Validation of Urban Community Survey Regarding Pandemic Flu Influenza A (H1N1) Using Rasch Measurement Tools

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Abstract—**This has made an attempt to apply the Rasch measurement model in the field of health sciences to validate the response behavioural patterns of local urban community regarding the risk of Pandemic Flu, Influenza A (H1N1). The variables include subjects' response behaviour towards HINI treatment effectiveness, knowledge, perceived risk, attitude and preventive practices towards HINI. Following this is the investigation of the nature of associations between the binary response patterns (knowledge) and the selected explanatory variables in the study (age, education status, effectiveness, perceived risk and preventive practices towards H1N1). The study used secondary survey data provided by the Department of Population Health and Preventive Medicine (PHPM), Faculty of Medicine, UiTM Shah Alam which were collected from communities residing at two different locations in Selangor, Malaysia. Results from the study show that community with different characteristics or background to some extent have provided true responses displaying moderate degree of knowledge and awareness towards the risk of H1N1. Significant association between knowledge and education status has also been detected.**

Index Terms: Risk of Influenza A (H1N1), Knowledge, Awareness, Response behaviour, Rasch measurement model, Logistic Regression Model

I. INTRODUCTION

A new influenza virus usually referred to as ''swine flu'', or commonly known as pandemic influenza A (H1N1) [1] is the most recent pandemic disease that has affected the world's population [2]. According to World Health Organization (WHO), it started infecting humans in Mexico and spread rapidly into several countries throughout the world. Malaysia is no exception where the first pandemic wave occurred between April and September, 2009. During that time, there was a wide coverage in the mass media on the government efforts and practices on how to control the transmission of pandemic influenza A (H1N1) [1]. The pandemic flu is of great concern to the world community particularly in Malaysia because the public may not be very receptive towards the extent of danger of this disease. Due to the possibility of pandemic influenza A H1N1, majority of the population had taken no action to change their lifestyle [3].

During an infectious Influenza A (H1N1) virus outbreak, personal preventive behaviors are very crucial and any individual should take responsibility for helping control emerging infectious diseases since the disease could spread widely in the community [4]. Effort has been made by several parties including a recent study by [5] which looked at the public's knowledge and attitude towards A H1N1. However, the extent of public truthful perception towards the Pandemic Flu is yet to be investigated. Hence, this would be the focus of the present study in which public responses towards the items of measurement shall be investigated for its validity and reliability using the Rasch measurement tools.

II. LITERATURE REVIEW

A. The Community's Behaviour Towards Pandemic Influenza A (H1N1)

It is crucial for individuals to have a good and correct knowledge as it will influence on both attitudes and practices in order to reduce the risk of getting A (H1N1). On the other hand, attitude may not be translated into behavioral changes without sufficient knowledge [6]. Eventhough there is a reduction of H1N1 transmission, education of health is still required [7].

Worldwide, the disease of pandemic A (H1N1) and its spread was increasing rapidly, few of respondents believed they were at high to very high risk of getting A (H1N1). Risk perceptions means perceived seriousness of health treats [8]. In previous study, [9] found perception of risk influences the community behavioral response regarding pandemic influenza.

Education status may also play a role on the choice of source for information regarding H1N1. The lower education group preferred television as a source of information and

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received added information compared to those with higher education status [10].

As strategies for avoiding infection, the generally approved public health measures according to [11] were washing hands, avoidance of infected people, avoidance of large gatherings of people and wearing masks in public places. Among influenza cases, the use of facemasks in public places especially in crowded areas was the most preferred [6] [12]. In contrast, [13] and [14] found respondents rated hand washing as the best practice regarding pandemic A (H1N1). However, [15] found that urban residents used proper disinfectants in washings hands as the preferred practice.

During the pandemic flu, the public were aware of the good health practice such as washing hands and use of face mask in public places when having flu symptoms [6]. [16] and [6] also reported that respondents considered face masks as the most effective preventive measure.

This is in contrast to [17] who found the most effective measure for preventing Influenza A (H1N1) was quarantine while herbal remedies and anti-virals were rated as the least effective measures [18].

The government and health authorities are important to provide consistent and clear updated information about the existence of disease that can evaluate whether the community understood about the messages that has been delivered [7]. In a previous study, [19] found that specific actions are required in order to reduce risks and also communicate about the government's plans and resources are important to improve good practices for helping control emerging infectious diseases.

