Multitrait Scaling and IRT: Part II

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Questionnaire Design and Testing Workshop

2nd Floor Conference Room

October 16, 2009 (3-5pm)

Hays, Brown, Brown, Spritzer & Crall (2006)

4036 surveys completed by parents of children enrolled in State Children's Health Insurance Program (SCHIP) in California

45% English, 46% Spanish, 3% Chinese, 5% Vietnamese or Korean

63% Hispanic, 20% non-Hispanic white, 12% Asian, 2% black, 3% other

Getting needed care (4 items)

5. Since your child joined his/her dental plan, how much of a problem, if any, was it to find a dental office or clinic for your child you are happy with?

12. In the last 12 months, how much of a problem, if any was it to get a referral to a dental specialist that your child needed to see?

25. In the last 12 months, how much of a problem, if any, was it to get dental care for your child that you or a dentist believed necessary?

26. In the last 12 months, how much of a problem, if any, were delays in your child's dental care while you waited for approval from your child's dental plan?

Getting care quickly (5 items)

16. In the last 12 months, when you called during regular office hours, how often did you get the help or advice you needed for your child?

18. In the last 12 months, how often did your child get an appointment to fill or treat a cavity as soon as you wanted?

20. In the last 12 months, how often did your child get an appointment for regular or routine dental care as soon as you wanted?

22. In the last 12 months, when your child needed care right away for a mouth pain or a dental problem how often did your child get care as soon as you wanted?

27. In the last 12 months, how often did your child wait in the dentist's office or clinic more than 15 minutes past the appointment time to see the person your child went to see?

Dental plan customer service (3 items)

47. In the last 12 months, how much of a problem, if any, was it to find or understand information in the written materials?

49. In the last 12 months, how much of a problem, if any, was it to get the help you needed when you called your child's dental plan's customer service?

51. In the last 12 months, how much of problem, if any, did you have with paperwork for your child's dental plan?

Dental office staff (2 items)

28. In the last 12 months, how often did office staff at your child's dentist's office or dental clinic treat you and your child with courtesy and respect?

29. In the last 12 months, how often were office staff at your child's dentist's office or dental clinic as helpful as you thought they should be?

Communication with providers (10 items)

30. In the last 12 months, how often did your child's dentists or other dental providers listen carefully to you?

31. In the last 12 months, how often did you have a hard time speaking with or understanding your child's dentists or other dental providers because you spoke different languages?

32. In the last 12 months, how often did your child's dentists or other dental providers explain things in a way you could understand?

33. In the last 12 months, how often did your child's dentists or other dental providers show respect for what you had to say?

35. In the last 12 months, how often were you in the room with your child while the dentist examined his/her teeth, or gave treatment (like filling a cavity)?

Communication with providers, cont. (10 items)

37. In the past 12 months, how often did your child have a hard time speaking with or understanding his/her dentists or other dental providers because they spoke different languages?

38. In the last 12 months, how often did dentists or other dental providers explain things in a way your child could understand?

39. In the last 12 months, how often did dentists or other dental providers spend enough time with your child?

32b. In the last 12 months, when you needed an interpreter to help you speak with your child's dentist or dental provider, how often did you get one?

32d. In the last 12 months, when your child needed an interpreter to help him/her speak with a dentist or other dental provider, how often did he/she get one?

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TABLE 1. Item-Scale Correlations for Hypothesized Scales (n = 664)

