

Scale	Condition	Items/Scoring	Impairment	Symptoms	Functional Limitations
AAOS Ankle-Hindfoot Scale (47)	Pathology at Ankle, Subtalar, Talonavicular, Calcaneo-cubiod joint levels	9 items Score range 0-100 Higher score greater ability	Sagital ROM(8) Hindfoot ROM(6) Ankle-hindfoot stability(8) Ankle-hindfoot Alignment(10)	Pain(40)	Activity limitations(10) Walking distance(5) Walking surfaces(5) Gait abnormality
AAOS Midfoot Scale (47)	Pathology at Cuneiform-cubiod, Naviculo-cubiod, Tarsometatarsal joint levels	7 items Score range 0-100 Higher score greater ability	Midfoot alignment(15)	Pain(40)	Activity limitations(10) Footwear requirements(5) Walking distance(5) Walking surfaces(5) Gait abnormality
AAOS Hallux Metatarsophalangeal-Interphalageal Scale (47)	Pathology at First metatarsal, MTP, Proximal phalanx, Distal phalanx, IP joint levels	8 items Score range 0-100 Higher score greater ability	MTP ROM(10) IP ROM(5) MTP-IP stability(5) MTP-IP callus(5) Hallux alignment(15)	Pain(40)	Activity limitations(10) Footwear requirements(5)
AAOS Lesser Toe Metatarsophalangeal-Interphalageal Scale (47)	Pathology at Metatarsal 2-5, MTP 2-5, Proximal, Middle, and Distal Phalanges 2-5, PIP 2-5 and DIP 2-5 joint levels	8 items Score range 0-100 Higher score greater ability	MTP ROM(10) IP ROM(5) MTP-IP stability(5) MTP-IP callus(5) Lesser toe alignment(15)	Pain(40)	Activity limitations(10) Footwear requirements(5)

**Figure 2.1: Summary of Specific Measures of HRQL for the Foot and Ankle**

Foot Function Index FFI (12)	Rheumatoid Arthritis	23 items 3 subscales Visual analog Score range 0-100 Higher score greater impairment	Pain sub-scale -Worst foot pain -Morning foot pain -Pain walking barefoot -Pain standing bare foot -Pain walking with shoes -Pain standing with shoes -Pain standing with orthotics -Pain walking with orthotics	Disability sub-scale -Walk in house -Walk outside -Walk four blocks -Climb stairs -Descend stairs -Stand on tip toe -Up from chair -Climb curb Activity Limitation sub-scale -Use device indoors -Use device outdoors -Stay inside all day -Stay in bed all day
Ankle Osteoarthritis scale AOS (23)	Osteoarthritis	19 items 2 subscales Visual analog Score range 0-100 Higher score greater impairment	Pain sub-scale -Worst foot pain -Morning foot pain -Pain walking barefoot -Pain standing bare foot -Pain walking with shoes -Pain standing with shoes -Pain standing with orthotics -Pain walking with orthotics	Disability sub-scale -Walk in house -Walk outside -Walk four blocks -Climb stairs -Descend stairs -Stand on tip toe -Up from chair -Climb curb

**Continue Figure 2.1: Summary of Specific Measures of HRQL for the Foot and Ankle**

Lower Extremity Function Scale LEFS (7)	Pathology at Hip, Knee, Thigh, Ankle and Foot	20 items Likert format Score range 0-80 Higher score greater function	<ul style="list-style-type: none"> <li>-Work, housework, or school</li> <li>-Hobbies, recreational or sports</li> <li>-Getting into or out of the bath</li> <li>-Walking between rooms</li> <li>-Putting on shoes and socks</li> <li>-Squatting</li> <li>-Lifting</li> <li>-Light activities</li> <li>-Heavy activities</li> <li>-Getting into or out of car</li> <li>-Walking two blocks</li> <li>-Walking a mile</li> <li>-Going up or down 10 stairs</li> <li>-Standing for 1 hour</li> <li>-Sitting for 1 hour</li> <li>-Running on even ground</li> <li>-Running on uneven ground</li> <li>-Making sharp turns while running fast</li> <li>-Hopping</li> <li>-Rolling over in bed</li> </ul>
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**Continue Figure 2.1: Summary of Specific Measures of HRQL for the Foot and Ankle**

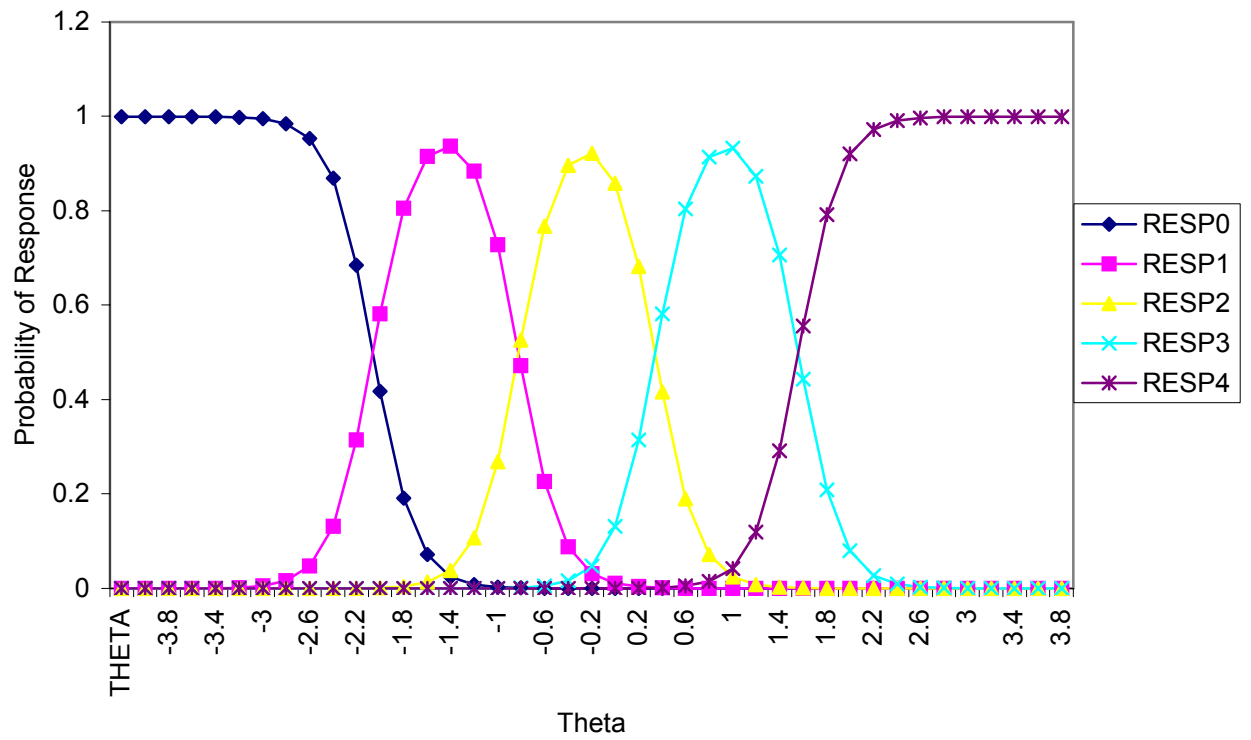
	<b>FFI Total Score</b>	<b>Activity Limitation Sub-scale</b>	<b>Disability Sub-scale</b>	<b>Pain Sub-scale</b>
<b>Number of painful hand joints</b>	0.33* 0.01** 61***	0.25 0.05 61	0.31 0.02 61	0.30 0.02 61
<b>Grip strength</b>	-0.47 0.0001 62	-0.42 0.0009 62	-0.48 0.0001 62	-0.37 0.003 62
<b>Number of painful foot joints</b>	0.53 0.001 61	0.43 0.0006 61	0.43 0.0001 61	0.54 0.0001 61
<b>Fifty feet walking time</b>	0.48 0.0002 57	0.42 0.001 57	0.51 0.0001 57	0.34 0.009 57

\* Pearson correlational coefficient

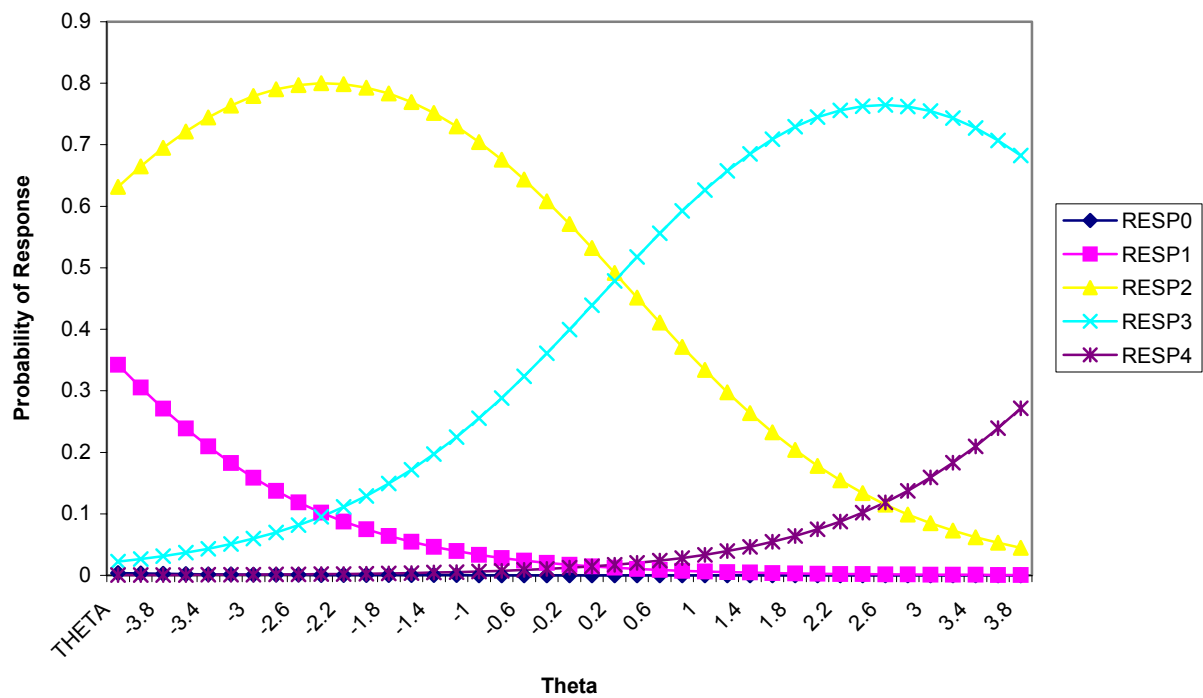
\*\* p value

\*\*\* number of subjects

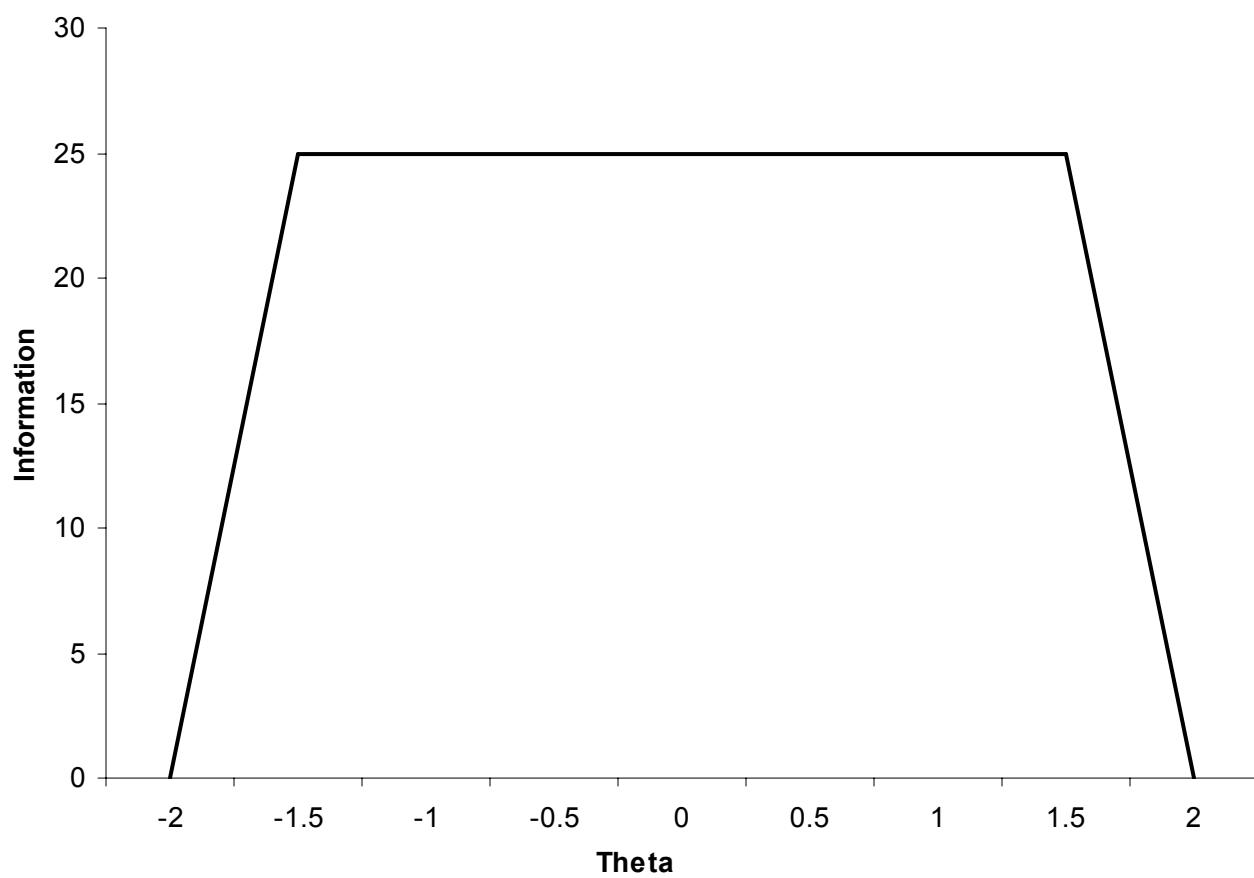
**Figure 2.2: Correlation Matrix Describing the Relationship of Foot Function Index to Clinical Measures.**



**Figure 3.1: Representative Item Characteristic Curve**



**Figure 3.2: Item Characteristic Curve for a Potentially Non-Responsive Item**



**Figure 3.3: Target Test Information Function**

Research question	Method of analysis
1) Assess Fit of Item Response Theory Model.	<p>A) Assess assumption of unidimensionality by performing exploratory factor analysis.</p> <p>B) Compare fit of partial credit model to the graded response model using twice negative log likelihood statistic.</p> <p>C) Assess property of invariance of parameter estimates by plotting pairs of parameter estimates for males vs. females, young vs. old and a random split sample.</p>
2) Which items are potentially responsive across all ability ranges?	Plot item characteristic curves.
3) Can a target test information function be produced that maximizes information through a broad range of physical function?	Assess test information function.

**Figure 3.4: Summary of Methods to Produce Final Version**

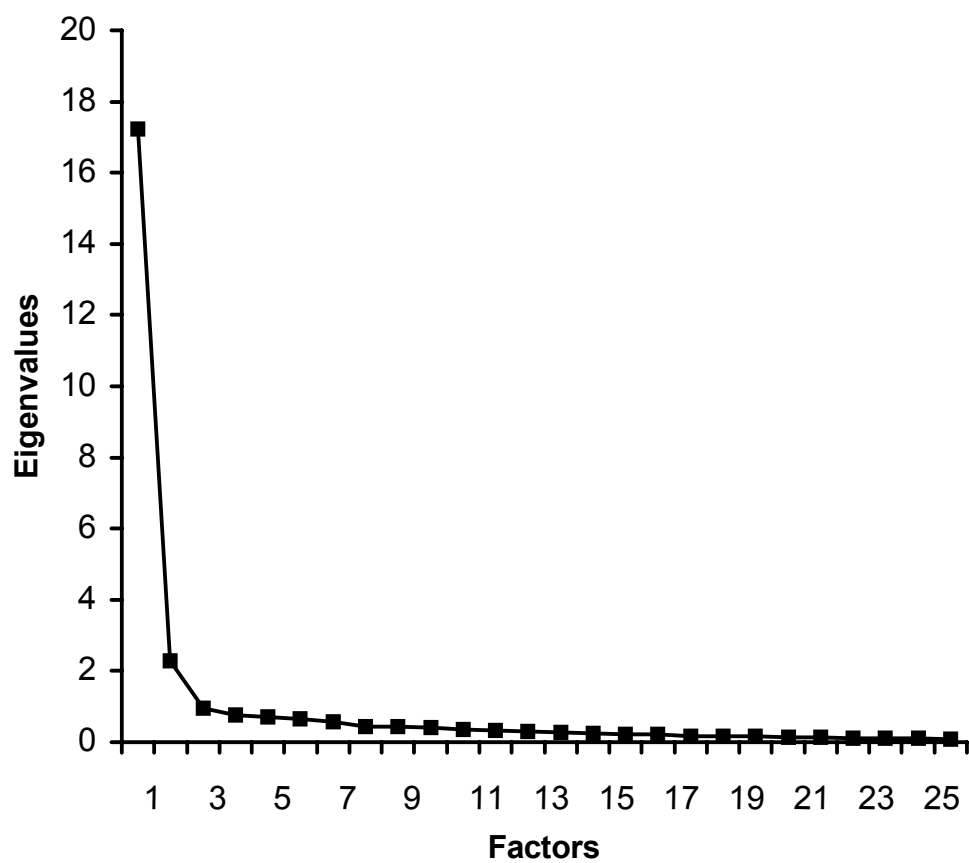


<b>Research Question</b>	<b>Sample</b>	<b>Method of analysis</b>	<b>Hypothesis</b>
What is the factorial structure of the FAAM ADL and Sports scales?	1) Change group 2) Stable group 3) Combined stable and change group	Exploratory factor analysis for each of the three groups to assess 1) eigenvalue, 2) factor loading, and 3) test of scree.	1) A single eigenvalue greater than one 2) All items will load on one factor. 3) Only one point will be at or to the left of the “elbow”.
Do the FAAM ADL and Sports scales demonstrate internal consistency?	Combined stable and change group	Estimate Cronbach’s alpha coefficient of the combined groups.	Coefficient alpha >0.90
Do the FAAMADL and Sports scales demonstrate test re-test reliability?	Stable group	ICC(2.1) using the initial and four week administration of the FAAM.	ICC >0.90
Are the FAAM ADL and Sports scales responsive to changes in individual’s physical function level?	1) Change group 2) Stable group	1) Two-way repeated ANOVA 2) 95% CI of Guyatt’s response index. 3) ROC curves	1) A significant interaction present. 2) 95% confidence intervals will not contain zero. 3) ROC curves have an area greater than 0.5
Are the FAAM ADL and Sports scales more responsive to changes in than a general measure of health status SF-36 (PF and PCS)?	1) Change group 2) Stable group	1) 95% CI of Guyatt’s response index. 2) 95% CI of Z-scores generated by ROC curve.	95% confidence intervals will not contain zero.
Are the FAAM ADL and Sports scales more responsive to changes in than a global rating of self-perceived level of functioning?	1) Change group 2) Stable group	1) 95% CI of Guyatt’s response index. 2) 95% CI of Z-scores generated by ROC curve.	95% confidence intervals will not contain zero.

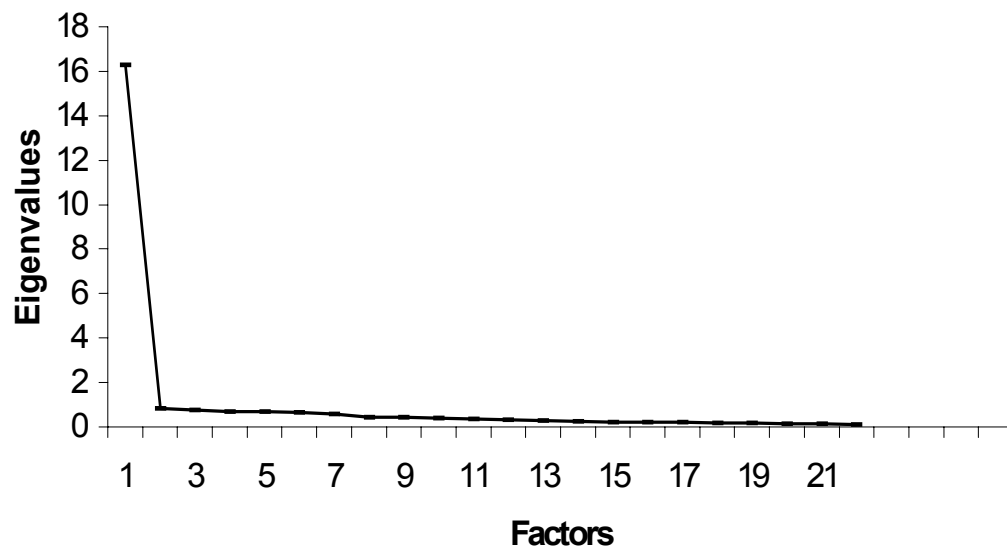
**Figure 3.5: Summary of Methods for Interpretation of the Score from the Final Version**

Research Question	Sample	Method of analysis	Hypothesis
What is the convergent and divergent evidence to support the interpretation of the final version of the FAAM ADL scale and Sports scales?	Combined stable and change group	1) Pearson product moment correlation coefficient with SF-36 (PF, PCS, MH, MCS). 2) Test for differences between correlation coefficients by comparing calculated t value to critical t value.	1) Convergent evidence $r > 0.60$ with PF and PCS Divergent evidence $r < .30$ with MH MCS. 2) The r for convergent evidence will be greater than r for divergent evidence.

