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Conceptualization of health and social vulnerability of marginalized populations during Covid-19: The case of Rohingya Refugees in Malaysia

Abstract

Covid-19 is a global health emergency and a systemic human development crisis. Marginalized populations’ ability to respond tends to be low and associated impacts can be serious for already vulnerable communities. The virus impacts vulnerable populations unequally. Pandemic containment measures can render vulnerable populations to multiple interacting stressors. In this paper, we report on an investigation into health and social vulnerability of Rohingya refugees in Malaysia, with a focus on health and social aspects. Results suggest that the Rohingya refugees are highly vulnerable. Factors contributing to their vulnerability are Covid-19 response, resilience, susceptibility, basic need conditions, anxiety, social stigma, awareness of Covid-19 prevention and isolation and fear.

Keywords: Covid-19, Rohingya, Refugees, Malaysia, Vulnerability, PCA.

Introduction

Refugees are one of the most vulnerable groups to global pandemics, such as Covid-19 and are at increased risk as pandemics spread (OCHA, 2020). Rohingya refugees in Malaysia are at heightened risk due to several factors, including the displacement as such, population density in settlements, difficulty accessing health care, inadequate access to water, sanitation, and hygiene (WASH). The elderly and people with pre-existing health conditions are particularly vulnerable (Smith & Judd, 2020). Marginalized, stateless, persecuted, discriminated and excluded, the Rohingyas are one of the most vulnerable communities in the world (Equal Rights Trust, 2014; Ullah, 2011).

Since violence in the Rakhine state of Myanmar intensified in June 2012, thousands of Rohingyas have fled the country to seek refuge in countries such as Bangladesh, Indonesia, Malaysia and Thailand (Chin et al., 2020). Southeast Asia is currently experiencing one of the largest refugee crisis in 21st century (Stange et al., 2019). There are nearly 900,000 Rohingya refugees currently residing in makeshift camps in Bangladesh (Alam, 2020; United Nations High Commissioner for Refugees, 2019). From Bangladesh, many Rohingyas crossed the Bay of Bengal and Anderman sea to reach Malaysia to seek employment (Amnesty International, 2015). Malaysia is considered a sanctuary for Rohingyas because of its relative proximity, livelihood opportunities and shared religious background (Ehmer & Kothari, 2020; Hoffstaedter, 2017) Following regional and international pressure, Malaysia agreed to provide temporary shelter for the Rohingyas until resettlement and repatriation (Oversea Development Insitute, 2016). However, resettlement rates have plunged in recent years despite the significant rise in the numbers of refugees globally (Buscher & Heller, 2010), particularly because many traditional resettlement destinations have closed their doors to asylum-seekers. Rohingyas increasingly end up in limbo in Malaysia for extended periods of time rather than using the country as a transit-point, forcing them to live on the margins of society (Hoffstaedter, 2019). In 2018, Malaysia received the second highest number of new asylum applicants in the world, after Egypt (UNHCR, 2019). Consequently, the decrease in third-country resettlement has become a serious problem for developing countries with limited resources in bringing forward sustainable solutions for refugees.

Despite being home to one of the world's largest urban refugee populations, Malaysia has not ratified the United Nations Convention Relating to the Status of Refugees (Amnesty International, 2015; Lego, 2018; Nungsari et al., 2020; Stange et al., 2019). Malaysia currently hosts refugees from more than 26 countries, with Rohingya being the largest refugee population. As of the end of March 2020, some 158,510 refugees and asylum seekers were registered with UNHCR in Malaysia (Palmgren, 2017; UNHCR, 2020b). However, it is important to note that Malaysian law does not distinguish undocumented inhabitants from refugees and asylum seekers making everyone vulnerable to arrest, detention, and deportation (Acciaioli et al., 2017).

Many Rohingya refugees in Malaysia have yet to be documented by the UNHCR and actual numbers are likely to be much higher than those officially recorded (Oversea Development Insitute, 2016). Among the refugees, 9761 were registered as children, with 2102 being female below 5 years old. There have been an increasing number of unaccompanied minors, often separated from their parents due to detention while entering Malaysia (Equal Rights Trust, 2014). Unlike neighboring Thailand, Malaysia have generally allowed Rohingyas arriving by boat to disembark on its territory. However, they are subjected to mandatory detention until registered by UNHCR. Refugees often do not receive any direct protection or assistance from the government as the country does not have an administrative framework to protect refugees on its territory (Amnesty International, 2010). Previous research has characterized these conditions of refugees and asylum seekers as one residing in “an indeterminate space, an unsettled socio-legal location” (Lego, 2018).

 In the absence of a formal legal framework, Rohingyas are denied the legal rights to work, and are often precariously employed in dirty, dangerous, and demeaning jobs to make ends meet (Buscher & Heller, 2010). This situation creates significant barriers to accessing health care, education and other basic social needs. The Rohingyas have been getting by for decades in the informal labor sector while suffering constant harassment, the risk of extortion and detention. Nungsari et al. (2020) reported that cases of bribery are frequently heard among Rohingyas to avoid arrest and detention by the authorities. As a result, arbitrary jailing and feelings of insecurity in their day-to-day lives are common. Unfortunately, these security issues have exacerbated during the COVID-19 pandemic, as the number of raids and forced detentions at jails and immigration centers have dramatically increased.

Refugees and asylum-seekers in Malaysia are primarily urban dwellers, residing in urban settlements instead of designated refugee camps like many other host countries (Yasmin Salim, 2019). Given that most refugee settlements are crowded and often in squalid conditions without social protection (International Rescue Committee, 2013), the Rohingyas in Malaysia are highly vulnerable to contracting viruses. The authorities have been raiding their homes and arresting hundreds of Rohingyas in an attempt to contain COVID-19 from spreading (The Asia Foundation, 2020). Fear of being detained prevents refugees from seeking access to health care. There is therefore a heightened risk of exposure and of spreading the virus. Mistakes have also been made in identifying refugees' locations and livelihood conditions and allocating needed resources (The Asia Foundation, 2020).

Generally speaking, preparedness, prevention, and response capability to public health emergencies of refugees need to improve and better quantification of the multifaceted nature of health and social vulnerability of Rohingya refugees in Malaysia is urgently needed. To address this need, this paper presents results of a study measuring Rohingya refugees’ health and social vulnerability to Covid-19 in Malaysia. This is based on context-specific variables and indicators through household survey techniques. It is demonstrated how vulnerability analysis can be operationalized in economically impoverished and marginalized settings. While the spread of Covid-19 can have devastating impacts on refugees living in crowed housing, many humanitarian partners, together with the UN, have made tremendous efforts to protect refugees and to reduce the risk of a COVID-19 outbreaks. This includes measures with regards to health, WASH, communication, nutrition, food security, and logistics (Inter-Sectoral Coordination Group (ISCG), 2020).

Rohingyas in Malaysia are considered ‘illegal’ or ‘prohibited’ immigrants under the Immigration Act and therefore are at higher risk of being left behind in terms of testing for COVID-19 and early responses (Amnesty International, 2010). As the Rohingyas in Malaysia live in overcrowded housing with a lack of access to educational opportunities, employment, and healthcare, they have a very high risk of infection and other associated challenges, such as losing income and shelter (Amnesty International, 2015). Humanitarian organizations are working closely with the refugees to assess vulnerability and provide immediate assistance. The need for vulnerability assessment is urgent in order to identify the location where mitigation is most needed and in order to be able to allocate essential resources (Holand et al., 2011).