Item	Mean	SD	Getting Needed Care	Getting Care Quickly	Communication	Office Staff	Customer Service
Finding office/clinic (5)	63.58	34.14	0.40*	0.34	0.33	0.29	0.34
Getting specialty referral (12)	55.03	27.61	0.44*	0.24	0.22	0.21	0.29
Getting necessary care (25)	69.74	36.85	0.57*	0.48	0.46	0.50	0.41
Delays getting care (26)	75.38	35.56	0.43*	0.28	0.28	0.27	0.30
Help or advice (16)	66.94	27.22	0.43	0.56*	0.54	0.58	0.27
Appointment for cavity (18)	59.58	30.83	0.37	0.63*	0.45	0.47	0.24
Appointment for routine care (20)	62.54	32.34	0.38	0.66*	0.52	0.50	0.25
Care for mouth pain/dental problem (22)	57.75	22.95	0.38	0.49*	0.34	0.39	0.23
Office wait (27)	54.62	36.92	0.19	**0.33***	0.41←	0.41←	0.16
Providers listen carefully (30)	71.37	31.34	0.43	0.60	0.69*	0.66	0.28
Hard time speaking with providers (31)	82.22	29.63	0.17	0.18	**0.26***	0.16	0.21
Explanations (32)	70.47	32.76	0.33	0.49	0.66*	0.56	0.21
Show respect (33)	77.12	29.07	0.43	0.56	0.72*	0.65	0.29
In exam room with child (35)	66.64	35.52	0.18	0.23	**0.26***	0.25	0.10
Child had hard time speaking with providers (37)	91.17	18.91	0.09	0.10	**0.19***	0.14	0.13
Explained to child (38)	76.32	25.97	0.21	0.34	0.44*	0.35	0.17
Spent enough time with child (39)	67.58	30.95	0.40	0.62	0.70*	0.63	0.29
Got interpreter (32b)	73.87	15.42	0.23	0.22	**0.29***	0.19	0.20
Child got interpreter (32d)	62.25	11.02	0.08	0.13	**0.19***	0.10	0.13
Treated with courtesy and respect (28)	77.93	28.37	0.39	0.57	0.61	0.78*	0.26
Helpful (29)	70.25	30.73	0.47	0.66	0.68	0.78*	0.27
Understanding written material (47)	72.57	29.46	0.38	0.25	0.28	0.19	0.46*
Help from customer service (49)	69.50	31.90	0.39	0.25	0.25	0.24	0.40*
Paperwork (51)	81.14	24.26	0.28	0.21	0.25	0.20	0.39*

Item numbers in survey shown in parentheses in first column. Items were transformed linearly to a 0–100 possible range, with higher score being a more positive experience.
← indicates item-scale correlation that exceeds correlation of item with its hypothesized scale.
*Correlation of item with hypothesized scale.
Bolded entries indicate correlation with hypothesized scale is less than 0.30 or less than correlations with other scales in the same row.

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TABLE 2. Item-Scale Correlations for Revised Scales (n = 666)

Item	Mean	SD	Getting Needed Care	Getting Care Quickly	Communication	Office Staff	Customer Service
Finding office/clinic (5)	63.54	34.21	0.39*	0.33	0.34	0.29	0.34
Getting specialty referral (12)	55.04	27.57	0.44*	0.24	0.21	0.21	0.29
Getting necessary care (25)	69.83	36.83	0.57*	0.47	0.45	0.50	0.40
Delays getting care (26)	75.46	35.53	0.43*	0.27	0.26	0.27	0.30
Help or advice (16)	66.94	27.17	0.43	0.56*	0.56	0.58	0.27
Appointment for cavity (18)	59.45	30.89	0.37	0.63*	0.47	0.47	0.24
Appointment for routine care (20)	62.45	32.39	0.38	0.66*	0.54	0.50	0.25
Care for mouth pain/dental problem (22)	57.77	22.92	0.38	0.49*	0.36	0.39	0.23
Office wait (27)	54.60	36.96	0.19	**0.33***	0.42←	0.41←	0.16
Providers listen carefully (30)	71.31	31.43	0.42	0.60	0.73*	0.65	0.27
Explanations (32)	70.36	32.83	0.33	0.49	0.68*	0.56	0.21
Show respect (33)	77.12	29.03	0.42	0.56	0.75*	0.65	0.28
Explained to child (38)	76.33	25.93	0.21	0.34	0.47*	0.35	0.17
Spent enough time with child (39)	67.48	31.01	0.39	0.61	0.73*	0.63	0.30
Treated with courtesy and respect (28)	77.95	28.35	0.39	0.57	0.63	0.78*	0.26
Helpful (29)	70.24	30.68	0.47	0.66	0.72	0.78*	0.27
Understanding written material (47)	72.50	29.44	0.38	0.25	0.23	0.19	0.46*
Help from customer service (49)	69.44	31.99	0.39	0.24	0.24	0.24	0.40*
Paperwork (51)	81.14	24.22	0.28	0.21	0.22	0.20	0.39*
Hard time speaking with providers (31)	82.27	29.61	0.17	0.18	0.24	0.16	0.21
In exam room with child (35)	66.64	35.47	0.18	0.23	0.29	0.25	0.10
Child had hard time speaking with providers (37)	91.17	18.88	0.09	0.10	0.18	0.14	0.13
Got interpreter (32b)	73.87	15.39	0.23	0.22	0.27	0.19	0.20
Child got interpreter (32d)	62.25	11.00	0.08	0.13	0.15	0.10	0.13