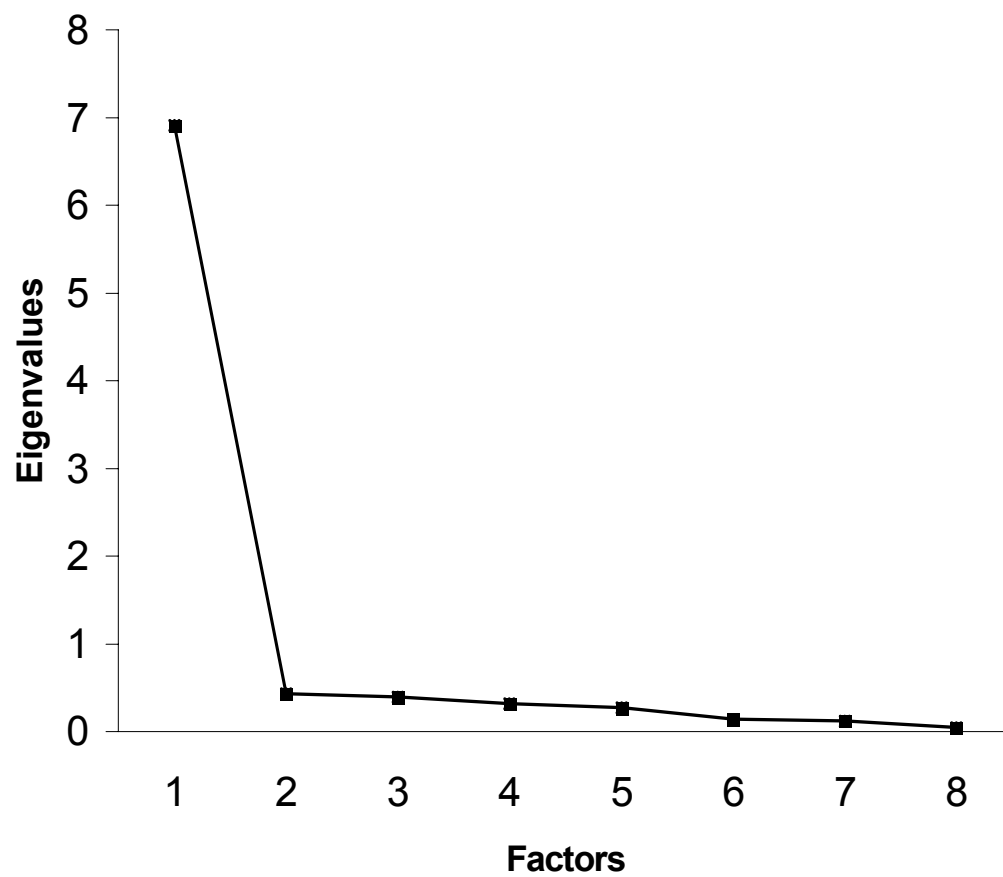
**Continue Figure 3.5: Summary of Methods for Interpretation of the Score from the  
Final Version**



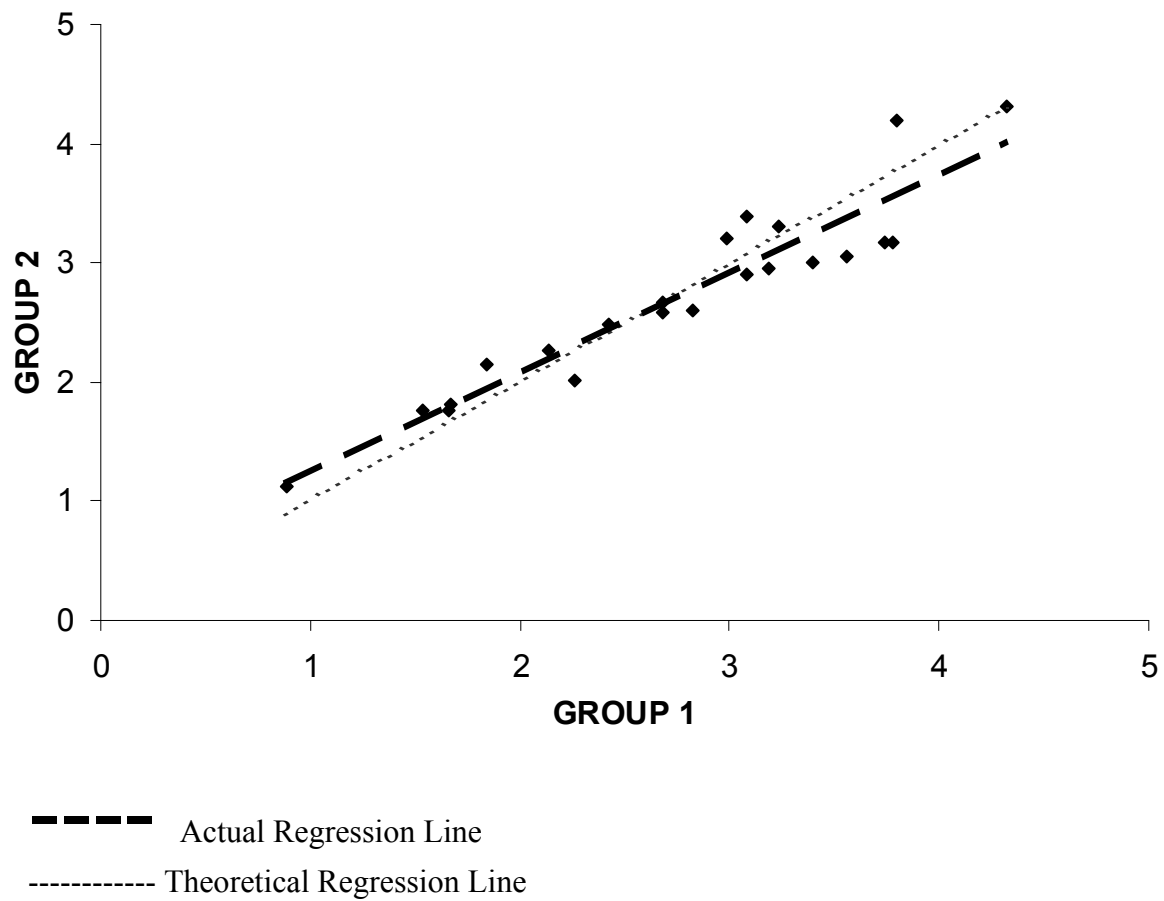
**Figure 4.1** Scree Plot for the 26-Item ADL Subscale



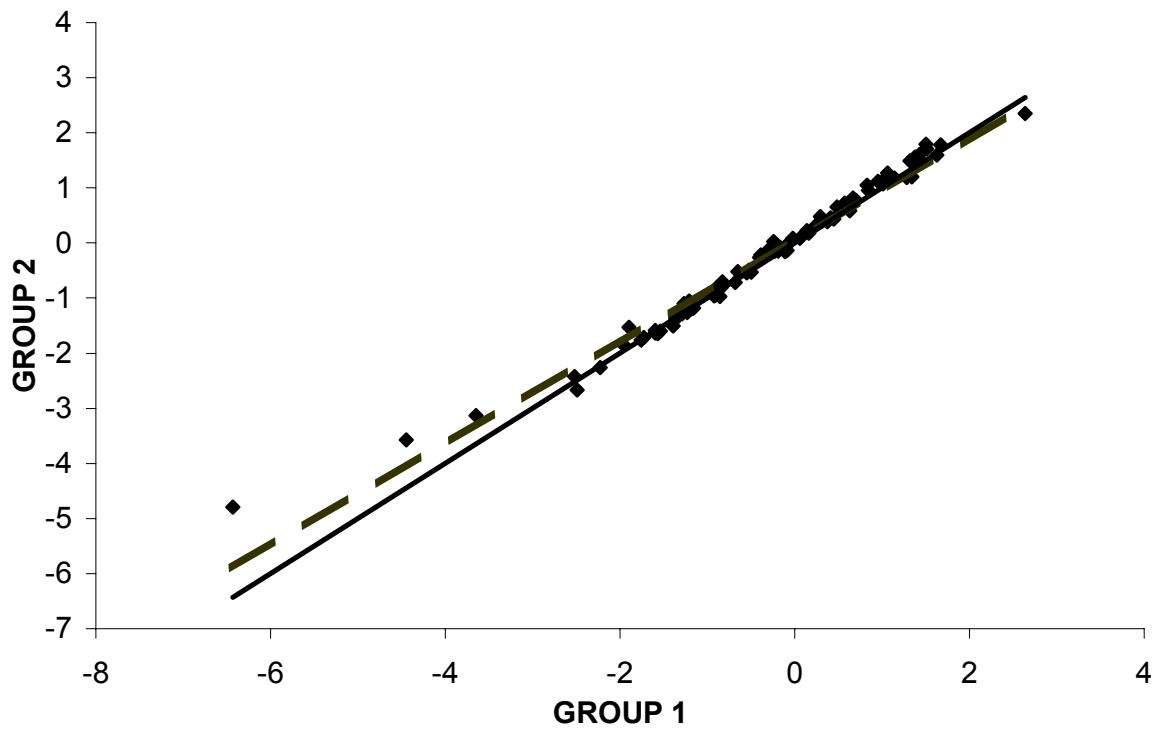
**Figure 4.2: Scree Plot for the 22-Item ADL Subscale**



**Figure 4.3: Scree Plot for the Sports Subscale**

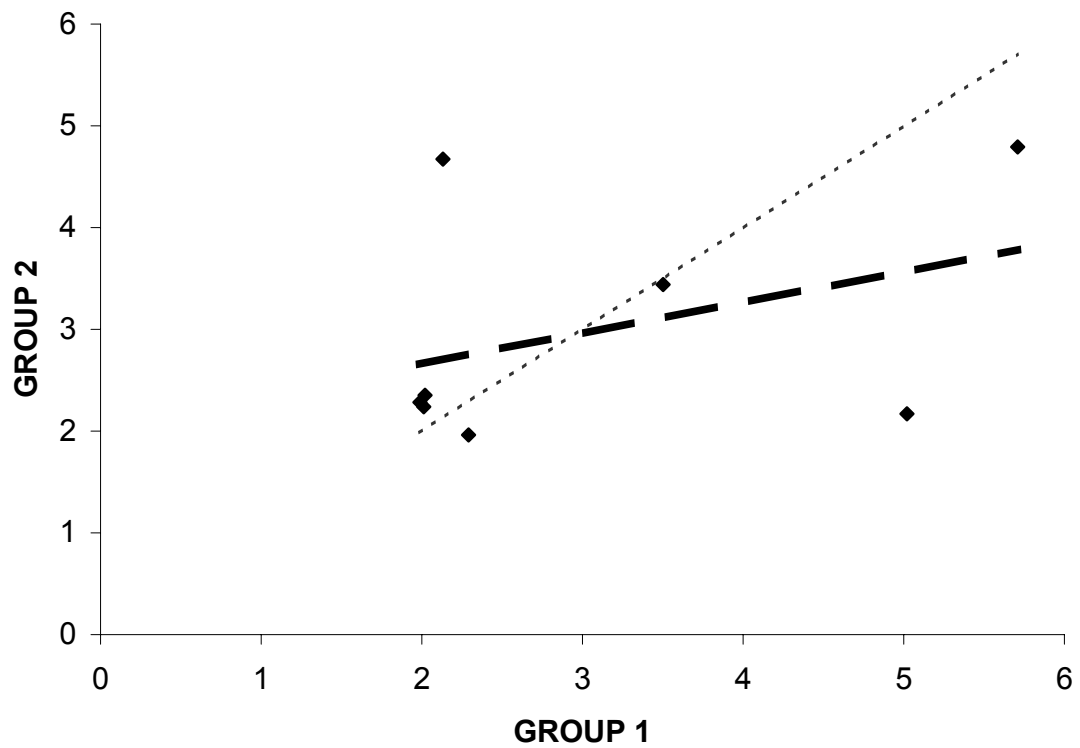


**Figure 4.4: Plot of Discrimination Parameters Group 1 versus Group 2 for the 22-Item ADL Subscale**



----- Actual Regression Line  
----- Theoretical Regression Line

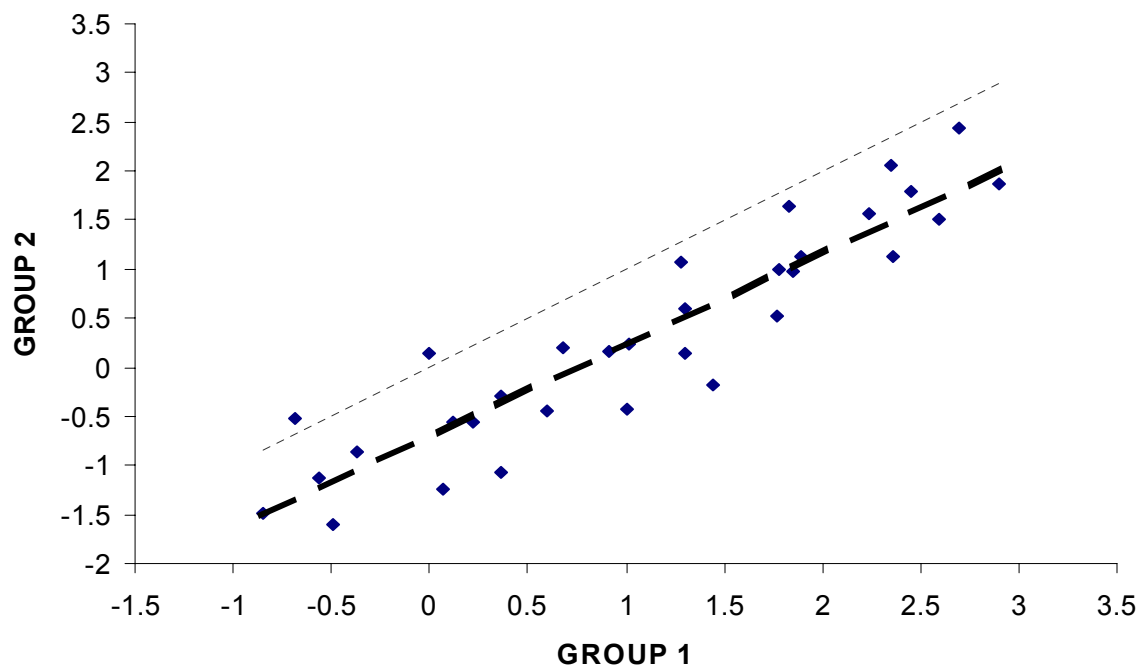
**Figure 4.5: Plot of Difficulty Parameters Group 1 versus Group 2 for the 22-Item ADL Subscale**



----- Actual Regression Line  
----- Theoretical Regression Line

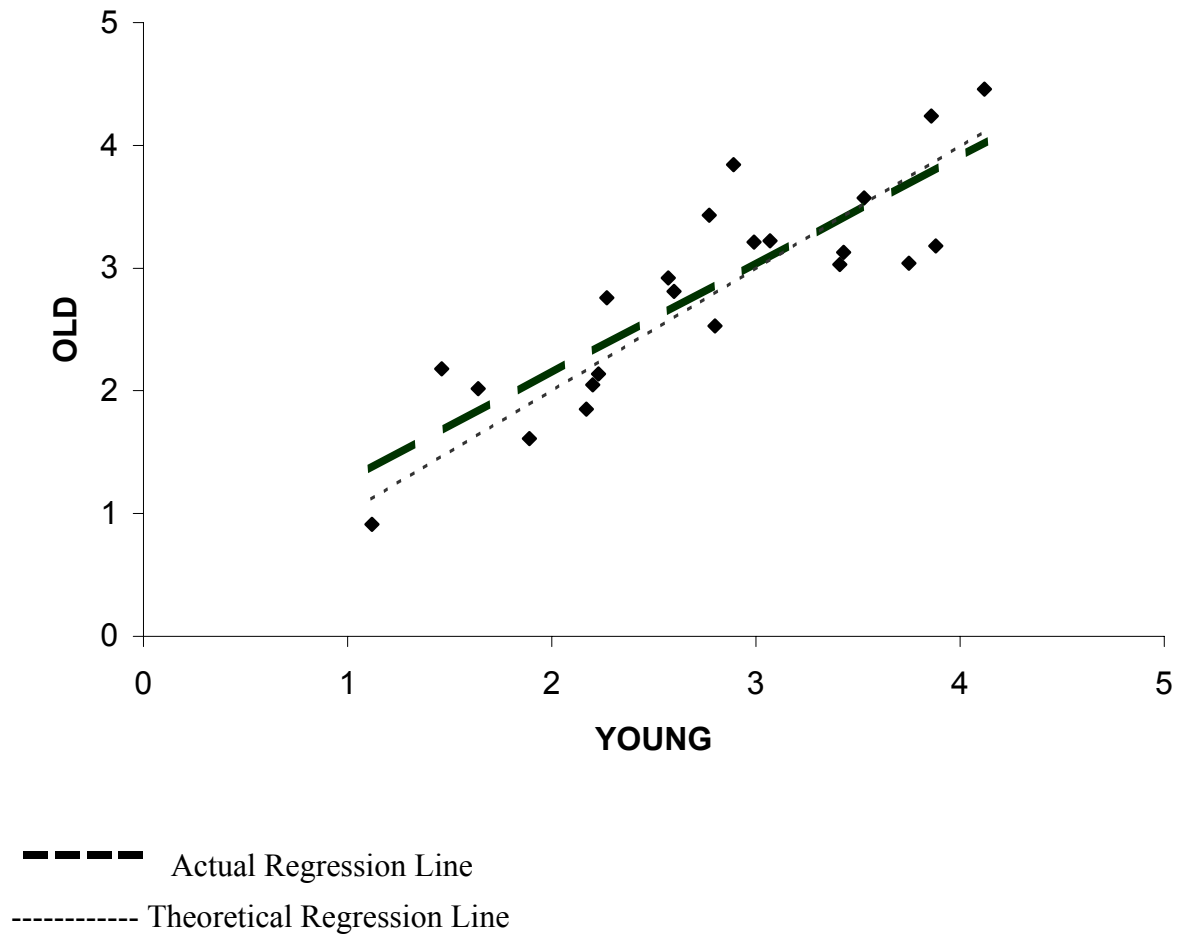
**Figure 4.6: Plot of the Discrimination Parameters Group 1 versus Group 2 for the Sports Subscale**



