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Validation of the Perceived Neighborhood Environment Questionnaire for diabetes mellitus type 2 patients

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ABSTRACT

The success of diabetes mellitus type 2 (DMT2) therapy does not solely depend on laboratory test results, but is also influenced by the patients' quality of life (QoL). Patients' QoL is affected by numerous factors, including distress and their home environment. This study aims to acquire a valid and reliable instrument concerning neighborhood conditions felt by DMT2 subjects. The research applied a cross-sectional design with adult DMT2 patients at the Local General Hospital Moewardi Solo. The Perceived Neighborhood Environment Questionnaire (PNEQ) was translated from English to Indonesian with the procedure of forward-backward translation. Statistical analyses were conducted to determine reliability, discriminant, convergent and known-group validity. The three domains of PNEQ have low reliability (Cronbach's alpha <0.7), while three questions have not met convergent validity and only one question has not attained discriminant validity. The PNEQ can be used on the Indonesian people with further explanations on questions that have not achieved reliability and validity.

Key Words: DM type 2, PNEQ, validation, Indonesia

1. INTRODUCTION

The population of diabetes mellitus type 2 (DMT2) patients continues to rise over time. Comparison between the years 2013 and 2015 shows that there was an increase in DMT2 cases by two million people (from 8.5 to 10 million).[1,2] This trend kept Indonesia in seventh place among countries with the largest number of diabetes subjects in the world.[1,2] The perpetually growing population of DMT2 sufferers does not only burden the state budget for health,[3] but also plays an important role through the quality of life (QoL) and psychological wellbeing of the afflicted,[4] particularly in aspects of psychological health and productivity.

The QoL in DMT2 patients encompasses a very broad domain, but our study focuses on their distress and neighborhood environment. Distress is the psychological display of DMT2 sufferers in the shape of anxiety, stress or depression, or the loss of willingness to perform activities.[5] Distress can come from within the DMT2 subject, such as unstable emotional states, or external factors, such as difficulties in contacting the doctor, therapeutic management or unsupportive family and surrounding circumstances.[5–8]

Few studies have delved deeper into the extent of inconvenient living environment around the DMT2 patient as

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a source of distress. DMT2 subjects are typically recommended to maintain a healthy lifestyle and always do physical exercise, but such advice is sometimes considered hard to apply due to, for instance, a lack of viable sports facilities or restricted access to healthy food.[5,8,9] To our knowledge, only one international publication has studied the correlation between distress and the home environment of DMT2 patients.[5]

QoL consists of three main components, namely physical and psychological conditions and the ability to interact with the surrounding environment.[10] One factor that greatly influences these three aspects is health, which accounts for the growing popularity of the term Health-Related Quality of Life (HRQoL). DMT2 is a chronic disease that strongly contributes to the decline of its sufferer's QoL,[4,11] but good treatment can minimize the impact of such decline. The form of such treatment is not limited to the realization of proper therapies,[4] but also involves providing appropriate psychological interventions to DMT2 patients.[6,7,12]

In addition to sociodemographic factors and clinical conditions, there are several internal factors which act as determinants of QoL in DMT2 subjects. The incidence of complications triggered by DMT2 is one of the primary causes of the deterioration of QoL.[13] However, the selection of suitable therapies would recuperate or even improve the QoL of DMT2 patients.[13–16] The internal state of a DMT2 sufferer also exerts a significant influence on blood sugar control, including the belief that the undertaken therapy will give a positive impact towards DMT2.[17]

Distress is a psychological condition prompted by a specific cause or a combination of factors, such as emotional weight, family issues, therapeutic management and/or relationship with the doctor.[6,7,18] If not handled well, this condition may develop into a more severe psychological state, such as depression or even, in certain cases, suicide committed by the DMT2 subject.[18] Emotional burden as a source of distress mostly occurs in DMT2 patients who are at a productive age[19,20] and female.[21] Meanwhile, male subjects or those in the retirement age group tend to suffer from distress triggered by therapy management, immediate family members, doctors who treat them, quality of health service, and HbA1c[6,7,12,19,20]

It is reported that the safety and comfort of the surrounding neighborhood generate positive effects on the DMT2 patient.[9] Likewise, supporting facilities around the house, including accessibility to healthy foods and feasible sports facilities, can favorably influence the psychological condition of a DMT2 subject.[5,8,9]

The identification of neighborhood as a reason for DMT2 distress requires a valid and reliable instrument. This background serves as rationale for this study, which aims to translate and adapt the Perceived Neighborhood Environment Questionnaire (PNEQ)[5,8] to Indonesian and validate the translated version.

