

## A Psychometric Assessment of the Newest Vital Sign among Youth in Guatemala City

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### Abstract

**Background and Objective:** Psychometrically sound health literacy assessments are widely available in the US for both adults and youth. However, among international youth populations there is a dearth of reliable instruments. This study was undertaken in order to assess the psychometric viability of using the Spanish version of the Newest Vital Sign (NVS; previously validated in the US) among a sample of youth living in Guatemala City.

**Methods:** Analysis is based on 230 youth who were attending various schools within Guatemala City, Guatemala. Rasch modeling was used to estimate item difficulty and discrimination parameters, item fit indices, item-total correlations, and differential item functioning between male and female youth.

**Results:** The majority of the items on the NVS exhibit acceptable properties. The last item demonstrated statistically significant DIF of a practically important magnitude ( $DIF > |0.43|$ ) suggesting that females are more likely than males to answer the item correctly after controlling for the 'amount' of health literacy that the students possess.

**Conclusion:** Those using the NVS among international Spanish-speaking youth populations should be aware that the NVS appears to be appropriate to use in Latin America. Females may tend to have slightly higher scores than males. Additional psychometric testing of the instrument among similar cross-national samples of youth is needed.

**Keywords:** Health literacy; Newest vital sign; Youth; Psychometrics; Health; Adolescence; Guatemala City

### Introduction

Health literacy is typically defined as an individual's ability to obtain, process, and understand basic health information in order to make informed decisions about their health [1]. Much research on health literacy has been conducted during the past 20 years, including studies looking at its connection to overall health, use of preventative care, hospitalization rates, and health care costs [2,3]. According to the Institute of Medicine, health literacy may impact not only health, but also the ability of health care systems to provide effective, high-quality health care [4].

Health literacy is a particularly relevant construct for youth living in developing countries. Adolescence is a time when youth begin demonstrating greater autonomy for making important health decisions, including decisions about chronic disease management, sexual behavior, substance use, and food consumption [5-8]. Unfortunately, youth in developing countries have few resources to assist them in making these decisions as their families often have less access to health professionals, less access to health information on the internet, and may not enjoy the benefits of advanced health care systems that maintain individual and family health records [9-11].

Because of these and other challenges, significant health disparities exist in Latin American countries, particularly among women [12]. While several Latin American countries have become exemplars due to their promising efforts to prevent and reduce health problems [13], further research is essential as it could have significant policy, research, and practice implications for health-related interventions. Advancing knowledge on the health literacy of young men and women in Latin American nations and other developing countries could provide key insights into their ability to access, understand, and apply the limited amount of information they receive.

The Newest Vital Sign (NVS) is an established and widely used assessment of health literacy that is available in both English and Spanish, making it an ideal instrument for psychometric testing among Spanish-speaking youth in developing countries. Other health literacy instruments tailored specifically for Spanish speakers have been used in other studies, such as the Short Assessment of Health Literacy for Spanish Adults (SAHLSA). However, these instruments demonstrated considerable psychometric weaknesses due to highly heterogeneous scores and poor discrimination [14,15]. In contrast to the SAHLSA and other measures that focus exclusively on literacy or reading comprehension, the NVS provides a more comprehensive understanding of health literacy inasmuch as it assesses reading, interpretation, and numeracy [16,17]. The assessment is administered

by handing the participant a picture of an ice cream label and asking them six questions (e.g., if you eat the entire container, how many calories will you eat?; the full assessment is available online at [http://www.pfizer.com/files/health/nvs\\_flipbook\\_english\\_final.pdf](http://www.pfizer.com/files/health/nvs_flipbook_english_final.pdf)). In various studies among unique adolescent populations it has been found to be a reliable and valid measure of health literacy [18,19]; however, a psychometric evaluation of the measure has not been conducted among Spanish-speaking youth in their countries of origin. The purpose of this study was to assess the psychometric properties of the NVS among Spanish-speaking youth living in a developing country. Based on its performance among other unique adolescent populations, we hypothesized that its psychometric properties would be adequate. Such a finding would provide health professionals and researchers confidence that the NVS can be used to evaluate health literacy with an international audience.

## Method

### Participants and procedures

The Arizona State University institutional review board approved this project and all its procedures. Youth attending 10 schools in Guatemala City, Guatemala were recruited for a pre/post study focusing on the cultural adaptation of the substance use prevention program 'keepin' it REAL. As part of the study youth were also recruited to participate in a five-minute survey/assessment centered on health literacy. For the 230 youth (ages 10-16; mean=12.1) who expressed interest, permission to participate was solicited and obtained from their parent/guardian. Trained data collectors individually removed students from class to deliver the survey and assess their health literacy using the NVS. Each student was provided a healthy snack and a health education handout for their participation.

### Data analysis

Rasch modeling was used to estimate item difficulty and discrimination parameters, item fit indices, item-total correlations, and differential item functioning between male and female youth. Item

difficulty refers to the level of health literacy needed to have a 50% chance of answering the item correctly. Item discrimination refers to the degree to which items differentiate students with high health literacy from students with low health literacy. More specifically, discrimination refers to the slope of the logistic function that describes the relationship between health literacy and the probability of answering an item correctly. The discrimination parameter was centered at 1 for the analyses, so items with values below 1 indicate less discriminating efficacy. Item fit refers to the degree to which observed responses to an item correspond to the expected responses given the difficulty of the item and the youths' level of health literacy. Acceptable unstandardized item fit values range from 0.6 to 1.4 [20]. Item-total correlations are simply the correlation between the score for the item and the total scale score. Differential item functioning (DIF) refers to the difference in item difficulty between males and females when controlling for the youths' level of health literacy. Items that demonstrate DIF indicate that responses are affected by factors other than, or in addition to, health literacy.