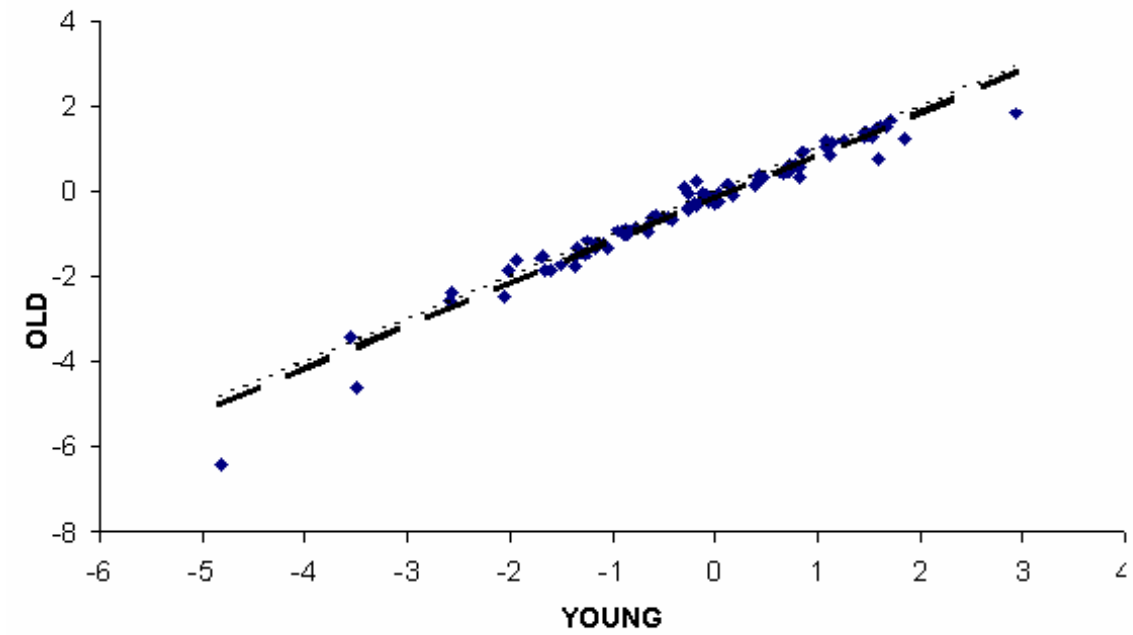


----- Actual Regression Line  
----- Theoretical Regression Line

**Figure 4.7: Plot of the Difficulty Parameters Group 1 versus Group 2 for the Sports Subscale**

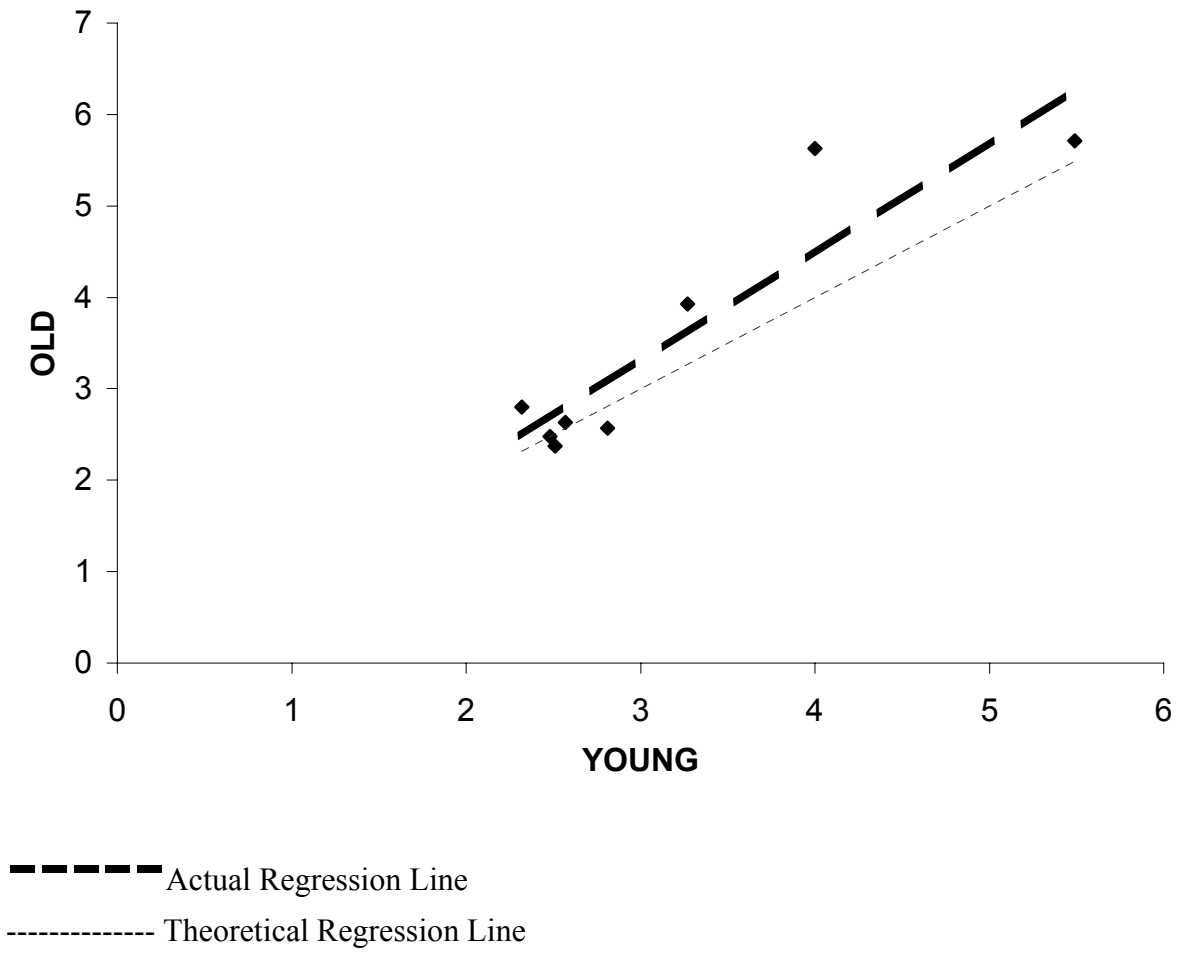


**Figure 4.8: Plot of Discrimination Parameters Young versus Old for the 22-Item ADL Subscale**

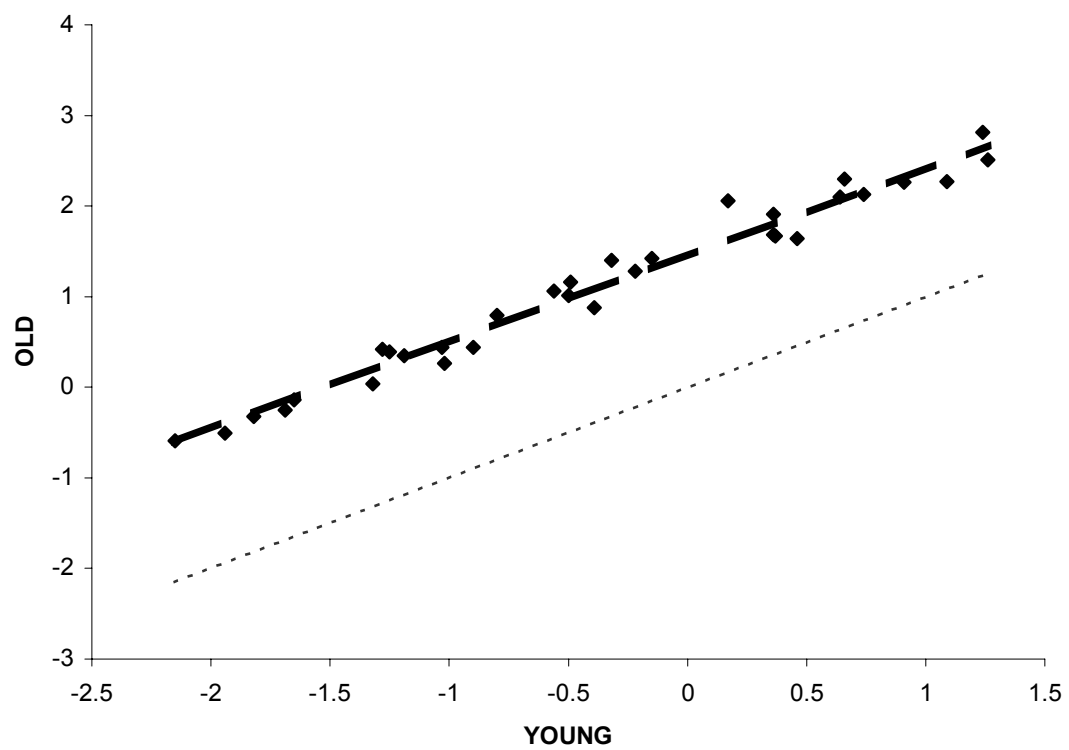


----- Actual Regression Line  
..... Theoretical Regression Line

**Figure 4.9: Plot of Difficulty Parameters Young versus Old for the 22-Item ADL Subscale**

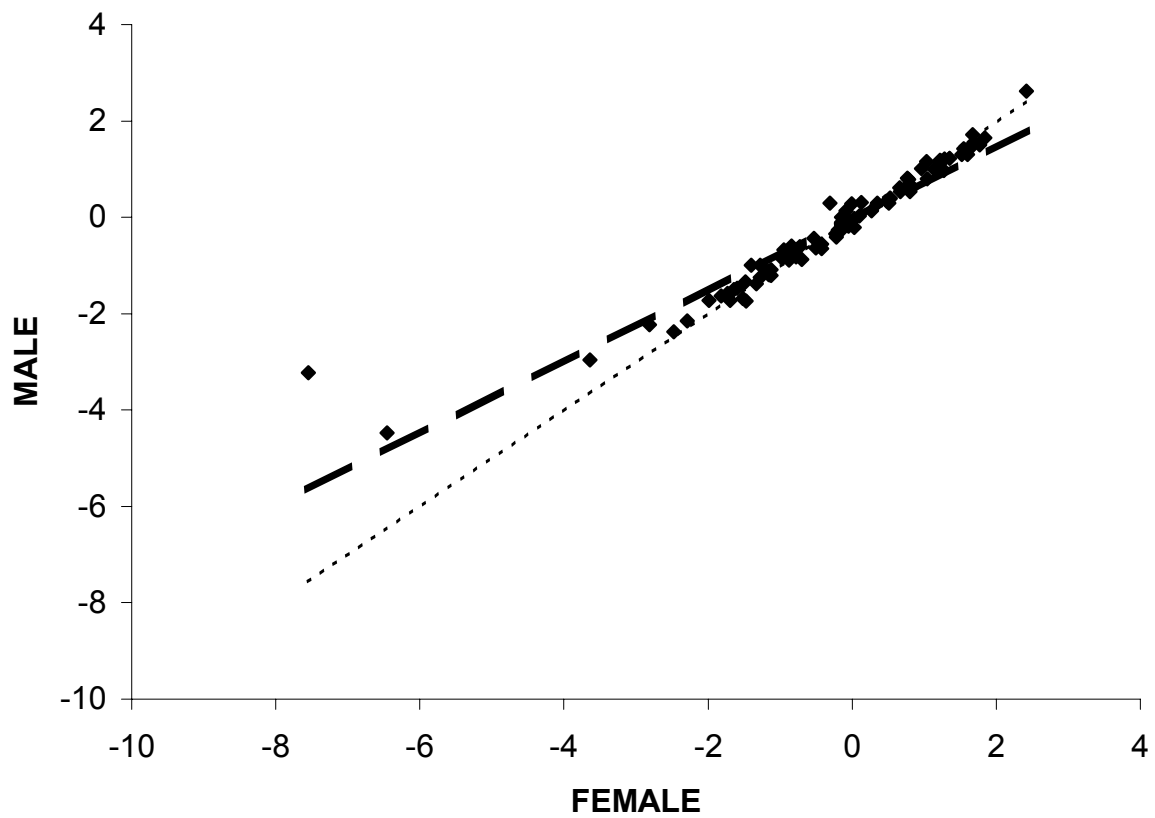


**Figure 4.10: Plot of the Discrimination Parameters Young versus Old for the Sports Subscale**



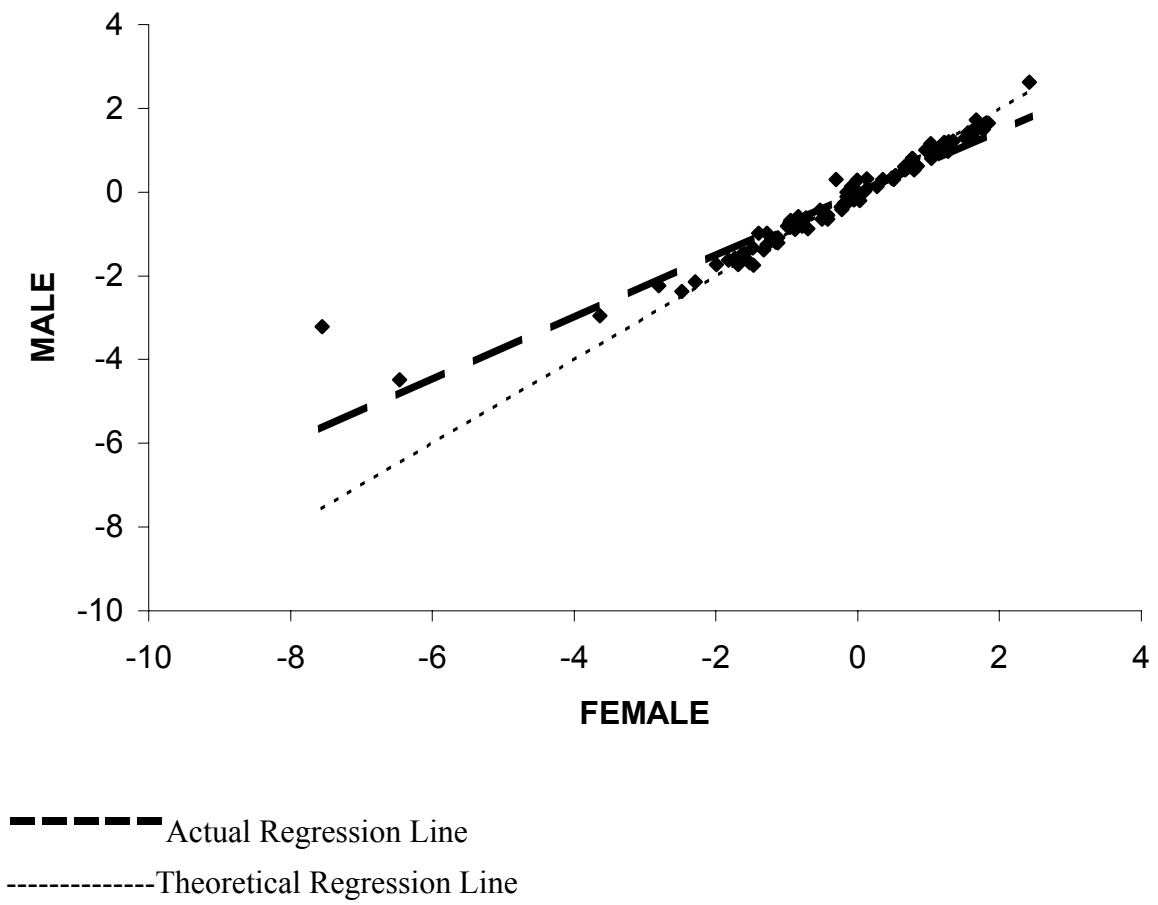
----- Actual Regression Line  
----- Theoretical Regression Line

**Figure 4.11: Plot of the Difficulty Parameters Young versus Old for the Sports Subscale**

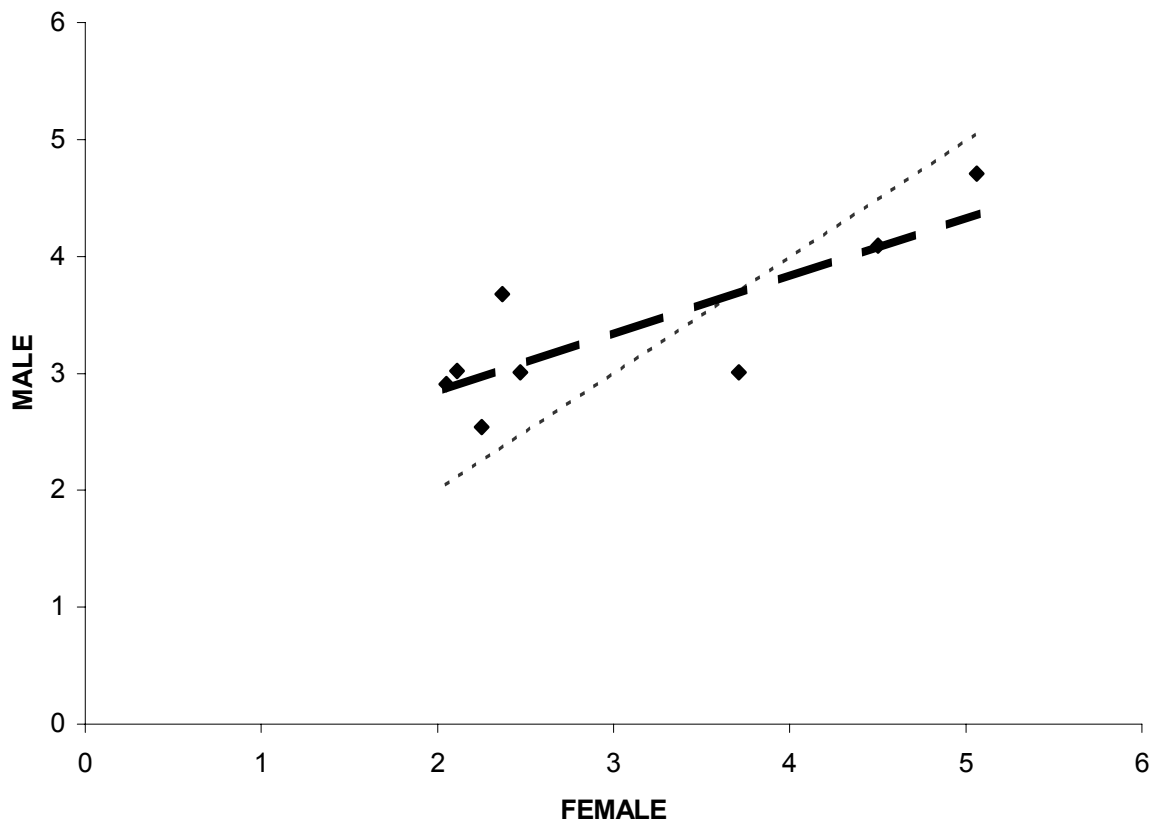


----- Actual Regression Line  
----- Theoretical Regression Line

**Figure 4.12: Plot of Difficulty Parameters Female versus Male for the 22-Item ADL Subscale**



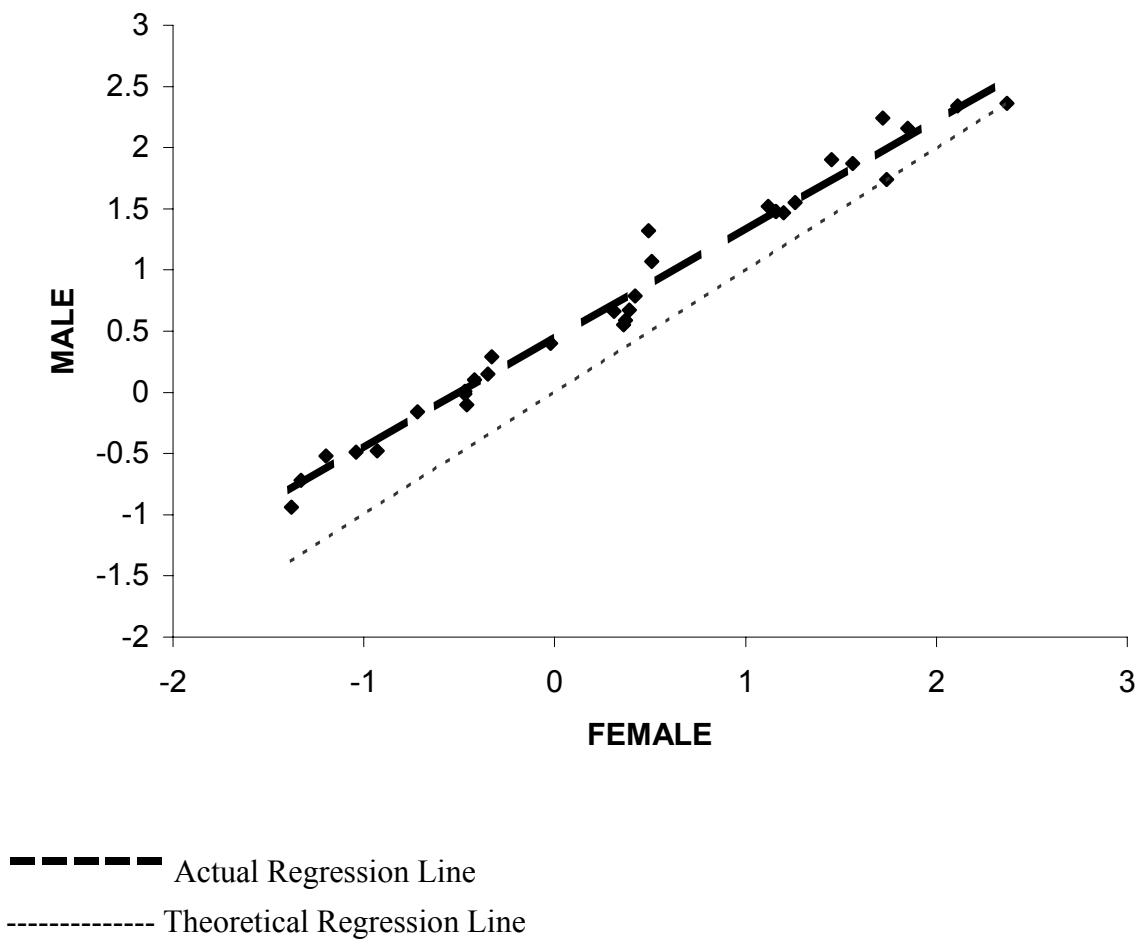
**Figure 4.13: Plot of Difficulty Parameters Female versus Male for the 22-Item ADL Subscale**



