

Research Article

A Rasch Analysis of Perceived Stigma of Covid-19 among Nurses in Indonesia Questionnaire

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Abstract

This study is the first to investigate and validate the psychometric properties of the perceived stigma of the Covid-19 questionnaire among nurses in Indonesia. The respondents in the study were 2156 nurses from various regions in Indonesia (34 provinces), consisting of 613 males (28.4%) and 1543 females (71.6%). The number of nurses consisted of 300 respondents (13.9%) from the western region of Indonesia, 1825 respondents (84.6%) from the central region of Indonesia, and 31 respondents (1.4%) from the eastern region of Indonesia. The Rating Scale Model used to investigate the questionnaire's psychometric properties. The analysis results showed that the perceived stigma questionnaire met all the psychometric aspects (unidimensionality, item fit analysis, item validity, diagnostic rating scale, and reliability). Rasch Model analysis showed a value that meets all aspects measured criterion limit. Therefore, this perception stigma questionnaire can measure the perceived stigma of Covid-19 among nurses in Indonesia.

Keywords: Covid-19; nurses; perceived stigma; Rasch Model.

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A Novel Coronavirus Disease 2019 (Covid-19) has become a global problem. The Ministry of Health of the Republic of Indonesia released the data through the website www.covid19.go.id. The data shows that the number of patients exposed to Covid-19 increases rapidly. In Indonesia, as of July 14, 2020, the number of positive cases of Covid-19 was 78.572, the number of recovered cases was 37.636, and the number of deaths was 3710.

[Kang et al. \(2020\)](#) stated that the rapid increase in the number of Covid-19 patients impacted the workload and risks faced by health workers. This situation can lead to mental health problems such as anxiety, depression, and stigma. A survey conducted by [Liu et al. \(2020\)](#) of 4679 nurses and doctors in 348 hospitals in 31 provinces in China shows the prevalence of psychological distress (15.9%), symptoms of anxiety (16%), and depression (34.6%). The mental health of health workers during a pandemic is crucial. Mental health is a health condition that is emotionally, psychologically, and socially seen in establishing interpersonal relationships that satisfy behavior, active coping, positive self-concept, and emotional stability ([Videbeck, 2011](#)).

Mental health is not a simple concept. It is closely related to happiness, joy, satisfaction, achievement, optimism, and hope. According to [Stuart \(2016\)](#), the criteria for mental health include having: a positive attitude towards oneself, self-development, self-actualization, resilience, integration, autonomy, perceptions, and self-control. An individual who can adapt to the changes that exist, then that person will be in mental health. However, on the other hand, if a person cannot adapt, there will be mental and emotional disorders, depression, and even mental disorders.

During the Covid-19 pandemic, various problems have arisen in the community. The fear of the disease create a high level of anxiety toward people, places, or things ([Bamijoko-Okungbaye, 2020](#); [Preti et al., 2021](#)). Excessive worry about the transmission of Covid-19 causes people to discriminate and stigmatize. Stigma toward Covid-19 patients and survivors

needs to be overcome through socialization and education to the public related to the understanding of Covid-19 (Dubey et al., 2020).

Health workers may experience avoidance by their family or community because of stigma. That difficult situation can become more complex (World Health Organization, 2020). Therefore, it is necessary to take appropriate steps to help health workers face psycho-social problems, especially mental disorders and stigma. Research exploring the mental health and stigma of Covid-19 vanguard nurses has been carried out by the Nursing Faculty of the University of Indonesia. The study used a test instrument to identify mental health and nurses' stigma as the vanguard of Covid-19 in Indonesia.

Accurate measurement requires a valid and reliable instrument. An accurate measurement can produce data that can describe actual conditions related to mental health problems and stigma. Furthermore, the data can be used by the government or related parties as a consideration in formulating policies to more effectively address the problem of mental health disorders and the stigma faced by nurses in Indonesia. One of the essential points is that an accurate measurement can be considered in preparing mental health care and psychological counselling programs for Covid-19 nurses in Indonesia. Therefore, it is crucial to conduct in-depth studies related to developing instruments that meet the criteria of validity and reliability.