In this paper, we introduce a vulnerability assessment based on a comprehensive, evidence-based analysis, using a set of factors potentially contributing to outbreak vulnerability and associated proxy measures. Systematically weighted parameters are used for a detailed examination. While the article focused on Rohingya refugees, the phenomenon is not exclusive to Rohingyas. The assessment methodology should be inherently applicable to all outbreak-prone infectious diseases. As governments and humanitarian organizations are increasing their attention towards responding to the Covid-19 pandemic, especially those associated with already vulnerable populations, such as refugees, infectious disease vulnerability data should become an essential consideration in decision-making. Vulnerability data will inevitably make it possible to address challenges faced by communities to prevent the spreading of disease better and develop an understanding of conditions for survival and adaptation. Resulting data and information vulnerability factors can be used to allocate resources and priorities for technical and funding support in response to Covid-19, particularly the distribution of upcoming Covid-19 vaccine. While this research provides a comprehensive analysis of the vulnerability of Rohingya refugees in Malaysia, the framework and findings are also relevant to other intermediate refugee host countries. The conceptual model developed, and methods used can be adapted and applied in the context of disease outbreaks in similar settings elsewhere.

Conceptual framework development

The first phase of the research project underlying this paper involved developing a conceptual framework as well as health and social vulnerability indicators for Rohingyas in Malaysia. Next, based on responses from a questionnaire survey, we performed principle component analysis (PCA) to reduce dimensionality of indicators and improve interpretability of the results. To date, there has been no risk and vulnerability assessment for Rohingya refugees in Malaysia. Most of the existing publications on Covid-19 vulnerability we are aware of target general populations in different countries. In the US, for example, the clinical AI company Jvion launched a Covid community vulnerability map built on Azur maps and Centers for Disease Control's Social Vulnerability Index to identify the population at higher risk (Jvion, 2020). Friedman (2020) provided vulnerability data for US cities based on critical underlying health and demographic indicators. Furthermore, Columbia University identified areas most vulnerable to Covid-19 hospitalization in US counties (Columbia Univesity, 2020). Studies assessing risk and impacts of Covid-19 outside the US include Coelho et al. (2020)’s study on Brazil and the African Center for Strategic Studies (2020)'s report on the African continent.

The majority of respondents to our questionnaire survey in Malaysia (71.10%) are concentrated in one state, Kuala Lumpur. However, socio-economic conditions of the Rohingya refugees overall are similar across Malaysia (Oversea Development Insitute, 2016), and therefore mapping vulnerability indices by states was not considered necessary. Rather, magnitude of health and social vulnerability of the refugees across Malaysia were assessed, and factors contributing to these vulnerabilities.

Vulnerability to disasters can be defined as the potential for loss of lives, livelihood, and socio-economic status (Angell & Stokke, 2014; Cutter et al., 2003; Weichselgartner, 2001). It is crucial to capture the socio-economic characteristics of individuals or communities at risk for measuring vulnerability. Vulnerability also varies across geography, time, space, and among different social groups. It is vital to gauge social vulnerability to hazards from a community level in risk affected places to avoid overlooking context-specific variables (Paul M. Muchinsky, 2012; Solangaarachchi et al., 2012). To assess vulnerability and susceptibility to disaster comprehensively, the conceptualization of vulnerability must encompass variables rooted in institutional, demographic, social, cultural, and socio-economic conditions within a specific geographic location (Fuchs et al., 2012; Siagian et al., 2014; Yoon, 2012). The extent of people’s susceptibility to hazards is not only dependent upon their exposure to hazards but also upon other socio-economic conditions, as well as demography, institutional settings, and their status in society. These factors greatly influence the capacity to respond and recover (Sherman et al., 2015). Specifically, wide gaps in access to essential resources and capabilities for risk prevention due to low-incomes and socio-economic stratifications can be significant drivers of disparities in vulnerability to infectious diseases (Stanturf et al., 2015). Common to health research and associated policy interventions is a concern that there is a differential impact with regards to health outcomes or health service utilization, due to this different socio-economic status, demography, perception and behaviour, protection status, and several other attributes.

Vulnerability is multidimensional and requires multiple variables in order to be able to provide a more holistic result (Park et al., 2016). The framework developed here integrates threat, vulnerability and resilience of the socio-economical system (see Figure 1). It takes into consideration the challenges of the social system to Covid-19 in addition to general health challenges. Vulnerability is expressed by the combined results of the direct impacts of Covid-19, health vulnerability, and social vulnerability. Assessing the vulnerability of a social system requires the integration of both, social and health threats to a system (Berrouet et al., 2018). These factors are the direct result of the threat faced by the community due to the outbreak. The system's current level of resilience and adaptive capacity have a decisive effect on the refugees before and after the initial threat from the outbreak. The changes in resilience and adaptive capabilities of the population are directly influenced by both, risk and vulnerability.

*Variables and Indicator Selection*

 In the selection of context-specific variables and indicators to measure the model, we primarily relied on an extensive review of the literature in the field of vulnerability and disaster risk reduction. An indicator-based approach has been commonly applied in assessing infectious disease vulnerability in a number of countries (Moret, 2014). The indicator approach provides an accurate estimation of baseline information and captures important observable variables for decision making in disaster risk reduction at the local level (Stafford & Abramowitz, 2017). Selected indicators must be able to address the research questions and test the developed concepts. Table 1 shows all parameters used in the analysis and their indicators. The parameters selected encompass the indicators widely used in social vulnerability measurements, for instance, gender, age, and education level. These are all factors considered in previous social vulnerability studies (Adger, 2000; Bergstrand et al., 2015; Kusenbach et al., 2010; Lee, 2014). To better understand the impact of the Covid-19 pandemic and the Rohingya refugees’ health and social vulnerability, we included context-specific variables such as Covid-19 related challenges, knowledge of Covid-19, response to Covid-19 and living conditions that reflect their susceptibility to the outbreak. Indicators are mostly derived from the Center for Disease Control, and Prevention (CDC)'s risk factors for Covid-19 (CDC, 2020) and a series of Covid-19 technical guidance produced by the World Health Organization (WHO, 2020b). Also, we consulted recent Covid-19 related publications, measuring risk and vulnerability in other countries (Africa Center for Strategic Studies, 2020; CARE, 2020; Coelho et al., 2020; DeCaprio et al., 2020; International Organization for Migration, 2020; Smith & Judd, 2020).

The current outbreak has provoked social stigma and discrimination of Rohingya refugees in Malaysia (Ananthalakshmi, 2020; Sukumaran, 2020). Media also play an important role in this factor as public support is often influenced by news coverage. It was reported that the media in Malaysia often portrayed refugees as violent and illegal outsiders even when state actors offer humanitarian aid (Ehmer & Kothari, 2020). This leads to further exclusion of refugees from treatment, making detection and diagnosis difficult. Stigma exacerbates social isolation and increases the risk of concealing the illness (WHO, 2020a). Therefore, we included six indicators based on WHO's guidance on the social stigma associated with COVID-19 and preparedness, prevention, and control of coronavirus disease (COVID-19) for refugees and migrants in non-camp settings (WHO, 2020a, 2020c).

Variables, indicators, and results of the analysis were reviewed and validated by two experts from the United Nations High Commissioner for Refugees based in Malaysia. The validation of results allowed us to incorporate practitioners' local knowledge, experience, and expertise. It increases the chance of the practical application of our findings. In this context, we conducted several virtual meetings with practitioners during the indicator selection phase and on final results (travelling was not possible due to restrictions during the pandemic). The variables finally selected are those with a high level of agreement.

Methodology

Information on communities and individuals vary with regards to many factors. The extent to which these relate to variables of interest is central to various questions, including how to target most vulnerable populations. The fundamental objective of this study was to collect and analyze data on refugees’ health and social vulnerability to Covid-19, from adult Rohingya respondents residing in Malaysia. Research questions are presented in Table 1.

Over a six-week period, we conducted a quantitative household survey with Rohingya refugees residing in Malaysia during April and May 2020 via phone interviews and an online questionnaire. On the assumption that many refugees are illiterate, self-administered telephone interviews in local language were conducted. We completed the questionnaire online simultaneously when the respondents answered questions over the phone. Online questionnaires were written in English and only literate refugees answered them. We gathered 180 responses via phone interviews and 103 responses via online questionnaire, resulting a total of 283 responses.

