The Patient - Patient-Centered Outcomes Research (2021) 14:283–293
https://doi.org/10.1007/s40271-020-00452-5

ORIGINAL RESEARCH ARTICLE

How Do Respondents Interpret and View the EQ-VAS? A Qualitative Study of Three Asian Populations

Rachel Lee-Yin Tan[1] · Zhihao Yang[2] · Ataru Igarashi[3] · Michael Herdman[4] · Nan Luo[1]

Published online: 18 September 2020

Abstract

Background This study aimed to understand how respondents from three Asian countries interpret and perceive the EuroQol Visual Analogue Scale (EQ-VAS).

Method Data were from a project that aimed to examine the cultural appropriateness of EQ-5D in Asia. Members of the general public from China, Japan, and Singapore were interviewed one-to-one in their preferred languages. Open-ended questions (e.g. What does "best imaginable health" mean to you?) were used to elicit participants' interpretation of the labels of EQ-VAS. How the scale could be improved was also probed. Thematic and content analyses were performed separately for each country before pooling for comparison.

Results Sixty Chinese, 24 Japanese, and 60 Singaporeans were interviewed. Interpretations of the label "Best Imaginable Health" varied among the participants. Interestingly, some participants indicated that "Best Imaginable Health" is unachievable. Interpretations for "Worst Imaginable Health" also varied, with participants referring primarily to one of three themes, namely, "death," "disease," and "disability." There were different opinions as to what changes in health would correspond to a 5- to 10-point change on the EQ-VAS. While participants opined that EQ-VAS is easy to understand, some criticized it for being too granular and that scale labels are open to interpretation. Findings from the three countries were similar.

Conclusion It appears that interpretations of the EQ-VAS vary across Asian respondents. Future studies should investigate whether the variations are associated with any respondent characteristics and whether the EQ-VAS could be modified to achieve better respondent acceptance.

1 Introduction

Though originally developed for use in Europe, the EQ-5D questionnaire [1] is currently used worldwide not only to describe and value health, but also to inform important policy decisions based on economic evaluations. EQ-5D is a generic, self-complete questionnaire comprising two parts. The first part is the EQ-5D descriptive system (DS), which asks respondents to describe their health in five dimensions (Mobility, Self-Care, Usual Activities, Pain/Discomfort, and Anxiety/Depression) using either three or five problem levels (EQ-5D-3L and EQ-5D-5L, respectively). A utility/index score can be generated using the responses to the DS to indicate the value of the described health state [1]. The second part of the EQ-5D questionnaire is the EuroQol Visual Analogue Scale (EQ-VAS), a 20-cm long vertical visual analog scale. The EQ-VAS contains a five-line instruction for respondents to rate their health on the day of the survey

✉ Nan Luo
ephln@nus.edu.sg

Rachel Lee-Yin Tan
racheltanleeyin@u.nus.edu

Zhihao Yang
zhihao_yang_cn@126.com

Ataru Igarashi
atarui1@mac.com

Michael Herdman
mherdman@ohe.org

[1] Health Systems and Behavioural Sciences Domain, Saw Swee Hock School of Public Health, National University of Singapore, Block MD1, 12 Science Drive 2, Singapore 117549, Singapore

[2] Guizhou Medical University, Guiyang, Guizhou, China

[3] Department of Drug Policy and Management, Graduate School of Pharmaceutical Sciences, The University of Tokyo, Tokyo, Japan

[4] Office of Health Economics, 105 Victoria Street, London SW1E 6QT, UK

Key Points

Asian respondents appear to understand the EuroQol Visual Analogue Scale (EQ-VAS), but interpret it quite differently.

The inter-respondent variations in interpretation of the EQ-VAS warrant further investigations.

The EQ-VAS might be easier to use if it is less granular.

using a vertical, thermometer-like scale marked from "0" to "100," with "100" labeled as "Best Imaginable Health" and "0" labeled as "Worst Imaginable Health."

The EQ-VAS is conceptually different from the EQ-5D DS, which measures health using a common set of dimensions and which allows for the calculation of an index score based on the general public's health preferences. The EQ-VAS, on the other hand, seeks the respondent's overall rating of their current health. The EuroQol Group recommends that both parts of the questionnaire should be administered [2].

The EQ-VAS was originally developed for use in Europe by a group of European researchers, and its suitability for use in other cultures has not been widely assessed. A recent systematic review found mixed evidence on the validity of EQ-VAS in five of ten Asian countries [3]. However, no study to date has investigated how Asian respondents interpret the EQ-VAS, how they use it to rate their own health, or whether they consider it an appropriate method for such assessment. The current study, which is part of a larger project aimed to examine the cultural appropriateness of the EQ-5D questionnaire in Asia, aimed to address this knowledge gap. Qualitative methods were employed to answer the following research questions: How do Asians use the EQ-VAS scale? How do they interpret the scale elements of EQ-VAS? How do they perceive a change in scores on the EQ-VAS? Are there differences in interpretations and use of the VAS across Asian populations?

