these findings.

Table 3: Intra-class Correlation Coefficient of questions on perceived vulnerability toward dogs (Section C) and precautionary behaviour around dogs (Section D)

	Average Measures	*p*	F test value	*95% Confidence Interval*	
				Lower Bound	Upper Bound
C1*	0.753	0.000	4.094	0.666	0.818
C2*	0.754	0.000	4.206	0.664	0.820
C3*	0.634	0.000	2.721	0.504	0.729
C4*	0.611	0.000	2.732	0.457	0.719
C5*	0.746	0.000	3.918	0.656	0.812
C6*	0.693	0.000	3.263	0.585	0.773
C7*	0.661	0.000	3.001	0.541	0.749
C8*	0.672	0.000	3.033	0.555	0.757
C9*	0.678	0.000	3.797	0.420	0.804
C10*	0.746	0.000	3.925	0.656	0.812
C11*	0.658	0.000	3.049	0.530	0.750
Overall C	0.842	0.000	7.239	0.804	0.875
D1*	0.789	0.000	4.714	0.714	0.844
D2*	0.736	0.000	3.810	0.643	0.805
D3*	0.725	0.000	3.682	0.629	0.797
D4*	0.708	0.000	3.440	0.605	0.784
D5*	0.642	0.000	2.816	0.516	0.735
D6*	0.707	0.000	3.412	0.604	0.783
D7*	0.632	0.000	2.707	0.501	0.728
D8*	0.673	0.000	3.058	0.557	0.758
Overall D	0.812	0.000	5.979	0.766	0.852

** Refer Table 4 for full description*

Validity

Exploratory factor analysis was performed for Section C and Section D Likert scale type of questions to explore the interrelation amongst variables in a set of variables. The exploratory factor analysis method used in this pre-test was principal components analysis (PCA). Variables that were correlated with one another but largely independent of other subsets of variables were combined into factors.

Principal components analysis for Section C revealed the presence of two components with eigenvalues that exceeded 1, explaining 27.657% and 10.916% of the variance, respectively. The two-component rotated solutions explained a total of 38.572% of the variance, with Component 1 contributing 19.841 % and Component 2 contributing 18.731 %. The interpretation of the two components was described as perception on ability to approach dogs safely, loading strongly on Component 1 and perception on invulnerability from dog attack, loading strongly on Component 2.

The analysis of Section D revealed the presence of two components with eigenvalues that exceeded 1, explaining 35.664% and 13.149% of the variance, respectively. The two-component rotated solutions explained a total of 48.813% of the variance, with Component 1

contributing 31.174% and Component 2 contributing 17.639%. The interpretation of the two components was described as behaviour upon approaching near a dog, loading strongly on Component 1 and behaviour without approaching near to dog, loading strongly on Component 2.

Table 4: Exploratory Factor Analysis of Section C and Section D

	Section C	Section D
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	.711	.780
Bartlett's Test of Sphericity (Sig.)	.000	.000

Rotated Component Matrix

Section C	Component	
	1	2
If my dog is sleeping deeply, I can touch or pet my dog without bothering it	.743	
I can play a bit harder or wrestle with my dog if it seems to be enjoying it	.694	
I can pet my dog while it eats as a reward for its good behaviour	.594	
I can play harder with dogs if I have just got vaccines of rabies	.550	
When mother dog is present, I can safely play with its puppies if I play gently	.525	
I think the dog in my own family is less likely to bite people than the average dog		.770
As long as the dog does not see me, I can safely approach the dog from behind		.650
I don't think I would ever be bitten by a dog		.595
I can run faster than unknown dogs so as to avoid them from biting me		.524
My dog knows me very well, so it would never hurt me in the future		.449
I can shout loudly to scare a dog away when it is coming towards me		.325
Section D	**Component**	
	1	2
How often do you pet a sleeping dog?	.820	
How often do you pet an eating dog?	.719	
How often do you approach a dog from behind?	.565	
How often do you play aggressively with a dog or wrestle with it?	.561	
How often do you play with puppy dogs when their mother is present?	.550	
How often do you approach a dog from front side?	.544	
How often do you yell at a dog?		.807
How often do you provoke a dog intentionally?		.698