Item numbers in survey shown in parentheses in first column. Items were transformed linearly to a 0–100 possible range, with higher score being a more positive experience.
← indicates item-scale correlation that exceeds correlation of item with its hypothesized scale.
*Correlation of item with hypothesized scale.
Bolded entries indicate means correlation with hypothesized scale is less than 0.30 or less than correlations with other scales in the same row.

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TABLE 3. Descriptive Statistics and Reliability Estimates (n = 4036)

Scale	No. Items	Mean	SD	% Floor	% Ceiling	Plan-Level Reliability	Alpha Reliability
Global rating of all dental care	1	77.93	23.14	1.7	27.3	0.98	N/A
Global rating of dental plan	1	78.86	22.94	1.9	29.6	0.98	N/A
Getting needed care	4	77.16	28.09	4.4	46.4	0.96	0.73
Getting care quickly	5	60.80	28.52	4.8	14.8	0.99	0.86
Communication by dental providers	5	75.50	24.89	0.8	29.5	0.99	0.86
Office staff	2	77.85	26.67	2.3	46.7	0.99	0.85
Dental plan customer service	3	75.69	30.39	6.2	53.6	0.87	0.75

(χ^2 = 1747.80, n = 3346, df = 26, $P < 0.001$) and had a comparative fit index of 0.91. Practical fit indices should be at least 0.90 to be acceptable.[18] The RMSEA was 0.14, exceeding the cutoff of 0.05 for good fit.[19] Standardized factor loadings ranged from 0.36 (item 37) to 0.89 (item 33), and the average absolute residual correlation was 0.05. The confirmatory factor analysis suggests borderline concerns about unidimensionality and under some circumstances might warrant excluding items that are responsible for violations of this assumption. We conduct IRT analyses on all 10 communication items to help reveal the potentially problematic items

than for any other item, which is consistent with this item's mean being among the lowest (mean = 67.58; Table 1) Specifically, the probability of responding *always* to this item is 50/50 for someone with a trait level of 0.18.

The slope parameters ranged from 0.73 (item 35) to 3.97 (item 33). Consistent with this is the fact that one of the lowest item-total correlation estimates was for item 35 (Table 1). Item 37, which had the lowest item-total correlation (r = 0.15), had a similarly low slope estimate (0.77). Items 30 and 33 had item-total correlations of 0.69 and 0.72 while the slope estimates were 3.50 and 3.97, respectively. Interestingly, the

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along the latent trait scale at which a respondent has a 0.50 probability of responding above the threshold. As seen in Table 4, a person with a trait level of −1.71 has a 50/50 chance of responding *never* versus *sometimes/usually/always* to the question about how often the dentist or other dental providers listened carefully to them. The trait level associated with a 0.50 probability of responding above the 3 thresholds is higher for item 39 (spend enough time with your child) close to zero. Larger differences were found for the interpreter items. For example, the expected proportion in the *always* response category for the child got an interpreter when needed item was 0.59 but the observed proportion was only 0.44.