B. *Rasch Measurement Model*

Rasch model is not only used in the social sciences area of research [20] but it also expanded to other areas such as health science [21] and engineering fields [22]. Rasch models are appropriate for assessing and measuring psychological variables such as abilities, attitudes, and personality traits where the purpose is to obtain a precise and objective measurement. Rasch model would be a good tool for calibration of items that provides a criterion for successful measurement [23].

A Rasch measurement model is an additive, conjoint, fundamental measurement by which one can create linear, objective measures applicable to the human sciences, education, psychology, medicine and health, marketing and business and judging in sports. A major advantage of Rasch analysis is that it places the items and the persons along a single-logit scale ruler [24]. The heart of the Rasch measurement model illustrates the Person-Item Distribution Map (PIDM) [25]. Other displays include item characteristic curve and scalogram. Basically, Rasch analysis is used so that the data are fitted to the model, rather than fitting the model to the data [26]. If the data does not fit the model well, this Application of Rasch Measurement Model in other studies

Rasch person-item distribution map is used to evaluate the range and precision of a new vision function questionnaire in early analysis (prior to full sample) [21]. The self-report questionnaire was used to measure the difficulty that persons with different level of visions loss performing daily activities. At the end of study, the researchers found that the questionnaire has good range and well centered with respect to the person measure distribution based on the Rasch reliability and validity analysis.

Rasch analysis had also been used to assess the psychometric properties of a disease-specific health related quality of life instrument using the patient's perspective on disease impact [27]. The questionnaire that could quantify the quality of life of people with refractive correction by spectacles, contact lens and refractive surgery in the age group was developed and validated using Rasch analysis [28]. Other than that, [29] reported Rasch analysis has been used to explore the potential of computerized adaptive testing (CAT) for measuring health status in knee osteoarthritis. Besides that, the application of a Rasch rating scale model has been used to investigate the effect of gender, ethnicity, practice site, income, and age on levels of job satisfaction among practicing pharmacists [30]. Rasch model has also been applied to describe the psychometric properties of the ICS questionnaire in a cataract population [24].

III. METHOD

A. *Source of Data*

This study had used secondary survey data provided by the Department of Population Health and Preventive Medicine (PHPM), Faculty of Medicine, UiTM Shah Alam [31]. The survey was conducted between December 2009 and April 2010 at two separate locations in Selangor. About 1000 communities from the age of 13 and 70 years old have participated in the study. The data were classified into several categories, which include demographic characteristics, knowledge, perceived risk, information, treatment effectiveness, attitude and preventive practices towards HINI. For the purpose of this study, 300 subjects were selected at random from the actual sample for cross validation and analysis. The results in the next few sections are based on this sample subjects.

B. *Data Analysis Procedure*

The data was analyzed using Winsteps 3.68.2 software. In the initial analysis, the reliability and validity of the instrument were examined. A Rasch measurement tools was then used to measure respondents' ability to provide appropriate response against items in the instruments, measured on an interval scale data and placed on the common logit scale. Other Rasch measurement tools are used to evaluate the fit of the data to the Rasch probability model. Fig. 1 show the analysis and validation process of the survey instruments.

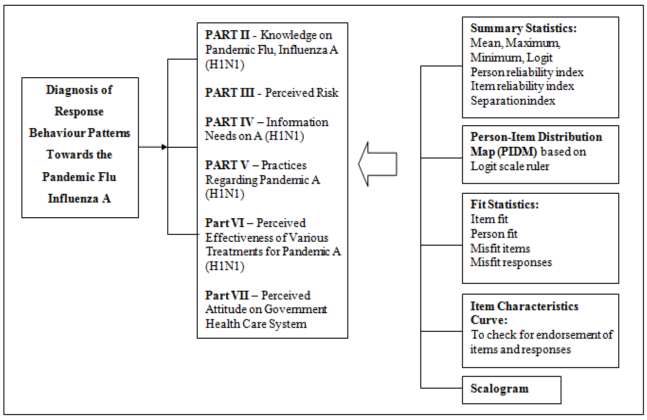

Figure 1. Analysis and Validation Process

IV. RESULTS

Since knowledge was identified as the main factor therefore it has been rigorously discussed in this study.