The purpose of this research is to obtain a valid and reliable instrument regarding the neighborhood conditions of DMT2 patients.

2. RESEARCH METHOD

2.1 Participants

The main participants in this study are DMT2 outpatients aged at least 18 and willing to participate by signing a form of consent as participant at RSUD Moewardi, Solo. Other participants are 10 healthy individuals not afflicted by DMT2 (in the adaptation phase). This study has been approved by Ethic Committee of Universitas Ahmad Dahlan Number 011703028.

2.2 Research instrument

The PNEQ[5,8] is a questionnaire with 32 statement items about the home environment of the DMT2 patient. All those statement items are classified into five domains, which are physical order (10 items), land use and services (13 items), social norms and values (2 items), social capital (4 items), and social order (3 items). There are two scales with six answer options on each: "strongly agree", "agree", "disagree", "strongly disagree", "don't know" and "refuse to answer" for the first, and "excellent", "good", "fair", "poor", "don't know" and "refuse to answer" for the other.

Concerning permission to use the questionnaire, Dr. Genevieve Gariepy as its owner has authorized the translation and adaptation of the questionnaire into Indonesian, as well as the validation of the translated version. This permission was granted via email from genevieve.gariepy@mail.mcgill.ca on 23 November 2016.

2.3 Research procedure

2.3.1 *Translation*

This process goes by two stages, namely forward and backward translations.[22,23] It began with forward translation, in which the authentic PNEQ document was sent to at least two Indonesian independent and credible translators. Results of their translation were compared with the original PNEQ, and then the research team established the final document, labelled document 1 (D1). In the process of backward translation, D1 was delivered to a minimum of two native English speakers able to use oral and written Indonesian well, who then translated D1 back to English. This process aims to

ensure that D1 has been properly translated from English to Indonesian, so that the end product is the proper Indonesian version, which we labelled document 2 (D2).

2.3.2 *Adaptation*

This process is the next step after the translation phase was completed, where D2 was adapted for 10 healthy individuals and 10 DMT2 subjects. The healthy participants contribute by expressing their opinions on each item of the questionnaire, while members of the DMT2 group are the main participants of this research. The adaptation stage sets to identify (i) which items are enquired the most by participants, (ii) inputs from DMT2 patients, (iii) the duration needed to complete the questionnaire. Results of this process were discussed with the research team, and the final product became document 3 (D3).

2.3.3 *Validation*

This step is the core of our study, where D3 was distributed to a larger group of DMT2 patients. The research uses a cross-sectional design. The minimum sample size required is 200 (within fair and adequate category, with not more than 40 questionnaire items).[24–26] It is otherwise suggested that the minimum sample size is ten times the number of questionnaire items to be validated ($10 \times 32 = 320$).[27,28] Informed consent is given to the subjects before the study.

2.4 Data analysis

The indicators used in this analysis are Cronbach's alpha, convergent and discriminant validity, and known-group validity.

3. Research results

The characteristics of patients in this study can be seen in Table 1. It shows that in terms of sex the frequency of female patients (57.1%) is greater than that of the male ones (42.9%). According to age, the DMT2 patients mostly fit into the age range of > 60 years old, where the average age is 60.98 ± 9.22. This differs from data of the International Diabetes Federation (IDF) which states that the age of diabetes sufferers is typically within the range of 40-59 years old.[2] Meanwhile, the majority of respondents in this survey had their last formal education at senior high school or lower (primary and junior high school) (56.32%), worked as employees (49%) and rode a motorcycle as daily transport (62.45%). Based on data about DMT2, many of the patients involved in this study had had DMT2 for more than five years with an average of 10.15 ± 7.9 years. Long-time DMT2 patients are prone to both macrovascular and microvascular complications, which is also the case in this research, in that 190 patients had already had complications. Regarding medication, oral drug combinations were more common among patients (32.2%) than insulin or singular oral drugs. Oral medicine is indeed the first-line therapy for DMT2. A therapy outcome of DMT2 patients is their blood glucose level, where the average fasting blood sugar (FBS) level of the patients was 155.3 ± 64.38 mg/dl and their mean level of postprandial blood sugar two hours after meals (2-hour PPBS) was 200.6 ± 71.15 mg/dl.