The item characteristic curve (ICC) or categorical response curve provides the probability of each response category being selected as a function of the estimated underlying

TABLE 4. Category Thresholds and Slope Estimates for Communication Scale (n = 4036)

Item	Category Threshold Parameter—Between *Never* and *Sometimes*	Category Threshold Parameter—Between *Sometimes* and *Usually*	Category Threshold Parameter—Between *Usually* and *Always*	Slope Parameter
Providers listen carefully (30)	−1.71	−0.95	−0.03	3.50
Hard time speaking with providers (31)*	−1.23	−2.66	−3.60	0.90
Explanations (32)	−1.69	−1.01	−0.16	2.55
Show respect (33)	−1.95	−1.19	−0.32	3.97
In exam room with child (35)	−2.24	−1.11	−0.31	0.73
Child had hard time speaking with providers (37)*	−2.35	−4.29	−5.20	0.77
Explained to child (38)	−1.96	−1.17	−0.18	2.07
Spent enough time with child (39)	−1.89	−0.93	0.18	2.73
Got interpreter (32b)	−2.14	−1.09	−0.39	1.85
Child got interpreter (32d)	−1.64	−0.81	−0.29	2.40

*Because these items were reverse scored, relative ordering of thresholds is opposite of the other items.

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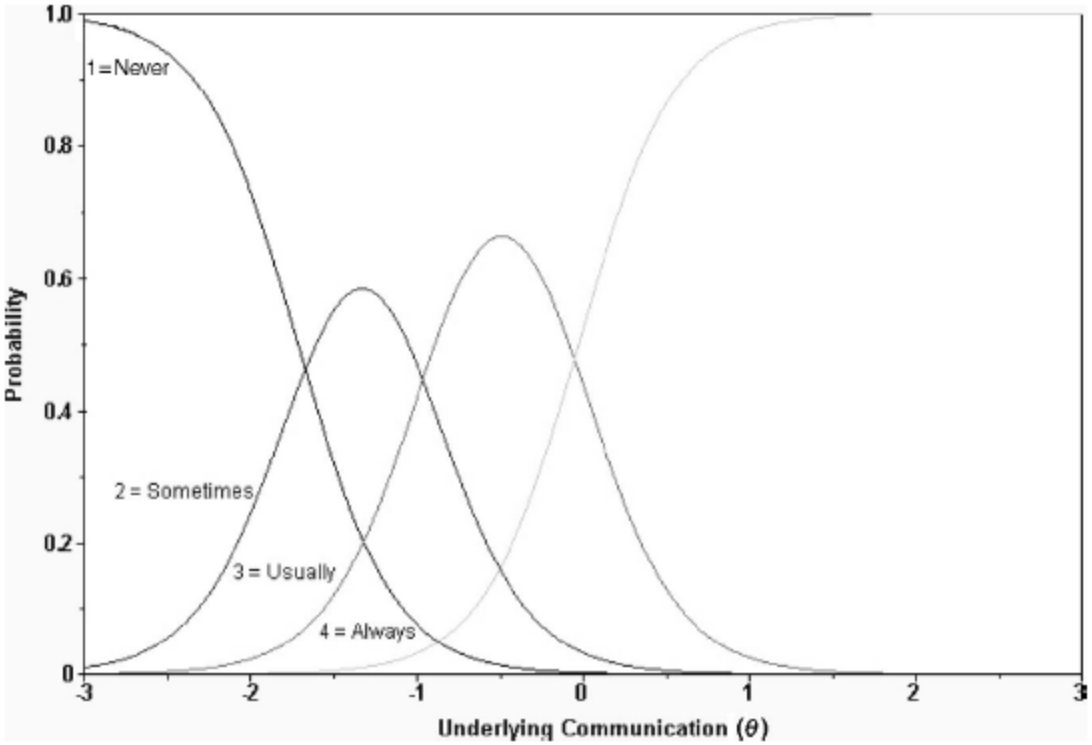