A. Reliability

From Table 1, the person ability and item difficulty for respondents' knowledge on Pandemic Flu, Influenza A shows a low person reliability index (0.34) and a high item reliability index (0.98). However, person reliability can be further improved by identifying and removing some misfit responses from the data. The high item reliability index indicates that items are replicable for measuring the same traits. The separation index for person is 0.72 which is considerably low to represent the spread of items and person along a continuum. This could be due to item redundancy and less variability of person's responses on the trait. For item separation index, it shows a large index of 8.01. This indicates a broader continuum for items than for person, and broader range of item difficulties.

TABLE 1. SUMMARY STATISTICS FOR KNOWLEDGE ON PANDEMIC FLU, INFLUENZA A – INITIAL ANALYSIS

	RAW SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	24.7	10.0	1.17	.55	.98	.0	.99	.1
S.D.	2.7	.1	.75	.10	.52	1.0	1.05	.8
MAX.	29.0	10.0	2.72	.91	2.94	3.0	6.60	2.8
MIN.	12.0	9.0	-2.06	.47	.13	-3.1	.11	-1.4

REAL RMSE .61 ADJ.SD .44 SEPARATION .72 Person RELIABILITY .34
MODEL RMSE .56 ADJ.SD .50 SEPARATION .90 Person RELIABILITY .44
S.E. OF Person MEAN = .05

MAXIMUM EXTREME SCORE: 36 Persons
VALID RESPONSES: 99.9%

Person RAW SCORE-TO-MEASURE CORRELATION = .92
CRONBACH ALPHA (KR-20) Person RAW SCORE RELIABILITY = .61

SUMMARY OF 10 MEASURED Items

	RAW SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	653.1	263.8	.00	.12	1.00	.0	.99	.2
S.D.	116.9	.4	1.10	.05	.10	.8	.23	1.2
MAX.	770.0	264.0	1.62	.20	1.21	.8	1.41	2.6
MIN.	457.0	263.0	-1.41	.08	.84	-1.9	.68	-1.2

REAL RMSE .14 ADJ.SD 1.10 SEPARATION 8.01 Item RELIABILITY .98
MODEL RMSE .13 ADJ.SD 1.10 SEPARATION 8.23 Item RELIABILITY .99
S.E. OF Item MEAN = .37

UMEAN=.000 USCALE=1.000
Item RAW SCORE-TO-MEASURE CORRELATION = -.98
2638 DATA POINTS. APPROXIMATE LOG-LIKELIHOOD CHI-SQUARE: 3148.88

In order to increase the separation index for person may require a suitable range of items difficulty, hence increasing the variability of person responses. Other possible remedy would require observing the responses for unusual fit through identification of misfit item and misfit response strings. Knowledge items were subjected to validity check using fit statistics. This is shown in Table 2. This procedure is performed in order to improve the reliability index of instrument.

TABLE 2. FIT STATISTICS FOR KNOWLEDGE ON PANDEMIC FLU, INFLUENZA A ITEMS BEFORE REMOVAL OF MISFIT RESPONSES

ENTRY NUMBER	RAW SCORE	COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PTMEA CORR.	EXACT MATCH OBS%	EXACT MATCH EXP%	Item
2	457	263	1.62	.08	1.04	.6	1.30	2.6	.57	36.1	40.4	eat pork
1	472	264	1.53	.08	.88	-1.9	.88	-1.2	.63	40.9	40.2	direct contact of infected animals
3	556	264	1.00	.08	1.05	.8	1.00	.0	.55	34.5	39.7	direct contact with person H1N1
4	598	264	.73	.08	1.00	.0	1.01	.2	.53	35.6	39.2	direct contact with contaminated surface
7	677	264	.13	.09	1.07	.8	1.10	.7	.40	65.9	64.5	H1N1 be treated
10	724	264	-.38	.12	.94	-.4	1.41	1.8	.32	79.9	79.8	control the spread H1N1
9	754	264	-.91	.15	.84	-.8	.82	-.6	.32	87.5	88.7	H1N1 be prevented
6	757	263	-1.06	.17	.94	-.2	.99	.1	.32	91.6	90.2	transmitted from person to person
8	766	264	-1.26	.19	.99	.0	.69	-.9	.32	93.6	92.4	H1N1 cause death
5	770	264	-1.41	.20	1.21	.8	.68	-.8	.24	92.4	93.3	cough/sneeze
MEAN	653.1	263.8	.00	.12	1.00	.0	.99	.2		65.8	66.8	
S.D.	116.9	.4	1.10	.05	.10	.8	.23	1.2		24.9	23.4	