Table 1. Patient characteristics (n = 261)

Characteristic	Frequency	%
Sex		
Male	112	42.9
Female	149	57.1
Education level		
No formal education	19	7.3
≤ Senior high school	147	56.32
≥ Undergraduate	84	32.1
Daily travel mode		
Private car	36	13.79
Motorcycle	163	62.45
Public transport	46	17.62
Walking	6	2.29
Employment		
Unemployed (including housewives)	77	29.5
Entrepreneur	51	19.5
Employee (public/private)	128	49.0
Complication		
Microvascular	104	39.8
Macrovascular	86	33.0
Administered medicine		
Oral	47	18.0
Insulin	83	31.8
Oral-oral	84	32.2
Oral-insulin	41	15.7
	Mean	**SD**
Age	60.98	9.22
DM duration	10.15	7.9
Fasting Blood Glucose (FBS)	155.3	64.38
Post Prandial Blood Glucose (PPBS)	200.6	71.15

The PNEQ validation began with its translation to Indonesian, which applied a forward-backward translation method. The forward translation process was done by two independent translators working as English lecturers at Universitas Ahmad Dahlan (UAD) Yogyakarta. Disparity in perception was discussed between both translators until agreement was reached. The Indonesian version of the PNEQ was then translated back to English by two independent native speakers in the Netherlands. No significant difference in perception took place between both native speakers as English has a broad vocabulary. The following process was pilot testing on DMT2 patients and healthy subjects. In general, both subject groups were able to accept and comprehend the Indonesian PNEQ. The words or sentences that were modified to be more suitable for Indonesian speakers are listed in Table 2.

Table 2. PNE questionnaire pilot testing results

No	Word in English	Word in Indonesian	Number in questionnaire
1	trash and litter	*sampah*	8
2	vandalism	*kerusakan* Note: Examples for this word were also given, e.g. glass hit by thrown stones.	9
3	graffiti	*tulisan corat-coret*	10
4	There are busy roads to cross when out for walks in my neighbourhood.	*Jalan di sekitar tempat tinggal saya selalu ramai ketika saya akan berolahraga dengan berjalan kaki. Karena kondisi ini, saya pernah terpaksa menyeberang jalan walaupun lalu lintasnya sangat ramai.*	17
5	How would you rate the policing in your neighbourhood?	*Bagaimana penilaian Anda terhadap kinerja aparat kepolisian atau petugas keamanan lainnya (petugas ronda, hansip) dalam menjaga ketertiban dan keamanan di lingkungan sekitar tempat Anda tinggal?*	20
6	People in my neighbourhood share the same values.	*Orang-orang di lingkungan saya sepaham untuk menganut nilai-nilai luhur yang sama, misalnya sebagian besar dari warga, tetap menjaga nilai-nilai saling menghormati (terutama kepada orang yang lebih tua), bekerja keras, kejujuran, and sebagainya.* Note: Examples of noble values were added.	29
7	Violence is not a problem in my neighbourhood.	*Lingkungan tempat saya tinggal tidak mengalami gangguan terkait dengan tindakan kekerasan, misalnya tindakan premanisme atau tawuran pelajar mampun antar warga atau tindakan kekerasan lainnya.*	31
8	There are too many people hanging around on the streets near my home.	*Terlalu banyak orang berlalu lalang di jalan-jalan sekitar tempat saya tinggal. Hal ini terkadang mengganggu ketika saya berolah raga.*	32