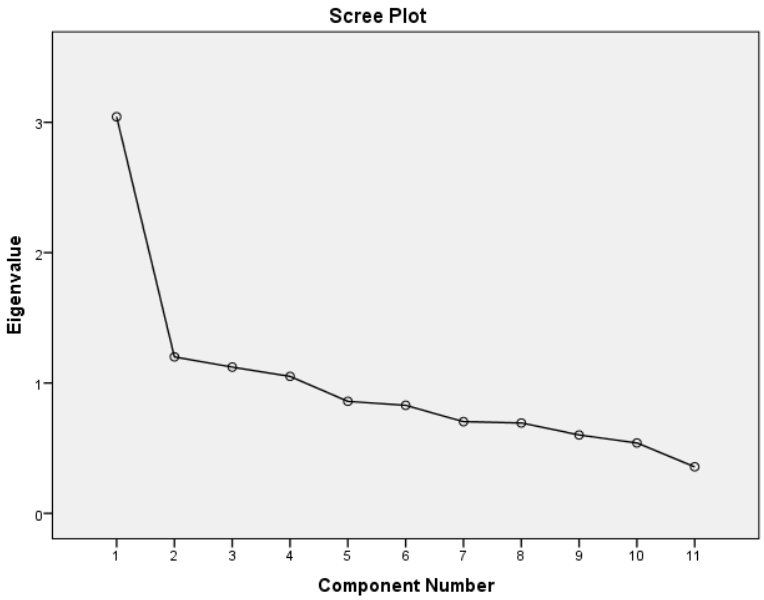

Figure 1: Scree Plot for Section C (Perceived vulnerability towards dog)

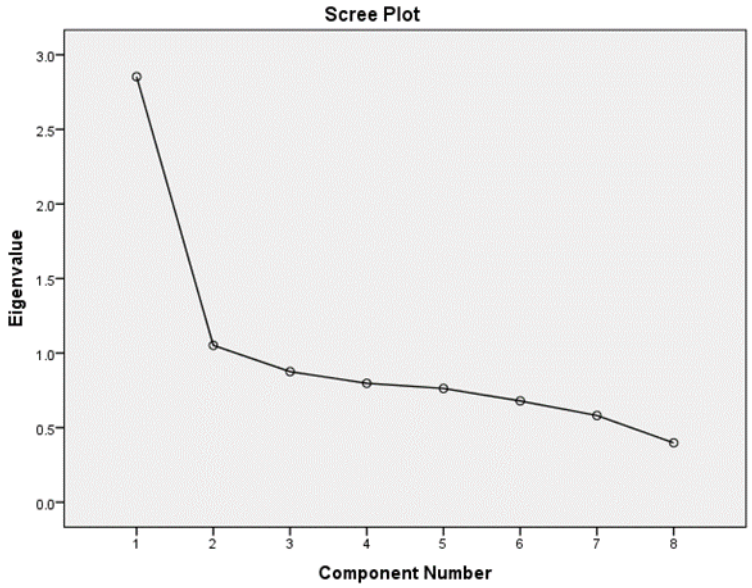

Figure 2: Scree Plot for Section D (Precautionary behaviour around dog)

Discussion

This pre-test study was to assess the validity and reliability of the questionnaire before its usage in the actual study. The respondents involved in this study were different from the actual study to avoid biasness in the latter (Hassan et al., 2006). The adaptation of questionnaire required a good understanding amongst the targeted population, which was vital for maintaining the actual study to be significantly relevant and reliable. The Malay language translated version of questionnaire was highly recommended to be distributed amongst respondents. This was agreed in consideration of the Malay language as the communication language in schools and

generally most students understand the language rather than the other languages. The selection of language was crucial to encourage truthfulness and sincerity amongst respondents in answering the questionnaire. Nevertheless, the concept within the translated questionnaire was kept equal to its original version. This approach was similar to a study in Norway (Gjersing et al., 2010).