Table 2 shows the fit statistics for knowledge items. MNSQ values of between 0.6 and 1.4 are productive for measurement (Bond and Fox, 2007). It is observed that persons and items can be overfit or underfit. Underfit (or noise) is indicated by a mean square (MNSQ) greater than 1.4 and standardized fit (ZSTD) greater than 2.0. Item 10 is observed to have an outfit value slightly over 1.4. This is an underfit and one that is expected as the agent of unusual or inappropriate response. Overfit is indicated by a mean square value of less than 0.6 and negative standardized fit. Overfit is explained as too little variation in the response pattern, and presence of redundant items. No items were found to be redundant as MNSQ is greater than 0.6.

Misfit responses were identified and hence removed from the data set. The process continues until all misfit responses were removed. The process of identifying and removal of unusual responses of clinic attendees' perception towards knowledge on Pandemic Flu, Influenza A was done in three stages until there was no misfit response. The summary statistics after each removal of misfit response is summarized in Table 3.

TABLE 3. SUMMARY STATISTICS FOR KNOWLEDGE ON PANDEMIC FLU, INFLUENZA A ACROSS THREE STAGES OF RELIABILITY CHECK

	Before removal of misfit response		After removal of all misfit response (Stage 1)		(Stage 2)		(Stage 3)	
PERSON	MNSQ	ZSTD	MNSQ	ZSTD	MNSQ	ZSTD	MNSQ	ZSTD
Mean	0.98	0	1	0	0.99	0	0.98	-0.1
Standard Deviation	0.52	1	0.55	1	0.69	1.1	0.84	1.1
Separation index	0.72		1.03		1.38		1.86	
Reliability index	0.34		0.51		0.66		0.78	
ITEM	MNSQ	ZSTD	MNSQ	ZSTD	MNSQ	ZSTD	MNSQ	ZSTD
Mean	1	0	0.97	0	1.29	0.7	0.85	-0.4
Standard Deviation	0.1	0.8	0.23	1.3	0.45	1.4	0.29	1.6
Separation index	8.01		8.1		6.82		9.95	
Reliability index	0.98		0.98		0.98		0.99	

Table 3 shows that the mean and standard deviation values for person measure indicate a more acceptable value close to 1.0. Separation index shows an increasing value from 0.72 to 1.86.

The indices indicate that person ability to response can be categorized into 1 to 2 levels of person ability. The initial person reliability index was estimated at 0.34 in stage 1, but it increases to 0.78 in stage 3 after the removal of all misfit responses. For summary statistics of items, there is an improvement in the fit statistics as compared to before removal of misfit responses. Overall item reliability index is estimated at 0.98 but increases slightly to 0.99 as items are more replicable. Items spread also shows more variability as separation index increases from 8.01 to 9.95.

TABLE 4. FIT STATISTICS FOR KNOWLEDGE ON PANDEMIC FLU, INFLUENZA A ITEM AFTER REMOVAL OF MISFIT RESPONSES

ENTRY NUMBER	RAW SCORE	COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PTMEA CORR.	EXACT MATCH OBS%	EXACT MATCH EXP%	Item
2	330	218	4.49	.11	1.06	.6	1.00	.1	.69	63.8	66.8	eat pork
1	361	224	4.21	.11	.79	-2.5	.72	-1.2	.71	54.9	57.7	direct ctc of infected animals
3	473	231	3.10	.10	1.25	2.6	1.03	.2	.67	52.8	58.2	direct ctc with person H1N1
4	521	227	2.29	.11	.97	-.2	.89	-.4	.71	68.7	68.1	direct ctc with contaminated surface
7	571	210	.56	.17	1.04	.3	.82	-.4	.64	78.6	82.7	H1N1 be treated
10	618	214	-1.62	.30	.77	-.7	.26	-1.1	.64	96.7	95.7	control the spread H1N1
9	648	219	-3.75	.46	.83	-.3	.26	-1.5	.54	98.2	98.0	H1N1 be prevented
6	662	223	-4.19	.49	.14	-3.1	.01	-3.9	.52	99.6	98.1	H1N1 be transmitted
8	678	227	-5.08	.71	.83	-.1	.02	-4.9	.42	98.7	99.1	H1N1 cause death
5	666	222	-7.64	1.76	MINIMUM ESTIMATED MEASURE							cough/sneeze
MEAN	552.8	221.5	-.76	.43	.85	-.4	.56	-1.5		79.1	80.5	
S.D.	121.6	6.1	4.07	.48	.29	1.6	.39	1.7		18.5	16.9	