2 Methods

2.1 Participants

The interviews were first conducted in Singapore, then simultaneously in China and Japan. All participants had to (1) be a native who has lived in the country for the past 5 years, (2) be able to converse in the local language, (3) not be a family member of a recruited participant, and (4) be willing to take part in the study and be audio recorded. A common set of quotas were set to ensure a heterogeneous sample in terms of gender, educational level, and experience with illness. Depending on the demographics in each country, additional quotas were applied. For example, in China, where there is a huge distinction between rural and urban areas, an additional quota was applied based on residence location. In Singapore, which is a very multi-ethnic country, an additional quota for ethnicity was applied.

In China, participants over 18 years old were recruited via convenience sampling from six different cities, namely, Shanghai, Guangzhou, Chengdu, Jinan, Harbin, and Guiyang. In Japan, participants between 20 and 69 years of age from Tokyo, Chiba, Saitama, and Kanagawa Prefecture were invited to take part in the study. These participants were members of a panel maintained by a commercial survey company. In Singapore, Chinese, Malay, and Indian participants over 40 years old were recruited from the general public using convenience sampling methods.

The interviews were first conducted in Singapore, followed by China and Japan. The original age criterion was set at 40 because the study team believed that, compared to this group of participants, younger participants might not have had as much experience with poor health or as much opportunity to reflect upon the concept of health. For that reason, the older age group was thought more likely to make a richer contribution when discussing the concept of health. However, after data collection in Singapore, the team members decided to lower the age limit for China and Japan in order to achieve a more heterogeneous sample. Based on the age of legal adulthood, the lower age limit for China and Japan samples was reduced to 18 and 20 years, respectively. Due to the high cost of performing face-to-face interviews in Japan, the sample size was strictly determined by data saturation. Data saturation was deemed achieved when no new themes and information emerged from the last five transcripts. Given the geographical and ethnic diversity in China and Singapore, respectively, the sample sizes for those countries were based on quotas as well as data saturation.

2.2 Data Collection

Consenting participants were interviewed face-to-face and one-on-one by a trained interviewer in quiet areas such as participants' homes or a meeting room. All interviews were recorded with a digital voice recorder. Participants' demographic characteristics were also collected.

A standard semi-structured interview guide was designed by the investigators to elicit participants' understanding and conceptualization of health in general before exploring their perceptions of the EQ-5D-5L questionnaire. The interview consisted of three main sections: (1) broad, open-ended questions were used to elicit the health concepts important to the participants; (2) participants were tasked to complete

the EQ-5D DS, provide their opinions on the adequacy of the DS, and suggest how it could be improved to make it more relevant and adequate for them; and (3) participants were asked to complete the EQ-VAS independently and were then questioned on how they used the scale (Did you consider choosing a number that was not a multiple of 5?) and their interpretations of the labels and numbers on the EQ-VAS scale (What does "100" or "the best health you can imagine" mean to you? Do you think you can achieve "100" in the future? Did you achieve "100" in the past? What does "0" or "the worst imaginable health" mean to you?). Participants were also invited to share how they valued a change in health score of 5–10 points (What would a 5- to 10-point increase from 80 points represent? What type of change in health status would lead to a 5- to 10-point drop in score?). Suggestions for how the EQ-VAS can be improved were also probed for. "Anything else?" and "Why?" were used to prompt respondents. This paper presents the results from the third section of the interview.

2.3 Data Analysis

Data for interpreting the labels "Best Imaginable Health" and "Worst Imaginable Health" were analyzed using thematic analysis [4, 5]. Thematic analysis allows for the derivation of the dimensions and domains participants used to interpret the labels [4, 5]. All coders coded the transcript line by line. Focused coding was then conducted, where the common initial codes were grouped together into themes. After which, axial coding was used to organize the themes into domains. To ensure consistency between the coders, a codebook was developed for each country. The codebook comprised five fields (code, title, definition, example, inclusion/exclusion criteria, and relationship to other codes). The definitions of the labels used were based on participants' interpretation. Content analysis [4] was used to analyze the remaining data. The main difference between thematic and content analysis is that the latter allows for quantification of the data [4]. Data from the three countries were analyzed separately before being pooled for comparison.

All interviews from China were transcribed and analyzed in the native language (Mandarin) by two research assistants from China before being translated to English. In the case where the two coders could not reach consensus, the principal investigator (NL) was consulted.

All interviews from Japan were transcribed in the native language (Japanese). The external survey company which conducted the interviews in Japan completed the open coding process. After the open codes were generated, the codes were translated into English. AI oversaw the translation process and made sure that no information was lost during translation. After which, the translated open codes were analyzed by a research assistant from Singapore.

