

# Implementing Rasch Analysis in Psychometric Evaluation of Patient-physician Interaction Scale

Mehul Dalal<sup>1</sup>, Everett Smith<sup>2</sup>, Bruce Lambert<sup>1</sup>, Christopher Olopade<sup>3</sup> and Stephanie Crawford<sup>1</sup>

<sup>1</sup>Pharmacy Administration, <sup>2</sup>Educational Psychology, <sup>3</sup>Medicine  
University of Illinois, Chicago, Illinois

For more information, contact:  
Mehul Dalal  
Dept of Pharmacy Administration  
M/C 871, # 241  
Chicago, IL 60612  
Tel. 312-996-0612  
E-mail: mdalal1@uic.edu

## Abstract

**Objectives:** The study involved validating the scaling properties of patient-physician interaction scale in a pulmonary specialty clinic using a clinic-specific scale, through the implementation of Rasch analysis.

**Data:** Cross-sectional data from 65 adult asthma patients at the University of Illinois Asthma clinic was used. Physician interaction was measured using eight Likert-type items. Patients' responded from "strongly disagree" (1) to "strongly agree" (4).

**Methods:** Scaling properties were assessed by investigating its fit to a Partial Credit Rasch Rating scale model that enabled item-by-item analysis. Winsteps® version 3.08 was used for analysis. Model determined scale robustness in terms of unidimensionality, additivity, linearity, and functioning of the rating scale.

**Results:** Analyses found person separation index of 1.86 with reliability of 0.77. The mean patient measure (0.69 logit) was greater than mean difficulty of items (0.00 logit) implying patient ability was greater than item difficulty. Ordering of items found item 'physician instructed patients on home steroid treatment' (STETX) had the highest logit measure of 0.69, however it misfits the model. Item 'physician asked about smoking habits' (ASKSMOK) had lowest measure of -0.70 logits. Fit statistics revealed high infit and outfit mean square (MNSQ) values (>1.4) for 16 patients. Seven items had MNSQ values within desired range of 0.6-1.4.

**Conclusion:** Items exhibited adequate reliability in separating persons. Some evidence of construct validity was established since only one item misfit the model. Item 'STETX' was the most difficult to endorse (higher on construct), since it might not be applicable to all, but severe asthmatics. Item 'ASKSMOK' was easiest to endorse, probably because it is a standard asthma care question. Nevertheless, misfitting persons implied inappropriate measurement of some patient attitudes. Thus, some plausibility in the unidimensionality and validity of the scale existed, and it exhibited moderate scaling properties.

## Introduction

- Compliance with asthma care has been identified as a leading cause of poor asthma outcomes
- Satisfaction with doctor-patient interaction and doctor behavior is known to be associated with noncompliance in asthma
- Few, if any asthma-specific patient-physician interaction scale have been reported in literature

## Data

- Questionnaires from adult asthma patients attending the UIC outpatient clinic between 1994 -1999
- Questionnaire was clinic-specific and items were based on recommendations of EPR-I
- Approval to use the data for the project was granted by the UIC Institutional Review Board (IRB)

## Instrument

- Eight items determining patient agreement on quality of interaction with physician
- Responses determined whether physician addressed specific asthma-treatment related issues
- Responses were scored on a 4-point Likert scale from strongly disagree (1) to strongly agree (4)

## Methods

- Cross-sectional analysis of secondary data
- Scaling properties were assessed by investigating fit of data to a Partial Credit Rasch Rating scale model
- Winsteps® version 3.08 was used for analyses

## Rasch Model

$$P = B_n - D_i - F_{ik}$$

P = mathematical expression of the probability of achieving a score within a particular score category on a particular item  $P = \log \{ P_{nik} / P_{ni(k-1)} \}$

$B_n$  = the ABILITY (B) of a particular person (n)

$D_i$  = the DIFFICULTY (D) of a particular item (i)

$F_{ik}$  = A set of step measures that represent the transition between points between categories (k)

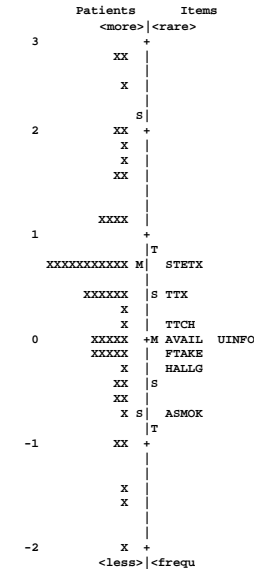
## Results

- Data obtained from 65 asthma patient surveys
- Mean age of patients was 42.3 years (SD = 15.7)
- 83% of the sample were female patients
- Around 80% of patients agreed that calling their physician for information was useful
- More than 80% believed that MD determined their current daily inhaled steroids intake and warned them against possible allergens