## Results

Rasch indicators of item-level properties (i.e., difficulty, discrimination, fit, item-total, DIF) are presented in Table 1 – bolded item parameters are considered problematic with regard to the guidelines listed in the data analysis section. The majority of the items on the NVS exhibit completely acceptable properties. The last item demonstrated statistically significant DIF of a practically important magnitude ( $DIF > |0.43|$ ) [21], suggesting that females were more likely than males to answer the item correctly after controlling for the 'amount' of health literacy that the students possess. Figure 1 visually depicts the relationship between item difficulties for males and females. The dotted identity line represents a perfect relationship between male and female responses (i.e., if items were of equal difficulty for males and females, then all data points would be on the identity line); the solid lines represent the 95% confidence interval around the identity line. Data points that fall outside of the confidence interval represent items with significant DIF.

	<b>Difficulty</b>	<b>Discrim.</b>	<b>Fit</b>	<b>Item-Total</b>	<b>DIF</b>
Item 1	3.25	1.11	0.86	.42	0.63
Item 2	0.28	1.05	0.95	.61	0.73
Item 3	-0.60	0.81	1.07	.58	0.22
Item 4	3.25	0.90	1.09	.33	-0.46
Item 5	-4.23	0.97	1.01	.48	-0.16
Item 6	-1.96	1.17	0.79	.65	-0.96*

**Table 1:** Rasch Results

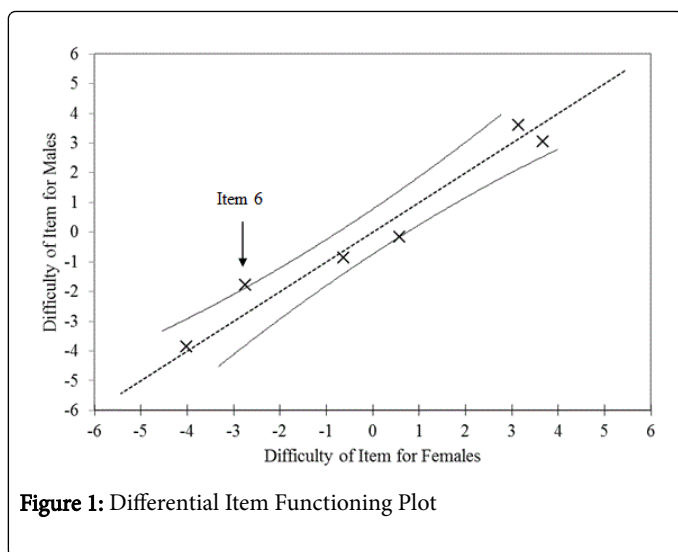


Figure 1: Differential Item Functioning Plot

## Discussion

As the health literacy of various international youth populations is unknown, the purpose of this study was to assess the NVS using Rasch modeling to determine whether the assessment is psychometrically adequate for Spanish-speaking youth in developing countries such as Guatemala. The results mostly supported our hypothesis that the NVS scores would be adequate. Due to the higher-than-expected rate of females answering item 6 correctly, researchers and practitioners who use the NVS to study health literacy among international adolescent populations should be aware that females may perform slightly better on the assessment even though their health literacy is not necessarily better than males. Why females performed better than males is perplexing, particularly given the nature of the problematic item. Question 6 is a follow-up to question 5, so if question 5 is incorrectly answered, question 6 is not asked to the participant and is marked incorrect. Thus, with results showing item 5 to be of equal difficulty, it is difficult to determine why item 6 was answered correctly by females at a higher rate. Although the exact answer to this conundrum may be impossible to pinpoint, it is possible that females in this sample had better reading comprehension, or that males were simply guessing correctly on item 5 at a higher than chance rate. Future studies should carefully consider this unique finding and assess whether it is replicated among similar populations.

In an effort to address some of the significant health disparities present in Latin American countries, the results of our study demonstrate that the NVS could be a powerful instrument for identifying low health literacy among youth. As a free, 3-5 minute brief assessment, the NVS is ideal for use in resource-constrained settings where limited time is available for non-essential undertakings. With few resources, limited access to health information, and increasing numbers of youth needing health literacy skills to manage chronic diseases, the utilization of the NVS is a strong first step towards addressing the many health needs of youth living in developing countries.

Two study limitations should be mentioned. As previously stated, all participants came from the same country, thus hindering the generalizability of these results to other developing countries. Moreover, our sample was comprised exclusively of youth attending public schools, and do not represent youth attending private schools or

not attending school. Also, as the average age of participants in this study was 12, the findings should not be interpreted for older youth populations. Future researchers may consider tackling these limitations by expanding their target samples to include youth of all ages attending all types of schools, as well as those not attending school. Despite these limitations, the results indicate that the NVS should be considered as a tool for quickly assessing adolescent health literacy among Spanish-speaking youth in developing countries.

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## What is already known on this subject?

Health literacy is a strong predictor of overall health, use of preventative care, and hospitalization rates. Youth in developing countries have limited access to health professionals and health information. The NVS is a brief, widely accepted instrument used to assess health literacy among both Spanish and English speakers in the US.

## What this study adds:

The application of the NVS was promising in a Latin American country using a convenience sample. Female youth in Spanish-speaking Latin American countries such as Guatemala may score slightly higher on the Spanish version of the NVS. Psychometrically sound health literacy assessments are needed among youth in developing countries in order to identify individuals and groups in need of health education interventions.

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