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Measuring health activation among foreign students in South Korea: initial evaluation of the feasibility, dimensionality, and reliability of the Consumer Health Activation Index (CHAI)

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Abstract

Foreign students in South Korea face important challenges when they try to maintain their health. As a measure of their motivation to actively build skills for overcoming those challenges, we evaluated the 10-item Consumer Health Activation Index (CHAI), testing its feasibility, dimensionality, and reliability. There were no missing data, there was no floor effect, and for the total scores the ceiling effect was trivial (< 2%). Results of the Kaiser-Meyer-Olkin test and Bartlett's test of sphericity indicated that the data were suitable for the detection of structure by factor analysis. The results of parallel analysis and the shape of the scree plot supported a two-factor solution. One factor had 3 items concerning "my doctor" and the other factor had the 7 remaining items. Reliability was high for the 10-item CHAI ($\alpha = 0.856$), for the 3-item subscale ($\alpha = 0.838$), and for the 7-item subscale ($\alpha = 0.857$). Reliability could not be improved by deletion of any items. Use of the CHAI to gather data from these foreign students is feasible, and reliable results can be obtained whether one uses the total score from all 10 items or scores from the proposed 7-item and 3-item subscales.

Keywords: Foreign students, CHAI, scale, health activation

1. Introduction

Maintaining health is obviously important, but it can be particularly difficult for people living outside their home country. Their abilities to actively participate in their own healthcare and health maintenance are challenged by language barriers, cultural differences, separation from previous sources of social support, and lack of familiarity with local healthcare systems, among other factors [1-8]. People may be more likely to meet and overcome those challenges, and they may be more likely to develop those abilities, if they are highly motivated to actively do so. Thus, one primary goal of research in this field is to measure that activation and motivation. The Consumer Health Activation Index (CHAI) [9] was developed to measure " 'activation,' or motivation to participate in healthcare decisions and actions" [10]. Our focus here is on the health of foreign students in South Korea [11-15]. To the best of our knowledge, the CHAI has not been used to measure health activation in relatively young, healthy adults who are living outside their home country. Therefore, we evaluated the feasibility, dimensionality, and reliability of the CHAI in these students. The results of that evaluation are reported here.

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2. Methods

2.1 Participants

Foreign students who were enrolled at a university in South Korea were recruited by poster. Some of them were native speakers of English, and the others could speak, read, and write English as a second language. Before starting to collect data, the researchers explained the purpose of the study in English, and gave the participants a document with information about the study. In total, 56 foreign students agreed to allow some of their personal information to be collected and agreed to participate in the study.

2.2 The CHAI

The CHAI questionnaire was developed in a rigorous process combining qualitative and quantitative methods, which has been described in detail [9]. To briefly summarize that process, we note that published literature on patient engagement and activation, as well as expert opinion in those and related areas, were taken into account. In addition, feedback on candidate items was obtained from people living with chronic medical conditions. Special attention was given to ensuring that the items were easy to read and easy to understand. Development also included psychometric reliability testing and extensive validation testing. The resulting scale has 10 items asking about 5 areas of health activation: 3 items asking about knowledge, 3 items asking about self-efficacy, 1 item asking directly about health as a priority, 2 items asking about health-related actions, and 1 item asking about health-related locus of control. We note that 3 of those 10 (2 of the 3 asking about self-efficacy and 1 of the 2 asking about health-related actions) included specific mention of “my doctor”. The response choices were on a 6-point Likert-type scale, from strongly disagree (1 point) to strongly agree (6 points), and thus the possible summary scores ranged from 10 points to 60 points.

2.3 Analyses

Frequencies of item endorsements were tabulated, as were floor and ceiling effects. The shapes of frequency distributions of responses for each item individually and also for the 10-item CHAI as a whole were described. The Kaiser-Meyer-Olkin test and Bartlett’s test of sphericity were used to determine whether the data were suitable for the detection of structure by factor analysis. Responses on the CHAI have been found to be unidimensional among adults in the USA [9]. One goal of the present study was to determine whether that unidimensionality was also the case among foreign students at a university in South Korea. Therefore, exploratory factor analysis (EFA) was used to elucidate the factor structure of the responses to the CHAI among these students. In factor analysis, maximum likelihood was used for extraction, and the number of factors to be retained was determined by parallel analysis. Rotation was orthogonal (varimax). As a separate analysis done to facilitate comparison with previous work [9], an oblique (oblimin) rotation was used. Coefficient alpha was used as the index of internal-consistency reliability. Computations were done using JASP (version 0.13.1).

3. Results

The participants were from more than 20 countries. Their ages ranged from 19 to 40 years (mean age was 24.4; standard deviation of age was 4.2; median age was 24; interquartile range of age was from 20.75 to 26.25).