**Table 1. Response Pattern on Patient-physician Interaction Scale (N = 65)**

| Parameter (# missing)  | Response level N (%) |           |          |                | Variable Abbreviations |
|--|----------------------|-----------|----------|----------------|------------------------|
|  | Strongly disagree    | Disagree  | Agree    | Strongly Agree |                        |
| MD/staff determines inhaled steroids taken (4)               | 6 (9.2)              | 6 (9.2)   | 31(47.7) | 18 (27.7)      | FTAKE                  |
| MD spends right time teaching asthma & control(0)            | 10 (15.4)            | 4 (6.2)   | 34(52.3) | 17 (26.2)      | TTCH                   |
| MD teaches you to treat attacks at home (0)                  | 8 (12.3)             | 13 (20.0) | 32(49.2) | 12 (18.5)      | TTX                    |
| MD teaches you to start on steroids (1)                      | 10 (15.4)            | 17 (26.2) | 26(40.0) | 11 (16.9)      | STETX                  |
| MD tells you about allergies in your home & surroundings (1) | 6 (9.2)              | 8 (12.3)  | 31(47.7) | 19 (29.2)      | HALLG                  |
| MD asks if anybody smokes(1)                                 | 4 (6.2)              | 5 (7.7)   | 35(53.8) | 21 (32.3)      | ASMOK                  |
| MD available to talk on telephone (3)                        | 6 (9.2)              | 9 (13.8)  | 33(50.8) | 14 (21.5)      | AVAIL                  |
| Calling useful in getting information & help (1)             | 8 (12.3)             | 5 (7.7)   | 33(50.8) | 18 (27.7)      | UINFO                  |

**Figure 1. Person Ability (Perceived interaction) and Item Difficulty (59 patients, 8 items)**



## Results (cont'd)

- Rasch model included data from 59 patient questionnaires with non-extreme scores
- Mean physician interaction measure (0.69 logits) was greater than the mean difficulty of items (0.00 logits)
- Person separation was 1.86 with a reliability of 0.77, while Item separation index was 1.54 with a reliability of 0.70
- Items measured patients in a narrow range of -1 to 1 logits
- Based on INFIT MNSQ values 16 patients did not fit the model
- STETX misfits the Rasch model with infit MNSQ (mean square)= 1.59, & was also the most difficult item to endorse, while ASMOK was easiest to endorse

**Table 2. Average Interaction Item Calibrations, SE, and Infit Statistic by Calibration**

| Interaction items | Number | Avg. item calibration (logits) | SE   | Infit statistic (MNSQ) |
|-------------------|--------|--------------------------------|------|------------------------|
| STETX             | 58     | 0.69                           | 0.19 | 1.59                   |
| ASMOK             | 59     | -0.70                          | 0.23 | 1.14                   |
| AVAIL             | 56     | -0.02                          | 0.22 | 1.14                   |
| FTAKE             | 55     | -0.20                          | 0.89 | 1.02                   |
| HALLG             | 58     | -0.25                          | 0.20 | 0.89                   |
| UINFO             | 58     | -0.05                          | 0.20 | 0.82                   |
| TTX               | 59     | 0.39                           | 0.20 | 0.69                   |
| TTCH              | 59     | 0.15                           | 0.19 | 0.61                   |

**Table 3. PCA Factors/Factor Loading of Items**

| Interaction items | Factor 1 (24.5%) | Factor 2 (21.3%) | Factor 3 (15.3%) |
|-------------------|------------------|------------------|------------------|
| FTAKE             | -0.52            | -0.34            | 0.43             |
| TTCH              | -0.57            | -                | -0.44            |
| TTX               | -0.59            | 0.21             | -0.30            |
| STETX             | -                | 0.89             | -                |
| HALLG             | -                | -0.82            | -                |
| ASMOK             | -                | -                | 0.77             |
| AVAIL             | 0.25             | -                | -                |
| UINFO             | 0.60             | -0.22            | -                |

## Conclusions

- Items in the scale exhibited near adequate reliability (0.77) in separating the patients
- STETX was most difficult item since it might not be applicable to all but only severe asthmatics, ASMOK was easiest since it is a standard item in any asthma therapy
- Misfitting patients implied inappropriate measurement of some patient attitudes
- Evidence for unidimensionality of scale was established since only one item misfit the model, however PCA showed 3 significant factors without any intuitive pattern of loading
- Results lay a foundation for research in identifying unique items that influences physician interaction in each sample group