FIGURE 1. Item Characteristic Curve for Item 30.

attribute. Figure 1 shows the ICC for item 30. This ICC demonstrates the sort of picture one likes to see for an item because at most points along the underlying continuum there is one response category that has the highest probability of

standard error and is conditional on trait level: SE = 1/(information$\|\theta)^{1/2}$. Figure 3 shows the information curve and measurement error for the communication scale. Note that information is highest (standard error lowest) in the range of −2 to 0 on

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always. Indeed, the item depicted in Figure 2, item 31, was 1 of the 5 items dropped from the communication scale based on the CTT analyses.

The information curve provides an indication of the amount of information the scale yields at different points along the underlying continuum. Information is inversely related to

Because the participation rate was 50%, some caution is warranted in interpreting the study results. Nonetheless, separate analyses of a CAHPS® item similar to item 27[6] revealed that the negative wording of this item confuses respondents. As a result, when CAHPS® 3.0 was released, the item was worded in terms of being seen within 15 minutes

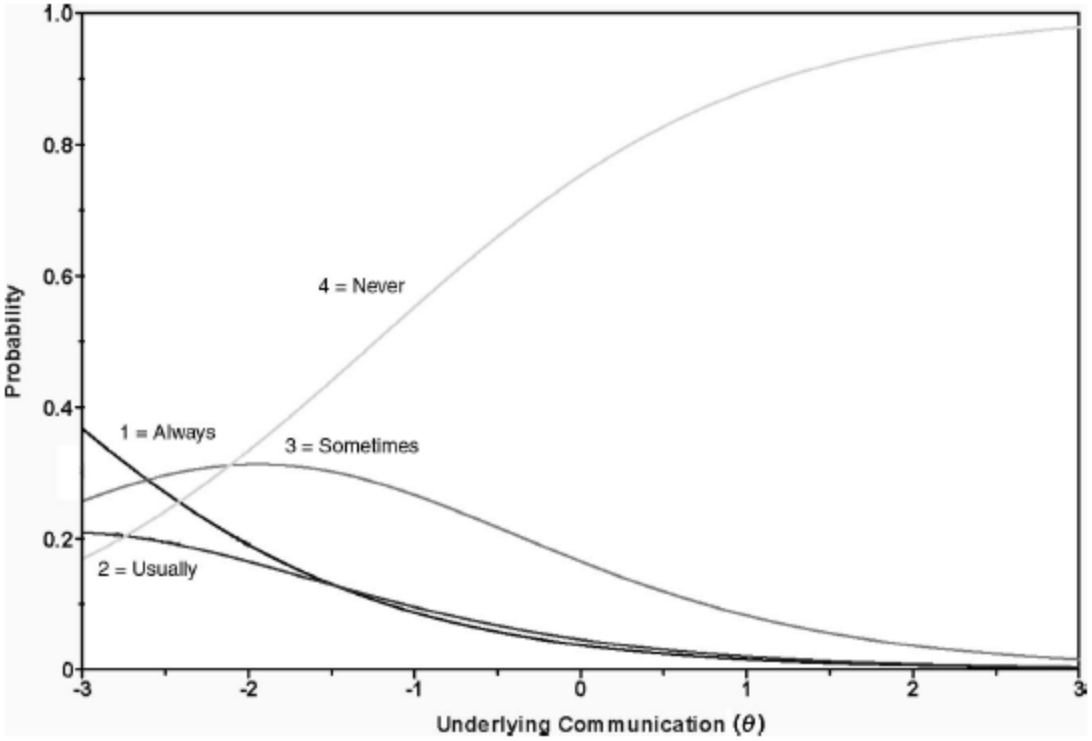

FIGURE 2. Item Characteristic Curve for Item 31.