Interviews in Singapore were either conducted in Mandarin or English. Interviews in Mandarin were transcribed and translated to English before analysis. The analysis was conducted by two research assistants from Singapore. In the case where the two coders could not reconcile differences, the principal investigator (NL) was consulted. One research assistant from Singapore pooled the data across the countries, following closely to the codebooks developed for each country for comparison.

Excerpts were used to support the analysis: prefixes C, J, and S were used to indicate participant's country of origin (China, Japan, and Singapore). Where necessary, minor modifications were made to the excerpts for easy understanding, such as when colloquial language was used or when a sentence was incomplete.

3 Results

3.1 Demographics

Sixty native Chinese were interviewed. Among those, 29 were male. The mean age was 48.2 (range 20–80) years. A majority of participants had either directly recieved or provided care (66.7%), were married (80%), and had at least a university degree (50%) (Table 1). A majority of participants lived in an urban location in China (75%) (data not shown).

Twenty-four native Japanese were recruited and interviewed, of which 12 were male. The mean age was 46.3 (range 27–68) years. A majority of participants did not have experience with receiving or giving care (79.2%). Most participants had completed secondary education (66.7%), and were married (70.8%) (Table 1).

Sixty native Singaporeans, comprising 20 Chinese, 20 Malays, and 20 Indians, were recruited and interviewed. Of the 60 participants, 28 were male, and the mean age was 58.9 (range 40–88) years. Most of the participants had either received or provided care for others (73.3%) (see Table 1). A total of six interviews were conducted in Mandarin, and the remainder were conducted in English. Since the initial analysis suggested insufficient differences between the three ethnicities to warrant being presented separately, they have been combined for presentation in this paper.

3.2 Using the EQ-VAS Scale

All participants from Japan ($n=24$) and almost all participants from China ($n=56$) and Singapore ($n=58$) chose a VAS score that was a multiple of 5 to rate their health on the day of the interview. Reasons given were that it was cognitively too challenging to express health to the degree of precision represented by the hash marks on the VAS, which

Table 1 Participants' characteristics

	China ($N=60$)	Japan ($N=24$)	Singapore ($N=60$)
Age (years)			
Mean (SD)	48.2 (15.8)	46.3 (14.4)	58.9 (10.4)
Gender, *n* (%)			
Male	29 (48.3)	12 (50)	28 (46.7)
Female	31 (51.7)	12 (50)	32 (53.3)
Care-taking experience, *n* (%)[a]			
Directly received/provided care	40 (66.7)	5 (20.8)	44 (73.3)
No experience	20 (33.3)	19 (79.2)	16 (26.7)
Highest education, *n* (%)			
Primary education or below	4 (6.7)	0 (0)	7 (11.7)
Secondary level (including "A" level, other diploma and professional qualification)	26 (43.3)	16 (66.7)	43 (71.7)
University and above	30 (50)	8 (33.3)	10 (16.7)
Marital status, *n* (%)			
Never married	12 (20)	6 (25)	4 (6.7)
Currently married	48 (80)	17 (70.8)	47 (78.3)
Separated/divorced/widowed	0 (0)	1 (4.2)	9 (15)
Occupation, *n* (%)			
Working	35 (58.3)	20 (83.3)	43 (71.7)
Homemaker/housewife	1 (1.7)	4 (16.7)	5 (8.3)
Retired	20 (33.3)	0 (0)	10 (16.7)
Unemployed	4 (6.7)	0 (0)	2 (3.3)

[a]Eight Chinese, two Japanese, and two Singaporean participants remarked that they received and gave direct care

Table 2 Reasons why participants choose only multiples of 5

Why choose "0" or "5"?	Supporting respondent quotes
Too granular	"I think it is better to use increments of 10-points." (C006) "Because I think it's impossible to rate in such granularity." (J010) "Just easier (to use increments of) 5. I mean how to quantify '97'?" (S008)
Influenced by visual cues	"I looked at the scale (points to 80 and 85 on the scale) and chose 85 because it is marked here already" (C020) "(I selected a score ending with '0' or '5') Because the scale I see is 0 or 5." (J017) "(Did not think of numbers ending with 1, 2, 3) because the numbers are all here [points to the numbers on the EQ-VAS scale]. So you know the numbers in between… I never thought of it." S016)
No difference in score, difference of less than 5 points	"To me, there is not much difference between the few points (between 60 and 65)." (C001) "I don't think this kind of thing needs such granularity. 80 and 82 would be the same." (J020) "(86, 87 or 84, 83), not much difference." (S040)

C Chinese participant, *EQ-VAS* EuroQol Visual Analogue Scale, *J* Japanese participant, *S* Singaporean participant

signify a difference of one point; that there is no difference between scores with a difference of less than 5 points; and that participants chose points on the scale that had a number printed next to them. Table 2 shows the reasons participants gave for choosing multiples of 5 to rate their health, with the corresponding example quotes.