The study aims to examine the instrument of the perceived stigma of Covid-19 among nurses in Indonesia through a psychometric approach. This research has never been done before, especially in Indonesia. According to Kean et al. (2018), psychometric evaluation in psychology and measurement in education has undergone a shift, which usually uses classical theory tests, now developing using modern test theory, such as item response theory and the Rasch measurement model. The Rasch model allows for in-depth investigations of various aspects of measurement, including dimensionality, local independence, item and test taker suitability, and the use of Wright maps (Rasch, 1960; Andrich & Marais, 2019; Rahayu et al., 2020). Wright and Mok (2004) stated some of the advantages of using the Rasch Model approach as it can: provide linear measures with the same intervals; carry out an accurate estimation process; find inappropriate (misfit) or uncommon (outliers) items; address missing data; yield replicable measurements (independence of the parameters studied). Considering those advantages, psychometric evaluation using the Rasch model is expected to produce the same quality measurements as measurements in the specific field. Therefore, the psychometric evaluation of the items in nurses' mental health and stigma identification tests in Indonesia used the Rasch model.

Method

Participants

The participants in this study consisted of 2,156 nurses from various regions in Indonesia (34 provinces). The nurses come from various health service units that handle Covid-19 (government hospitals, private hospitals, community health centers, and integrated service units). The following is a table of the characteristics of the respondents used.

Table 1.
Demographic Characteristics of the Sample

Variables	<i>M (SD)</i>	Total	Percentage (%)
Age	32.44 (7.38)		
Male		613	28.4%
Female		1543	71.6%
Centre Region of Indonesia		1825	84.6%
Western Region of Indonesia		300	13.9%
Eastern Region of Indonesia		31	1.4%

The sample used in this study was obtained using the nonprobability sampling method. The distribution of respondents in this study covered three regions. It is known that Indonesia is divided into three zones of time including: Western Region of Indonesia (Riau, Central Kalimantan Bengkulu, Central Java, West Sumatra, Kepulauan Riau, Bangka Belitung Islands, Jambi, South Sumatra, Lampung, Jakarta, Banten, Aceh, West Java, Yogyakarta, East Java, North Sumatra, West Kalimantan), Central Region of Indonesia (Bali, North Sulawesi, East Nusa Tenggara, East Kalimantan, West Nusa Tenggara, South Kalimantan, North Kalimantan, Gorontalo, West Sulawesi, South Sulawesi, Central Sulawesi, Southeast Sulawesi), Eastern Region of Indonesia (Maluku, North Maluku, Papua Barat, Papua).

Rasch Model

One of the revolutions in psychometrics is the probabilistic model introduced by George Rasch in 1960. According to [Wright and Masters \(1982\)](#), the limitations of classical theory can be overcome by using the Rasch Model approach. It is used in constructing a measurement scale more accurately. The Rasch model is a model that has been used widely in the development of measurement instruments in various fields, including mental health and psychology research ([Luszczakoski et al., 2016](#)). The Rasch model has many advantages so that the measurements are more accurate. Therefore, this study used the Rasch Model approach in evaluating the validity and reliability criteria of the developed instrument.