Furthermore, the systematic approach of explanation about the research with clear explanation by the researcher on each question and answer in the questionnaire through the presentation slides helped to improve the respondents' understanding of the questions and answers provided. The effort to project some clearer pictorial items in the questionnaire on a big white screen assisted the respondents to understand the questions because the printed photos in the questionnaire were not sufficiently clear. The flow of questions and division of sections were appropriate. Respondents were also required to follow a step-by-step method in answering questions, which were guided and led by the researcher through the presentation slides. This helped all respondents to understand the questions and answers provided in the questionnaire better and were able to answer each question timely. This had reduced the risk of allowing any questions being left unanswered due to uncertainty. Moreover, this method had minimised the risk of overconsumption in time taken for the session. The session was held for about 45 minutes, which was appropriate as the students may lose concentration if longer time was taken and subsequently may result in an inaccurate response.

The sitting position amongst respondents were adequately arranged to prevent any discussion or copying of answers. This encouraged them to answer the questions sincerely and truthfully. Furthermore, the accompanying teachers were seated at a few corners in the hall, which were far from the respondents. Therefore, the respondents may answer the questions freely without pressure or emotional distraction that may be developed due to the presence of teachers near them. All precautionary measures had contributed in reducing biasness in response.

All questions in the questionnaire were based on the objective of the actual study. The accuracy of translation was ensured by back-to-back translation from English language to Malay language that was validated by a preventive scientist and a public health physician. The coding system was also well organised and made the questionnaire easy to understand.

The reliability was good with Cronbach's alpha of more than 0.7 (University of California Los Angeles, 2020). Moreover, it was found that the intra-class correlation coefficient of questions on perceived vulnerability towards dogs in Section C (ICC = 0.842; 95% CI 0.804 -0.875) and precautionary behaviour around dogs in Section D (ICC = 0.812; 95% CI 0.766 -0.852) indicated good values (Koo & Li, 2016). Both sections used a five-point Likert scale with different types of answer. The former assessed on the agreement of the statement, whereas the latter assessed on the frequency of performing certain behaviours. The result of intra-class correlation coefficient for both sections suggested that participants were consistent in answering the questions, even though the gap between the two same tests was 10 days.

Although the result of this pre-test study was reliable and valid, extra precaution was needed in the actual study, especially on the explanation of each and every question, as well as the choice of answers to ensure the respondents were able to understand them and subsequently answer all questions accurately. Generally, the result of this pre-test study had provided some ideas about the possible results to be obtained in the actual study.

The main strength of this study was that interviewer-assisted interview method was done by interviewers by using the national language that could be easily understood by the respondents. This helped in engaging a good rapport with the respondents for a more reliable response. The respondents were also interviewed in their schools which further facilitated better and non-threatening response with full cooperation from the school administration

Conclusion

The method of conducting of the pre-test study can be possibly applied in the actual study as it had created many significant advantages towards accuracy, validity and reliability of result. Therefore, the questionnaire used for the pre-test purpose was found to be suitable and appropriate for the data collection procedure in the actual study, following minor adjustment. The game application can be invented based on the interest amongst the population within this age groups so that it may give a positive impact in achieving the objective of the actual study, which was to prevent dog bites amongst school-aged children.

Conflicts of Interest

This research has no conflicts of interests

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MINI REVIEW **Open Access**

Unique Challenges for Mental Health in Inpatient Settings Amid the COVID-19 Pandemic: Perspective from Sabah

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Abstract

COVID-19 has impacted the world in many ways due to fears of contracting the pandemic, social distancing, and large-scale movement control rules. These have especially grave consequences for inpatient psychiatry. This article reviews measures taken to adapt to the new norm in inpatient care, both for standalone psychiatry units and consultation-liaison units. For inpatient units, changes have been made for personal protective equipment usage, screening and triaging policies, and training and educational policies. Consultation liaison units together with inpatient units have been required to expand the scope of coverage and difficulties by providing certain teleconsultation services. As the new norm takes precedence, Sabah has to embrace and empower community-based psychiatry services for better outreach and coverage. This article discusses the issues underlying the new norm in the management of inpatient psychiatry patients in both units and presents some points and practical solutions on the ground to instil hope.

Keywords: inpatient, consultation liaison, psychiatry, COVID-19.

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Introduction

The novel Coronavirus (COVID-19) was first identified in a 41-case pneumonia outbreak in Wuhan, Hubei Province, China, with symptoms onset as early as 8th December 2019 (World Health Organization, 2020). In Malaysia, the country's first patient (who travelled from China via Singapore) was identified on 25th January 2020 (Joseph, 2020). On 12th March 2020, Sabah reported its first confirmed positive case involving a male resident from Tawau, who was one of the participants in a religious gathering in Sri Petaling, Kuala Lumpur (Daily Express, 2020b). The second positive case was reported the following day in Papar, also originated from the religious gathering (Daily Express, 2020a).