3.3 Interpretation of the Label "Best Imaginable Health" or "100"

Participants' interpretations of "100" were classified into five themes, namely, *physical health*, *mental well-being*, *social relationships*, *medical conditions and treatment*,

Table 3 Domains and themes used to interpret "100"/"Best Imaginable Health"

Domain	Theme	Operational definition	Respondent quotes
Physical health[a]	Activities	Ability to carry out physical activities	"It means being able to perform daily activities without a problem." (J022)
	Appearance	Outward physical traits of a person	"…person with 100 looks very active." (S053)
	Physiological fitness	Physiological aspects of the body that makes a person physically fit	"…means physically you are fit. Fit like you can jump and swim like an athlete." (S009)
	Undesirable bodily sensations	Experience or lack of negative sensations	"100 means not feeling any pain, no (bodily) suffering." (J004)
Mental well-being[b]	Cognitive function	Basic functions relating to mental processes involved in knowing, learning, and understanding things	"…you can think wisely." (S035)
	Emotions	Feelings of emotional distress or positive emotional experiences	"Not being worried or having anxiety about mental and physical health is the best state of health." (J003)
	Mind-set	Persons' general attitudes or way of thinking	"100 means…being able to stay positive." (J015)
Social relationship[c]	Burden to others	Self-perception of putting mental, financial, or physical pressure on others due to own health state	"It means you don't bring trouble to your family. You can live on your own and take care of yourself." (C007)
	Quality of relationships	Degree of harmony between family and non-family members and the ability to partake in social activities	"It means you have a good relationship with your family, friends and colleagues." (C013)
Medical conditional and treatment[d]	Financial burden	Feelings of financial burden due to own health status	"In Malay we call it 'ortang', 100 means you never owe people money." (S028)
	Medical diagnosis	Presence/absence of illness confirmed by medical test(s) or the doctor	"100 means to not have any serious illnesses, especially cancer, cardiovascular diseases." (C011)
	Medical treatment	Need for medical resources including medicine prescription, medical aids, examinations, or tests as well as the other medical advice	"…means the person does not need to see a doctor." (S055)
Health promotion knowledge and behaviours[e]	Behaviors	Behaviors associated with improving/damaging health	"It means eating three meals a day at a regular time and sleeping more than six hours a day." (J001)

C Chinese participant, *J* Japanese participant, *S* Singaporean participant

[a]This domain surrounds the physical aspects of health

[b]This domain comprises status and abilities related to mental activities

[c]This domain includes themes related to the quality of interpersonal relationships and its consequences

[d]This domain surrounds medical conditions

[e]This domain refers to the knowledge and behaviors that promote good health

and *health promotion knowledge and behaviors*. Table 3 shows the domains and themes used by participants to interpret "100," with corresponding example quotes. Except for *social relationships*, all themes were mentioned by participants from all three countries. The Japanese participants were the only ones not to describe "100" in terms of *social relationships*. Participants most frequently described "100" as a combination of different themes, and differences in the combinations were apparent between and within countries. Table 4 shows the top 5 combinations of themes participants used to interpret "Best Imaginable Health," with supporting quotes.

3.4 Achievability of "Best Imaginable Health" or "100" on EQ-VAS

All Japanese and almost all Chinese (91.6%) and Singaporeans (91.6%) did not rate themselves at "100" on the VAS. Reasons given included feeling fatigued, a lack of sleep, feelings of stress or pain and discomfort, and having an

Table 4 Top 5 combination of domains used by respondents when interpreting "100"/"Best Imaginable Health," with supporting quotes

Top 5 combination of domains	Supporting quotes
Medical	"100 means that I don't have diabetes I don't have high blood pressure. No illness at all." (S015)
Physical	"Your whole body is working well." (C012)
Medical + mental	"Not being ill, healthy. In addition, not being tired or sleepy. Being positive about everything." (J002)
Medical + physical	"I can sleep all the way till the sun rises… and when I have no sickness, of course I am 100%." (S001)
Mental + physical	"I can go about easily and I do not need to worry about things." (S027)

C Chinese participant, *J* Japanese participant, *S* Singaporean participant

Table 5 Respondents quotes for the achievability of "100"