Rasch modeling continues to evolve not only for dichotomous but also for polytomous data. The questionnaire used to measure perceived stigma was an ordinal scale of answer choices. The Rasch model's choice in analyzing data with a rating scale is very appropriate because the rating scale response data produces ordinal data that needs to be transformed into an interval scale to increase the measurements' accuracy (Boone et al., 2014). Rating Scale Model (RSM; Andrich, 1978) is a polytomous IRT model. Let X be an ordinal item data matrix of size $n \times m$. K is an item that has the same category. The RSM mathematical equation for the probability of a v test taker getting an h score on item i is as follows,

$$P(X_{vi} = h) = \frac{\exp(h(\theta_v + \beta_i) + \omega_h)}{\sum_{l=0}^k \exp(l(\theta_v + \beta_i) + \omega_l)}$$

θ_v represents the test taker parameter while β_i represents the item location parameter. Each category h is symbolized by the ω_l category parameter, which is constant across items. It means that the item differences are in the shift β_i between items. RSM is part of the Rasch Model, so that the characteristics of the Rasch Model also apply to this model, including the assumptions of the analysis. RSM requires assumptions: Unidimensional, local independence, monotonic scale, difficulty level/threshold, ordered on the category threshold in each item (de Ayala, 2009; Distefano & Morgan, 2010). RSM analysis in this study was carried out using Winstep software (Linacre, 2016).

Results

Dimensionality Test

Table 2.
Variance of Standardized Residual

Standardized Residual Variance	Item Informations Units	
	EigenValue	Observed
Total raw variance in observations	91.04	100%
Raw variance explained by measured	75.04	82.4%
Raw variance explained by persons	21.14	23.2%
Raw variance explained by items	53.90	59.2%
Raw unexplained variance (total)	16.00	17.6%
unexplained variance in 1 contrast	2.76	3.0%

The instrument's unidimensionality is an important measure to evaluate whether the instrument developed can measure what should be measured; in this case, the perceived stigma of the Covid-19 among nurse. In the Rasch model, the principal component analysis of the residuals is used, namely the extent to which the diversity of the instruments measures what it wants to measure.

Based on the table above, the total raw variance data is 91.04%. This value is not much different from the expected value. It shows that the unidimensional conditions have been met. Linacre (2016) states that the minimum value of total raw variance to meet unidimensional requirements is at least 40%. It is supported by the table's information that all other variances that the test instrument cannot explain are below 10%. It meant that the level of independence of the test instrument items is in the item category. The unidimensional assumption based on the opinion of Linacre (1998) states that if the value of raw variance explained by Measures > 30%, then an instrument meets the unidimensional criteria. From the analysis results, the raw variance explained by measures value is more than 30%. In 2016, Linacre stated that the eigenvalue of unexplained variance in first contrast is quite small (2.76) with an observed percentage value of 3%. It also shows the dimension of an instrument.

Item Fit

Table 3.
Item Fit Summary

Entry No	Total Score	Total Count	Measure	Model S.E.	INFIT		OUTFIT		PTMEASURED	
					MNSQ	ZSTD	MNSQ	ZSTD	CORR	EXP
12	709	2156	0.81	0.03	1.22	4.3	1.26	2.8	0.34	0.40
14	737	2156	0.78	0.03	1.08	1.7	0.89	-1.3	0.45	0.41
11	779	2156	0.73	0.03	1.25	5.1	1.15	1.8	0.38	0.41
4	881	2156	0.64	0.03	1.02	0.5	0.79	-3.0	0.48	0.43
3	1074	2156	0.48	0.03	1.13	3.4	1.21	2.8	0.43	0.45
13	1081	2156	0.48	0.03	1.19	4.9	1.33	4.4	0.42	0.45
5	1247	2156	0.36	0.03	0.83	-5.3	0.75	-4.4	0.54	0.47
9	1560	2156	0.16	0.02	0.69	-9.9	0.65	-7.4	0.59	0.50
7	1625	2156	0.12	0.02	0.69	-9.9	0.59	-9.3	0.63	0.50
8	1930	2156	-0.04	0.02	0.66	-9.9	0.64	-9.0	0.64	0.52
6	2306	2156	-0.23	0.02	0.86	-5.6	0.85	-3.9	0.56	0.54
10	2466	2156	-0.31	0.02	0.70	-9.9	0.67	-9.9	0.65	0.55
15	3032	2156	-0.58	0.02	1.14	5.4	1.12	3.5	0.57	0.56
16	3884	2156	-0.60	0.02	0.64	-9.9	0.70	-9.9	0.62	0.56
1	3837	2156	-0.96	0.02	1.31	9.9	1.25	9.9	0.22	0.56
2	5258	2156	-1.84	0.03	1.44	9.9	1.33	9.9	0.31	0.52