Table 4 shows that no item falls under the underfit range. This indicates that there is no existence of misfit response in the data set. However, items 6 and 8 were found to be redundant as MNSQ are less than 0.6. PIDM map in Fig. 2 is executed to show the distribution of items and persons on a common logit scale prior to the removal of misfit response strings.

B. Items and Persons Distributions

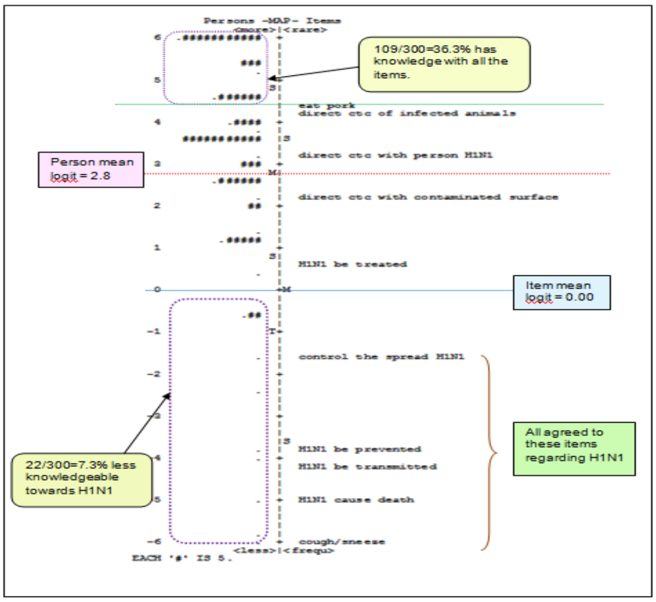

Figure 2. PIDM for Knowledge on Pandemic Flu, Influenza A (H1N1(Before Removal of Misfit Responses)

Fig. 2 shows that person ability is distributed within ±2.0 standard deviation which is approximately normal. The position of respondents with high capability (easy to endorse) is above the mean logit scale, while the position of respondents with lower capability (difficult to endorse) is below the mean logit scale. The item which is difficult to endorse relates to people who eat pork at 1.60 logit on the upper scale, while the item which is easy to endorse relates to droplets from cough/sneeze of H1N1 at -1.40 logit on the lower scale.