When?	Respondent quotes
Not 100 in the present (day the interview itself)	"I have high blood pressure and some cavities in my teeth, so I took some points off '100'" (C035, on existing medical conditions) "I thought about how tired I am both mentally and physically." (J014, on feeling fatigued) "I feel some stress from work, so I took some points off." (J003, on feeling stressed) "I got a slight fever today and last night I got asthma, so I'm '75'." (S022, on existing medical conditions)
Was "100" in the past but not now	"Definitely achieved '100' when I was younger when my health had no problems." (C060, on being younger and free of illnesses) "When I was in sixth grade…I was totally free of anxiety or sickness." (J016, on not feeling anxious or having illnesses) "Yes (I experience '100') …when I was young I can do everything." (S029, on being able to do everything he wants)
Will not be "100" in the future	"No way (I can be at '100' in the future). Because as I get older, I wouldn't know when I will be diagnosed with an illness such as arthritis." (C060, on being more susceptible to illnesses due to aging) "Because I'll only get older and I'm sure I'm going to be frail when I get 60's or 70's." (J021, on becoming frail due to aging) "(100) not possible (in the future) … When you are older, in a lot of aspects like your sense of hearing, sense of sight, a lot of aspects will deteriorate. Mental faculty will also deteriorate." (S007, on physical deterioration due to aging)
Will never be at "100"	"It is impossible for someone to not have any problems. Everyone has problems to a certain extent." (C059) "Being 100% healthy means being perfect and that's impossible. If you a human, you should have something to worry about." (J022) "As a human being, nobody is 100%." (S050)

C Chinese participant, *J* Japanese participant, *S* Singaporean participant

existing medical condition (Table 5). A majority of Chinese (63.3%), Japanese (54.2%), and Singaporean (56.7%) participants considered that they would have assigned themselves a score of "100" in the past, for example, because they were younger, able to do more things, not diagnosed with any medical condition, and were experiencing less stress (Table 5). A majority of Chinese (66.7%), Japanese (54.2%), and Singaporean (68.3%) participants believed that they would not rate themselves at "100" in the future, for example, because of physical deterioration due to aging and the increased likelihood of being diagnosed with a medical condition. A minority of participants in each country (15% in China, 4.2% in Japan, and 23.3% in Singapore) believed that "100" is impossible to attain for a human being. Supporting quotes can be found in Table 5.

3.5 Interpretation of the Label "Worst Imaginable Health" or "0"

The interpretation for "Worst Imaginable Health" was also diverse. Responses from participants can be grouped into three themes. Table 6 summarizes the themes used by participants when interpreting "0," with corresponding participant quotes. Firstly, the concept of *death*. It is related to states such as "near-death," "being dead," or "the stage when they felt dying rather than living." The second theme, *disease*, marked the presence of a serious illness or advanced chronic diseases, such as advanced cancer or an advanced stage of dementia. The third theme concerned various degrees of *disability*, whereby participants reported

Table 6 Themes used to interpret "0"/"Worst Imaginable Health"

Theme	Respondent quotes
Death[a]	"Maybe the person is close to death, or maybe the doctor told the person that he/she has only 3 months to live." (C011, on being close to death)
	"Knowing you can't live longer, knowing your days are numbered." (J002, on being close to death)
	"0 to me is die already [being dead]". (S011, on being dead)
Disease[b]	"The worst health condition is when you are diagnosed with a serious illness." (C053, on being seriously ill)
	"('0' means) Being hospitalized for illness." (J010, on having a serious illness)
	"Senile also […] Then forget family, that's the worst." (S034, on having advance dementia)
Disability[c]	"The worst is when you have lost your ability to live independently and require others to take care of you." (C052, on being reliant on others)
	"Bed-bound and unable to move. Being unable to eat and need another person to take care of you." (J017, on being disabled)
	"Zero means you are bedridden already." (S041, on being disabled)

C Chinese participant, *J* Japanese participant, *S* Singaporean participant

[a]This theme surrounds the concept of "death"

[b]This theme marks the presence of a serious illness or advanced chronic diseases

[c]This theme concerned various degrees of "disability"

that being unable to walk, being wheelchair-bound, or being paralyzed or bedridden would represent being at "0" on the EQ-VAS.

3.6 Change in Health State Corresponding to a 5- to 10-Point Change on the EQ-VAS

Opinions varied as to what change in health would correspond to a 5- to 10-point change on the EQ-VAS.

Table 7 Domains mentioned by respondents when discussing a 5- to 10-point change in VAS score