The values in the measure column of the table above are sorted based on the logit values for each item, from highest to lowest. The logit value of 0.81 for item B11b indicates that this item is the most difficult item for respondents to answer in the given questionnaire. In

contrast, item B2 with a logit value of -1.84 indicates the easiest item for respondents to answer. The total count column contains the same value (2156). It shows that no data is missing for each item analyzed.

To determine how well the items are in an instrument, the MNSQ outfit criteria were used from 0.5 to 1.5 (Bond & Fox, 2015). From the table above, all MNSQ outfit values are in this range. It shows that all items in the questionnaire meet the criteria for item validity. Thus, the questionnaire items have the decent quality to be used in data collection related to mental health problems especially the perceived stigma experienced by Covid-19 nurses in Indonesia.

Rating Scale Diagnostic

Table 4.

Rating Scale Diagnostic Summary

Category		Observed		Observed Avrge	Sample Expect	Infit MNSQ
Label	Score	Count	%			
0	0	7086	76	-5.71	-5.70	0.98
1	1	255	3	-0.99	-1.21	0.98
2	2	764	8	0.10	-0.07	0.96
3	3	1159	13	7.36	7.45	1.11

Rating scale diagnosis is an analysis conducted to verify whether the preferred rating used is confusing to respondents or not. The Rasch model provides a verification process for the ranking assumptions used in the test instrument. The perceived stigma nurse questionnaire instrument has four answer choices of a Likert rating for each item (no, doubtful, maybe, yes).

The table above shows that the average observation starts from -5.70 logit for the choice of score 0 (no), then the choice of score 1 (doubtful) is -0.99 logit and increases to 0.10 logit for the choice of score 2 (possible), and 7.36 logit for the category of score 3 (yes). Based on the data, there is an increase in the logit value compared to the score category. This fact indicates that the respondent can ensure his choice properly.

Reliability

Table 5.
Reliability Test Summary

	Total Score	Count	Measure	Model S.E.	Infit		Outfit
					MNSQ	ZSTD	MNSQ
Mean	1499.8	1712.0	0.00	0.03	1.07	-0.4	0.93
P.SD	1145.5	0.0	1.07	0.01	0.33	6.5	0.39
S.SD	1183.1	0.0	1.10	0.01	0.34	6.7	0.41
Max.	4544.0	1712.0	1.14	0.05	1.86	9.9	2.17
Min.	403.0	1712.0	-2.97	0.03	0.70	-9.9	0.59

Real RMSE 0.04 True SD 1.07 Separation 27.73 Item Reliability .98 Model RMSE 0.04 True SD 1.07 Separation 30.37 Item Reliability 0.98 S.E. of Item Mean = 1.000

The table above describes the instrument's character, including the respondent's ability to its reliability. The item reliability value showed the number .98, which means that the value is very good. Thus, value indicates that the item will consistently provide the same measurement value for various respondents (Abdullah et al., 2012). The separation section shows that the instrument can divide respondents into several groups (Othman et al., 2012). The higher the separation value, the better the instrument.

One of the features of the Rasch Model with Winstep is to produce a map depicting the distribution of respondents' abilities and the difficulty level of items on the same scale or known as the Wright Map. As depicted below, the item difficulty level and the respondent's ability are mapped on the same measurement scale (a vertical line with logit units). The Wright map above shows that the average logit item is at a value of 0.00 logit, while the logit average of the respondent's ability is around the value of -1.2. The item difficulty level's value is in the logit range of 0.81 to -1.84, where the test-takers hardest and most capable items are placed on the scale. This figure shows that the distribution of respondents' abilities is in the range of logit values from 0.4 to -2.1.