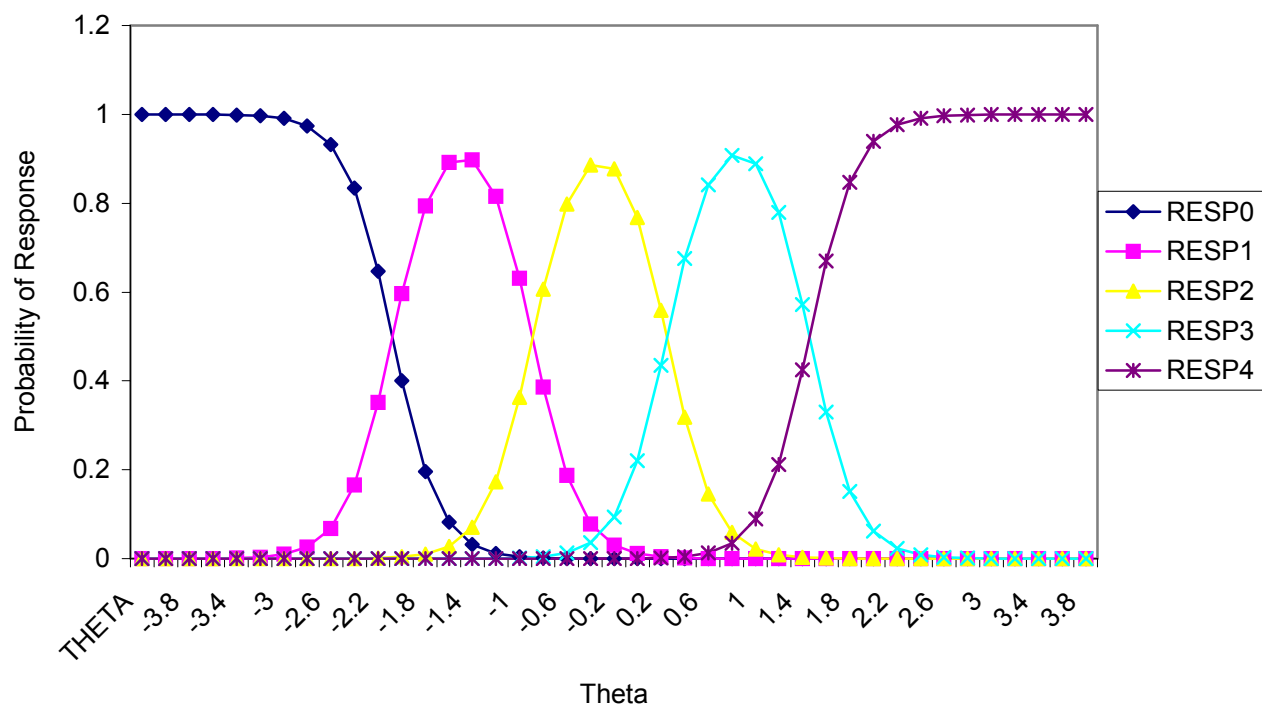
----- Actual Regression Line  
----- Theoretical Regression Line

**4.14: Plot of the Discrimination Parameters Female versus Male for the Sports Subscale**

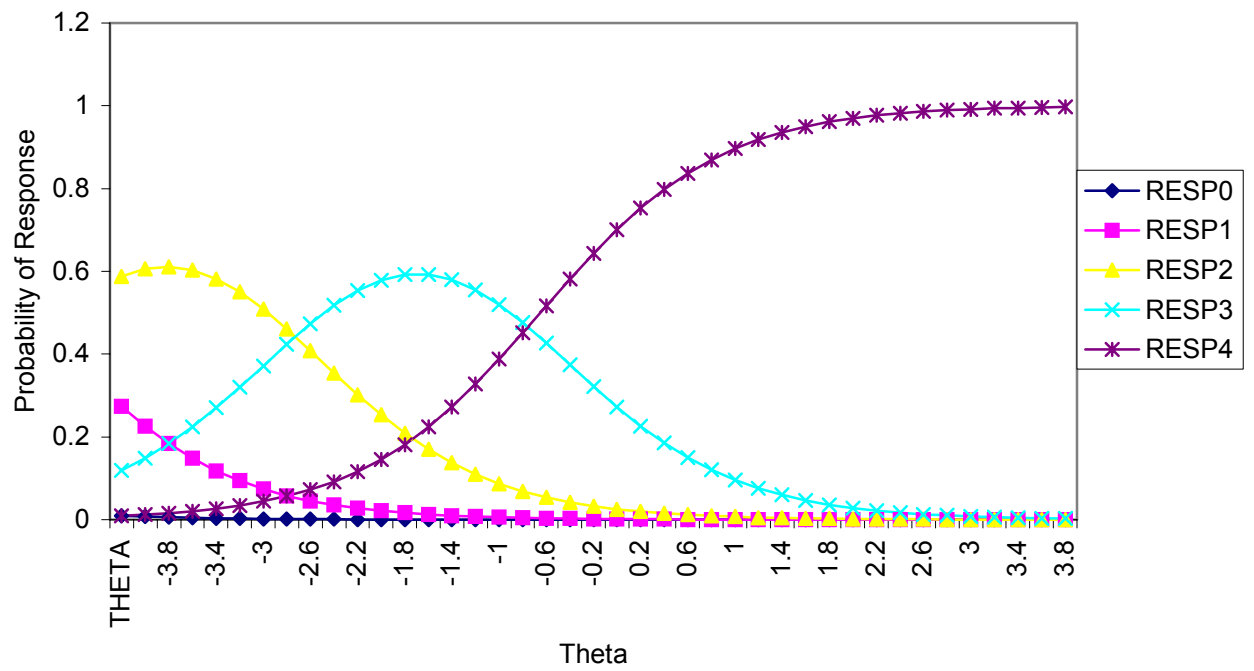




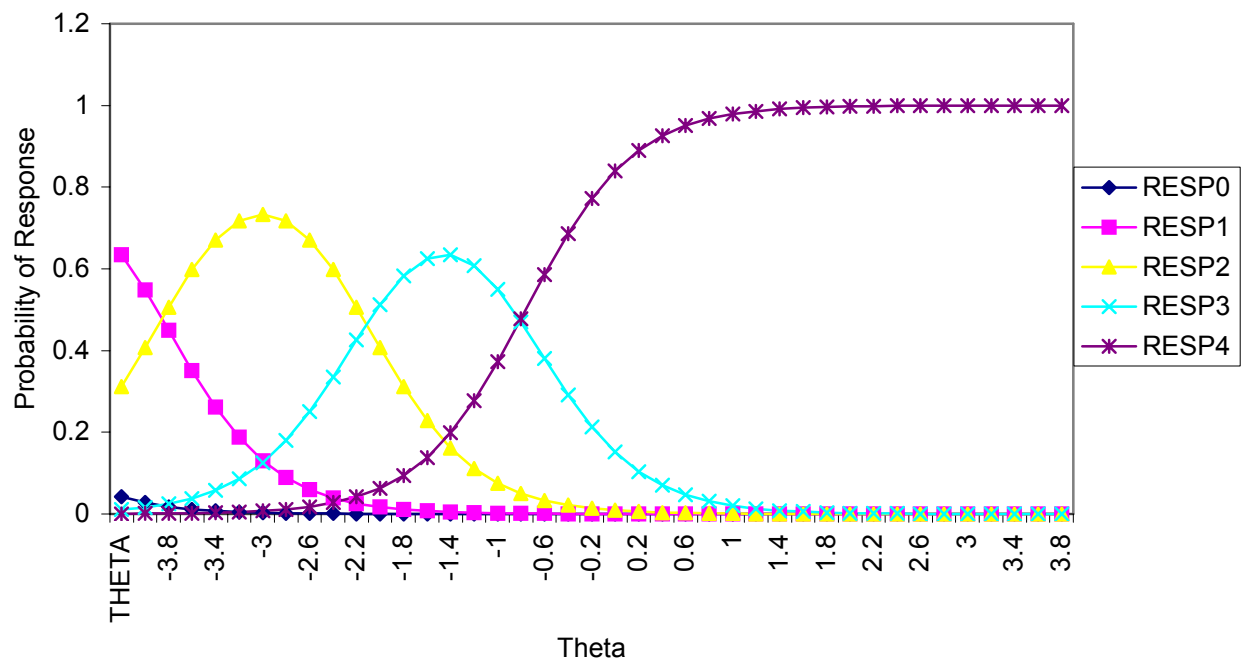
**Figure 4.15: Plot of the Difficulty Parameters Female versus Male for the Sports Subscale**



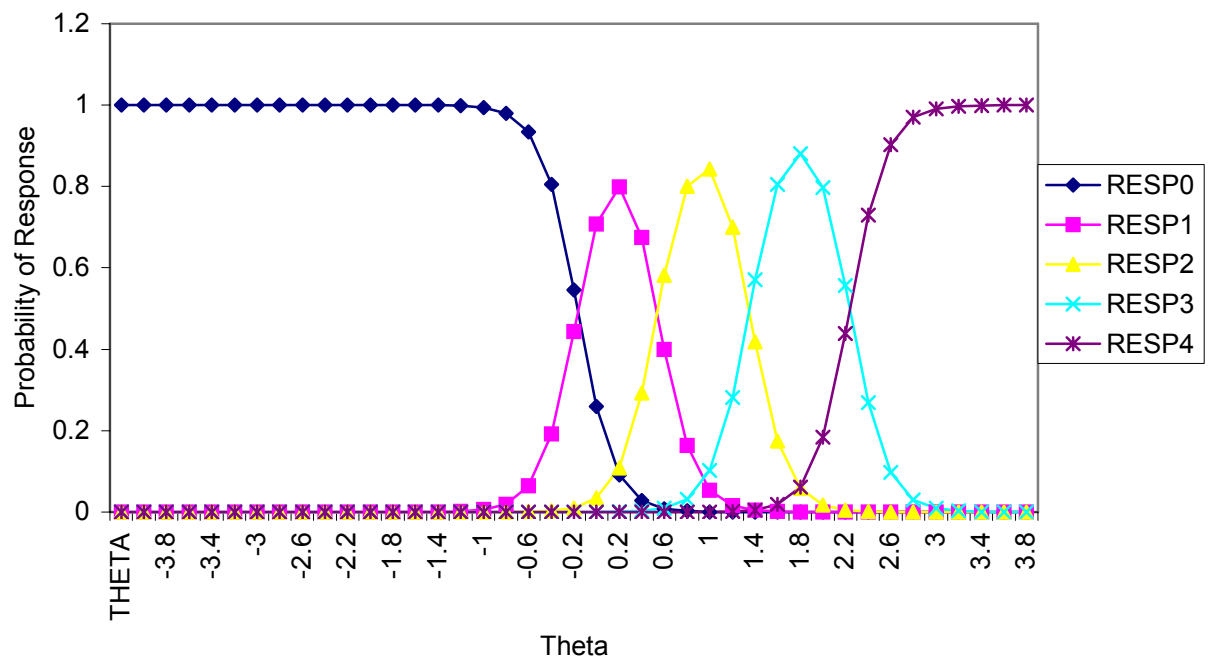
**Figure 4.16: Representative Item Characteristic Curve for the 22-Item ADL Subscale**



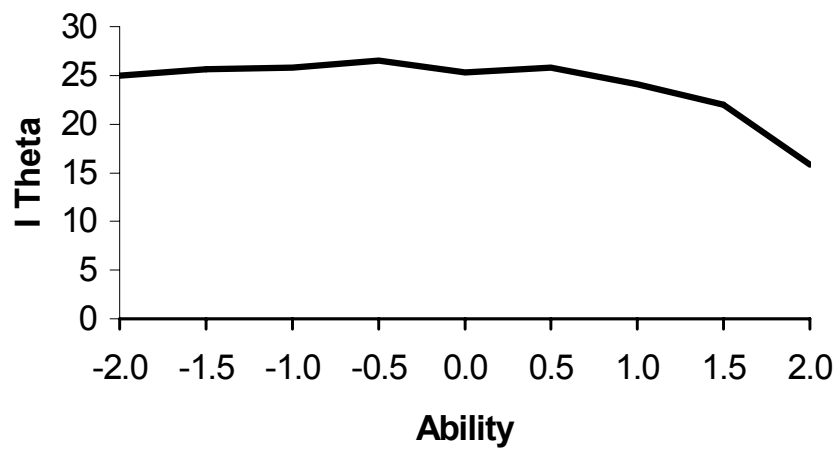
**Figure 4.17: Item Characteristic Curve for Item 11 (Sleeping) for the 22-Item ADL Subscale**



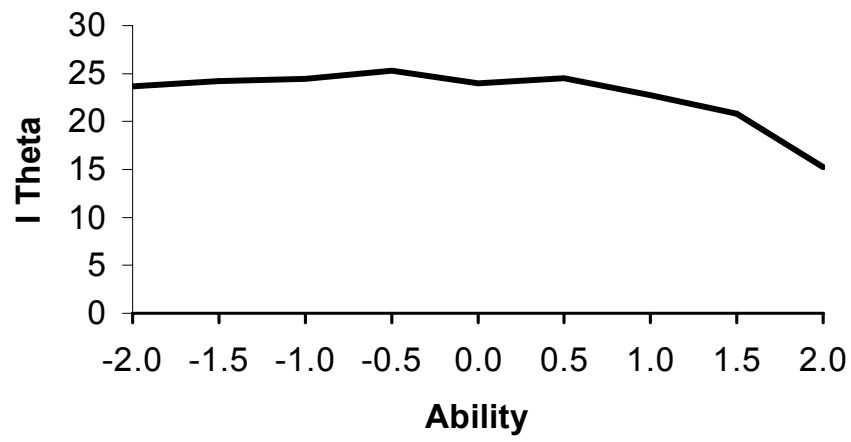
**Figure 4.18: Item Characteristic Curve for Item 19 (Personal Care) for the 22-Item ADL Subscale**



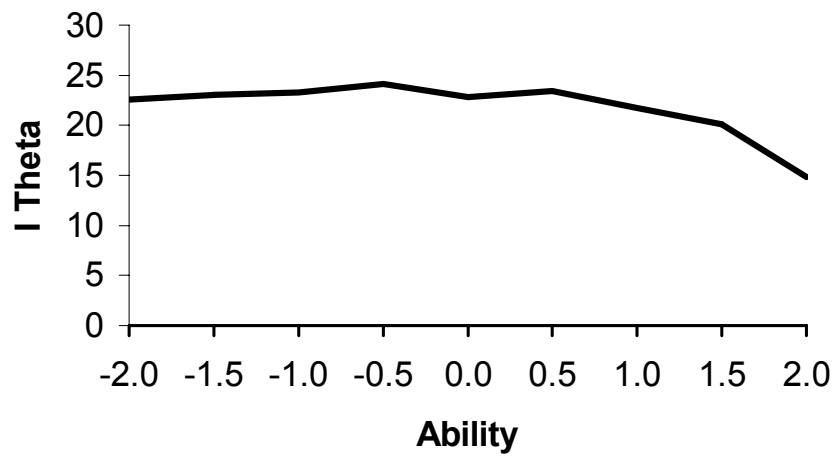
**Figure 4.19: Representative Item Characteristic Curve for the Sports Subscale**