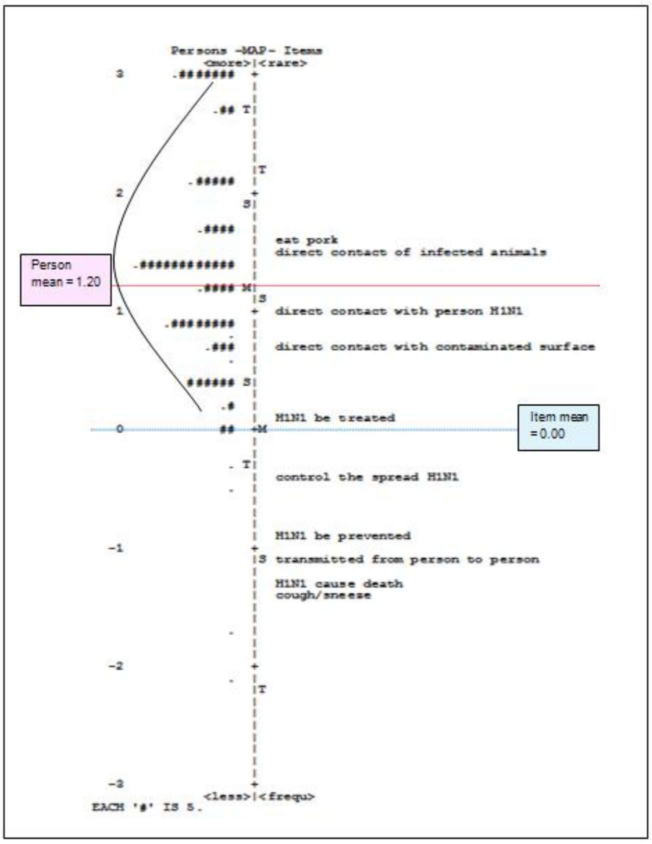

Figure 3. PIDM for Knowledge on Pandemic Flu, Influenza A (H1N1) (After Removal of Misfit Responses)

Fig. 3 shows the Person-Item Distribution Map (PIDM) for community's knowledge on Pandemic Flu, Influenza A (H1N1). In the map, there are about 36.3% respondents who indicated a high level of knowledge regarding H1N1. Meanwhile, there are about 7.3% respondents who are considered as less knowledgeable towards H1N1 as their logit falls below the item mean logit at 0.00.

Knowledge items are considered as quite difficult to endorse by respondents because more than half of the items are located above the item mean logit at 0.00. The most difficult item to endorse is Question 2, which is "People who eat pork".

Most respondents thought this item is difficult to endorse because they are unsure whether H1N1 can be spread through eating bacon, ham, or any other pork products. Overall, about 60% respondents are able to endorse the knowledge items. This indicates that respondents have some knowledge on pandemic flu, influenza A (H1N1) based on several sources.

TABLE 5. KNOWLEDGE-ITEM LOGIT BEFORE AND AFTER REMOVAL OF MISFIT RESPONSES

No	Items A. Mode of transmission	Item logit Before removal of misfit responses		Item logit After removal of misfit responses
A1	Eat pork	1.62		4.49
A2	Direct contact of infected animals	1.53	Item logit increases	4.21
A3	Direct contact with person H1N1	1.00	→	3.10
A4	Direct contact with contaminated surface	0.73	Easy to difficult	2.29
A5	H1N1 be treated	0.13		0.56

No	Items B. Mode of transmission	Item logit Before removal of misfit responses		Item logit After removal of misfit responses
B1	Control the spread H1N1	-0.38		-1.62
B2	H1N1 be prevented	-0.91	Item logit decreases	-3.75
B3	Transmitted from person to person	-1.06	→	-4.19
B4	H1N1 cause death	-1.24	Difficult to easy	-5.08
B5	Cough/sneeze	-1.41		-7.64

Table 5 shows an increment of logit values for all items after removal of misfit responses. After removal of misfit responses, all items logit change from either easy to difficult to endorse or from difficult to easy to endorse. For example, item A1 has item logit 1.62 before removal of misfit items and increases to 4.49 logit after removal of misfit response. As the logit values increases, the difficulty of the items also increases. In this case, item A1 changed from easy to difficult to endorse by respondents. For item B5, the item logit value decreases from -1.41 before removal of misfit responses to -7.64 after removal of misfit responses. This suggests that only valid items are represented by true responses.

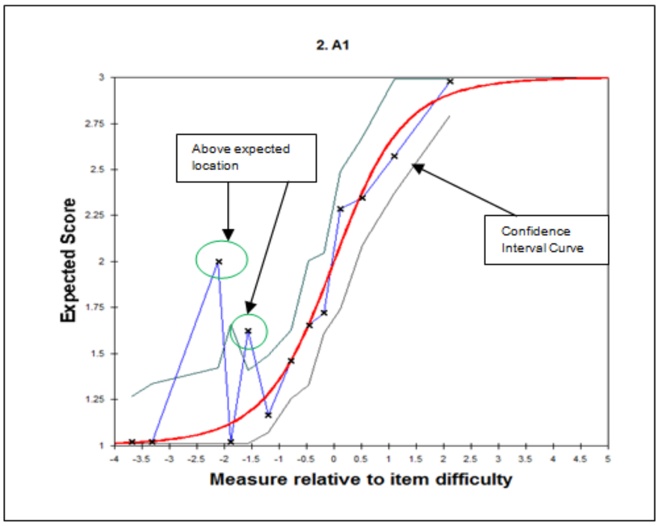

Figure 4. The Expected Empirical ICC for Item A1 "Eat Pork"

Fig. 4 shows the Item Characteristics Curve (ICC) for Knowledge item A1. This item asks respondents about the modes of transmission of H1N1 by people who eat pork. It can be seen that the expected score of responses are located outside the 95% confidence limit, an indication of a possible misfits.