Table 3. Reliability test results

No	Domain	Cronbach's alpha
1	Physical order	0.61
2	Land use and services	0.60
3	Social norms and values	0.93
4	Social capital	0.93
5	Social order	0.50

The outcome of the reliability test is presented in Table 3. Three domains had Cronbach's alpha values under 0.7, namely physical order, land use and services and social order. This shows that the questions in those domains ought to be modified so that the respondents can understand them. The reliability scores of the domains in the PNEQ indicate that they are reliable, since, for a new instrument, a reliability score of 0.5-0.6 is seen acceptable. Several preceding publications on the same type of questionnaire directed at the influence of neighborhood on physical activities give reliability scores of less than 0.7.[29,30] This owes to the numerous answer options provided in the questionnaire, which possibly confounded the patients. Conversely, the questions in the domains of social norms and values and social capital are more understandable and often manifest in everyday situations in people's lives, allowing participants to answer more consistently and hence producing considerably high reliability. Questions concerning physical order, land use and social order are less relevant with neighborhood contexts, accounting for the respondents' lack of comprehension over the points of the questions. Examples of such questions include those about vandalism and graffiti, in that not all neighborhoods face such issues. In the translating process, both words have been equipped with descriptions to facilitate the subjects' understanding, but oral explanations are still necessary to enhance clarity. A similar case was found in the validation of the questionnaire regarding neighborhood situations among the population of Nigeria.[31] For future surveys, these questions will still be used, as they relate to the psychological state of diabetes patients, especially security and convenience in practicing daily physical activities as a part of a series of efforts to maintain their lifestyle.

Results of convergent and discriminant validity analyses are given in Table 4. The questions with Pearson's correlation values of less than 0.4, comprising numbers 11, 13 and 17, do not satisfy the precondition for convergent validity. The significant number of question items not achieving this type of

validity may reflect the overextending distribution of answers on the Likert scale, offering too many options for the questionnaire's users. Furthermore, the words "sangat" (very) and "agak" (somewhat) may further confuse users in making their choices.

Table 4. Convergent and discriminant validity test results

Item	Pearson's Correlation Coefficient				
No.	Physical Order	Land Use and Services	Social Norms and Values	Social Capital	Social Order
1	.472**	.234**	.187**	.234**	.178**
2	.455**	.269**	.202**	.167**	.105
3	.416**	.056	.032	.108	.069
4	.463**	.017	.003	.172**	.053
5	.447**	-.011	-.055	.023	.081
6	.428**	.004	.060	.057	.035
7	.513**	-.027	-.028	.044	.217**
8	.521**	.071	-.005	.164**	.167**
9	.564**	.166**	.092	.209**	.236**
10	.551**	.149*	.135*	.137*	.152*
11	.184**	.254**	.066	.228**	.172**
12	.138*	.642**	.237**	-.023	.153*
13	.078	.335**	.158*	.060	.088
14	.062	.463**	.072	.061	.114
15	-.108	.403**	-.061	-.056	.000
16	-.038	.517**	.155*	-.011	.064
17	.214**	.093	-.038	.024	.158*
18	-.016	.355**	.160**	.057	.080
19	.146*	.450**	.129*	.153*	.181**
20	.029	.358**	.027	-.003	.144*
21	.221**	.439**	.148*	.210**	.335**
22	.178**	.451**	.161**	.218**	.285**
23	-.050	.482**	.080	-.131*	.048
24	.130*	.231**	.959**	.085	.114
25	.082	.203**	.956**	.045	.092
26	.183**	.112	.086	.931**	.290**
27	.245**	.082	.096	.943**	.303**
28	.257**	.152*	-.009	.844**	.338**
29	.224**	.085	.081	.913**	.286**
30	.216**	.159*	.145*	.505**	.594**
31	.131*	.290**	.012	.159*	.776**
32	.184**	.172**	.088	.062	.620**