**Figure 4.20: Test Information Function for the 22-Item ADL Subscale**

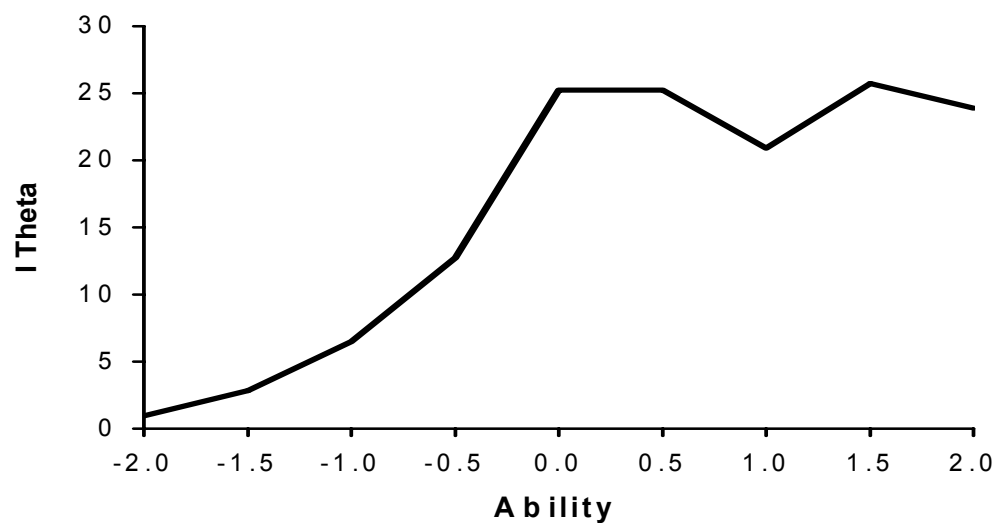


**Figure 4.21: Test Information Function for the 21-Item ADL Subscale**

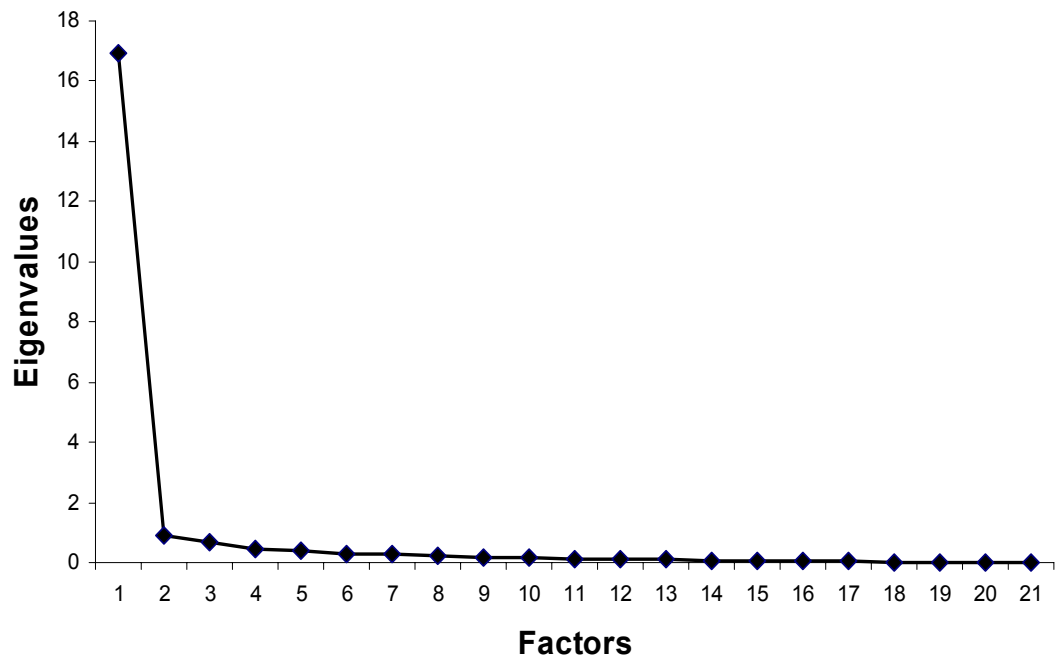


**Figure 4.22: Test Information Function for the 20-Item ADL Subscale**

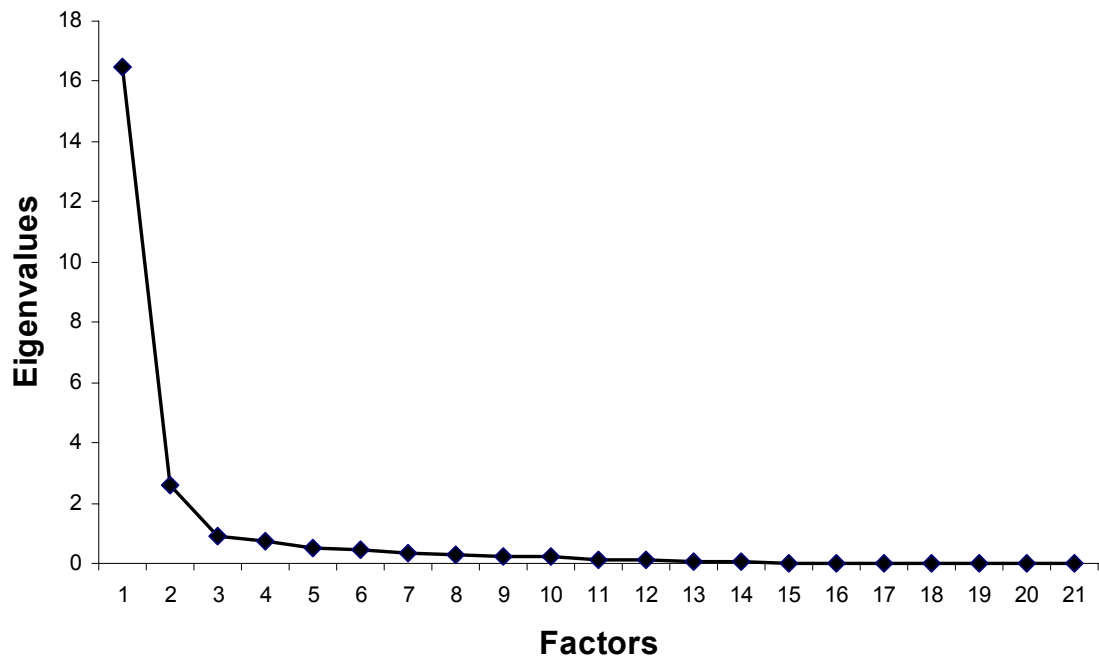




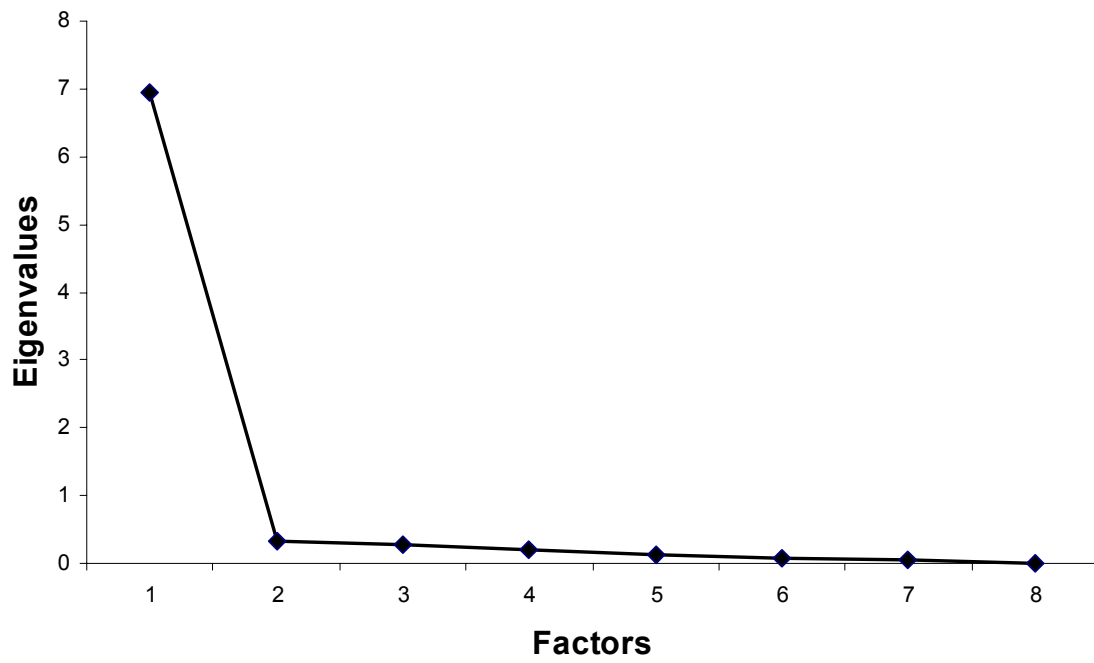
**4.23: Test Information Function for the Sports Subscale**



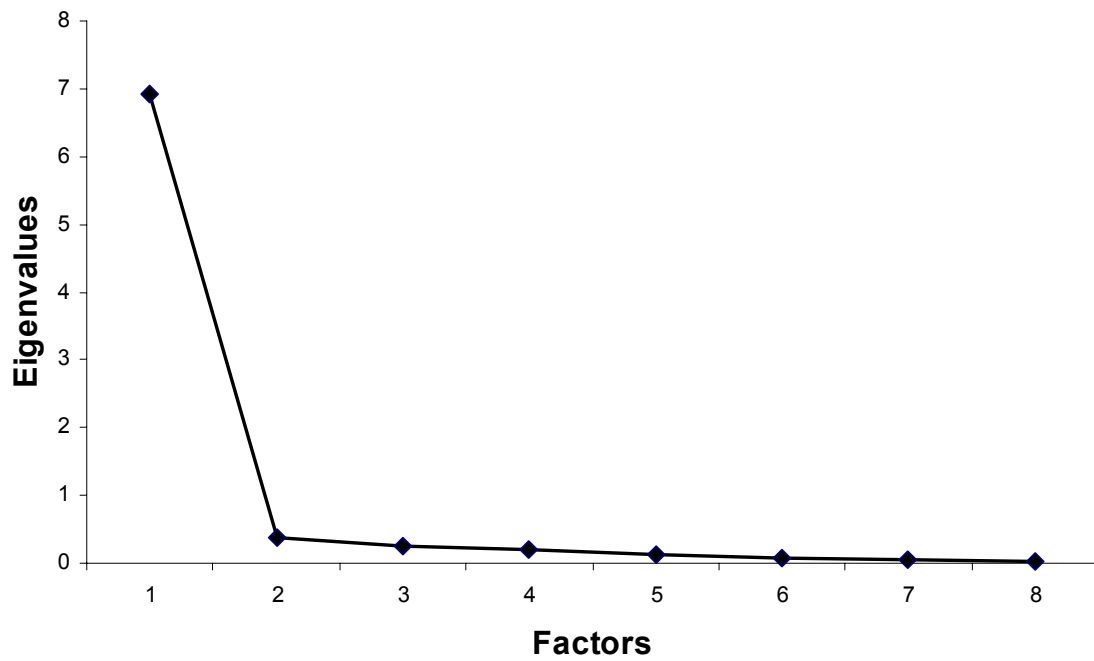
**Figure 4.24: Scree Plot for the ADL Subscale for the Group Expected to Change**



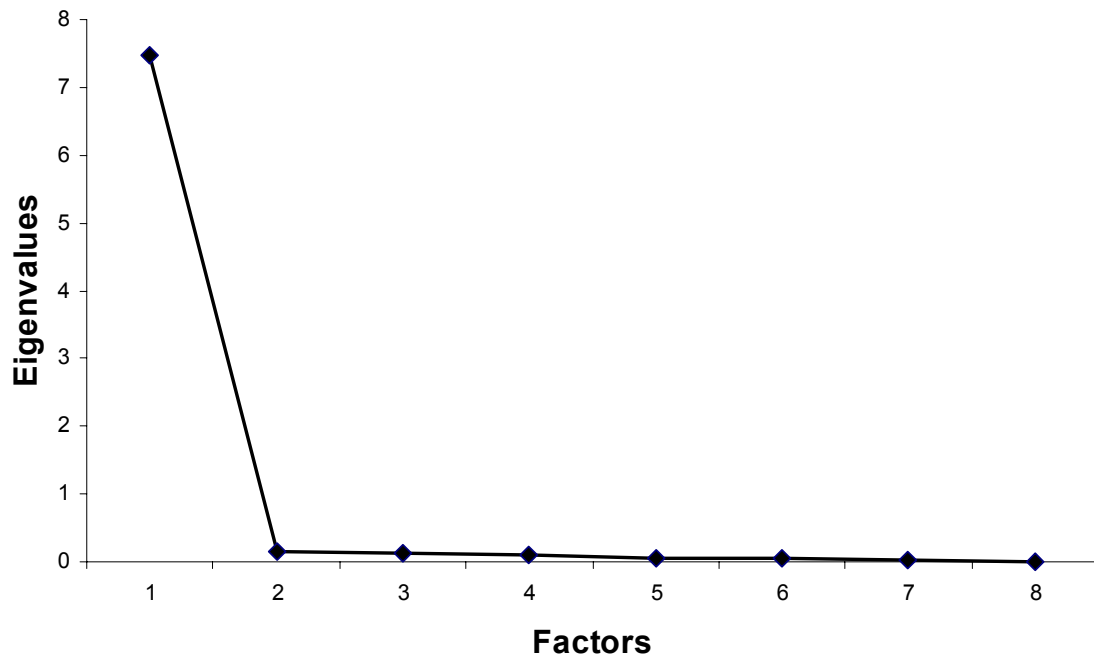
**Figure 4.25: Scree Plot for the ADL Subscale for the Group Expected to Remain Stable**



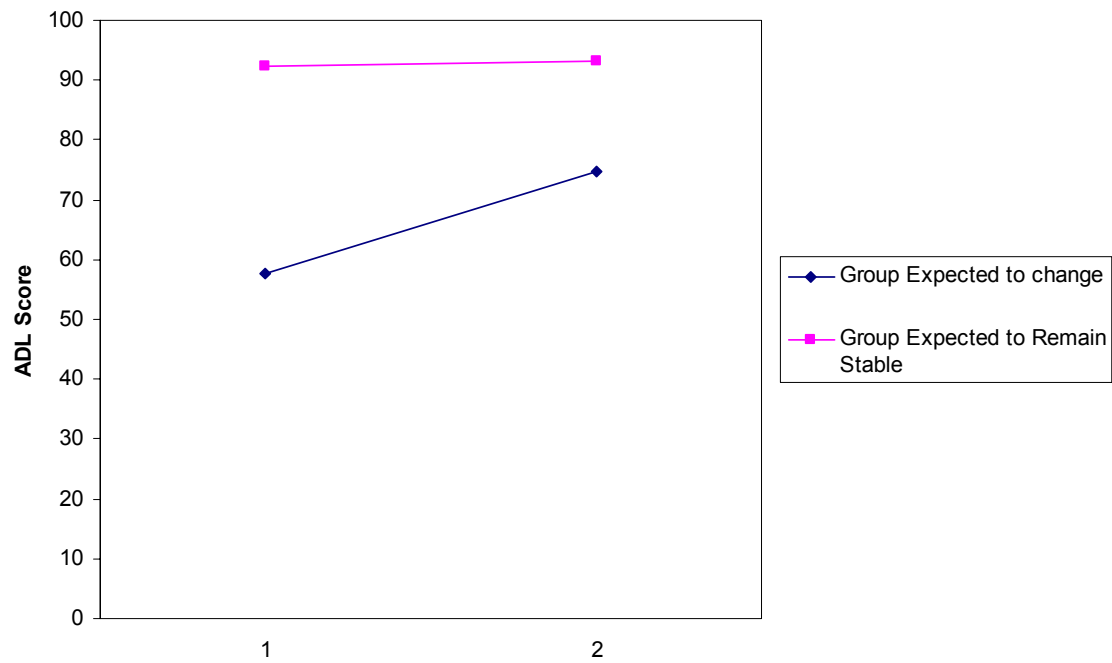
**Figure 4.26: Scree Plot for the Sports Subscale for the Group Expected to Change**



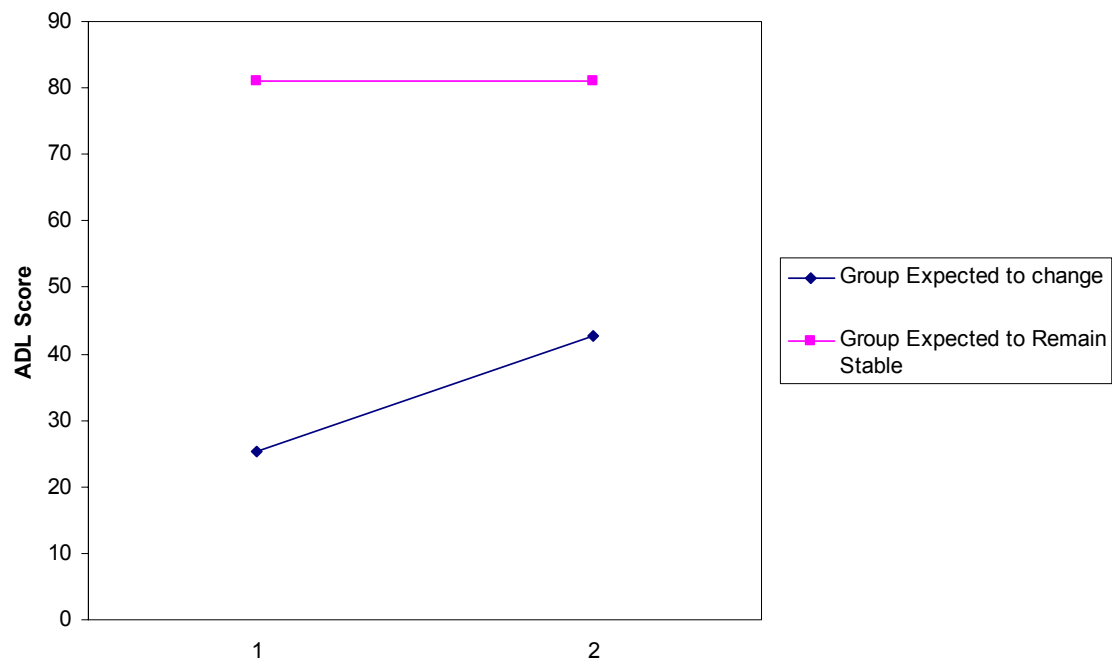
**Figure 4.27: Scree Plot for the Sports Subscale for the Group Expected to Remain Stable**



**Figure 4.28: Scree Plot for the Sports Subscale for the Group Expected to Change and the Group Expected to Remain Stable Combined**

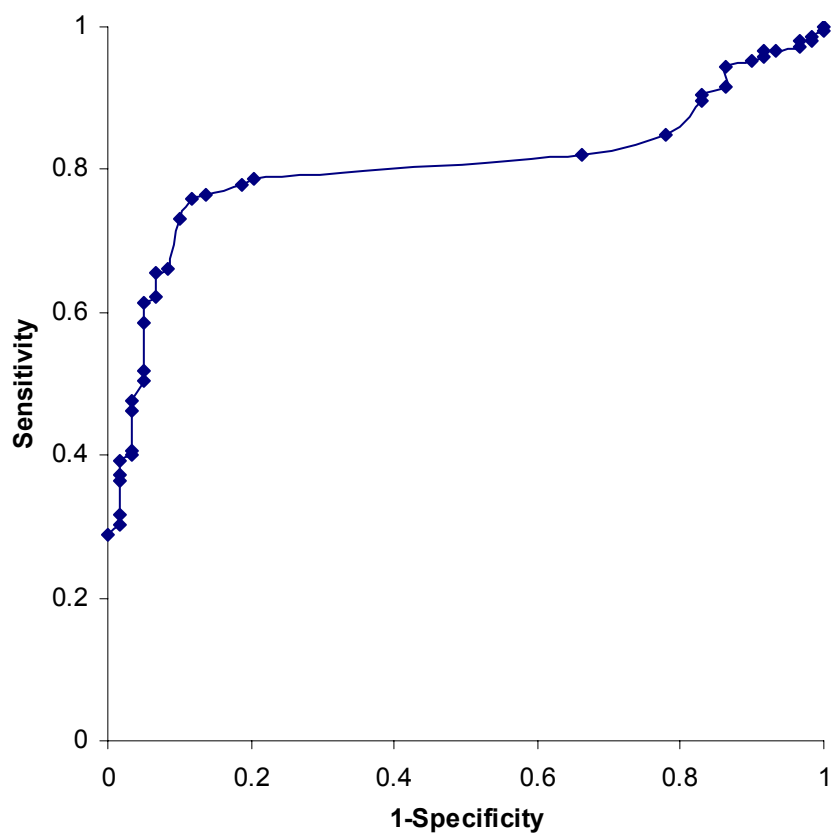


**Figure 4.29: Plot of Initial and Final FAAM Average ADL Scores for the Group Expected to Change and the Group Expected to Remain Stable**

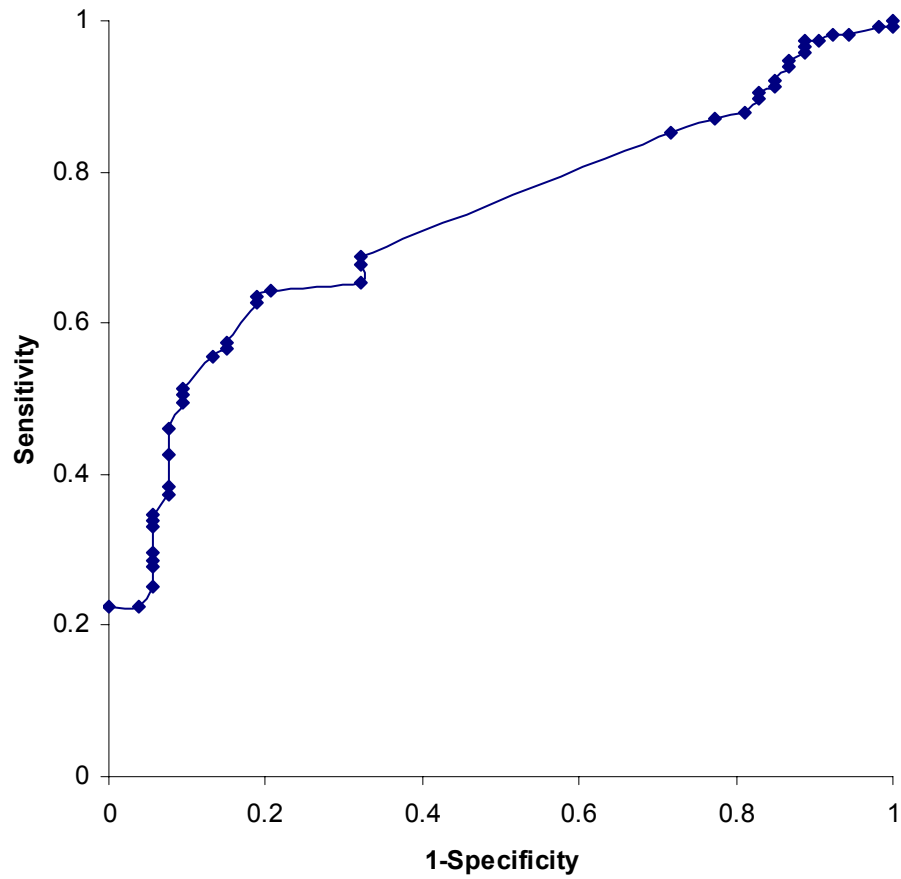


**Figure 4.30: Plot of Initial and Final FAAM Average Sports Subscale Scores for the Group Expected to Change and the Group Expected to Remain Stable**