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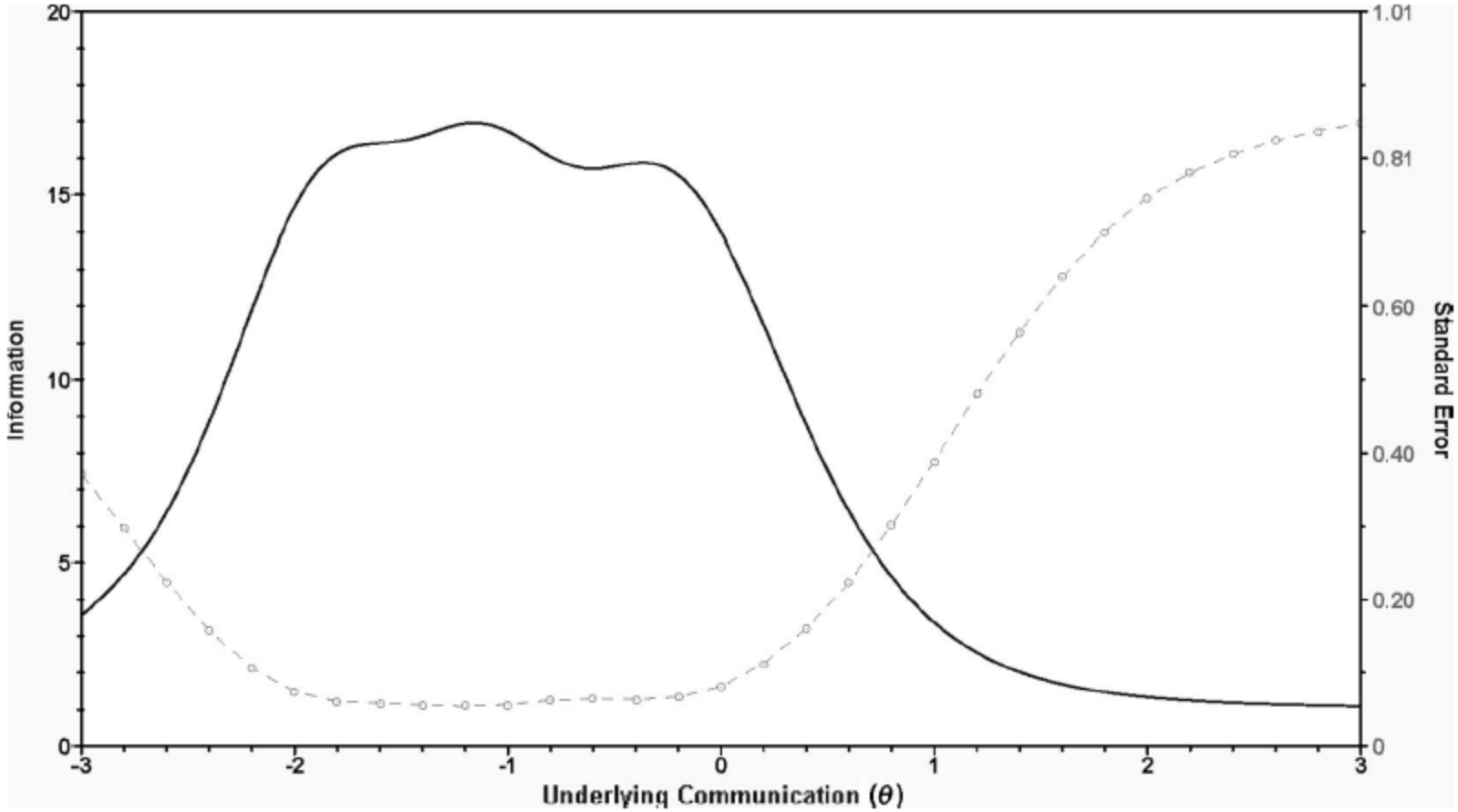
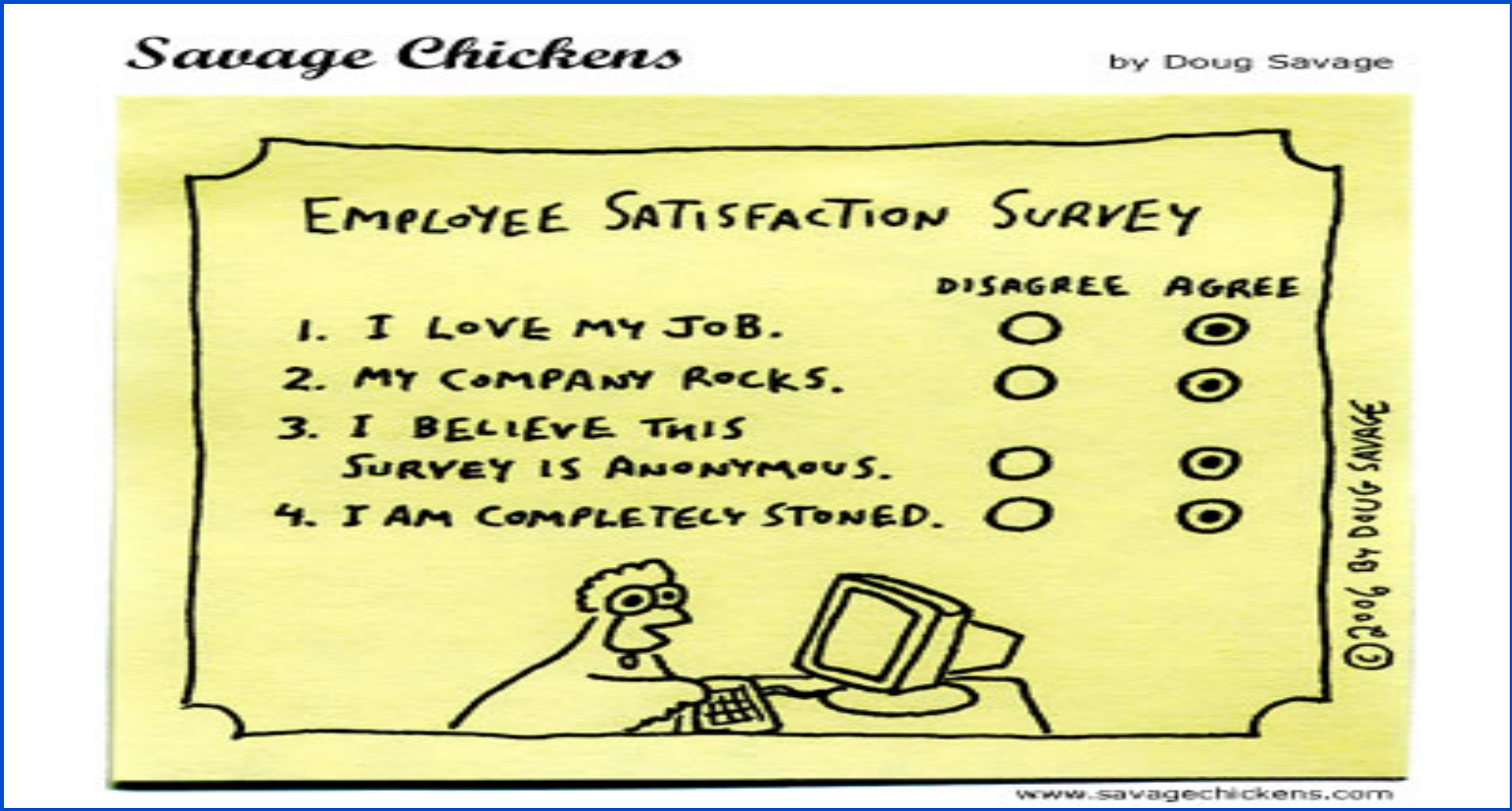


FIGURE 3. Communication Scale Information and Measurement Error.

(ie, in the positive direction). Based on the results of the analyses conducted here, we recommend that item 27 be

Analyses of the CAHPS® surveys, where missi are prevalent because of multiple skip patterns, illus

Questions?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