The number of confirmed positive patients in Sabah has increased since then, hence the Malaysia Federal Government implemented an approach called the Movement Control Order (MCO), which to date has lasted for two months in Sabah. This has resulted in massive upheavals and disruptions to the provision of psychiatric services, as different measures need to be strengthened to prevent the risk of COVID-19 infection. In view of these changes, a "new norm" has been required to be implemented for the provision of adequate inpatient and outpatient psychiatric services.

There have been some major changes in pre-existing psychiatric services in Sabah. This ranges from difficulties for patients to visit hospitals for follow-ups, initiation of phone consultations, postage of medications in between districts, high defaulter rates in view of fear of coming to hospitals due to the perceived highly infectious nature of COVID-19 and the setting up of screening counters in hospitals. In this review, some unique changes, challenges and difficulties in inpatient psychiatric services in Sabah are highlighted, and the experiences on the ground of psychiatrists in both inpatient and consultation liaison units are shared.

Difficulties in COVID-19 and challenges in inpatient psychiatry

In Sabah, there are four hospitals currently providing in-patient psychiatry services. One is a mental institution, namely Hospital Mesra Bukit Padang. The other three hospitals are general hospitals with dedicated psychiatry wards, namely Hospital Keningau, Hospital Tawau, and Hospital Duchess of Kent which is in Sandakan. As a mental institution, Hospital Mesra Bukit Padang caters for psychiatric inpatients on the entire West Coast of Sabah. With such a high volume of patient load, there is a very high risk of cross-infection if COVID-19 indeed infiltrates the hospital. Moreover, due to its status as a mental institution, there are many long stay in-patients who are old and frail and have very little social or family support, and long-stay forensic patients who will not able to be discharged in the near future. Therefore, a sudden infiltration of COVID-19 would be catastrophic and would lead to a high death toll.

A thorough and drastic set of preventive measures were taken by the administration of Hospital Mesra Bukit Padang in the early stages of the Malaysian MCO to prevent an avoidable outbreak in the psychiatric hospital. A triage centre was setup in the main entrance of the hospital to screen all staffs and the public who entered the hospital. The newly formed triage team comprised of medical officers, staff nurses, and medical assistants who worked 24 hours

in shifts. They were required to undergo training and wear personal protective equipment (PPE) while screening patients. Body temperature was checked and handwashing was strictly enforced prior entering the clinic premises. The hospital also strictly adhered to Ministry of Health policies for social distancing. As such, no visitors were allowed to visit patients during the MCO period. For those patients originating from COVID-19 transmission hotspots, they were attended by doctors in designated areas outside the hospital.

Those patients who presented high risk of self-harm and harm to others were screened thoroughly prior to admission into the male and female admission wards. In both locations, patients were clerked in designated open areas with proper social distancing practised by the doctors and allied health professionals.

This also necessitated changes in the "new norm" of providing inpatient care. Grand ward rounds were continued with minimal number of doctors. Only psychiatrists and one medical officer from each respective teams was required to attend the grand ward round, with all requisite social distancing measures like spaced-out seating and adequate sanitation measures. This differed from previous times where all doctors were required to attend the grand ward rounds.

Training and education were also subjected to new norms in light of COVID19. House officer continuous medical education (CME) were conducted via video conferencing to reduce mass gathering risks. From a patient's perspective, many changes were required in light of COVID-19. Group rehabilitation activities i.e job placement, social group training, and children developmental training were withheld temporarily. At the same time, movement control was implemented in hospital areas, whereby staff from particular wards were not allowed to go to other wards unless indicated. The underlying principle at Hospital Mesra Bukit Padang was to continue delivering optimal in-patient psychiatry services without interruption. Hence, acute and maintenance Electroconvulsive Therapy (ECT) would be conducted if indicated. As it requires anaesthesia and the use of suctioning and possible intubation or mask ventilation, each indicated ECT was performed with proper PPE and necessary sanitation measures.