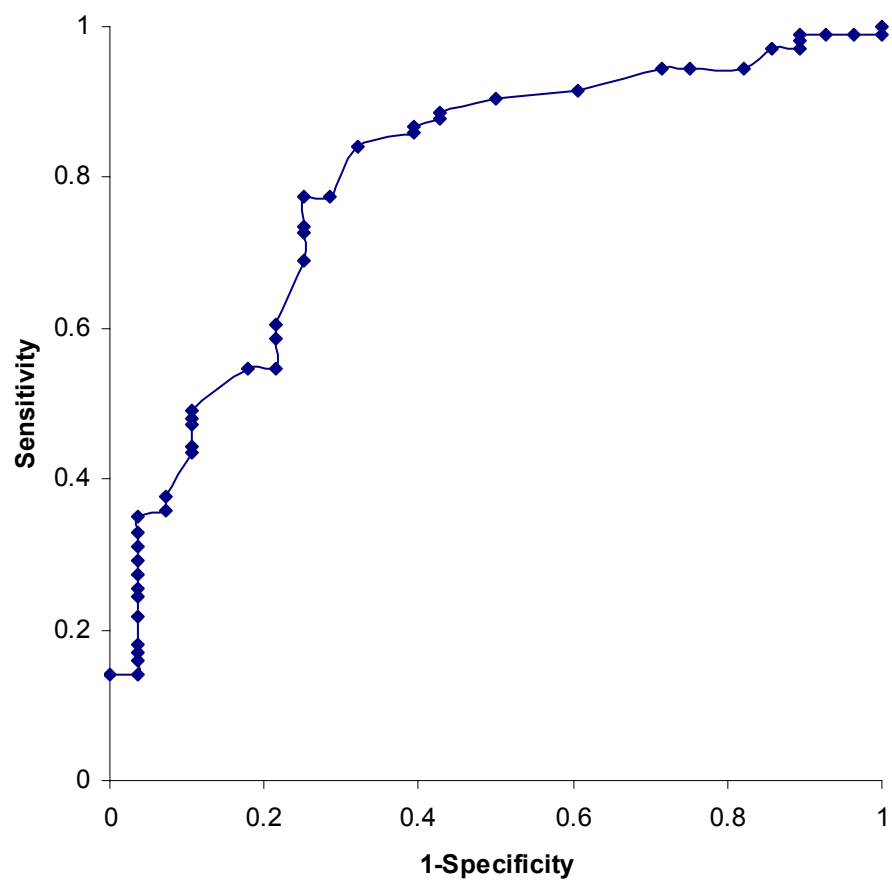




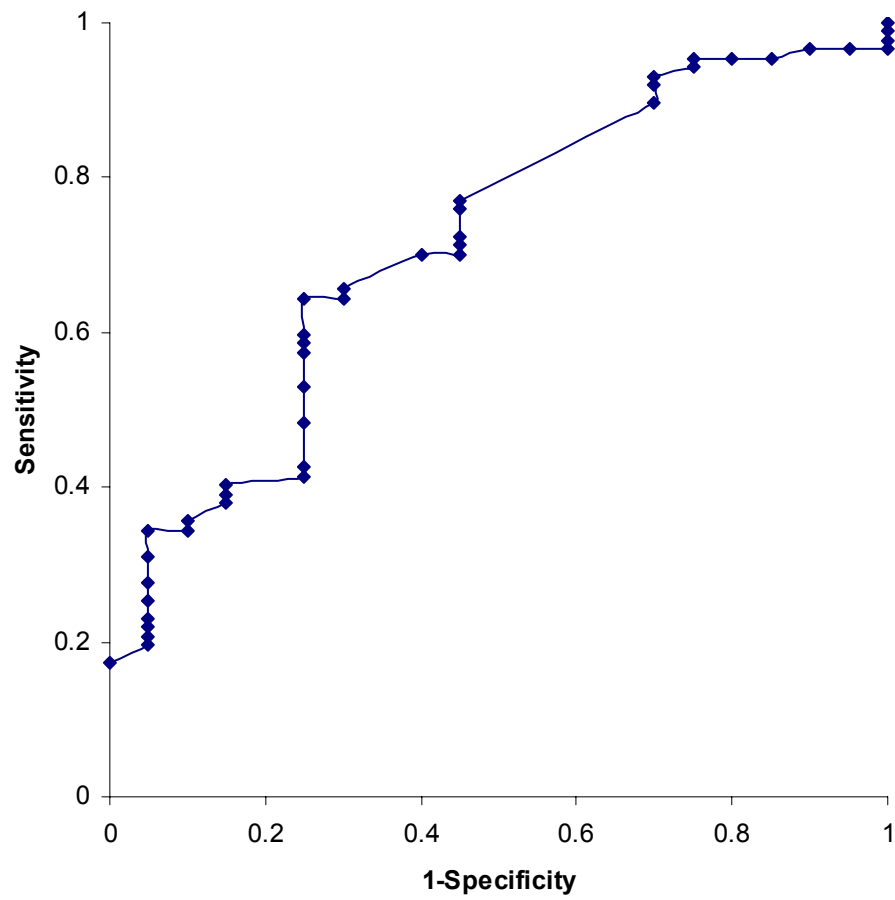
**Figure 4.31: ADL Subscale ROC Curve Using the Group Expected to Change and the Group Expected to remain Stable Intact**



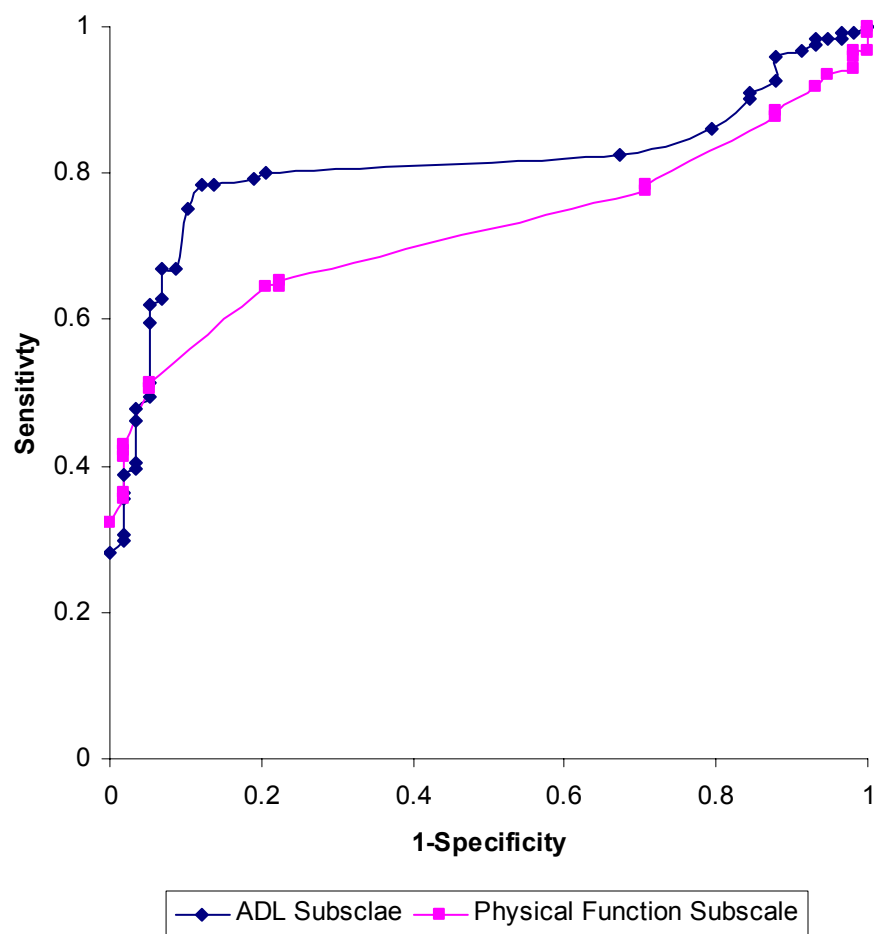
**Figure 4.32: Sports Subscale ROC Curve Using the Group Expected to Change and the Group Expect to Remain Stable Intact**



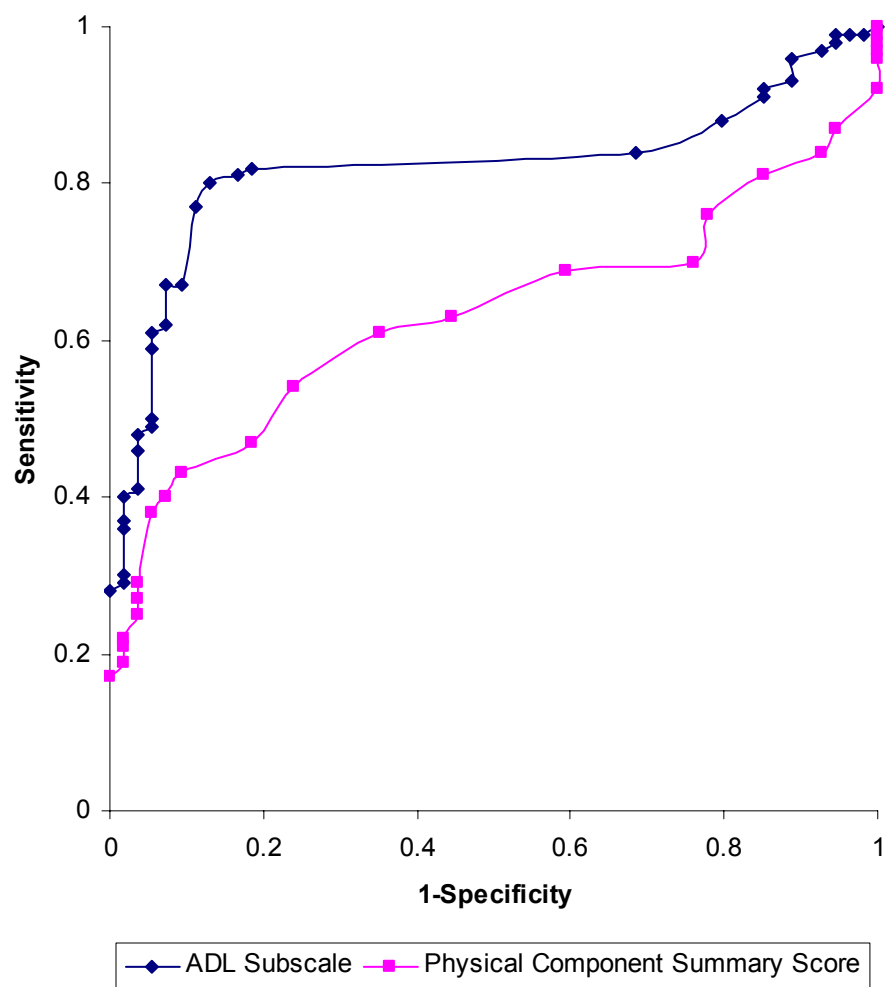
**Figure 4.33: ADL Subscale ROC Curve Using the Dichotomized Group Expected to Change**



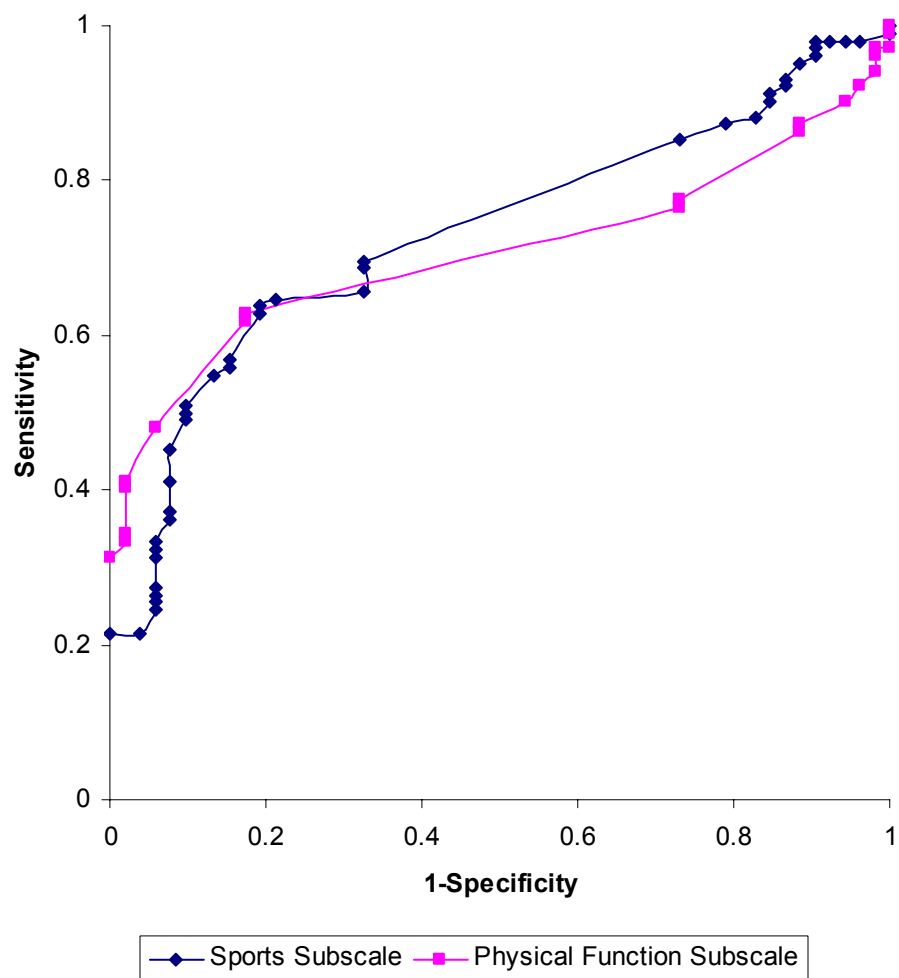
**Figure 4.34: ADL Subscale ROC Curve Using the Dichotomized Group Expected to Change**



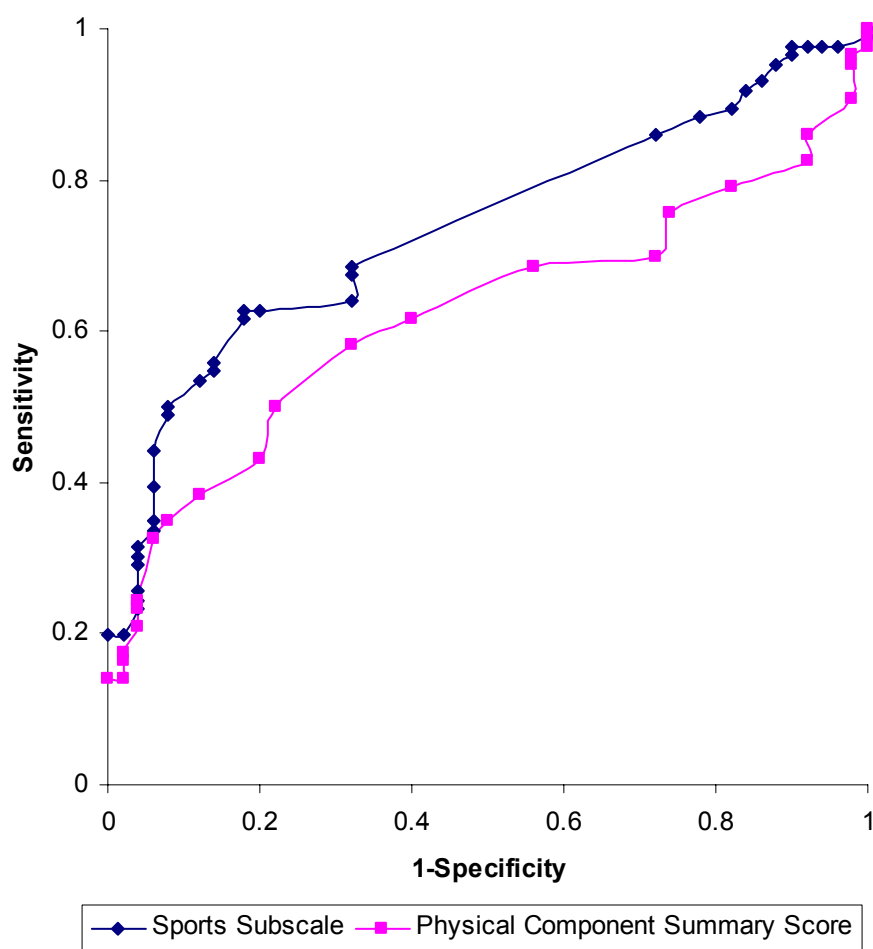
**Figure 4.35: ROC Curve Comparing the ADL Subscale to Physical Function Subscale**