As shown in Table 1, there were no missing data. For item 4 and item 7, only 5 of the 6 available response choices were used. In contrast, for items 1, 2, 3, 5, 6, 8, 9, and 10, all of the 6 available response choices were used. The distribution of scores was left-skewed. While the possible range of total scores was from 10 to 60, with almost no exception the actual total scores ranged from 40 to 60. The only exception was 1 student’s total score of 16. For all 10 items, the floor effects were either 1.8% or 0%. A few items had notable ceiling effects, but for the total score the ceiling effect was very small: 1.8% (1/56).

Table 1. Descriptive statistics for each item and for the total score

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	1	2	3	4	5	6	7	8	9	10	Total
Valid	56	56	56	56	56	56	56	56	56	56	56
Missing	0	0	0	0	0	0	0	0	0	0	0
Floor (n, %)	1, 1.8	1, 1.8	1, 1.8	0, 0	1, 1.8	1, 1.8	0, 0	1, 1.8	1, 1.8	1, 1.8	0, 0
Ceiling (n, %)	33, 59	12, 21	11, 20	11, 20	16, 28	15, 27	12, 21	17, 30	24, 43	14, 25	1, 1.8
Mean	5.375	4.821	4.696	4.786	4.946	4.714	4.732	4.929	4.964	4.679	48.643
Median	6.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	48.000
Std. Deviation	1.054	0.993	0.989	0.929	0.980	1.124	0.981	1.042	1.250	1.146	6.942
Skewness	-2.554	-1.477	-0.981	-0.964	-1.452	-0.920	-0.745	-1.453	-1.495	-0.984	-1.679
Range	5.000	5.000	5.000	4.000	5.000	5.000	4.000	5.000	5.000	5.000	44.000
Minimum	1.000	1.000	1.000	2.000	1.000	1.000	2.000	1.000	1.000	1.000	16.000
Maximum	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000	60.000
25th percentile	5.000	4.000	4.000	4.000	5.000	4.000	4.000	4.750	4.000	4.000	45.000
75th percentile	6.000	5.000	5.000	5.000	6.000	6.000	5.000	6.000	6.000	5.250	53.250

The result of the Kaiser-Meyer-Olkin test was 0.72, and for Bartlett's test of sphericity the chi-squared value was 269.95, degree of freedom (df) was 45, and p was less than 0.001, which indicates that the data were suitable for the detection of structure by factor analysis. After extraction of factors by maximum likelihood, parallel analysis indicated that 2 factors should be retained. (See Figure 1, which displays all eigenvalues.)

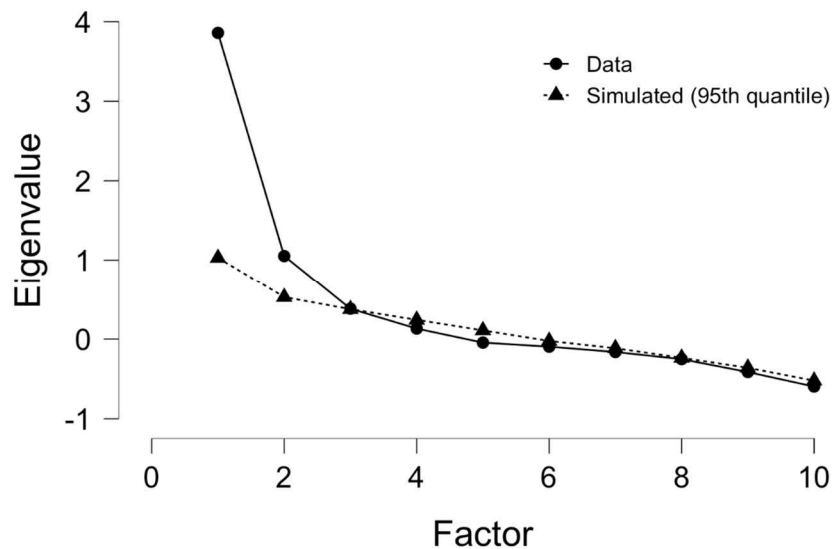


Figure 1. Scree plot, showing results both from the actual data and also from the parallel analysis (95th quantile of the simulated data)

After orthogonal (varimax) rotation (Table 2), items 1, 2, 3, 4, 5, 7, and 10 loaded strongly on the first factor, and that factor accounted for 32% of the total variance. Items 6, 8, and 9 loaded strongly on the second factor, and that factor accounted for an additional 22% of the total variance. There was no substantial cross-loading. When oblique (oblimin) rotation was used, the correlation between the two factors was low (0.34), and when two subscales were constructed using the two sets of items mentioned above, the correlation between the scores on those two subscales was also low (Kendall's tau-b = 0.33).

Table 2. Factor Loadings

Item number	Factor 1	Factor 2
1	0.481	0.274
2	0.749	0.067
3	0.864	0.064
4	0.684	0.140
5	0.616	0.216
6	0.196	0.665
7	0.650	0.288
8	0.105	0.992
9	0.238	0.705
10	0.564	0.212

Note. Applied rotation method is varimax.