The purpose and use of the survey, the identity of the researchers, the principle of confidentiality, risks and benefits, their rights, and result dissemination were explained to all respondents and verbal/written consent was ensured before proceeding with the survey. The research instrument (can be found in supplementary information) included closed ended (yes/no) and open-ended questions. We used a stratified simple random sampling technique based on registered Rohingya refugee populations in Malaysia. For sample size calculation, we used SurveyMonkey sample size calculator (<https://www.surveymonkey.com/mp/sample-size-calculator/>). For 90% confident level and 5% margin of error, the sample size recommended was 272. Given the difficulty to collect responses during a global pandemic, we consider our sample size to be sufficient and representative of the refugee population at overall population level.

Finally, we applied principal components analysis (PCA) to reduce the original set of variables into a smaller number of linear variates (Solangaarachchi et al., 2012). PCA has been widely applied in assessing socio-economic and health vulnerability in many studies (Chan et al., 2019; Ringnér, 2008; Vyas & Kumaranayake, 2006). The goal is to reveal how different variables influence each other and how they are associated (Nardo et al., 2005). PCA is a statistical technique that transforms correlated variables into a new set of uncorrelated variables, using covariance or correlation matrix (Vyas & Kumaranayake, 2006). Thus, the result of PCA is a set of uncorrelated components that represent linear weighted variables (Stafford & Abramowitz, 2017). In this case, PCA creates a set of principal components from health and social vulnerability indicators by extracting the substantial variation in the underlying input data. We aggregated and used the resulting components to obtain component loadings that provide single values for each observation in the dataset, health and social vulnerability scores. These PCA-based results allow to encapsulate much information in a comprehendible formal (Yoon, 2012). We performed PCA, using Stata MP, using orthogonal rotation. Four variables (Q18 (Worry about the corona crisis), Q22 (The source of information), Q27 (households by shelter type), and Q 41 (Number of health facilities)) were dropped from the analysis because of their different response structure (continuous response rather than binary response). Less than 1% (0.38%) of the data were missing and we used listwise deletion to deal with missing data. We selected an eigenvalue threshold of 2.33 for Covid-19 health vulnerability and an eigenvalue threshold of 2.05 for Covid-19 social vulnerability since the subsequent eigenvalues dropped dramatically. Initially, we adjusted the measurements of the variables to consistently generate the response, reflecting positive directions (i.e. contributing positively to vulnerability).

After performing PCA, we first defined factors representing health and social vulnerability represented by each principal component based on the relative loadings of each indicator on that component. At the next step weights from the PCA factor loadings are constructed. We normalized the resulting variables to a scale of 0-1, using the Min-Max method as follows:

$δ = \left(χ -χ \_{min}\right)/\left(χ \_{max}-χ \_{min}\right)$ ……………………………………………………(1)

$$δ = the normalized values $$

$$χ = the original values$$

As each factor reveals the set of indicators with which it has the strongest association, we used them as the weights of each variable (Foa & Tanner, 2007; Nardo et al., 2005). Following Abson et al. (2012), the normalized variables were then aggregated to provide final weights.

 We then aggregated the response of each indicator from the questionnaire, using the following equation:

$Vx\_{i}=\frac{B\_{i}\left(x\right)+C\_{i}\left(1-x\right)}{Bⅈ+C\_{i}}$……………………………………………………………………………………(2)

$$x=\left\{\begin{array}{c}0,\left(1-x\right)=1\\1,\left(1-x\right)=0\end{array}\right.$$

Vx*i* is the value of the variable in the questionnaire.

The values were then multiplied by weights obtained from PCA, and the final score was obtained. This process allowed us to convert the heterogeneous data in a dimensional score between 0 and 1. The score of 1 would indicate very high health and social vulnerability. Accordingly, a final score <0.33 would indicate low health and social vulnerability. Between ≥ 0.33 and <0.66 would suggest medium health and social vulnerability. Between ≥ 0.66 and <1 or =1 would indicate high health and social vulnerability associated with Covid-19. The empirical validation of the results was not possible as there is no existing dataset available for our study area.

**Results and Discussion**

*Covid-19 Health Vulnerability*

The output of PCA gives factor scores or weights for each variable (Vyas & Kumaranayake, 2006). Four principal components were retained in PCA for health vulnerability measurement. This comprises 41 variables with binary response items (coded as 0=No and 1=Yes), measuring health-related conditions of respondents during Covid-19. First, we estimated tetrachoric correlations for our binary variables and obtained r(Rho) from the pairwise correlation matrix. We then performed a principal component analysis (PCA) with an orthogonal rotation of the 41-item scale. The Kaiser (1961) rule suggests that eigenvalues larger than 1 should be retained; in our study, because of the large number of variables and the rarity of scales developed for Covid-19, we retained factors with eigenvalues from 2.33 to 11.72, resulting in a 4-factor solution that accounted for 56.21% of the variance (see Table 2 for a list of items and factor loadings). After that, the eigenvalues of the fifth factor significantly dropped and therefore was not retained. Our decision to retain four rather than all 12 factors (with eigenvalues > 1) was based on statistical, theoretical, as well as practical concerns. We hoped to maintain statistical and theoretical rigour while also increasing ease of use of this instrument. The 4-factor solution was satisfactory, based on the following criteria: (a) a minimum of complex items (i.e., items having a loading of ≥.40 loading on more than one factor); (b) a minimal number of factors that do not load on any one factor; and (c) the intelligibility of the factors (Sandin, Chorot, & McNally, 1996; Hinton, Pich, Safren, Pollack, & McNally, 2006). We also performed an oblimin rotation, and similar results were obtained.

 Table 2 displays the Principal Component of Covid-19 Health vulnerability. Based on factor loading, health vulnerability is categorized as Covid-19 Response (FI), Covid-19 resilience (FII), Covid-19 susceptibility (FIII) and Basic need conditions (FIV). These factors indicate relative health vulnerability, based on the dominant indicators of each principal component. The factor I, "Covid-19 Response” (eigenvalue, 12.15; variance, 27.61%) corresponds to the measures taken to respond to Covid-19 and how well the community is responding to the outbreak. This factor is mostly measured by a set of variables, including taking precautionary measures, information and communication, access to testing, willingness to get tested, and access to health care facilities that are assessed on the basis of several questions. Factor II (eigenvalue, 6.14; variance, 13.96%), identifies "Covid-19 resilience". Resilience refers to how the community responds to drivers of change and is considered one of the key factors in their vulnerability (Berrouet et al., 2018). Resilience also is the capacity of the community to respond to the outbreak and being able to recover to its equilibrium. In this study, this factor is predominantly determined by troubles faced during a pandemic and support from aid organizations. Factor III (eigenvalue, 3.70; variance, 8.41%), assesses “Covid-19 susceptibility". Susceptibility, in our case, refers to the degree to which the Rohingya refugees are susceptible to Covid-19. This factor is measured by variables ranging from the quality of life during the pandemic, having cross interaction with other communities, having close contact with positive cases to having special need populations in the household - all of which relates to high vulnerability. The final principal component for health vulnerability, Factor IV (eigenvalue, 2.74; variance, 6.23%) represents “Basic needs conditions during Covid-19”. Lack of basic needs such as food, water, shelter and hygiene supplies are regarded as central contributors to vulnerability in health research (Stanturf et al., 2015), and also highlighted by the WHO (2020a) as some of the most important factors for Covid-19 affected marginalized populations. We measure this factor, using variables including access to water, soap and disinfectant products, food, health care services and electricity, and the ability to make a living during the crisis.

*Covid-19 Social Vulnerability*

Table 3 below displays the Principal Component of Covid-19 Social vulnerability. This consists of 25 variables with binary response items (coded as 0-No and 1=Yes), measuring social-related concerns of respondents during Covid-19. We used the same methods and criteria (PCA and orthogonal rotation) to extract factors from the 25-item scale. For social vulnerability, we also retained four factors with eigenvalues from 2.05 to 9.89, which accounted for 70.24% of the variance in the data. Similar concerns (theoretical, statistical and practical) as above were given in deciding on how many factors to retain. The 4-factor solution has a satisfactory fit following the above criteria ([Sandin et al., 1996](https://www-sciencedirect-com.proxy.bc.edu/science/article/pii/S0887618505000447%22%20%5Cl%20%22bib22)). The loading of each variable for the retained principal components for social vulnerability is detailed in Table 3, with the most substantial loading highlighted in bold. Based on the results, the four retained principal components can be broadly described as: "Covid-19 related anxiety", "Covid-19 Social Stigma", "Awareness of Covid-19 prevention" and "Isolation and fear".