**Figure 4.36: ROC Curve Comparing the ADL Subscale to Physical Component Summary Score**

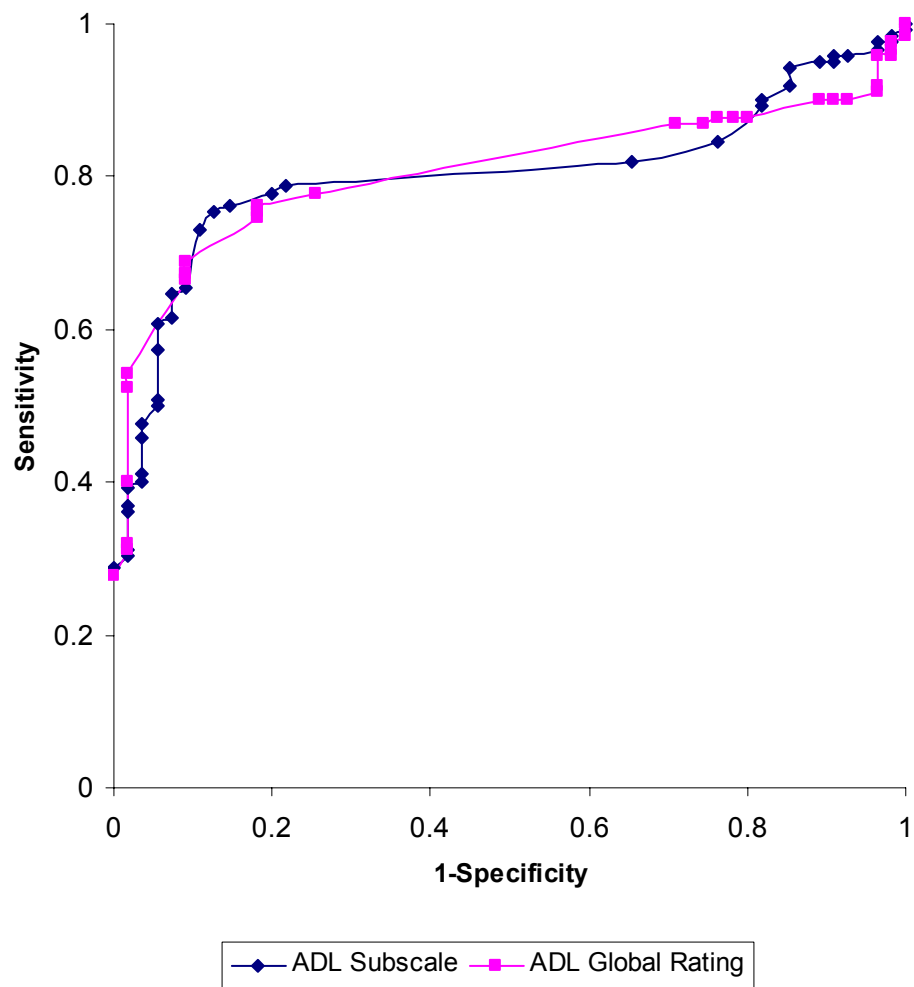


**Figure 4.37: ROC Curve Comparing the Sports Subscale to Physical Function Subscale**

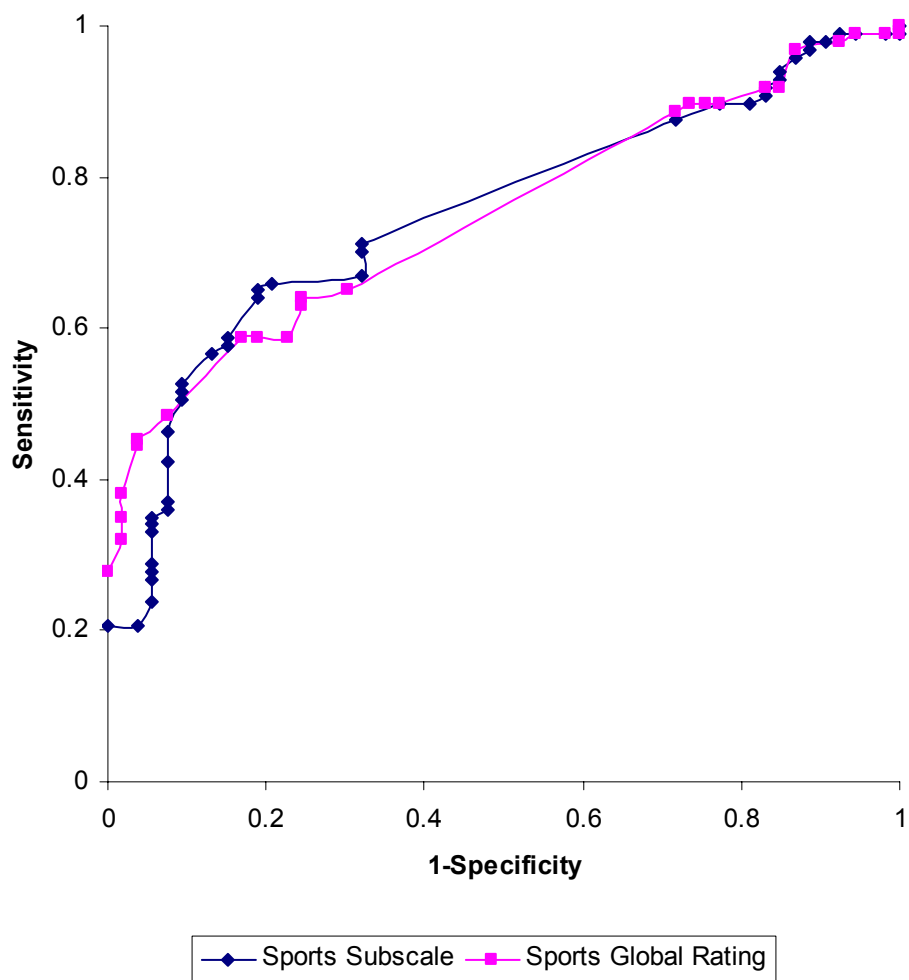


**Figure 4.38: ROC Curve Comparing the Sports Subscale to Physical Component Summary Score**

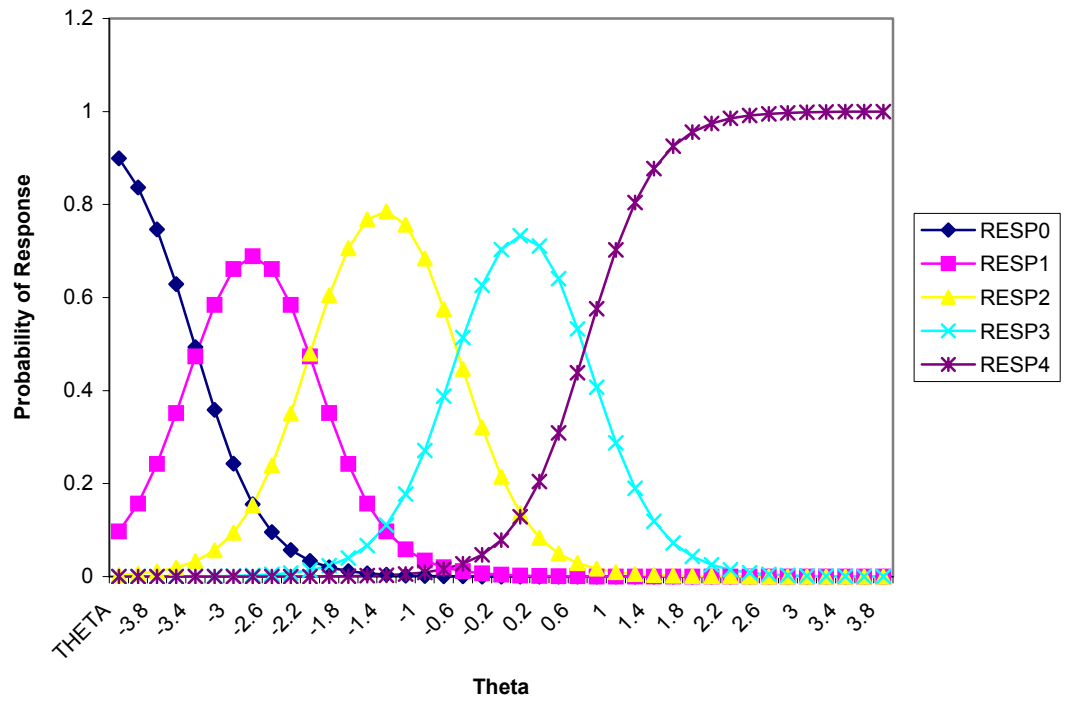




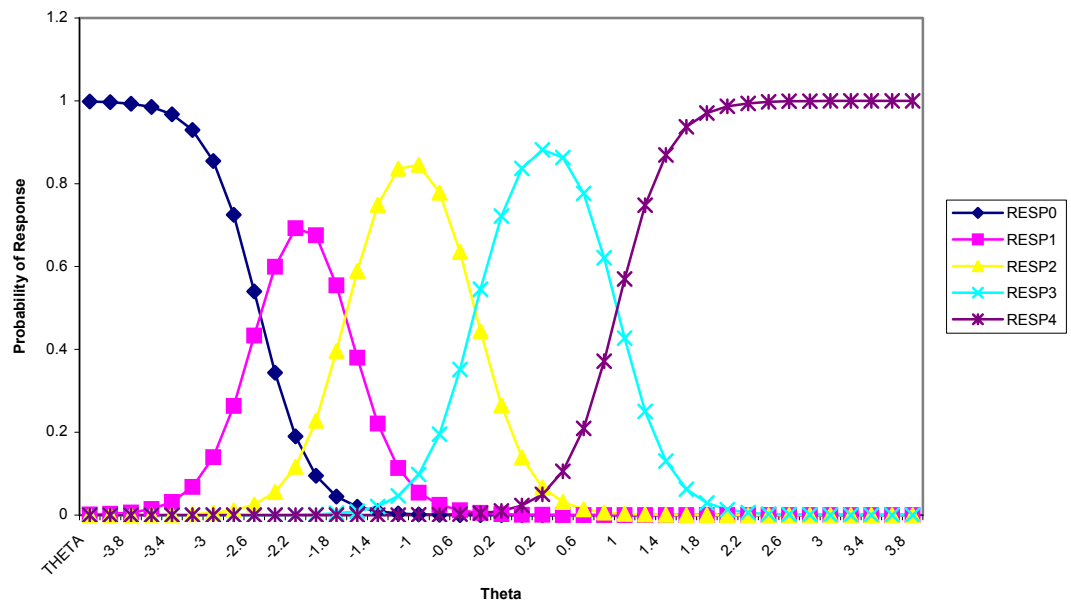
**Figure 4.39: ROC Curve Comparing ADL Subscale to ADL Global Rating**



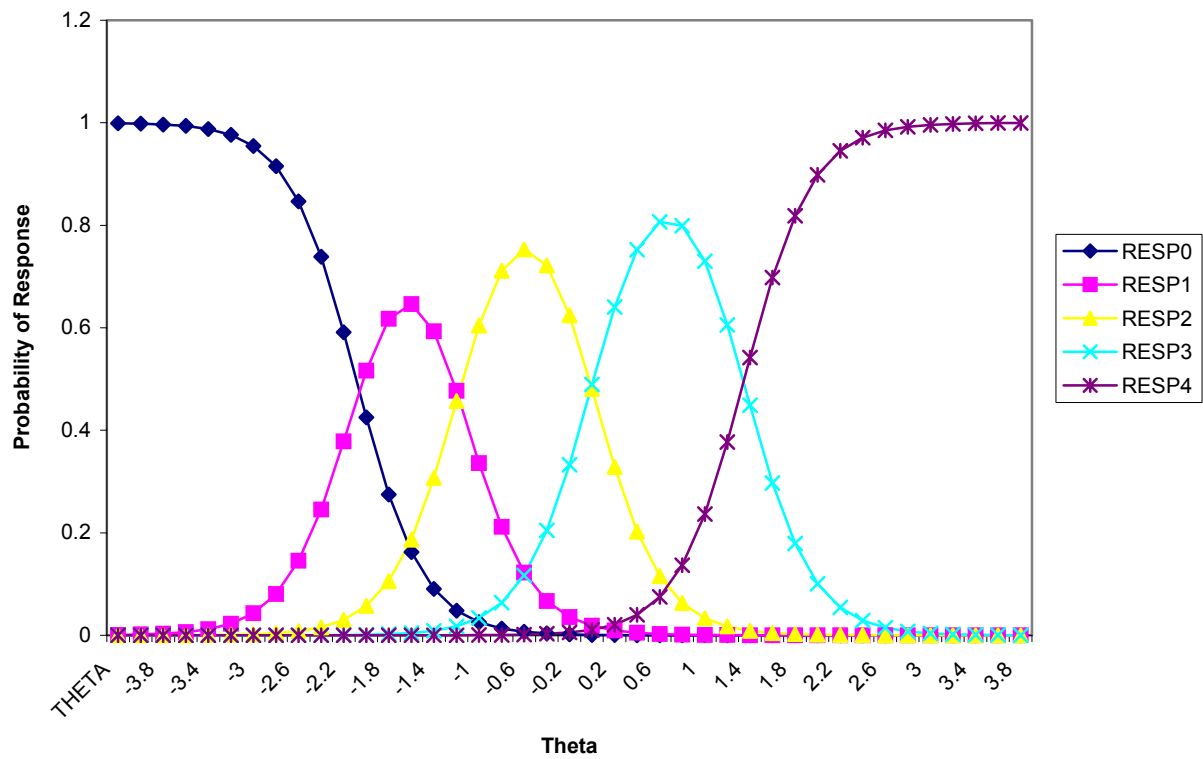
**Figure 4.40: ROC Curve Comparing Sports Subscale to Sports Global Rating**



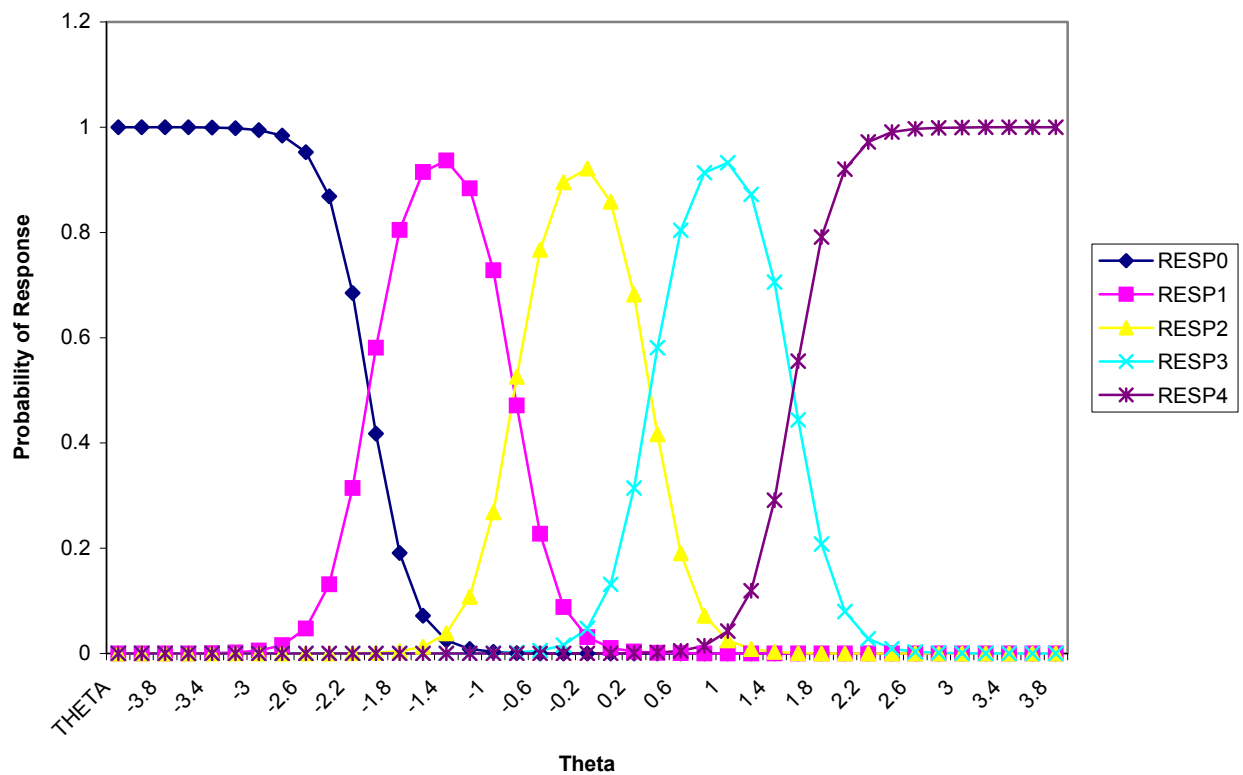
**Item Characteristic Curve for Item 1 (Standing) the 22-Item ADL Subscale**



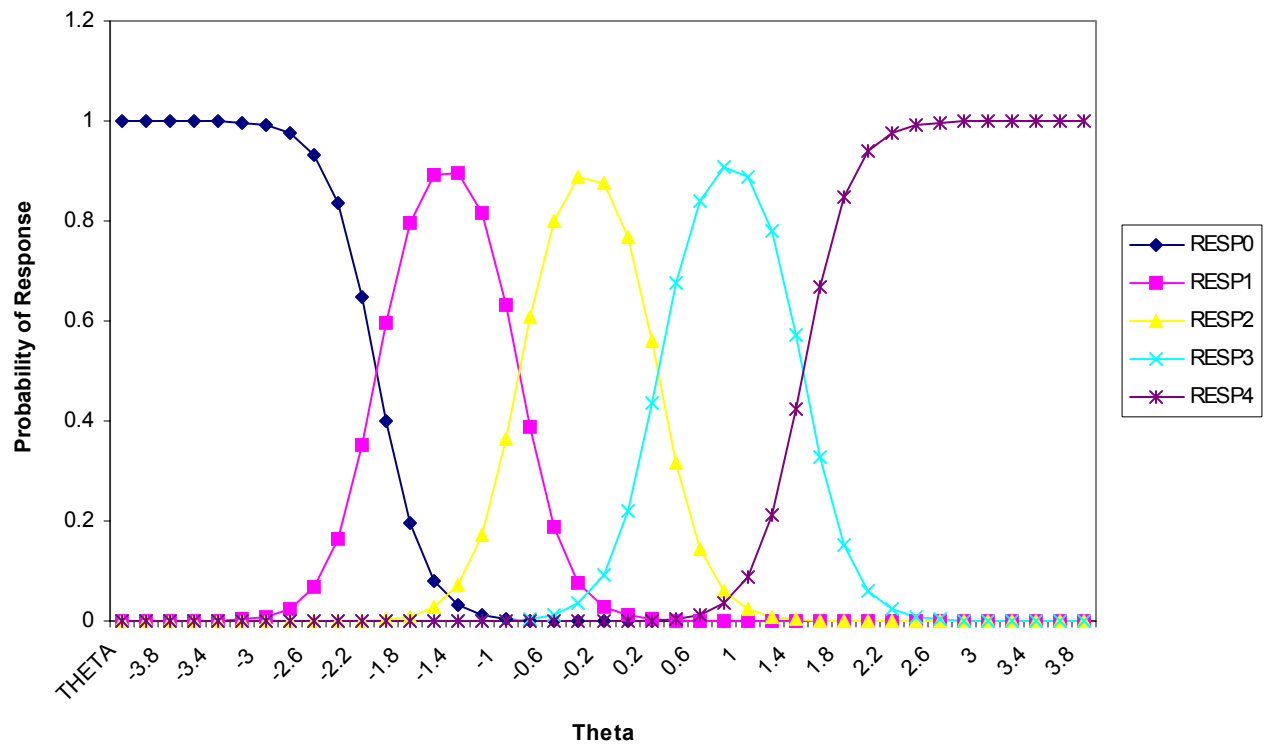
**Item Characteristic Curve for Item 2 (Walking on Uneven Ground) for the 22-ADL Subscale**



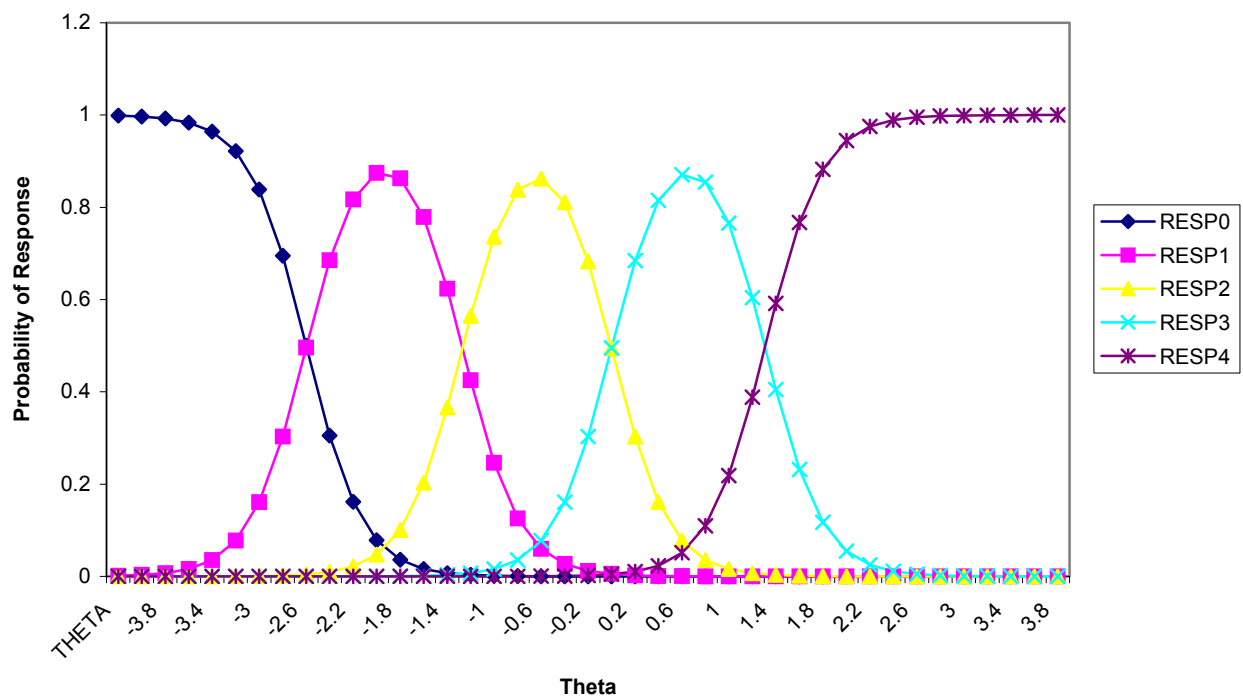
**Item Characteristic Curve for Item 3 (Walking on Uneven Ground Without Shoes)  
for the 22-Item ADL Subscale**



**Item Characteristic Curve for Item 4 (Walking Up Hills) for the 22-Item ADL Subscale**

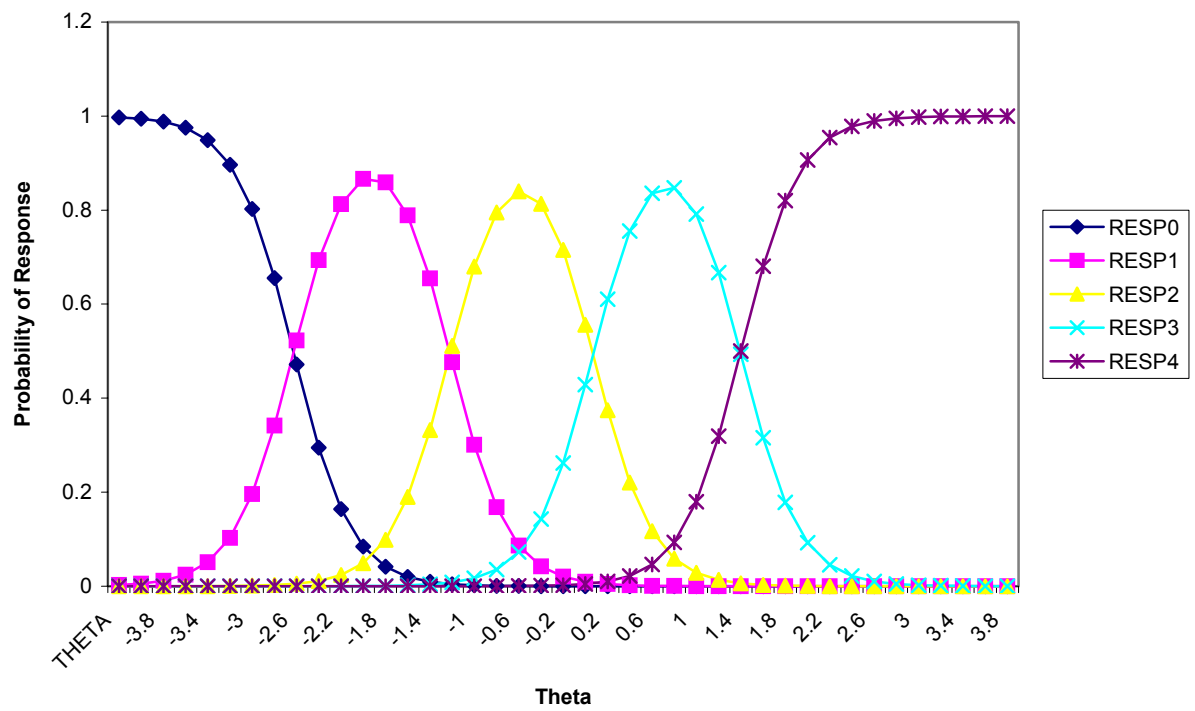


**Item Characteristic for Item 5 (Walking Down Hills) for the 22-Item ADL Subscale**



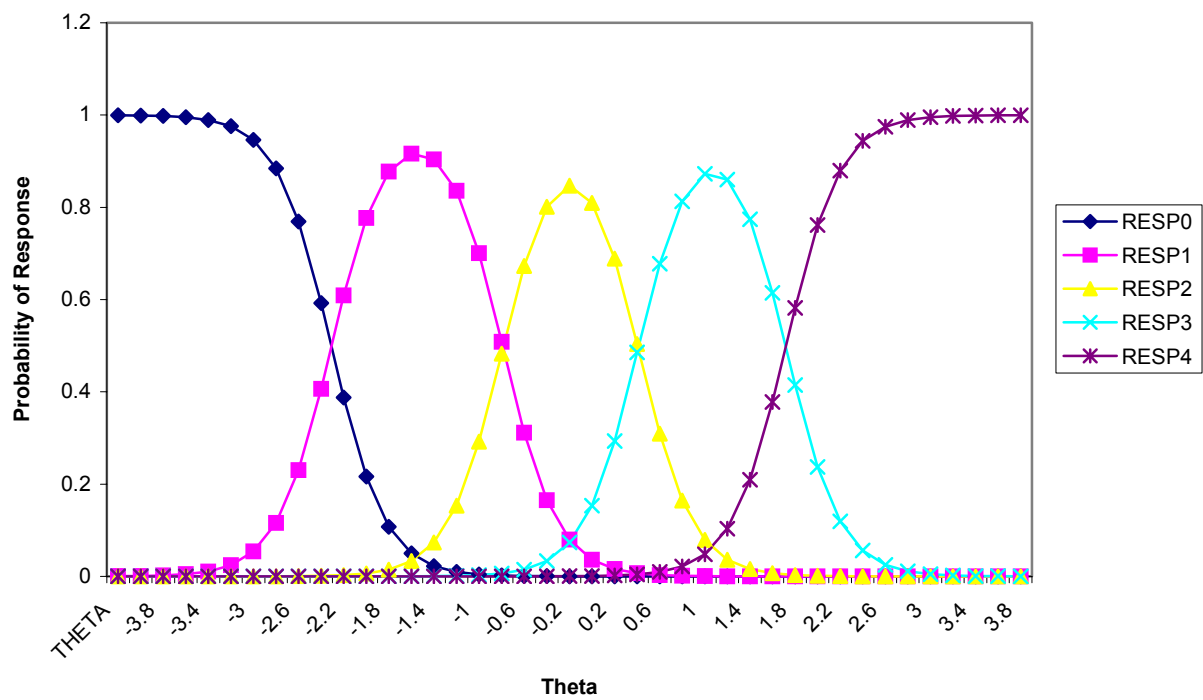
**Item Characteristic Curve for Item 6 (Going Up Stairs) for the 22-Item ADL Subscale**