Internal-consistency reliability was high for the 10-item CHAI: coefficient alpha = 0.856. It was also high both for the subscale constructed using only the 7 items that loaded strongly on factor 1 (coefficient alpha = 0.857), and also for the subscale constructed using only the 3 items that loaded strongly on factor 2 (coefficient alpha = 0.838). In no case could reliability be improved by deletion of any items.

4. Discussion

Overall, these results show that using the CHAI with foreign students at a university in South Korea is feasible, and that the resulting scores are psychometrically reliable. These results also provide some evidence that the CHAI measures two distinct domains of health activation in this population.

The factor structure found in this study differs from the factor structure of the CHAI as reported previously [9]. Specifically, in its development-and-validation study, the CHAI was found to be substantially unidimensional. The factor analysis in that study included oblique (oblimin) rotation, whereas our preference in this study was to use orthogonal (varimax) rotation, but that does not account for the difference in the dimensionality of the results. The multidimensionality of the present data was clear before rotation, that is, it can be seen in the results of parallel analysis and from the appearance of the scree plot (Figure 1). In addition, as noted above, as a separate analysis to facilitate comparison of the present results with previously published work [9], we also applied oblique (oblimin) rotation. Both the low correlation between the two factors after oblique rotation and the low correlation between the scores on the 7-item and the 3-item subscales are consistent with true multidimensionality of the CHAI in these data.

Of the 2 domains found by factor analysis of the present data, 1 domain is measured by the 7 items that do not refer to “my doctor”. The other domain is measured by the 3 remaining items, all of which do mention “my doctor”. Therefore, the second factor can be interpreted as reflecting health activation specifically with regard to interactions with one’s regular physician, while the first factor might be interpreted as reflecting the other aspects of health activation.

Limitations: We note the following two limitations of this study. First, these participants were students, and different results might well be found in other groups of people living outside their home country (e.g. refugees or expatriate adults). Second, while the present results suggest that multidimensionality of the CHAI is possible, confidence in the results of factor analysis would be greater with a larger sample [16-19].

Practical implications: The multidimensionality of the present data and the difference in dimensionality between the present results and previous results raise the practical question of which should be used: the total score of the 10-item CHAI, or the scores on the two separate groups of 7 items and 3 items. In that regard the reliability results may be helpful. They show that whichever is used, the reliability is likely to be high: In the present results the lowest value of internal-consistency reliability (alpha) was 0.83, which is higher than the

minimum value that is generally considered to be required for nearly all research purposes. Thus, the present results have implications regarding the practical application of the CHAI. Specifically, it may be reasonable to consider the CHAI as a 10-item scale with two subscales, and the choice of which to use can fit the purpose of the research. When the goal is to measure health activation overall, the total 10-item CHAI scores could be used. In contrast, when the goal is to separate health activation regarding one's regular physician from other aspects of health activation, then the scores on the 7-item and 3-item subscales could be used separately.

Theoretical implications: Investigation of the reason for the difference in dimensionality between previous results and the present results could have implications for health-activation theory, although such an investigation is beyond the scope of the present study. Nonetheless, one may speculate that the difference in dimensionality is related to real differences in the experiences of the people who provided the data. Because they were generally young and relatively healthy, the students who participated in the present study may have had little or almost no experience in clinical encounters with someone they would refer to as "my doctor". Whether their responses would be different if they had more personal experience as patients is a potential topic for future study. From the standpoint of health-activation theory, long-term longitudinal analyses of CHAI data (spanning years or perhaps even decades) might reveal whether there are changes in dimensionality associated with life experiences. This could be important in understanding the experiences both of students [20] and of older people [21]. One might test the hypothesis that the multidimensionality found here would shift to unidimensionality as the participants accumulate more personal experience as patients interacting with physicians. The present results also imply that, for a deeper theoretical understanding, in future research a bi-factor model might be useful.

Overall, the present results suggest that in these foreign students studying in South Korea the CHAI can provide psychometrically reliable data, and it may measure two distinct concepts: health activation as it relates to "my doctor", and other aspects of health activation. Given the characteristics of the participants, the multidimensionality of CHAI data in this study could be related to the participants' recent encounters or, more likely, their relative lack of recent encounters, with physicians as healthcare providers.

5. Conclusions

As noted above, these results have the practical implication that researchers' choices among 10-item, 7-item, and 3-item CHAI scores can depend only on the goal of the research, because all three were psychometrically reliable. In addition, also as noted above, these results have the theoretical implications that CHAI scores might be multidimensional, and that their dimensionality might be related to experiences as patients, a hypothesis that can be tested in future research, perhaps employing a bi-factor model. We conclude that use of the CHAI to gather data from foreign students in South Korea is feasible, and that psychometrically reliable results can be obtained whether one uses the total score from all 10 items or scores from the 7-item and 3-item subscales as defined above.

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