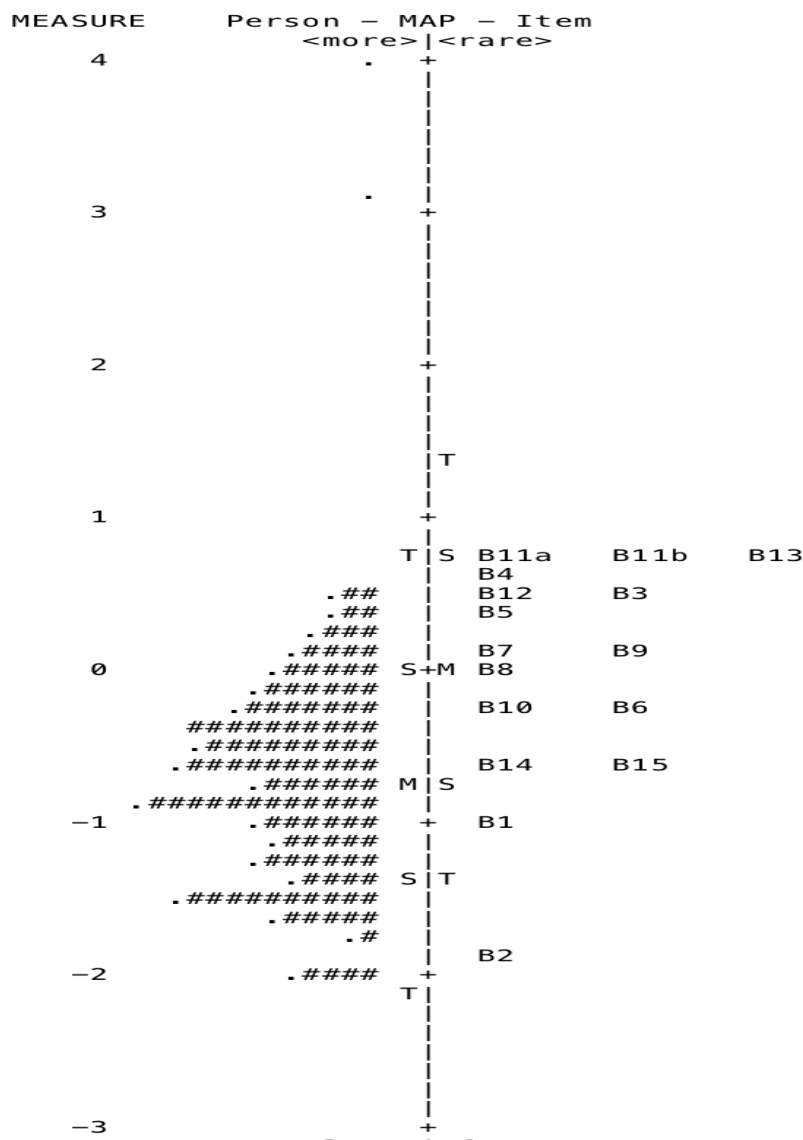


Figure 1. Wright Map

Discussions

The measurement of the perceived stigma of Covid-19 among nurses is needed in the current pandemic era since nurses are at the forefront of tackling Covid-19. How can one trust that questionnaires provide meaningful information about the condition of nurses' perceived stigma? It is needed to have a scientific justification for the response data given to the questionnaire items (Clinton et al., 2014). The scientific justification for this research is done by using the Rasch model approach. Quantitative social research often does not engage with these issues and takes questionnaire (and other) data at 'face value,' ignoring

potential problems of reliability and validity (Shryane et al., 2020). The Rasch model provides a combination analysis technique between statistical models and measurement theory to justify the validity and reliability of multivariate data (Baker, 1998).