The first factor (eigenvalue, 6.21; variance, 24.84%), "Covid-19 related anxiety" identifies the level of anxiety experienced by the Rohingya population during the outbreak. It is measured through a list of variables assessing their concerns, for instance, getting sick, getting arrested, losing job and income, security, violence and difficulty accessing medical care. Factor II, (eigenvalue, 2.45; variance, 9.81%) "Covid-19 Social Stigma" determines stigma and discrimination faced by refugees during Covid-19. A marginalized population often encounters stigma and xenophobia, and this may hamper the response to an outbreak (WHO, 2020a). Key variables for the assessment of this factor are: being treated differently to the existing population by the host country government and community, facing discrimination when trying to access health care and developing feelings of isolation (ACAPS, 2020). The third component (eigenvalue, 1.75; variance, 6.98%) is "Awareness of Covid-19 prevention". The awareness about pandemic preparedness and response plays a critical role in health-seeking behaviour, trust in respondents and willingness of the communities to comply with health measures. We measure this component with indicators such as the awareness of isolation and treatment facilities, and awareness of risk communication. Factor IV, "Isolation and fear" (eigenvalue, 1.67; variance, 6.69%) describes possible social isolation of marginalized groups, contributing to social vulnerability in crises (WHO, 2020b).

Table 4 summarizes the correlation matrix of COVID-19 Health and Social vulnerability. The principle component scores tell us the magnitude and direction of the relationships between each, health and social component. For example, basic needs and resilience are strongly positively correlated (r=0.77), while anxiety and response are weakly negatively correlated (r=-0.28).

Table 5 presents descriptive statistics of demographic information. 73% of the respondents are between the age of 25 to 55. Almost 60% of sample are male. Over half of the respondents are married with 1-3 children. Less than 40% of the respondents did not receive formal education; roughly half of the respondents received primary or secondary school education, while around 15% received high school or tertiary school education. Almost 9 out of 10 people in the sample were unemployed. Over 70% of the sample live in Kuala Lumpur, while the rest spreads out over other 7 provinces. Around half (54.20%) of the sample have lived in Malaysia for 3 to 5 years; around 25% have lived there from 5 to 8 years, while 13% have lived in Malaysia for 8 or more years.

*Composite Scores*

Table 5 depicts the score of Covid-19 related health and vulnerability of the Rohingya refugees in Malaysia. As expected, overall health and social vulnerability are high, with a total score of 0.670 and 0.661, respectively. Within health vulnerability, the score ranges from moderate vulnerability (Covid-19 resilience (0.560) and Covid-19 susceptibility (0.580)), to high vulnerability (basic need conditions (0.789) and Covid-19 Response (0.750)), the latter being the most vulnerable health factor among the refugees. During Covid-19, the disruption of normal economic activities and access to essential commodities, and loss of income are eroding the Rohingyas already struggling to meet basic needs (ACAPS, 2020). These include poor food security as well as lack to access to water, soap and disinfectant products. This can lead to an increase in disease transmission and susceptibility. Water, sanitation and hygiene (WASH) are vital in the prevention and control of Covid-19 (WHO, 2020c). The effects of the pandemic on the refugees are compounded by pre-existing drivers of humanitarian needs such as poverty, inequality, discrimination, low education level and lack of legal status in Malaysia (OCHA, 2020). Limited social assistance and unequal access to information further exacerbate their vulnerability. Secondly, “Covid-19 Response" is one of the critical factors contributing to health vulnerability. This factor can be the result of negative feedback loops due to the lack of basic needs. As the refugees had already been struggling to meet their basic needs even before the pandemic, there is an increased likelihood that they ignore or lack capacity to follow prevention measures, such as mobility restrictions or increased levels of sanitation. Lack of information and communication about Covid-19 can also weaken their consciousness about the severity of the disease. Other vital indicators contributing to this factor are difficulties in accessing testing and health care facilities, and an unwillingness to get tested. Although the Malaysian government has accelerated testing for refugees, Rohingyas might conceal their symptoms and thus avoid testing due to fear of arrest or violence (UNHCR, 2020a). Limited testing overall and an unwillingness to get tested means that the extent of the spread is unknown.

The next factor, "Covid-19 susceptibility" obtained a medium health vulnerability score. The high proportion of the existence of people with underlying health conditions, special needs and Covid-19 symptoms, as well as older adults and pregnant women in households make the Rohingyas highly susceptible to Covid-19 and prone to complications if infected. Susceptibility also increases when they have difficulties accessing basic needs and support from aid organizations. All these parameters are correlated with susceptibility. Consequently, population groups with these conditions are less able to cope when infected. The deficiencies of these parameters often lead to a lack of "Covid-19 resilience". This factor also obtains a medium health vulnerability score. This factor is mostly decided by parameters such as having trouble accessing medical care, shelter, food, income and the absence of support from aid organizations during the crisis. These challenges impact on the ability of the population to cope with the crisis and respond to the evolution of the pandemic.

 Another critical area for action, ‘social vulnerability’ scored highly in our analysis. Covid-19 is having an unprecedented impact on vulnerable populations like Rohingya refugees in Malaysia, in term of social and economic impacts, and persecution from the host community (USAID, 2020). "Awareness of Covid-19 prevention" is contributing most to their social vulnerability with a score of 0.719. This factor is predominantly measured by insufficient isolation and treatment facilities, as well as insufficient risk communication and community engagement, and isolation. As a result, lack of information about Covid-19 responses and prevention measures can weaken social cohesion, and lead to discrimination, marginalization and xenophobia (United Nations Coordinated Appeal, 2020). Hence, the second most vulnerable factor is “Covid-19 Social Stigma” (0.685). The main parameters in this factor include being treated differently by the host country government and community, facing discrimination in accessing medical facilities, being afraid of getting arrested and feeling socially isolated. In our survey, 89% of the respondents were treated differently by the host country government and community, 81% experienced discrimination in medical facilities, 92% have a fear of getting arrested, and 82% feel socially isolated during Covid-19. This result is consistent with a survey conducted by USAID (2020). The findings also support comprehensive documentation of anti-Rohingya and anti-refugee campaigns, and detention of refugees in Malaysia (USAID, 2020). The next factor is “Covid-19 related anxiety", measuring refugee's significant concerns during Covid-19 health hazards. Covid-19 and protective measures imposed in the country exacerbate concerns, such as getting sick, dying, financial difficulties, difficulty to getting medical care, difficulty following preventive measures, feeding the family, losing job and isolation. Besides, the Rohingyas in Malaysia are particularly worried about Covid-19 leading to more violence and arrest. This increased anxiety and stress can worsen mental health and well-being. In a previous study, some of the major stress factors contributing to the severe mental health symptoms of Rohingyas in Malaysia were identified as being fear of arrest by authorities (police, immigration), livelihood difficulties, and difficulties in accessing healthcare (UNHCR, 2018).

 "Isolation and fear" scored moderately. This factor was measured by experiencing fewer connections with family, friends, neighbours and colleagues during Covid-19. Isolation and other Covid-19 measures might impact family separation, lead to neglect of children or other people with special needs in the household (United Nations Coordinated Appeal, 2020). This situation might encourage behaviours contradicting recommended social-distancing measures and lead to spreading the virus. Thus, providing adequate shelter to support density reduction and isolation efforts is crucial. At the same time, providing support for people with disability, older people and children is necessary. It is essential to note that as Malaysia does not have any refugee camps, Rohingyas are mostly concentrated in urban areas with proximity to local populations. Consequently, failing to protect this vulnerable population would also pose serious health risks and impacts on the host population.