Difficulties in COVID-19 and challenges in Consultation Liaison psychiatry

The second part of inpatient psychiatry relates directly to COVID-19 related issues in inpatients who are in non-psychiatry wards with psychiatry or psychological issues. Hospital Queen Elizabeth is the largest tertiary center in Sabah. Besides, Hospital Queen Elizabeth is also one of the COVID-19 treating hospital. The psychiatry team in Hospital Queen Elizabeth offers liaison consultation services for inpatients. Numerous challenges were anticipated by healthcare workers when handling both COVID and non-COVID cases.

Firstly, there was the challenge of the limitation of staffing. Due to the massive COVID-19 outbreak, the healthcare workers were assigned to both screening and managing of the COVID cases. All non-COVID related tertiary departments were required to send their staff to

relieve the staffing of managing COVID cases, which in turn interrupted routine departmental services. Moreover, there were staff who were required to be quarantined after being in contact with COVID-19 positive patients. On the other hand, the possibility of undisclosed information of exposure to confirmed or suspected COVID patients by staff or patients may lead to high potential of spread or contact to healthcare personnel, which subsequently may further reduce the number of active workforce in the ward.

Secondly, there was the limitation of resources. Staffs were required to wear proper personal protective equipment (PPE) while managing COVID cases. However, due to the limitation of time and prohibition of formal CME sessions, only minimal training was provided. The physical limitations of proper PPE further worsened the situation. Staffs need to wear proper PPE throughout the services for COVID cases. It was not comfortable for the staff as theyhad to wear the PPE for a long duration without resting.

Thirdly, there was the psychological turmoil among healthcare workers themselves. Staffs often face anxiety, insomnia, and stress while managing COVID cases. They might be stigmatised by the public due to their exposure to the cases. There were health care workers refusing to manage COVID cases despite the possibility of facing disciplinary actions. The healthcare workers required substantial psychological support. They were often sad, worn-out, and frustrated. Mental health psychosocial support were provided for these workers in Queen Elizabeth Hospital via numerous facilities such as virtual mental health services, phone call counselling, individual counselling, and education to relieve their psychological burden.

Fourthly, there was a limitation of care for non-COVID cases. Due to the utilisation of services by COVID cases and the limited number of resources and staffing, the monitoring and management for non-COVID cases became extremely difficult. Medical staffs faced challenges of handling difficult patients such as delirious and aggressive patients. The assessment and monitoring were compromised due to the limitation of staffs. The equipment allocation especially for intensive cases was difficult due to the utilisation for COVID cases.

Fifthly, there ws a limitation in health seeking services due to the Movement Control Order (MCO). Malaysia initiated the MCO on 18th March 2020. Therefore, patients had difficulty to seek medical help at hospitals. This often-caused patients to delay seeking treatment and their presentation was often severe. The treating team faced difficulty to manage severe cases due to the tardiness in seeking treatment.

Lastly, the QEH consultation liaison team faced unique difficulties to manage COVID consultation liaison cases. Due to the limitation of PPE, psychiatry liaison services could only be carried out via phone call or distant assessment. There were times the psychiatry staff needed to wear proper PPE to assess the patient's mental status properly. Psychological services were also required to be provided to family members whose close ones had died due to COVID-19. Psychiatry staffs often had limited knowledge on wearing proper PPE. This increased the risk of COVID -19 exposure to the staffs.

Discussion

Challenges

The challenges for inpatient psychiatry have been discussed in other countries too. In China, there have been changes to mental health services, as they have been required to transition online in the COVID-19 pandemic. These include online mental health surveys, online mental health education with communication programmes, and online psychological counselling services (Liu et al., 2020).

Similar to Malaysia, the issues of overcrowding and consequent difficulties in social distancing most certainly present themselves in China. Another interesting dilemma identified is the need for psychiatry inpatients in particular to get involved in group activities as part of the therapeutic healing process, for example occupational therapy, physiotherapy, horticulture, supported employment and other activities which by necessity include other people (Xiang et al., 2020). Accordingly, there is a need to adjust to the new norm. Therapeutic activities no doubt still need to continue, but perhaps with the practising of adequate social distancing, use of face masks, and adequate hand sanitisation facilities, the risks of the pandemic versus the benefits of performing therapeutic activities will be able to be balanced out.