*: $p < .05$; **: $p < .01$

The questions within the domains reach discriminant validity if the correlation of each question with its domain is stronger than with any other domain. The only question not to attain discriminant validity is number 17, which pertains more to physical order. These results in discriminant validity are satisfactory, as each question item relates to its domain apart from two items. Prior research on neighborhood environment and safety for physical activities also show that the reliability and construct validity are at an acceptable level but not a decent one.[32] A study in Nigeria found that the validity of the questionnaire on surrounding conditions for physical activities ranges from low to moderate, because not all respondents made use of their neighborhood for everyday actions. For instance, in question number 17 regarding the situation on the road when the respondent crosses it, one who goes from one place to another on foot will observe the surroundings more than one using another transport mode. The weak relationship in this construct validation has also been revealed by other studies in developing countries.[31] Similar research carried out in developed countries which uti-

lize neighborhood more in daily pursuits would yield better construct validation outcomes.[33]

The known-group validity analysis was based on groups of complications and administered drugs. Results of this analysis can be observed in Tables 5 and 6. According to the analysis, there is no significant difference between groups in complications and consumed medicines, except in the physical order of the complication groups. This discrepancy mostly due to the complications that impact on the physical order of the patients.

Table 5. Known-group validity by complication

Complication	Physical order (mean ± SD)	Land use and services (mean ± SD)	Social norms and values (mean ± SD)	Social capital (mean ± SD)	Social order (mean ± SD)
Microvascular	2.47 ± 0.18	2.13 ± 0.21	2.11 ± 0.53	1.93 ± 0.29	2.25 ± 0.30
Macrovascular	2.54 ± 0.20	2.15 ± 0.21	2.05 ± 0.54	1.96 ± 0.32	2.27 ± 0.26
p value	.016*	.654	.423	.474	.530

* significantly different

Table 6. Known-group validity by administered medication

Utilized drug	Physical order (mean ± SD)	Land use and services (mean ± SD)	Social norms and values (mean ± SD)	Social capital (mean ± SD)	Social order (mean ± SD)
Oral	2.53 ± 0.19	2.17 ± 0.22	2.11 ± 0.63	1.95 ± 0.36	2.31 ± 0.25
Insulin	2.48 ± 0.20	2.13 ± 0.20	2.10 ± 0.52	1.95 ± 0.29	2.26 ± 0.30
Oral-insulin	2.51 ± 0.17	2.12 ± 0.21	2.09 ± 0.46	1.96 ± 0.30	2.28 ± 0.25
Insulin-insulin	2.50 ± 0.15	2.16 ± 0.21	2.18 ± 0.41	1.84 ± 0.37	2.29 ± 0.26
p value	.56	.35	.88	.38	.65

The purpose of PNEQ is to identify the factors of distress in DMT2 patients relating to five domains of their neighborhood, consisting of physical order (10 items), land use and services (13 items), social norms and values (2 items), social capital (4 items), and social order (3 items).

Table 7. PNEQ domains' mean

Domain	Mean	SD
Physical order	2.50	0.19
Land use and services	2.14	0.22
Social norms and values	2.11	0.51
Social capital	1.94	0.32
Social order	2.28	0.27

Table 7 displays the resulting means from PNEQ, where the highest score (negative perception) lies within the physical order domain at 2.50, while the lowest (positive perception) is in the domain of social capital with 1.94. This is the first study using the PNE questionnaire carried out in Indonesia, and its outcomes indicate that the DMT2 patients hold fair perceptions towards their neighborhood environment, which can support their everyday activities in improving their lifestyle. The weakest value in the social capital domain does not necessarily imply that DMT2 patients regard their surroundings negatively, but the low reliability of social order items suggests that further comprehension of the domain is needed.

One limitation of this research is that the authors did not make any observations on the home environment of DMT2 patients, to the extent that no explanation can be offered for any plausible event that may pertain to questions with low reliability and validity. It is therefore recommended that subsequent investigations conduct qualitative studies on the questions in domains that are not yet considered reliable and valid.

4. Conclusion

The majority of question items in the Indonesian version of PNEQ have fulfilled the criteria of reliability and convergent validity, whereas its discriminant validity is acceptable. In future studies, the researchers will more closely re-examine the composition resulting from the forward-backward translation.

Conflicts of Interest Disclosure

The authors declare that they have no competing interests.

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