Domain	Supporting respondent quotes
Physical health[a]	"You might drop 10 points with the kind of stomach ache where you can bear the pain and not necessarily require medication or need to go to the hospital." (C037, on physical pain and discomfort) "If the pain I feel in my shoulders eases." (J008, on physical pain) "(Drop 5–10 points) if I still put on weight." (S057, on physical health)
Mental well-being[b]	"Someone who makes me unhappy will cause me to drop 5 points. I believe that emotional fluctuations can easily change my score by 5 or 10 points. A change in physical health might be more than that." (C026, on mental well-being) "If I don't feel any anxiety about my job, my score will be 10 points higher." (J003, on mental well-being) "If I don't have stress, maybe I can increase (by 5–10 points)." (S024, on mental well-being)
Social relationship[c]	"I will take 10 points off if I quarrel with my family member or with another colleague." (C027, on social relationships) "If my kids don't give me any problems, then it will increase (by 5–10 points)." (S038, on social relationship)
Medical condition[d]	"I will drop 10 points if I have an illness that is a little bit more serious than a cold." (C052, on medical condition) "(Increase 5–10 points) If can stop my medication." (S016, on medical condition)
Health promotion knowledge and behaviours[e]	"I will take 5 points off if I start to indulge in myself and not watch my diet." (C020 health promotion) "(Increase 10 points if) I eat a proper meal three times a day." (J001, on health promotion knowledge and behaviors)
5 point change is insignificant	"I find 5 points not that much (difference)… 80 to 85 is a 5-point change only." (S012) "Five points do not make much difference in the state of my health." (J020)

C Chinese participant, *J* Japanese participant, *S* Singaporean participant, *VAS* visual analog scale

[a]This domain surrounds the physical aspects of health

[b]This domain comprises status and abilities related to mental activities

[c]This domain includes themes related to the quality of interpersonal relationship and its consequences

[d]This domain surrounds medical conditions

[e]This domain refers to the knowledge and behaviors that promote good health

Responses from participants could be grouped into five domains, namely, *physical health*, *mental well-being*, *social relationship*, *medical conditions and treatment*, and *health promotion knowledge and behaviors*. Table 7 shows the summary of health domains participants mentioned, if affected, would correspond to a 5- to 10-point change on the EQ-VAS, together with supporting participant quotes.

Notably, some participants from Japan and Singapore felt that a 5-point change on the VAS would not be particularly significant. Supporting quotes can be found in Table 7.

3.7 Comments and Suggestions to Improve the EQ-VAS

Participants who considered EQ-VAS to be a good scale indicated that they found the VAS easy to understand. EQ-VAS was also thought to be a tool for getting people to reflect on their health. A few participants also mentioned having a scale high in granularity as a positive aspect. Corresponding quotes can be found in Table 8.

The most frequent negative comments about EQ-VAS across the three countries were that the scale is too granular and that the scale labels and number points were vague and open to interpretation. To address these negative aspects, participants suggested using a shorter scale and introducing explanatory word labels or examples to the scale number points. Other negative comments included that it is difficult to summarize a complex concept such as health into one number, and that the instructions on the EQ-VAS are too long. One Singaporean and one Chinese participant were not able to complete the EQ-VAS. Corresponding quotes can be found in Table 8.

One participant from Japan commented that it would be easier to read the scale if it was oriented horizontally (Table 8).

4 Discussion

As part of the EQ-5D questionnaire, the EQ-VAS has been widely used in Asian populations. To the best of our knowledge, this is the first study to investigate respondent perceptions of the scale in depth in Asia. Generally, there are similarities across the countries in how respondents interpret and use the EQ-VAS. Interestingly, there were considerable inter-respondent variations in the way participants interpreted labels and scores on the VAS. Furthermore, some respondents believed that "100" is never attainable, while some respondents believed that "0" corresponds to being dead, suggesting that the two anchor scores will never be utilized by them. The study also revealed individual differences within each country in terms of the achievability of "100" over time.

Varied or mistaken interpretations of VAS labels were also observed in previous studies [6–8]. For example, an early study revealed that there were differences in interpretation as to what "Best Imaginable Health" and "Worst Imaginable health" meant to different researchers [7]; another study revealed that some college students misinterpreted "Best Imaginable" as how easily the health state could be imagined [8]. Inter-respondent differences in interpretations could invalidate the comparability of the EQ-VAS scores across groups of respondents if the differences are associated with certain respondent characteristics. Different scores could be chosen by respondents in identical health status if their interpretations of "Best Imaginable Health" are different. For example, if a lot more Singaporeans than Japanese think "Best Imaginable Health" is not achievable, one would expect the EQ-VAS scores of Singaporeans to be lower than those of Japanese when other things are equal. Hence, systematic difference in scale interpretation might be responsible for the mixed evidence on the known-groups construct validity of EQ-VAS in Asia [3]. For example, EQ-VAS scores did not differ as expected between different severity groups of diabetic patients in Singapore [9] and Brunei [10]. Therefore, future studies should investigate whether interpretations of the EQ-VAS are associated with any respondent characteristics in Asian populations.

It should be noted that this variability is unlikely to affect the intra-rater reliability (e.g., test-retest reliability) or responsiveness of the EQ-VAS. This is because, as long as an individual has his or her own way of interpreting the EQ-VAS, the interpretation is unlikely to change over a short period of time. This might explain why the EQ-VAS is found to have good reliability and responsiveness in Asia [3]. Those two measurement properties were assessed in terms of the within-individual change in the EQ-VAS scores. This means that, although the construct measured by EQ-VAS may differ across respondents, this difference does not affect the ability of the scale to capture change in the measured health construct that occurs to respondents or groups of respondents.