Inpatient psychiatry will pose a unique difficulty level. Due to the high levels of care required, it is almost impossible to avoid close contact, both in consultation and psychotherapeutic situations, and in acute stabilisation scenarios where close contacts are needed to deescalate and possibly use physical restraints (Li, 2020). In these scenarios, it is not always feasible to put on personal protective equipment, especially in the acute stabilisation scenario.

Besides that, stronger measures are needed to safeguard ward entry. Pre-COVID19, perfunctory medical assessments would have been performed with admitting inpatient psychiatry patients, as no suspicion of any highly contagious illness were present. Post-COVID19, it is likely that there will be more stringent screening of incoming inpatients to assess for contact, travel, or symptomatic risk, which has proven to be a good strategy as shown by Shanghai Mental Health Center, a 2400 inpatient beds centre with 0 case of inpatient infection (Shao et al., 2020). At the same time, the awareness and provision of basic sanitation and personal hygiene measures will be increased.

Emerging Importance of Community Psychiatry

Another issue identified which is paralled in the China setting is the effect of mass quarantine strategies upon the provision of community psychiatry care. In China, due to pre-existing lack of community based services, a lot of psychiatric services have been centralised in major hospitals (Xiang et al., 2012). However, in the time of COVID-19, it is preferable for patients to reduce the attendant risks of entering a potentially highly infectious hospital by having community services go to the patient's house instead. Another issue highlighted is the suspension of public transportation and multiple roadblocks in China, which can be

extrapolated to the Malaysian situation. This will create significant barriers for patients to access treatments. This will then widen the treatment gap for serious mental disorders, at least in the short to medium term. Brief interventions are hence very helpful in dealing with the distress surrounding COVID-19, as they can be administered online as well as offline (Pang, Shoesmith, et al., 2020). These interventions can have the added benefit of improving psychological mindedness, which has been found to mediate the relationship between dysfunctional coping styles and depressive symptoms (Pang, Masiran, et al., 2020).

Dilemma of Patients with Psychiatric Disorders

Another issue presented in this paper is the difficulty of managing patients with severe psychiatric disorders who have suspected or confirmed COVID-19. This represents a major logistical challenge, as psychiatric patients with medical illnesses are by right treated in a medical-based hospital, as there is far from sufficient facilities and grossly inadequate training in psychiatric hospitals to provide adequate medical care. Isolation wards have been proposed to be set up in psychiatric hospitals. However, these can increase nosocomial infection risk, especially if there is a lack of capacity for infection control (Xiang et al., 2020).

One of the biggest factors is the higher risk per se of contracting pneumonia in individuals who are known to have severe mental illness. There are multiple possible explanations, including cognitive impairment, little awareness of risk, and diminished efforts regarding personal protection in patients, as well as confined conditions in psychiatric wards (Seminog & Goldacre, 2013).

Secondly, there are clear and present barriers for patients with known mental health disorders in getting timely medical attention, which is quite unfortunately related to pre-COVID19 discrimination in the world of healthcare when speaking of mental health issues (Yao et al., 2020). There is a lot of enacted stigma especially amongst healthcare workers – many people with mental illness have had physical symptoms misinterpreted as symptoms of mental illness, and their complaints can be trivialised or assumed to be a result of "wrong reporting" rather than actual illness.

This increases the risk of false negatives in mental health patients. For instance, individuals who take a medication called clozapine tend to experience higher levels of constipation, which can lead to a serious and life-threatening consequence called intestinal obstruction (Tang & Ungvari, 1999). However, in individuals with schizophrenia, stigma can result in patients' complaints being discounted. Therefore, in the crucial times of COVID-19, individuals with mental illness face the possibility of genuine medical risk if the stigma occurs.