This study used RSM to assess and validate the questionnaire on the perceived stigma of nurses for Covid-19 among nurses. The results of the analysis of the questionnaire indicate that the questionnaire items are generally adequate for measuring the nursing stigma perception in Indonesia. A unidimensional assumption is a prerequisite that needs to be met to justify the quality of the questionnaire using the Rasch Model approach (Mair, 2018). In Winstep, testing this unidimensional assumption is carried out using principal component analysis; this can be seen as a limitation in this study. Testing the prerequisite for this unidimensional assumption is important because more than one method must be used to ensure that unidimensional assumptions are met. One of the methods is Confirmatory Factor Analysis (CFA) (Flora & Curran, 2004). The results show that the questionnaire used has a high level of reliability.

Furthermore, the RSM analysis offers additional analysis of each item's performance and response category of the perceived stigma questionnaire. The diagnostic rating scale indicates that nurses have no difficulty confirming their answers to the answer choices provided on the questionnaire. The rating scale diagnostics show that respondents inconsistently select several categories; the solution to the problem is to combine the categories that are close together and re-analyzed. It increases variable clarity and eliminates noise (Fox et al., 1994; Linacre, 1999; Wright & Linacre, 1992). RSM shows that most of the stigma questionnaire items are perceived to have outfits and infits. In addition, MNSQ statistics are still within the standard criteria limit. This shows that, in general, these questionnaire items consistently measure one defined construct (Tennant & Conaghan, 2007).

The results of the fit item analysis have shown that the items usually function to measure the perceived stigma. An inappropriate question indicates a misconception between the item and the respondent. It will be useful for those who take measurements to improve the quality of these items to produce accurate data. According to Boone et al. (2004), and Bond & Fox (2015), treating an inappropriate item is by reviewing and then considering whether the item will be repaired or replaced with the new one. It ensures that the measurement carried out related to the perceived stigma is done by using qualified items in the future.

One of the revolutions in the item response theory is Wright Maps. This map illustrates the

diagnostic results for rating scale data, even for high complexity. Theoretical and conceptual definitions of latent variables need to be done properly. Well-defined definitions can improve test quality and avoid too many test items so that respondents do not waste time doing the test. It makes the responses more accurate. The Wright map allows researchers to evaluate how questionnaire items define a latent variable by following three steps: assessing the strengths and weaknesses of an instrument documenting the questionnaire item hierarchy, and comparing theory with the results of observational data (Boone et al., 2014). The Wright map above shows that the average item is one logit above the respondent's average ability. According to Boone et al. (2014), based on the literature review, the optimal test instrument is achieved when the average items are equal to the average person. However, other references state that the optimal test instrument is psychologically achieved when the average item is one logit higher than the average person (Linacre, 2010). The Wright map indicates that items B11a, B11b, B13, and B4 have a difficulty level far above the respondent's ability. The difficulty level in items B11a and B11b is likely caused by questions that unmarried nurses can only answer for item B11a, while married nurses can only answer b11b. Thus, in the results of the WINSTEP analysis, most of the nurses could not answer these questions.

Therefore, on the Wright map, B11a and B11b are detected as questions with difficulty levels above the test-taker's ability. This matter needs to be considered by the test developer to review the analysis results before deciding to dispose of the item (Downing, 2006; Haladyna & Rodriguez, 2013). The level of difficulty of this difficult question does not mean that the item in question must be discarded. Instead, it will be better if it is reviewed and corrected. Meanwhile, items B13 and B4 have different cases. In terms of editorial, the questions used are concise. However, these two items have a difficulty level above the respondent's ability. It is most likely caused by unfocused questions so that respondents cannot ensure the choice of response they provide.

The limitation in this study is that the unidimensional test used is the principal component analysis method. To strengthen further the testing of unidimensionality assumptions in the questionnaire used, there is a need for a more in-depth study that applies other methods to test the unidimensionality of this questionnaire, for example, by using Confirmatory Factor Analysis (CFA) (Flora & Curran, 2004). Besides, the respondents in this study are from various regions throughout Indonesia. This regional difference certainly affects the cultural variations of the multiple respondents in this study. It may cause bias in the items used. Therefore, it is necessary to have further research regarding the differential item function test

for each item to further strengthen the psychometric evaluation so that the data obtained can honestly describe the condition in the field.