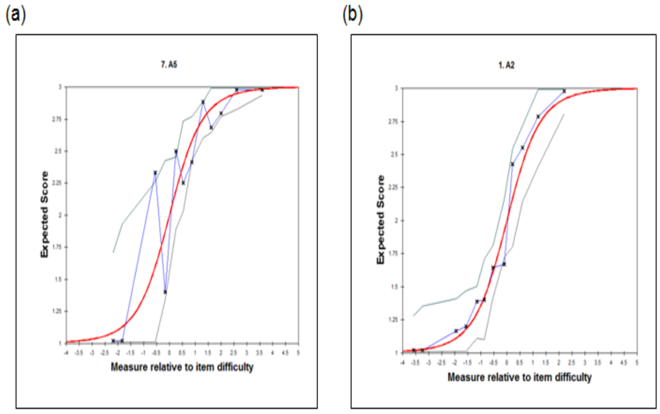

Figure 5. The Expected Empirical ICC for a) Item A5 "H1N1 Be Treated" and b) Item A2 "Direct Contact of Infected Animals"

Fig. 5 shows no unusual response patterns as indicated by the points which fall within the 95% confidence limit. Item Characteristics Curves (ICCs) in Fig. 6 illustrate the response patterns for easy to endorse for items "cough/sneeze", "H1N1 cause death" and "Transmitted from person to person". These ICCs illustrate various patterns of responses from easy to moderately easy to endorse where the distribution of expected logit scores are within the 95% confidence limit and mainly fall along the sigmoid curve.

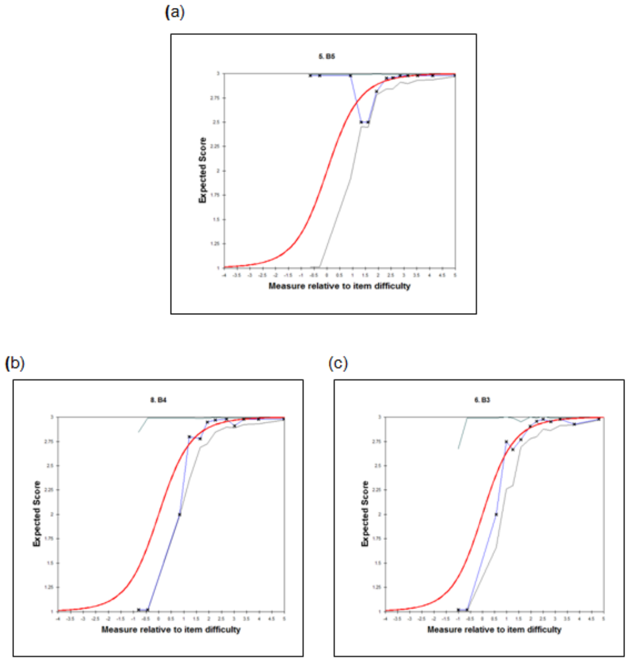

Figure 6. The Expected Empirical ICC for a) Item B5 "Cough/Sneeze" b) Item B4 "H1N1 Cause Death" and c) Item B3 "Transmitted from Person to Person"

C. Multiple Logistic Regression

This study had also investigated the nature of associations in the response patterns between knowledge on Pandemic Flu Influenza A H1N1 and perceived risk of getting A H1N1, practices regarding pandemic A H1N1, perceived effectiveness of various treatments towards the Pandemic Flu Influenza A H1N1, age of respondents and education status of respondents.