In this study, we found that the 1-point increment on the EQ-VAS scale was not particularly significant to respondents. While a few respondents also saw the 5-point increment on the EQ-VAS as trivial, most respondents were able to explain a change in health state that corresponds to a 5- to 10-point change on the EQ-VAS. This is consistent with existing literature that found the minimal clinically important difference (MCID) [11] of EQ-VAS to be around 8 [12–14].

Table 8 Comments and suggestions for improvement of EQ-VAS

Comment/suggestion	Comment summary	Supporting respondent quotes
Positive comments	EQ-VAS is easy to understand	"It (EQ-VAS) is very easy to understand. You can see it (the scale) at a glance." (J007)
	EQ-VAS is a good exercise to reflect upon health	"It (EQ-VAS) makes you think… what is my score? And you have to be honest with yourself." (S013)
		"It (EQ-VAS) is good. It will remind me to take care of my health" (S039)
		"It (EQ-VAS) makes me feel like I'm here (at this level of health) and that I need to do something about it." (S039)
	EQ-VAS is good because of its high granularity	"I think 1 to 100 not bad also. Because people can give you the plus-minus 1, 2 that kind of thing." (S055)
		"I think it's good. At least we can go like, there are small numbers (41,42,43)." (S045)
Negative comments and/or suggestions for improvement	EQ-VAS is too high in granularity	"Because I think… 0 to 100 like very wide (range)… (the VAS) don't need to (have so many options), at least it'll be easier to complete the question." (S012)
		"The scales are too granular. I can't even describe the state of my own health to such details." (J014)
		"It (EQ-VAS) would be easier to complete had it not been so granular. With such granular scales, one is forced to think harder and feel pressured to be exact." (J022)
		"Maybe, instead of 0 to 100, make it 0 to 5." (S054)
	The labels on EQ-VAS were vague and open to interpretation	"It (EQ-VAS) is not very useful because we are getting older and the best health you can expect changes." (S022)
		"The definition of being in the best of health or the worst of health is also different from one person to another." (J002)
		"Why don't you show a sample description of the score of 50, for example?" (J002)
		"Maybe what you can do … 50, 'good', maybe 100 is 'excellent'. So, there's some kind of (word label) marking." (S033)
	Difficult to summarize health into a single numerical value	"I don't think it (EQ-VAS) is that comprehensive. It is a number. It is hard to quantify (health) into a number." (S016)
		"It is hard to understand because this is a ruler to measure your health but health also includes sleep, food, everything so it encompasses a lot of things. It also depends on mood and like different events in life." (S020)
		"If I get a diagnosis, it would be better to put two different scores for physical health and mental health respectively." (J003)
	Instructions on the EQ-VAS might be too long	'When I read: "We would like to know how good or bad is your health status today." And I started looking immediately at the scale. And I was thinking "wow, the scale is very long to read." Then after that is, the second sentence 0 to 1, I had to read through to the fourth point to know that I have to tick. The instruction was only at the fourth.' (S042)
		"I was confused because there were so many instructions." (J014)
	Change scale format (make it horizontal/use another form of measurement instead of a ruler)	"I find it easier to check the number on a horizontal scale rather than a vertical scale." (J021)

C Chinese participant, *EQ-VAS* EuroQol Visual Analogue Scale, *J* Japanese participant, *S* Singaporean participant

Although the majority of the studied respondents had a positive opinion of the VAS and found it relatively easy to understand and respond to, some potential issues surfaced. For example, respondents tended to only use values that are multiples of 5 on the VAS to rate their health, which may limit the instrument's precision. Some respondents also considered that EQ-VAS was not easy to respond to, though only two respondents failed to complete it. The two respondents who failed to complete the EQ-VAS had difficulty summarizing health into a single number. This suggests that the EQ-VAS might represent a cognitive challenge to some respondents, a finding which echoes results from an earlier UK study [15].

One suggestion from our respondents might be useful for improving the design of EQ-VAS, should there be such a need in the future. Based on our findings, the hash-mark lines that represent an increment of 1-point could be removed to simplify the task for respondents. Should such a modification be made, research will need to be done to verify if the benefits of doing so outweigh any inconvenience to respondents who prefer to use the hash-marks to pinpoint their scores. More research is also warranted to verify if the benefits of such changes will also apply to respondents from other countries.