Conclusions

The current global Covid-19 pandemic is unprecedented: Covid-19 is a global first for coronavirus and a health crisis, unlike any experienced in the 21st century (Smith & Judd, 2020). It is escalating human suffering, weakening the global economy and destabilizing people’s lives. Displaced people and refugees all over the world are at heightened risk as the pandemic spreads. The virus has overwhelmed healthcare systems in even some of the most advanced countries in the world (IASC, 2020) and the pandemic disproportionately impacts the world’s most vulnerable groups, such as refugees and IDPs. It is essential to protect these communities as the impact can go beyond vulnerable societies. Rohingya refugees are among the most vulnerable. As the virus recently reached the largest refugee camps in the world in Bangladesh, humanitarian organizations are taking a series of actions in its field operations to help respond to the public health emergency and prevent further spread (UNHCR, 2020b). While the virus can have a catastrophic effect on the Rohingya refugees in Bangladesh, a series of factors make Rohingyas in Malaysia also extremely vulnerable to the spread of the virus. These factors include but are not limited to, the displacement, poverty, and lack of legal status, as well as no legal protection from the host government and lack of protection from aid organizations.

In this paper, we first presented a conceptual framework for the evaluation of health and social vulnerability when facing threats in the populations already at a disadvantage. Our proposed framework establishes the link between the threat of Covid-19, socio-economic, health and social factors, and vulnerability and resilience. It considers the difference between characteristics of health and social vulnerability in the face of a threat to the social system. We then conceptually differentiated between health and social vulnerability. Using a Principal Components Analysis technique based on selected indicators, we have shown how different aspects of vulnerability influence marginalized populations’ overall health and social vulnerability during health hazard. Data on health, social and socio-economic information generated are likely to be useful for an outbreak investigation in a humanitarian setting.

We found that health vulnerability is predominantly determined by Covid-19 Response, Covid-19 resilience, Covid-19 susceptibility and basic need conditions. As the refugees in Malaysia live in communal accommodations in cities, industrial and urban areas, they face similar health threats from coronavirus as the host populations, but with limited access to health care and preventative measures, and are excluded from national protection schemes (WHO, 2020d). Policies to reduce vulnerabilities and build capacities to tackle crises, both in the short and long term, are vital to enable these vulnerable populations to cope and recover from shocks (Kovacevic & Jahic, 2020). The government and humanitarian organizations should prioritize to preserve the ability of people most vulnerable to meet their basic needs, such as health services, food, water and sanitation, nutrition and shelter. Social vulnerability is mainly influenced by Covid-19 related anxiety, Covid-19 Social Stigma, Awareness of Covid-19 prevention and Isolation and fear (FIV). It is imperative to ensure inclusion and non-discriminatory access of refugees to public health services, response plan and interventions (Toppenberg-Pejcic et al., 2019). The government also should prevent risks of violence and xenophobic behaviour towards refugees by enhancing awareness at the community level. It is evident that stigma and fear during global pandemic hinder an adequate response (WHO, 2020b). Building trust in health services and preventative measures, social cohesion and non-discriminatory practical measures help to support those at higher-risk and the host population. As promising vaccine development is underway, the inclusion of refugees and migrant for equitable access is extremely important. To ensure equitable access of vulnerable populations, effort need to build on coordination between local and international actors as the existing resources are often limited in host countries (Severoni & Bartovic, 2020).

From a policy perspective, our contextualized and expert validated vulnerability indicators will prove useful as they provide detailed information in a comprehensive and easy to visualize manner. An extensive set of individual vulnerability indicators are otherwise extremely difficult to interpret and gathering a direct response from the refugees is even more challenging in humanitarian settings. Our findings provide robust evidence-based information targeting responses on the ground and contributing towards offering information for the international support related to the challenges facing Rohingya refugees in Malaysia. These findings can be useful for identifying causes and impact, health and social vulnerability during Covid-19 across marginalized populations around the world. More broadly, the implications of vulnerability, in a context where a refugee crisis is intertwined with a global pandemic, has important consequences for how scholars and policy makers think about successful humanitarian aid.

This paper fills a significant gap in the knowledge of how the refugee population in intermediate countries have historically been marginalized and their vulnerability during a global pandemic. While this study is inductively based on the survey with affected population, future research on refugee vulnerability should take government officials into consideration. Although we validated our methods and findings with non-governmental organization closely involved with the issue, in the absence of information provided by the authorities, consolidating authorities’ perspective might provide more comprehensive result. It is also important to note that this paper captures an emergent and dynamic vulnerability, rather than a static measure of chronic vulnerability. Future research should focus on documenting and mapping chronic vulnerability of refugees to several environmental and economic changes and disease outbreaks.

Declaration of interest statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Adger, W. N. (2000). Social vulnerability to climate change and extremes in coastal Vietnam. *World Development*, *2*, 249–269. https://doi.org/10.1163/15691497-12341403

Africa Center for Strategic Studies. (2020). *Mapping Risk Factors for the Spread of COVID-19 in Africa Mapping Vulnerability by Risk Factor*.

Amnesty International. (2010). *Abused and Abandoned: Refugees denied rights in Malaysia*.

Amnesty International. (2015). *Deadly Journeys. The Refugee and Trafficking Crisis in Southeast Asia*. https://www.amnesty.org/en/documents/ASA21/2574/2015/en/

Ananthalakshmi, A. (2020). *Rohingya targeted in Malaysia as coronavirus stokes xenophobia*. Reuters. https://www.reuters.com/article/us-health-coronavirus-malaysia-rohingya/rohingya-targeted-in-malaysia-as-coronavirus-stokes-xenophobia-idUSKBN22Z00K

Angell, E., & Stokke, K. B. (2014). Vulnerability and adaptive capacity in Hammerfest, Norway. *Ocean and Coastal Management*, *94*, 56–65. https://doi.org/10.1016/j.ocecoaman.2013.11.009

Bergstrand, K., Mayer, B., Brumback, B., & Zhang, Y. (2015). Assessing the Relationship Between Social Vulnerability and Community Resilience to Hazards. *Social Indicators Research*, *122*(2), 391–409. https://doi.org/10.1007/s11205-014-0698-3

Berrouet, L. M., Machado, J., & Villegas-Palacio, C. (2018). The vulnerability of socio—ecological systems: A conceptual Framework. *Ecological Indicators*, *84*(September 2017), 632–647. https://doi.org/10.1016/j.ecolind.2017.07.051

CARE. (2020). *Global Rapid Gender Analysis for Covid-19*. 1–20. https://reliefweb.int/sites/reliefweb.int/files/resources/Global rapid gender analysis for COVID-19.pdf

CDC. (2020). *Assessing Risk Factors for Severe COVID-19 Illness*. https://www.cdc.gov/coronavirus/2019-ncov/covid-data/investigations-discovery/assessing-risk-factors.html

Chan, E. Y. Y., Huang, Z., Lam, H. C. Y., Wong, C. K. P., & Zou, Q. (2019). Health vulnerability index for disaster risk reduction: Application in belt and road initiative (BRI) region. *International Journal of Environmental Research and Public Health*, *16*(3). https://doi.org/10.3390/ijerph16030380

Chin, T., Buckee, C. O., & Mahmud, A. S. (2020). Quantifying the success of measles vaccination campaigns in the Rohingya refugee camps. *Epidemics*, *30*(January), 100385. https://doi.org/10.1016/j.epidem.2020.100385

Coelho, F. C., Lana, R. M., Cruz, O. G., Villela, D., Bastos, L. S., Pastore y Piontti, A., Davis, J. T., Vespignani, A., Codeco, C., & Gomes, M. F. C. (2020). Assessing the Potential Impact of COVID-19 in Brazil: Mobility, Morbidity and the Burden on the Health Care System. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3559609