Additionally, mental health disorder comorbidities have the potential to make treatment of COVID-19 more challenging and potentially less effective (Yao et al., 2020). Individuals with mental health disorders take antipsychotics that can lead to them developing higher risk of metabolic syndrome, including such illnesses as hypertension, diabetes, and higher lipid and cholesterol levels (Riordan et al., 2011). Also, the medications can have drug-drug interactions

with the medications that they might be taking for COVID-19, due to potential induction or inhibition in the liver (Roncero et al., 2018; Zhang et al., 2020). Thus, they might actually have poorer response or toxicity to COVID-19 medications, at normal doses to other individuals who are not taking medications. There is also emerging evidence that shows that certain mental illnesses, for example schizophrenia and depression, have independent associations with diabetes and cardiac disorders respectively, which is independent of medication use (Fiedorowicz, 2014). This may be multifactorial and be linked to different genetic and phenotypic factors; to the social, occupational and interpersonal dysfunction that is secondary to the illness progression; or could be due to socioeconomic variables e.g. poverty, food insecurity, and financial privations that are associated with mental illness.

Third, the COVID-19 epidemic has caused a parallel epidemic of fear, anxiety, and depression. People with mental health conditions could be more substantially influenced by the emotional responses brought on by the COVID-19 epidemic, resulting in relapses or worsening of an already existing mental health condition because of high susceptibility to stress compared to the general population. However, there are two sides to this coin. From personal experiences, many clients with mental disorders actually find the enforced societal isolation of social distancing, movement control orders, and not being able to socialise with others somewhat reassuring, as it "normalises" the restrictions that are already present in their lifestyle. Hence, we need to be careful of the danger of generalising psychological effects on COVID-19 on all individuals with mental illness, and the behaviour of individuals in the COVID-19 crisis can run the full gamut, from extremely negative to extremely positive outcomes (Koh et al., 2020).

Tele-psychiatry: An Alternative

Finally, many people with mental health disorders attend regular outpatient visits for evaluations and prescriptions. However, nationwide regulations on travel and quarantine have resulted in these regular visits becoming more difficult and impractical to attend (Chattopadhyay, 2020). This can lead to higher risk of adherence issues, difficulty in maintain therapeutic relationship with patients, and patients' feeling of isolation increasing. However, many psychiatrists are beginning to use telepsychiatry services judiciously to adopt to the "new norm". In the absence of necessity of physical examinations for most individuals with mental illness, telepsychiatry is hence being deployed to provide continuation of care (Webster, 2020). Due to the advent of online prescription systems, patients can then be prescribed medications from a distance, and collect at hospital pharmacies through contactless dispensing. This system certainly looks ideal on paper, but as it has been launched without any pre-planning for most hospitals and psychiatrists due to the necessity of launching it in a time of crisis, not peacetime, there have been many practical issues in implementation. Firstly, many patients who are acutely unwell require face-to-face de-escalation, and there needs to be a backup mechanism in all hospitals to allow for that to happen, and on-call doctors 24 hours (Gibson et al., 2011). Secondly, there are certain patients who will require a more face to face intervention in order to run certain complicated psychological interventions which require preferentially the therapist to be present in person, e.g. desensitisation procedures. However, in the new norm, therapists then need to take it upon themselves to boost their IT capabilities and use

videoconferencing tools cleverly to ensure all treatment protocols can proceed as usual (Wagnild et al., 2006). Last but not least, there is always the lingering issue of boundary violations. Using internet services to provide consultations always leave the risk of clients being able to access therapists' phone numbers and personal contacts 24 hours (and vice versa too for vulnerable clients and unscrupulous therapists) (Sanders & Bashshur, 1995). Therefore, it is important that standard operating procedures for teleconsultations and high-security teleconsultation services be established early on. This is especially because of the inherent suicidal and aggression risk incorporated in psychiatric teleconsultation. Legal measures need to be enacted and strengthened, while medical insurance policies need to be notified thereof as well, to ensure that teleconsultations do not put therapists at unnecessary increased medicolegal risk.

Conclusion

There are multiple challenges for the new norm in psychiatry, and in medicine, we always need to balance beneficience versus non-maleficience, both to healthcare workers and to patient. There needs to be an urgent effort to increase preparedness and readiness efforts for the psychiatry fraternity to change the way things are being done to embrace the new norm. This is because come rain, shine, or COVID-19, inpatient psychiatry will still need to go on albeit with certain modifications. It is hoped that this article can shed some light into the practical difficulties of providing inpatient psychiatry in both general psychiatry and consultation liaison settings, and serve as the springboard for further discussion of the best way to practically implement what is known in theory about how we can safeguard our inpatient psychiatry services against the danger of COVID-19, while simultaneously being able to not compromise the quality of care for patients.

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