Conclusion

Based on the results of the response analysis that has been carried out on the psychometric properties of the perceived stigma of Covid-19 among nurses in Indonesia questionnaire, most of the items in the questionnaire used are good in terms of psychometric aspects (unidimensionality, item fit analysis, item validity, diagnostic rating scale, and reliability). Furthermore, this questionnaire can collect data related to mental health problems and perceived stigma faced by Covid-19 nurses. The data can be used to consider the government and related parties in formulating programs to follow up on these problems. Further research can increase measurement accuracy, including by testing the assumption of unidimensionality using other methods such as factor analysis. In addition, further can also be done to improve the quality of the measurement by considering the function of differential information on the questionnaire items.

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Competing interests

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Appendix

Questionnaire of Perceived Stigma of COVID-19 among Nurses in Indonesia

Item	Indonesian Version	English Version
1	Apakah anda lebih senang orang lain lebih mengetahui kondisi anda sekarang?	Would you prefer other people to know more about your current condition?
2	Apakah anda pernah bercerita kepada orang terdekat anda mengenai kondisi anda sekarang?	Have you ever told your closest relatives/friends about your current condition?
3	Apakah anda merasa rendah diri karena kondisi anda sekarang?	Do you feel inferior because of your current condition?
4	Pernahkah Anda dipermalukan karena kondisi anda sekarang?	Have you ever been humiliated because of your current condition?
5	Apakah orang-orang disekitar anda tidak menghormati anda akibat kondisi anda sekarang?	Do people around you disrespect you because of your current condition?
6	Apakah menurut anda jika orang lain berinteraksi dengan anda, hal ini dapat berpengaruh buruk terhadap orang tersebut?	Do you think that if other people interact with you, this can adversely affect that person?
7	Apakah anda merasa telah dijauhi orang lain akibat kondisi anda sekarang?	Do you feel that others have shunned you because of your current condition?
8	Apakah orang lain akan menolak mengunjungi rumah anda Karena kondisi anda sekarang?	Will other people refuse to visit your home because of your current condition?
9	Jika orang-orang mengetahui kondisi anda, apakah hal ini dapat menyebabkan mereka memandang rendah keluarga anda?	If people found out about your condition, could this cause them to humiliate your family?
10	Apakah anda ,merasa bahwa kondisi anda sekarang dapat mempengaruhi kehidupan sosial anda di masyarakat?	Do you feel that your current condition can affect your social life in society?
11. a	Untuk anda yang belum menikah, apakah anda merasa kondisi anda sekarang telah menyebabkan kesulitan untuk menikah?	Do you feel that your current condition has made it difficult for you to get married to those who are not married?

11. b	Untuk anda yang sudah menikah, Apakah anda merasa bahwa kondisi anda sekarang menyebabkan masalah dalam pernikahan anda?	For those of you who are married, do you feel your current condition is causing marriage problems?
12	Apakah anda merasa bahwa kondisi anda sekarang membuat keluarga atau kerabat anda kesulitan untuk menikah?	Do you feel that your current condition makes it difficult for your family or relatives to get married?
13	Pernahkah anda diminta untuk menjauhi lingkungan tempat tinggal anda?	Have you ever been asked to stay away from your environment?
14	Pernahkah anda memutuskan sendiri untuk menjauh dari komunitas di lingkungan anda?	Have you ever decided to stay away from the community in your neighborhood?
15	Karena kondisi anda merawat pasien covid-19, orang lain berpikir bahwa anda juga memiliki kesehatan seperti pasien COVID-19?	Because of your condition treating COVID-19 patients, do other people think you also have health problems like COVID-19 patients?

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