Columbia Univesity. (2020). *Mapping the Areas Most Vulnerable to COVID-19 Hospitalizations | Columbia University Mailman School of Public Health*. https://www.mailman.columbia.edu/public-health-now/news/mapping-areas-most-vulnerable-covid-19-hospitalizations

Cutter, S. L., Boruff, B. J., & Shirley, W. L. (2003). Social vulnerability to environmental hazards. *Social Science Quarterly*, *84*(2), 242–261. https://doi.org/10.1111/1540-6237.8402002

DeCaprio, D., Gartner, J., Burgess, T., Kothari, S., Sayed, S., & McCall, C. J. (2020). *Building a COVID-19 Vulnerability Index*. 1–9. http://arxiv.org/abs/2003.07347

Friedman, L. (2020). *US city COVID-19 vulnerability data - dataset by liz-friedman | data.world*. https://data.world/liz-friedman/us-city-covid-19-vulnerability-data/contributors

Fuchs, S., Birkmann, J., & Glade, T. (2012). Vulnerability assessment in natural hazard and risk analysis: Current approaches and future challenges. *Natural Hazards*, *64*(3), 1969–1975. <https://doi.org/10.1007/s11069-012-0352-9>

### Hinton, D. E., Pich, V., Safren, S. A., Pollack, M. H., & McNally, R. J. (2006). A[nxiety sensitivity among Cambodian refugees with panic disorder: A factor analytic investigation](https://libkey.io/libraries/431/articles/20410629/full-text-file?utm_source=api_536). *Journal of Anxiety Disorders, 20*(3), 281-295. doi:10.1016/j.janxdis.2005.02.006

Holand, I. S., Lujala, P., & Rod, J. K. (2011). Social vulnerability assessment for Norway: A quantitative approach. *Norsk Geografisk Tidsskrift*, *65*(1), 1–17. https://doi.org/10.1080/00291951.2010.550167

Inter Sectoral Coordination Group (ISCG). (2020). *COVID-19 : Preparedness and response for the Rohingya refugee camps and host communities in Cox ’ s Bazar District Key Preparedness and Response*. *March*, 1–4.

International Organization for Migration. (2020). *Rapid Assessment : Covid-19 Related Vulnerabilities and Perceptions of Non-Thai Populations in Thailand* (Issue April).

International Rescue Committee. (2013). In search of survival and sanctuary in the city. In *JLTA Journal* (Vol. 16, Issue 0). https://doi.org/10.20622/jltajournal.16.0\_toc1

Jvion. (2020). *COVID Community Vulnerability Map*. <https://covid19.jvion.com/>

Kaiser, H. F. (1961). A note on Guttman's lower bound for the number of common factors. *British Journal of Statistical Psychology*, 14, 1-2.

Kusenbach, M., Simms, J. L., & Tobin, G. A. (2010). Disaster vulnerability and evacuation readiness: Coastal mobile home residents in Florida. *Natural Hazards*, *52*(1), 79–95. https://doi.org/10.1007/s11069-009-9358-3

Lee, Y. J. (2014). Social vulnerability indicators as a sustainable planning tool. *Environmental Impact Assessment Review*, *44*, 31–42. https://doi.org/10.1016/j.eiar.2013.08.002

Mavhura, E., Manyena, B., & Collins, A. E. (2017). An approach for measuring social vulnerability in context: The case of flood hazards in Muzarabani district, Zimbabwe. *Geoforum*, *86*(September), 103–117. https://doi.org/10.1016/j.geoforum.2017.09.008

Moret, W. (2014). Vulnerability Assessment Methodologies: A Review of the Literature. In *United States Agency for International Development (USAID)* (Vol. 54, Issue 2).

OCHA. (2020). *COVID-19: Global Humanitarian Response Plan*.

Oversea Development Insitute. (2016). *Livelihood strategies of Rohingya refugees in Malaysia* (Issue June). https://www.odi.org/publications/10449-livelihood-strategies-rohingya-refugees-malaysia

Park, Y., Pradhan, A. M. S., Kim, U., Kim, Y. T., & Kim, S. (2016). Development and Application of Urban Landslide Vulnerability Assessment Methodology Reflecting Social and Economic Variables. *Advances in Meteorology*, *2016*(July 2011). https://doi.org/10.1155/2016/4572498

Paul M. Muchinsky. (2012). Measuring Vulnerability to Natural Hazards. In *Measuring Vulnerability to Natural Hazards : Towards Disaster Resilient Societies* (Vol. 53, Issue 9, pp. 1689–1699). https://doi.org/10.1017/CBO9781107415324.004

Ringnér, M. (2008). What is principal component analysis? *Nature Biotechnology*, *26*(3), 303–304. <https://doi.org/10.1038/nbt0308-303>

Sandin, B., Chorot, P. & McNally, R. J. (1996). Validation of the Spanish version of the Anxiety Sensitivity Index in a clinical sample. *Behaviour Research and Therapy, 34*(3), 283-290.

Sherman, M., Ford, J., Llanos-Cuentas, A., Valdivia, M. J., & Bussalleu, A. (2015). Vulnerability and adaptive capacity of community food systems in the Peruvian Amazon: a case study from Panaillo. *Natural Hazards*, *77*(3), 2049–2079. https://doi.org/10.1007/s11069-015-1690-1

Siagian, T. H., Purhadi, P., Suhartono, S., & Ritonga, H. (2014). Social vulnerability to natural hazards in Indonesia: Driving factors and policy implications. *Natural Hazards*, *70*(2), 1603–1617. https://doi.org/10.1007/s11069-013-0888-3

Smith, J. A., & Judd, J. (2020). COVID-19: Vulnerability and the power of privilege in a pandemic. *Health Promotion Journal of Australia*, *31*(2), 158–160. https://doi.org/10.1002/hpja.333

Solangaarachchi, D., Griffin, A. L., & Doherty, M. D. (2012). Social vulnerability in the context f bushfire risk at the urban-bush interface in Sydney: A case study of the Blue Mountains and Ku-ring-gai local council areas. *Natural Hazards*, *64*(2), 1873–1898. https://doi.org/10.1007/s11069-012-0334-y

Stafford, S., & Abramowitz, J. (2017). An analysis of methods for identifying social vulnerability to climate change and sea level rise: a case study of Hampton Roads, Virginia. *Natural Hazards*, *85*(2), 1089–1117. https://doi.org/10.1007/s11069-016-2622-4

Stanturf, J. A., Goodrick, S. L., Warren, M. L., Charnley, S., & Stegall, C. M. (2015). Social vulnerability and Ebola virus disease in rural Liberia. *PLoS ONE*, *10*(9), 1–14. https://doi.org/10.1371/journal.pone.0137208

Sukumaran, T. (2020). *As Malaysia battles the coronavirus, its Rohingya refugees face a torrent of hate | South China Morning Post*. South China Morning Post. https://www.scmp.com/week-asia/politics/article/3081958/malaysia-battles-coronavirus-its-rohingya-refugees-face-torrent

The Asia Foundation. (2020). *Malaysia’s Marginalized and Covid-19*. https://asiafoundation.org/2020/05/13/malaysias-marginalized-and-covid-19/

UNHCR. (2018). Culture , Context and Mental Health of Rohingya Refugees. *UNHCR: The UN Refugee Agency*, 1–72.

UNHCR. (2020). *UNHCR - Figures at a Glance in Malaysia*. UNHCR USA. <https://www.unhcr.org/en-us/figures-at-a-glance-in-malaysia.html>Vyas, S., & Kumaranayake, L. (2006). Constructing socio-economic status indices: How to use principal components analysis. *Health Policy and Planning*, *21*(6), 459–468. https://doi.org/10.1093/heapol/czl029

Weichselgartner, J. (2001). Disaster mitigation: The concept of vulnerability revisited. *Disaster Prevention and Management: An International Journal*, *10*(2), 85–94. https://doi.org/10.1108/09653560110388609

WHO. (2020a). *COVID19 Stigma Guide* (Issue February).