There are a few limitations to this study. Firstly, unlike the sample from China and Japan, the Singaporean sample only included participants who were aged 40 years old and above. Since the younger generation might have different views, the data reflected in this study might not be comprehensive. However, an argument in favor of this older sample is that, compared to the younger generation, the older generation has a higher likelihood of experiencing poor health, and is, therefore, able to contribute more during the cognitive interview. Secondly, the analysis of the Japanese data was conducted by two Singaporeans. Therefore, there might be a possibility of losing nuances during translation. However, this is highly unlikely as AI ensured coding quality.

5 Conclusion

In conclusion, this study provides new information on how respondents from China, Japan, and Singapore interpret and perceive the EQ-VAS. Given the variation in interpretations among respondents, future studies should investigate whether the variations could be a threat to the comparability of the EQ-VAS scores in group comparisons. Results of this study might be used to tweak the EQ-VAS in order to improve its respondent acceptance.

Declarations

Funding This study was funded by the EuroQol Group (EQ Project 2016290) and the Humanities and Social Sciences (HSS) Seed Fund from the National University of Singapore (1/2019).

Conflict of interest Nan Luo, Michael Herdman, Zhihao Yang and Ataru Igarshi are members of the Euroqol Group. Rachel Lee-Yin Tan declare no conflict of interests.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee (NUS-IRB Ref No.: S-19-129E and B-16-252) and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Consent to participate Informed consent was obtained from all individual participants included in the studies.

Consent for publication As part of informed consent for the study, participants gave consent for publication of the data derived from their participation in the research study.

Availability of data and material The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Code Availability NA.

Author contributions NL and MH contributed to the study conception and design. AI and ZY collected the data in Japan and China respectively. RL-YT consolidated and analyzed the data. The first draft of the manuscript was written by RL-YT. All authors read and approved the final manuscript.

References

1. Devlin NJ, Brooks R. EQ-5D and the EuroQol group: past, present and future. Appl Health Econ Health Policy. 2017;15(2):127–37.
2. EQ-5D-5L User Guide. 2019. https://euroqol.org/publications/user-guides/. Accessed 29 May 2020.
3. Qian X. Tan RL-Y, Chuang L-H, Luo N. Measurement properties of commonly used generic preference-based measures in East and South-East Asia: a systematic review. PharmacoEconomics. 2020;38:159–70.
4. Vaismoradi M, Turunen H, Bondas T. Content analysis and thematic analysis: implications for conducting a qualitative descriptive study. Nurs Health Sci. 2013;15(3):398–405.
5. Elo S, Kyngäs H. The qualitative content analysis process. J Adv Nurs. 2008;62(1):107–15.
6. Torrance GW, Feeny D, Furlong W. Visual analog scales: do they have a role in the measurement of preferences for health states?. Thousand Oaks: Sage Publications Sage CA; 2001.
7. Fox-Rushby J, Selai C. What concepts does the EQ-5D measure? Intentions and interpretations. In: Brooks R, editor. The measurement and valuation of health status using EQ-5D: a European perspective. Dordrecht: Springer; 2003. p. 167–82.
8. Busschbach J, Hessing D, de Charro F. Observations on one hundred students filling in the EuroQol questionnaire. In: Kind P, editor. EQ-5D concepts and methods: a developmental history. Dordrecht: Springer; 2005. p. 81–90.
9. Luo N, Cang S-Q, Quah H-MJ, How C-H, Tay EG. The discriminative power of the EuroQol visual analog scale is sensitive to survey language in Singapore. Health Qual Life Outcomes. 2012;10(1):32.

10. Koh D, Bin Abdullah AMK, Wang P, Lin N, Luo N. Validation of Brunei's Malay EQ-5D questionnaire in patients with type 2 diabetes. PloS One. 2016;11(11):e0165555.
11. Jaeschke R, Guyatt G, Keller J, Singer J. Measurement of health status: ascertaining the meaning of a change in quality-of-life questionnaire score. Control Clin Trials. 1989;10:407–15.
12. Luo N, Chew L-H, Fong K-Y, Koh D-R, Ng S-C, Yoon K-H, et al. Do English and Chinese EQ-5D versions demonstrate measurement equivalence? An exploratory study. Health Qual Life Outcomes. 2003;1(1):7.
13. Chen P, Lin K-C, Liing R-J, Wu C-Y, Chen C-L, Chang K-C. Validity, responsiveness, and minimal clinically important difference of EQ-5D-5L in stroke patients undergoing rehabilitation. Qual Life Res. 2016;25(6):1585–96.
14. Zanini A, Aiello M, Adamo D, Casale S, Cherubino F, Della Patrona S, et al. Estimation of minimal clinically important difference in EQ-5D visual analog scale score after pulmonary rehabilitation in subjects with COPD. Respir Care. 2015;60(1):88–95.
15. Devlin NJ, Hansen P, Selai C. Understanding health state valuations: a qualitative analysis of respondents' comments. Qual Life Res. 2004;13(7):1265–77.