TABLE 6. SUMMARY STATISTICS FOR KNOWLEDGE ON PANDEMIC FLU, INFLUENZA A – INITIAL ANALYSIS

Variables in the Equation

	B	S.E	Wald	df	Sig.	Exp(B)
Age	0.002	0.014	0.014	1	0.906	1.002
Education			10.359	4	0.035	
Primary	0.537	0.887	0.366	1	0.545	1.710
Secondary	1.628	0.843	3.731	1	0.053	5.093
College	1.928	0.929	4.306	1	0.038	6.877
University	2.861	1.115	6.580	1	0.010	17.481
Risk	-0.217	0.185	1.373	1	0.241	0.805
Practices	0.074	0.357	0.043	1	0.836	1.077
Effectiveness	0.920	0.231	15.888	1	0.000	2.509
Constant	-2.974	1.213	6.013	1	0.014	0.051

Table 6 shows that college and university education status contributed significantly to the knowledge towards H1N1 ($p < 0.05$). This implies the importance of higher education status in assessing knowledge about H1N1. The effectiveness of various treatments for H1N1 also shows a significant contribution to the odds of knowledge status of respondents towards Pandemic Flu Influenza A H1N1 compared to age, risk and practices.

TABLE 7. SUMMARY OF LOGISTIC REGRESSION RESULTS AND ODDS RATIO (SIGNIFICANT PREDICTORS)

Variables in the Equation

	B	S.E	Wald	df	Sig.	Exp(B)
Education			13.975	4	0.007	
Primary	0.596	0.867	0.472	1	0.492	1.814
Secondary	1.580	0.838	3.553	1	0.059	4.857
College	1.752	0.889	3.887	1	0.049	5.765
University	2.739	1.093	6.282	1	0.012	15.475
Effectiveness	0.884	0.201	19.413	1	0.000	2.419
Constant	-3.124	1.022	9.352	1	0.002	0.044

Table 7 shows the significant effect of education status and effectiveness of various treatments for H1N1 shows a significant contribution to the odds of knowledge status of respondents towards Pandemic Flu Influenza A H1N1.

Taking into consideration all significant predictors, the final regression model is:

$$\log\left(\frac{\pi}{1-\pi}\right) = -3.124 + 0.596 * primary + 1.580 * secondary + 1.752 * college + 2.739 * university + 0.884 * effectiveness \quad (1)$$

Therefore, education status and effectiveness of various treatments for H1N1 will be used in predicting the knowledge status of respondents towards H1N1.

TABLE 8. TEN HIGHEST PREDICTED PROBABILITIES OF KNOWLEDGEABLE RESPONDENTS

Education Level	Effectiveness	$\pi = P(\pi(y)=1)$
University	Very effective	0.98258
University	Very effective	0.98258
University	Effective	0.98258
University	Very effective	0.98258
Secondary	Effective	0.98029
College	Effective	0.98029
Secondary	Very effective	0.97929
University	Effective	0.97317
University	Effective	0.97013
Secondary	Very effective	0.97013

Table 8 illustrates the first ten highest predicted probabilities of those who were considered as highly knowledgeable in H1N1 issues. The results indicate that respondents who were knowledgeable had college and university education and their perception towards various treatments for pandemic A H1N1 was rated as very effective.

V. CONCLUSION

This study have successfully shown that response behavioral patterns towards the risk of pandemic Flu Influenza A (H1N1) of Urban Communities can be assessed using the Rasch measurement tools. Fit statistics and misfit response strings were effectively used to identify unusual and inappropriate response patterns and items. This was illustrated in the improved reliability index for person responses when misfit responses were excluded. This was further demonstrated in the Person-Item Distribution Map which has able to show the distribution of the persons' true response against the agent of response (i.e., item constructs). This map which is the heart of Rasch analysis illustrates a picture of the true responses after considerable amount of person reliability measure. This measure can be enhanced based on the exclusion of misfit responses, hence resulted in a good person reliability index. Identification of true response is also supported by a measure of fit statistics which is used to identify misfit response strings based on mean square and standardized values from infit and outfit indices.

The study has illustrated that person who has more of the trait of interest; in this case their knowledge towards the risk of pandemic Flu Influenza A (H1N1) flu is reflected by a wide range of person with different levels of ability with items of some difficulty levels. The study concludes that persons with different characteristics and social background have provided a true response on their knowledge towards the risk of pandemic Flu Influenza A (H1N1) flu which resulted in communities displaying moderate degree of knowledge and awareness towards the risk of H1N1.

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