WHO. (2020b). *Critical preparedness, readiness and response actions for COVID-19*. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/critical-preparedness-readiness-and-response-actions-for-covid-19

WHO. (2020c). *Preparedness, prevention and control of coronavirus disease ( COVID-19 ) for refugees and migrants in non-camp settings* (Issue April).

Yoon, D. K. (2012). Assessment of social vulnerability to natural disasters: A comparative study. *Natural Hazards*, *63*(2), 823–843. https://doi.org/10.1007/s11069-012-0189-2

|  |  |  |
| --- | --- | --- |
| Domain | Variables  | Indicators |
| Health and Social  | Demographic Information | * Gender
* Age
* Marital status
* Number of children
* Population density (number of individuals in a household)
* Education level
* Employment status
* Location
* Years living in Malaysia
 |
| Health | Covid-19-related challenges | * **Symptoms of the** Covid-19 **(e.g., cough, difficulty breathing, pain in lungs), high heart rate, extreme fatigue, fever, low blood pressure, or high blood pressure)**
* **Got tested for covid-19**
* tested positive/negative for coronavirus
* know where to get tested if having symptoms
* willingness to get tested if having symptoms
* someone close to the individual tested positive for the coronavirus
* The impacts of corona measures on an individual's life
* additional difficulties in accessing legal information, support, and procedures linked to the residence status or asylum procedure since the beginning of the corona crisis.
* Since the corona crisis, the individual faced challenges for the following matters:
1. Housing situation
2. Safety
3. Food
4. Cloth
5. Support form aid organizations
6. Medical care
7. Health situation
8. Relationship with family and friends
* Quality of life worsens after the virus
 |
| Health | Knowledge of COVID-19 | * **heard about coronavirus cases reported in Malaysia.**
* **source of the information**
* **attended awareness sessions or on this topic**
* **the information that individuals are receiving about coronavirus are generally sufficient to make decisions**
* **knowing what to do if they, a member of the family or a neighbour, developed symptoms.**
* **Knowing to whom they should report and refer suspected cases.**
 |
| Health | Living situation | * households by shelter type
* Pre-existing health conditions
* Having a particular need population in households
* The existence of pregnant women
* Having an adequate food supply
* Having access to clean water
* Having access to soap and disinfectant products
* Received family hygiene kits
* being connected to the electricity grid
* Access to restrooms
* Ability to make a living during the crisis
* Having cross interaction with different groups or communities
 |
| Health | Health access and hygiene conditions (Covid-19 response)  | * precautions are taken to avoid transmitting coronavirus.
* Increased handwashing/use of hand sanitizer
* Covering nose and mouth in public
* Increased physical distance from others
* Avoid public transport
* Avoid going out of the house
* Other precautions
* Access to health facilities
* No. of health facilities
* Challenges in accessing health facilities
* Risk Communication and Community Engagement
* The establishment of isolation and treatment facilities
 |
| Social  | Social well-being and connectedness | * **Feeling of isolation**
* **Since the corona crisis, experience more/less connected with:**
1. **Family in another country**
2. **Friends in this country**
3. **Friends in another country**
4. **Colleague**
5. **Neighbours**
* The level of concern about corona crisis
* Main concerns:
1. Getting sick
2. Loved ones getting sick
3. dying
4. suffer severe financial consequences
5. difficulty getting necessary medical care
6. difficulty feeding the family
7. struggle to follow preventive measures
8. losing job
9. security situation getting worse
10. (more) violence
11. isolation from family and caregivers
12. future becoming uncertain
13. getting arrested
 |
| Social | Social Stigma and Discrimination | * different treatment by the host country government and citizens than before
* facing discrimination in accessing medical facilities
 |

Table 1: List of indicators of health and social vulnerability of refugees to Covid-19

| **Item** | **Factor I****(Covid-19 Response)** | **Factor II****(Covid-19 resilience)** | **Factor III****(Covid-19 susceptibility)** |  **Factor IV****(Basic need conditions)** |
| --- | --- | --- | --- | --- |
| 1. Did not get tested for COVID-19
 | **0.68** | -0.14 | -0.06 | -0.06 |
| 1. Tested positive for the corona virus
 | **0.51** | 0.19 | 0.32 | -0.04  |
| 1. Not willing to get tested if have symptoms
 | **0.67** | 0.07 | -0.23 | -0.07 |
| 1. Did not hear about the coronavirus cases reported in Malaysia
 | **0.67** | 0.18 | -0.53 | 0.10 |
| 1. Did not attend awareness sessions on this topic
 | **0.71** | 0.07 | 0.23 | 0.04 |
| 1. The information that individuals are receiving about coronavirus generally not sufficient to make decisions
 | **0.76** | -0.05 | -0.12 | 0.10  |
| 1. Not knowing what to do if they, a member of the family or a neighbor developed symptoms
 | **0.80** | 0.07 | -0.04 | 0.05 |
| 1. Not knowing a whom they should report and refer suspected cases
 | **0.72** | 0.13 | 0.16 | 0.37  |
| 1. The existence of pregnant women
 | **0.33** | -0.02 | -0.14 | -0.06 |
| 1. No adequate food supply
 | **0.47** | -0.06 | -0.40 | 0.35 |
| 1. Did not Receive family hygiene kits
 | **0.42** | -0.16 | 0.04 | 0.16 |
| 1. No access to latrines
 | **-0.54** | -0.02 | 0.38 | -0.04 |
| 1. No ability to make living during the crisis
 | **0.69** | -0.11 | -0.25 | 0.32 |
| 1. Did not increase handwashing/use of hand sanitizer
 | **0.77** | 0.11 | -0.05 | 0.12 |
| 1. Not covering individual’s nose and mouth in public
 | **0.80** | -0.05 | -0.08 | -0.01 |
| 1. Did not increase physical distance from others
 | **0.79** | 0.05 | -0.11 | 0.05 |
| 1. Not avoiding public transport
 | **0.69** | 0.01 | 0.20 | 0.46 |
| 1. Not avoiding going out of individual’s house
 | **0.40** | 0.06 | -0.07 | 0.42 |
| 1. Taken no other precautions
 | **0.80** | 0.01 | 0.10 | 0.08 |
| 1. Taken no precautions
 | **-0.69** | 0.02 | 0.27 | 0.01 |
| 1. Having challenges in accessing healthcare facilities
 | **-0.51** | 0.17 | 0.02 | -0.33 |
| 1. Having symptoms of the Covid-19
 | -0.15 | **0.26** | 0.16 | 0.21 |
| 1. Having trouble with housing situation
 | 0.36 | **0.62** | -0.03 | -0.14 |
| 1. Having more difficulties accessing income
 | -0.32 | **0.46** | 0.62 | 0.12  |
| 1. Having more difficulties feeling safety
 | -0.31 | **0.36** | 0.34 | -0.12 |
| 1. Having more difficulties getting food
 | -0.19 | **0.57** | 0.05 | -0.47 |
| 1. Having trouble with cloth
 | 0.16 | **0.80** | -0.02 | -0.21 |
| 1. No access to support from aid organization
 | -0.10 | **0.89** | 0.19 | -0.05 |
| 1. Having trouble with medical care
 | -0.04 | **0.84** | 0.18 | 0.05 |
| 1. Having trouble with health situation
 | -0.21 | **0.53** | 0.19 | 0.06 |
| 1. Having trouble with relationship with family
 | 0.11 | **0.79** | -0.07 | 0.01 |
| 1. Having trouble with relationship with friends
 | 0.25  | **0.61** | -0.10 | -0.14  |
| 1. Someone close to the individual tested positive for the corona virus
 | 0.18 | 0.13 | **0.44** | 0.10 |
| 1. Have negative impact of corona virus on individual’s life
 | 0.08 | 0.15 | **0.64** | -0.36 |
| 1. Difficulties accessing residence status or asylum procedure
 | -0.27 | 0.16 | **0.53** | -0.06 |
| 1. Quality of life worsened after the corona virus
 | 0.17 | 0.24 | **0.74**  | -0.19 |
| 1. Having special need population in households
 | 0.32 | 0.18 | **-0.38** | -0.26 |
| 1. No cross interaction with different groups or communities
 | 0.05 | -0.16 | **0.53** | 0.36 |
| 1. No access to clean water
 | 0.16 | -0.24 | 0.05 | **0.80** |
| 1. No access to soap and disinfectant products
 | 0.47 | 0.01 | -0.28  | **0.49** |
| 1. Not connected to the electricity grid
 | 0.15 | -0.02 | -0.21 | **0.83** |

Table 2. Principal Component Analysis of the Covid-19 Health vulnerability (orthogonal rotation)

*Note*. In the rotation, only loadings of the first four factors are reported. Highest factor loadings among the four factors are in bold.

| **Item** | **Factor I** | **Factor II** | **Factor III** |  **Factor IV** |
| --- | --- | --- | --- | --- |
| 1. Less connected with neighbours
 | **0.35** | -0.23 | 0.31 | 0.14 |
| 1. Worry about getting sick
 | **0.84** | 0.18 | -0.08 | 0.11 |
| 1. Worry about loved ones getting sick
 | **0.78** | 0.33 | -0.14 | 0.04 |
| 1. Worry about dying
 | **0.45** | 0.21 | -0.14 | -0.07 |
| 1. Worry about suffering the serious financial consequence
 | **0.76** | 0.32 | 0.11 | 0.14 |
| 1. Worry about difficulty getting the medical care they need
 | **0.87** | 0.08 | 0.01 | 0.14 |
| 1. Difficulty feeding the family
 | **0.95** | 0.13 | 0.09 | 0.08 |
| 1. Difficulty in following preventive measures
 | **0.99** | 0.04 | 0.02 | 0.01 |
| 1. Worry about losing the job
 | **0.64** | -0.01 | 0.36 | -0.13 |
| 1. Worry about the security situation will get worse
 | **0.80** | 0.17 | -0.16 | 0.24 |
| 1. Worry about lead to more violence
 | **0.76** | 0.13 | -0.02 | 0.20 |
| 1. Worry about become isolated from family and caregivers
 | **0.73** | 0.20 | -0.06 | 0.13 |
| 1. Worry about future becomes uncertain
 | **0.64** | 0.40 | 0.01 | 0.17 |
| 1. Feel socially isolated now
 | 0.32 | **0.74** | 0.02 | 0.28 |
| 1. Worry about getting arrested
 | 0.47 | **0.61** | 0.05 | 0.29 |
| 1. Differently treated by the host county government and citizens before
 | 0.29 | **0.78** | -0.07 | 0.08 |
| 1. Face discrimination in accessing medical facilities
 | 0.06 | **0.75** | -0.28 | -0.31 |
| 1. Worry about the coronavirus
 | 0.25 | 0.39 | **0.48** | -0.03  |
| 1. Not aware of risk communication and community engagement
 | -0.14 | -0.12 | **0.59** | 0.07 |
| 1. Not aware of the establishment of isolation and treatment facilities
 | -0.26 | -0.16 | **0.78** | 0.08 |
| 1. Less connected with family members
 | 0.33 | 0.25 | **-0.27** | 0.69 |
| 1. Less connected with friends in this country
 | 0.25 | -0.02 | **0.22** | 0.87 |
| 1. Less connected with colleagues
 | 0.12 | -0.14 | **0.70** | -0.09 |
| 1. Less connected with family in another country
 | 0.33 | 0.25 | -0.27 | **0.69** |
| 1. Less connected with friends in another country
 | 0.25 | -0.02 | 0.22 | **0.87** |

Table 3. Principal Component Analysis of the Covid-19 Social vulnerability (orthogonal rotation)

*Note*. In the rotation, only loadings of the first four factors are reported. Highest factor loadings among the four factors are in bold.

| **Scale** | **Health I**  | **Health II** | **Health III** | **Health IV** | **Social I** | **Social II** | **Social III** | **Social IV** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Health Factor I: Response  | 1 |  |  |  |  |  |  |  |
| Health Factor II: Resilience  | -0.04 | 1 |  |  |  |  |  |  |
| Health Factor III: Susceptibility  | -0.14 | 0.20 | 1 |  |  |  |  |  |
| Health Factor IV: Basic needs  | -0.05 | 0.77 | 0.32 | 1 |  |  |  |  |
| Social Factor I: Anxiety  | -0.28 | 0.34 | 0.17 | 0.22 | 1 |  |  |  |
| Social Factor II: Social stigma | 0.45 | 0.17 | 0.04 | 0.13 | -0.13 | 1 |  |  |
| Social Factor III: Awareness  | -0.10 | -0.04 | 0.11 | -0.07 | -0.31 | 0.11 | 1 |  |
| Social Factor IV: Isolation and fear  | 0.05 | -0.10 | 0.01 | -0.20 | -0.28 | -0.15 | -0.15 | 1 |

Table 4. Correlation matrix of the scores of the eight factors within COVID-19 Health and Social vulnerability

*Note:* Correlation results are based on factor scores of the four health factor components and four social factor components.

|  |  |  |
| --- | --- | --- |
|  | Frequencies  | Percentage (%) |
| Age  |  |  |
|  Under 18  | 22 | 8.37 |
|  18-24 | 23 | 8.75 |
|  25-34 | 49 | 18.63 |
|  35-44 | 77 | 29.28 |
|  45-54 | 66 | 25.10 |
|  55-64 | 16 | 6.08 |
|  65-74 | 7 | 2.66 |
|  75-84  | 3 | 1.14 |
| Gender  |  |  |
|  Male  | 155 | 58.94 |
|  Female  | 108 | 41.06 |
| Marital status  |  |  |
|  Married  | 156 | 59.32 |
|  Never married  | 50 | 19.01 |
|  Divorced  | 17 | 6.46 |
|  Widowed  | 40 | 15.21 |
| Number of Children  |  |  |
|  None  | 59 | 22.43 |
|  1-3  | 171 | 65.02 |
|  4 +  | 33 | 12.55 |
| Education level  |  |  |
|  No formal education  | 99 | 37.64 |
|  Primary or Secondary  | 125 | 47.53 |
|  High school or Tertiary school  | 39 | 14.83 |
| Number of individuals in the household |  |  |
|  1  | 10 | 3.80 |
|  2-4  | 173 | 65.78 |
|  4+  | 80 | 30.42 |
| Employment status  |  |  |
|  Employed  | 29 | 11.03 |
|  Not employed  | 234 | 88.97 |
| Location  |  |  |
|  Pehang  | 6 | 2.28 |
|  Johor  | 10 | 3.80 |
|  Kedah  | 13 | 4.94 |
|  Kelantan  | 15 | 5.70 |
|  Kuala Lumpur  | 187 | 71.10 |
|  Penang  | 15 | 5.70 |
|  Perak  | 6 | 2.28 |
|  Perlis  | 11 | 4.18 |
| Years living in Malaysia  |  |  |
|  Less than three years  | 18 | 6.87 |
|  3 to 5 years  | 142 | 54.20 |
|  Over five years less than eight years  | 68 | 25.95 |
|  Eight years or more  | 34 | 12.98 |

Table 4. Descriptive statistics of demographic information

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Category | Factor  | Weight | Score | Weighted Score  |
| Health Vulnerability  | Covid-19 Response (FI)Covid-19 resilience (FII)Covid-19 susceptibility (FIII)Basic need conditions (FIV) | 0.8850.6920.6590.881 | 0.8470.8100.8810.896  | 0.7500.5600.5800.789  |
| Total Score |  |  |  | 0.670 |
| Social Vulnerability  | Covid-19 related anxiety (FI)Cocid-19 Social Stigma (FII)Awareness of Covid-19 prevention (FIII)Isolation and fear (FIV) | 0.7460.7740.8260.700 | 0.8740.8860.8700.842 | 0.6520.6850.7190.590 |
| Total Score |  |  |  | 0.661 |

Table 5. Composite score



Fig 1. Vulnerability and resilience model of Rohingya refugees in Malaysia