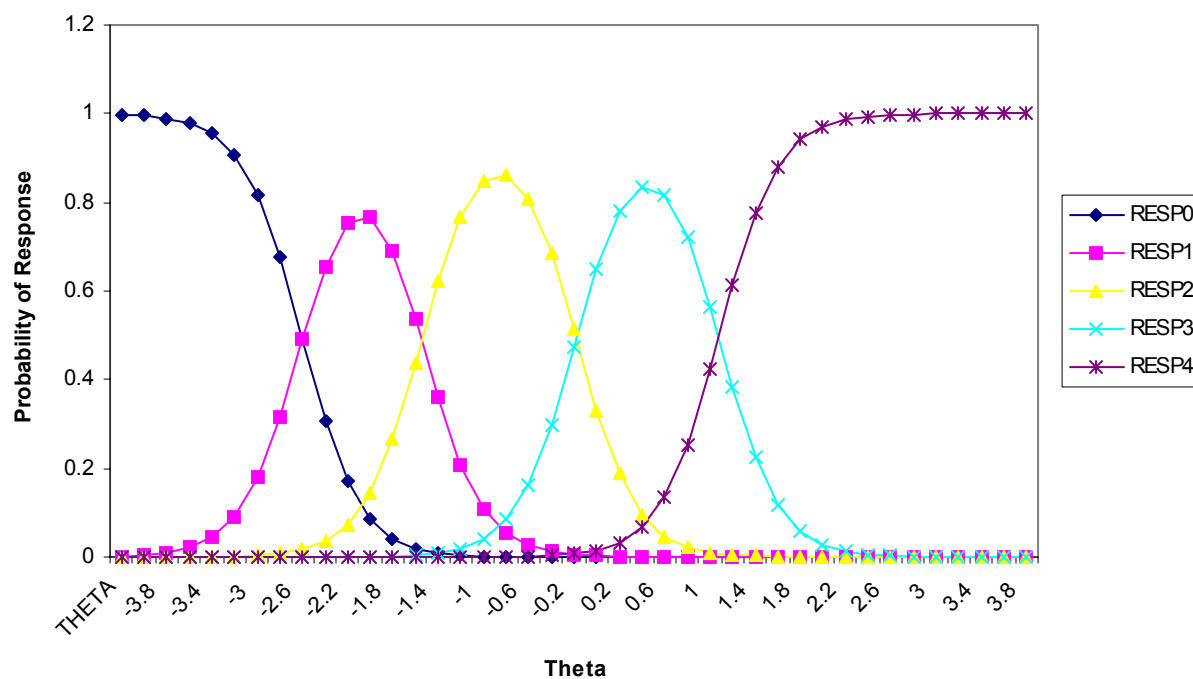


**Item Characteristic Curve for Item 7 (Going Down Stairs) for the 22-Item ADL**

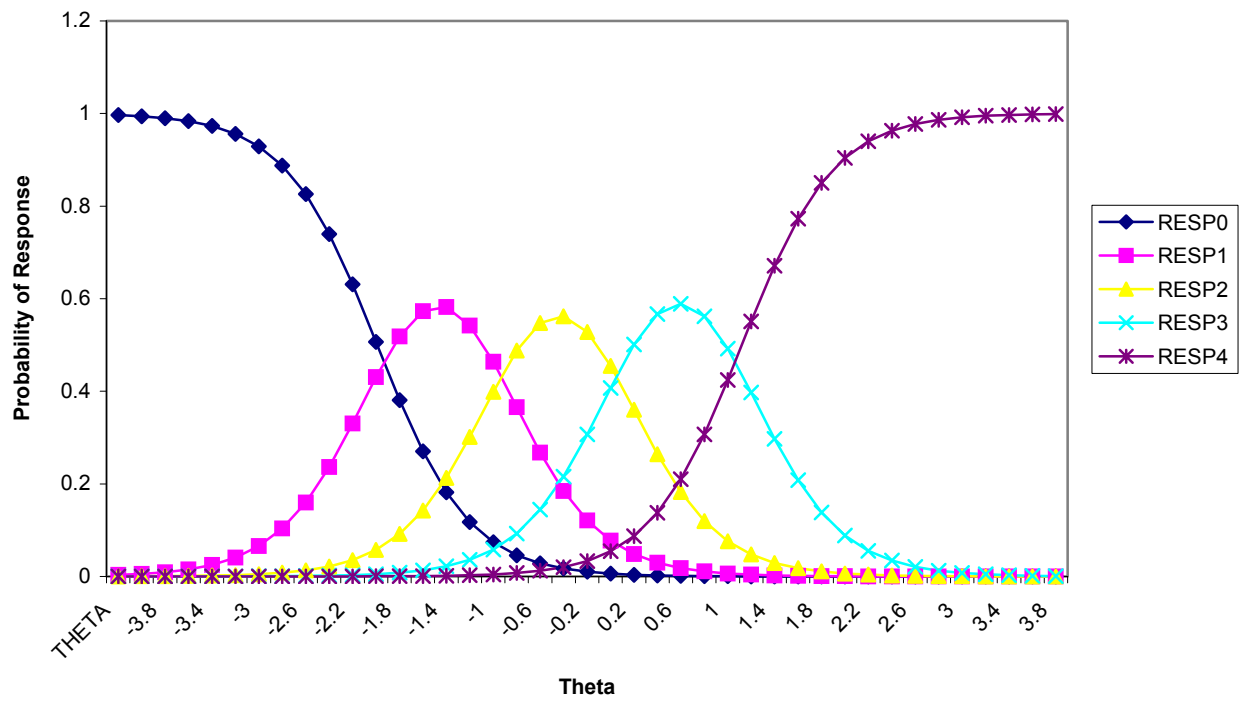
**Subscale**



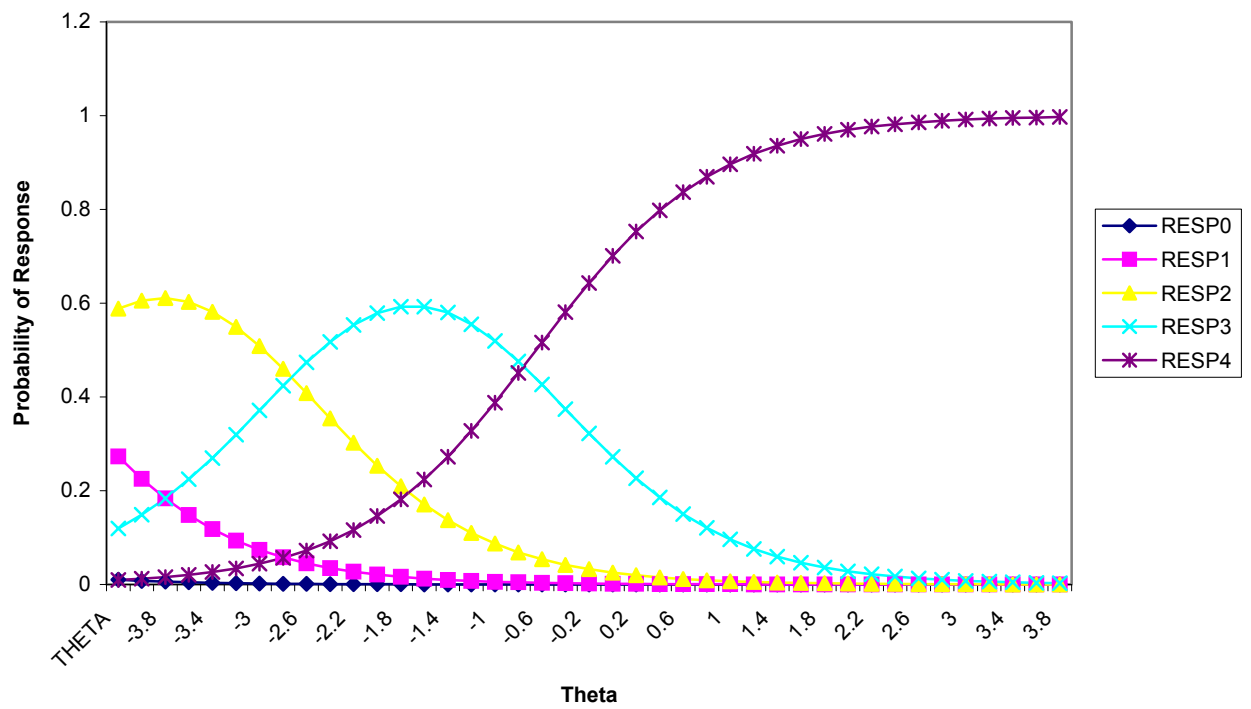
**Item Characteristic Curve for Item 8 (Walking on Uneven Ground) for the 22-Item ADL Subscale**



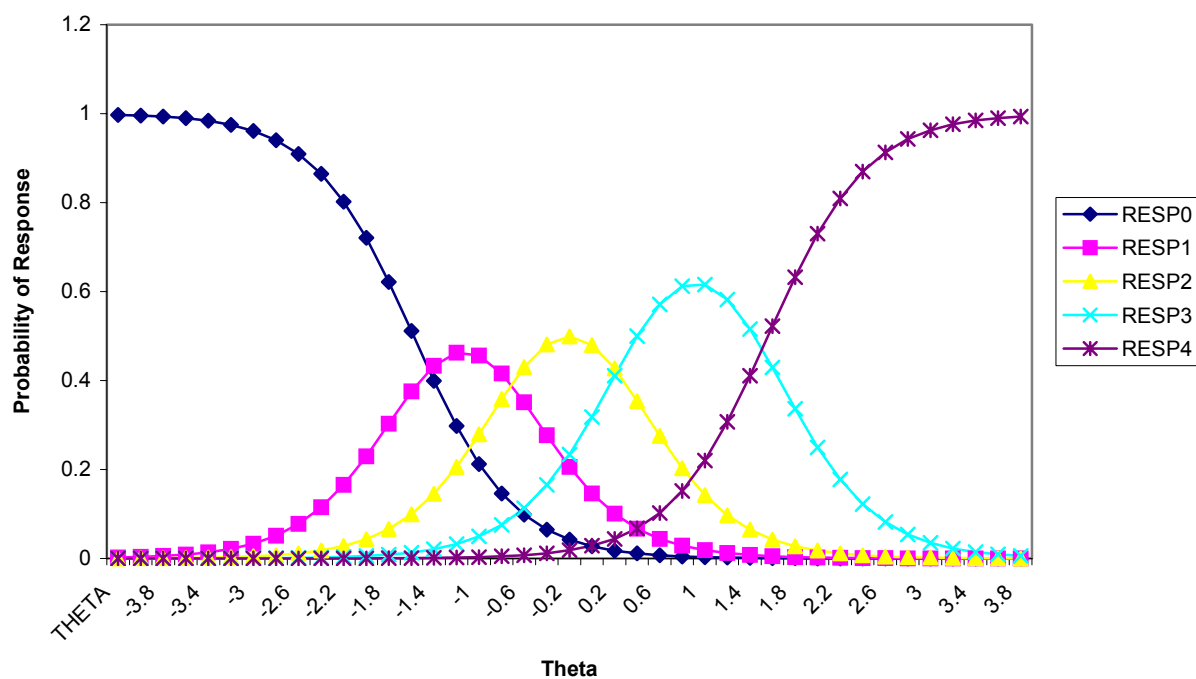
**Item Characteristic Curve for Item 9 (Stepping Up and Down Curbs) for the 22-Item ADL Subscale**



**Item Characteristic Curve for Item 10 (Squatting) for the 22-Item ADL Subscale**

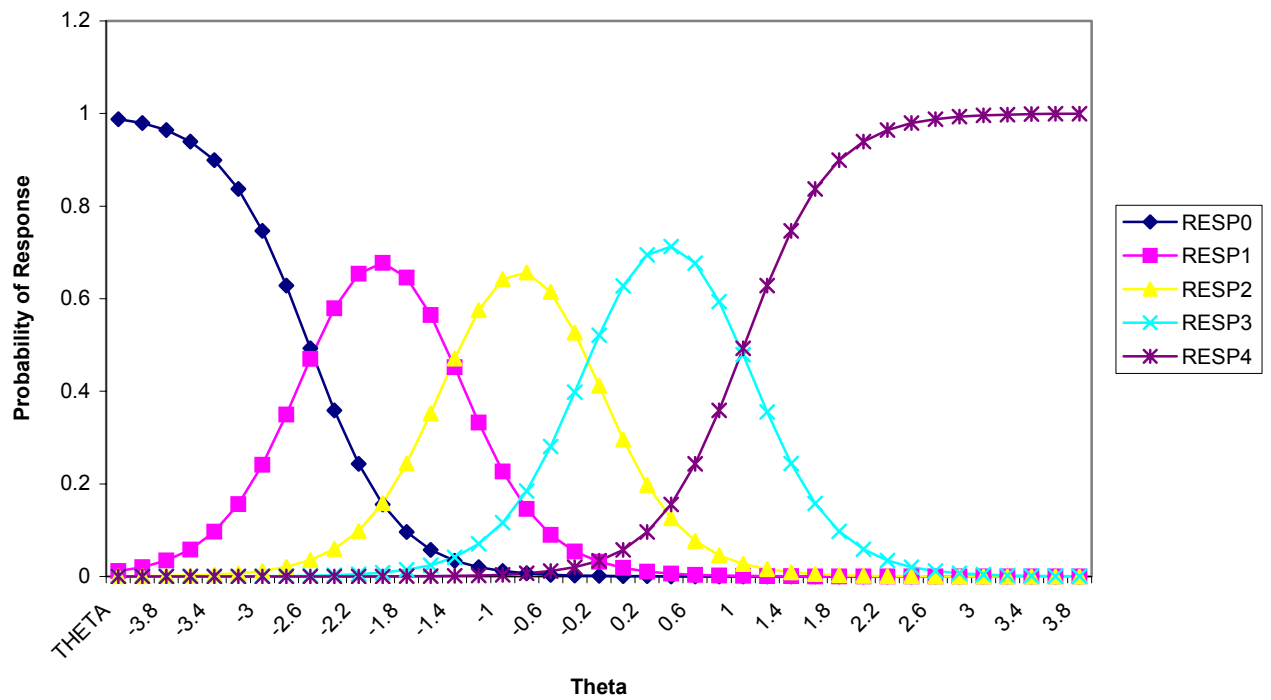


**Item Characteristic Curve for Item 11 (Sleeping) for the 22-Item ADL Subscale**

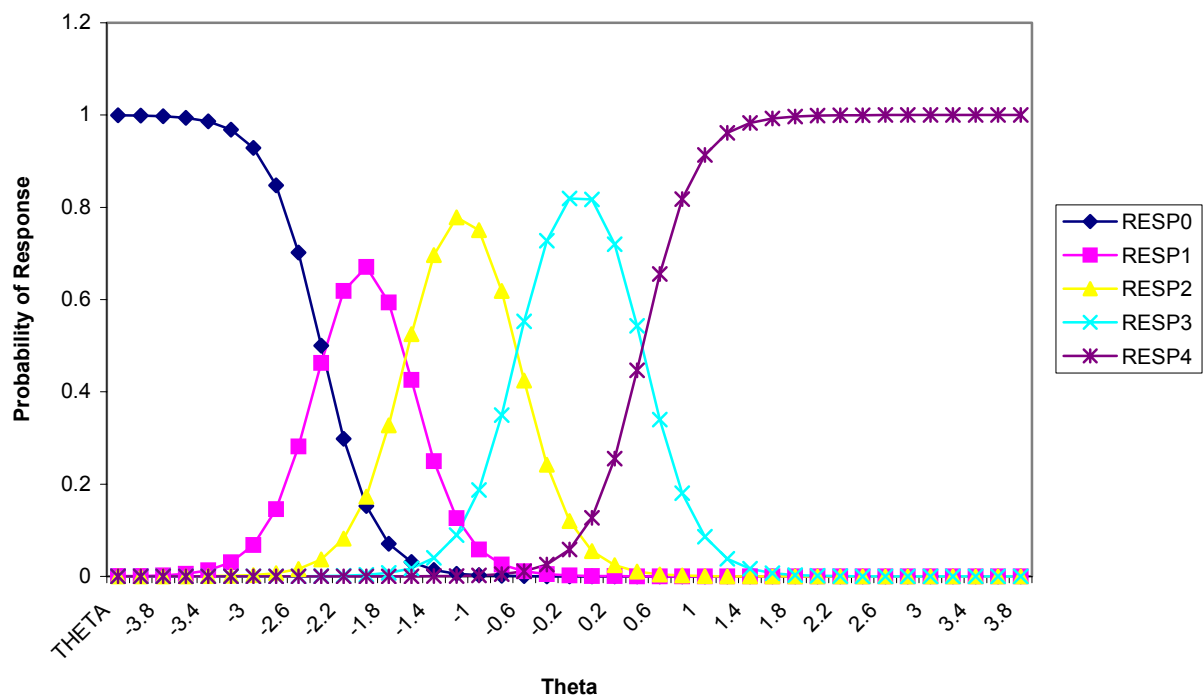


**Item Characteristic Curve for Item 12 (Coming Up on Toes) for the 22-Item ADL**

**Subscale**

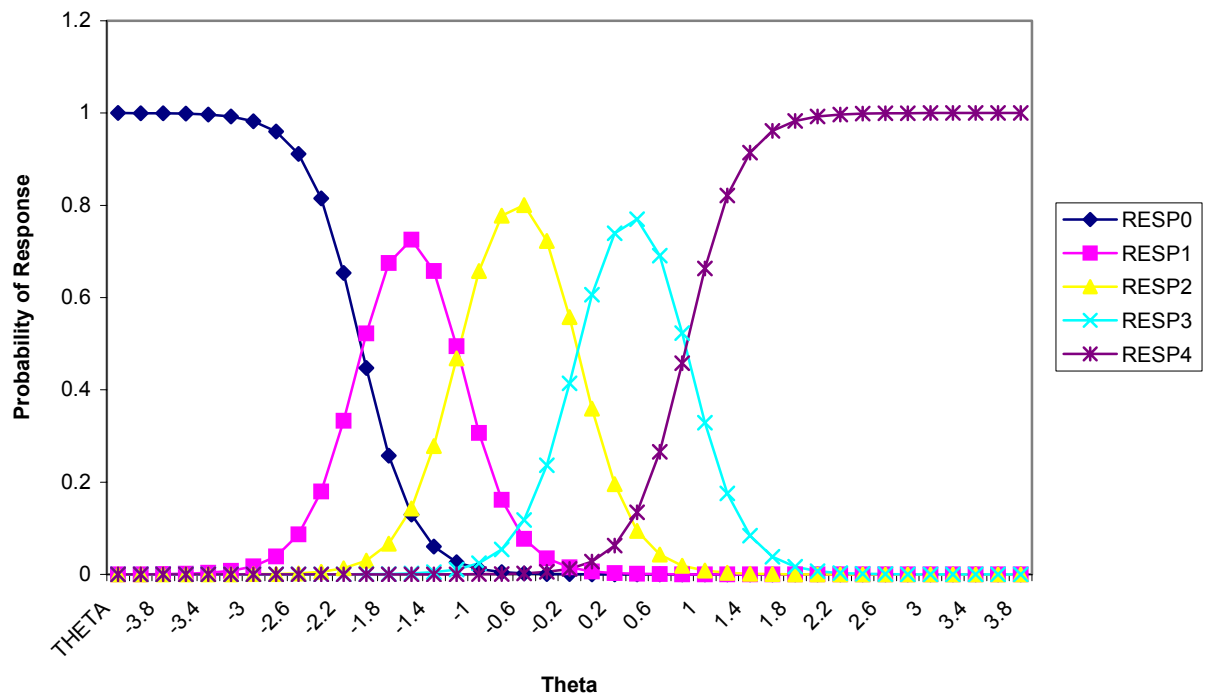


**Item Characteristic Curve for Item 13 (Walking Initially) for the 22-Item ADL Subscale**

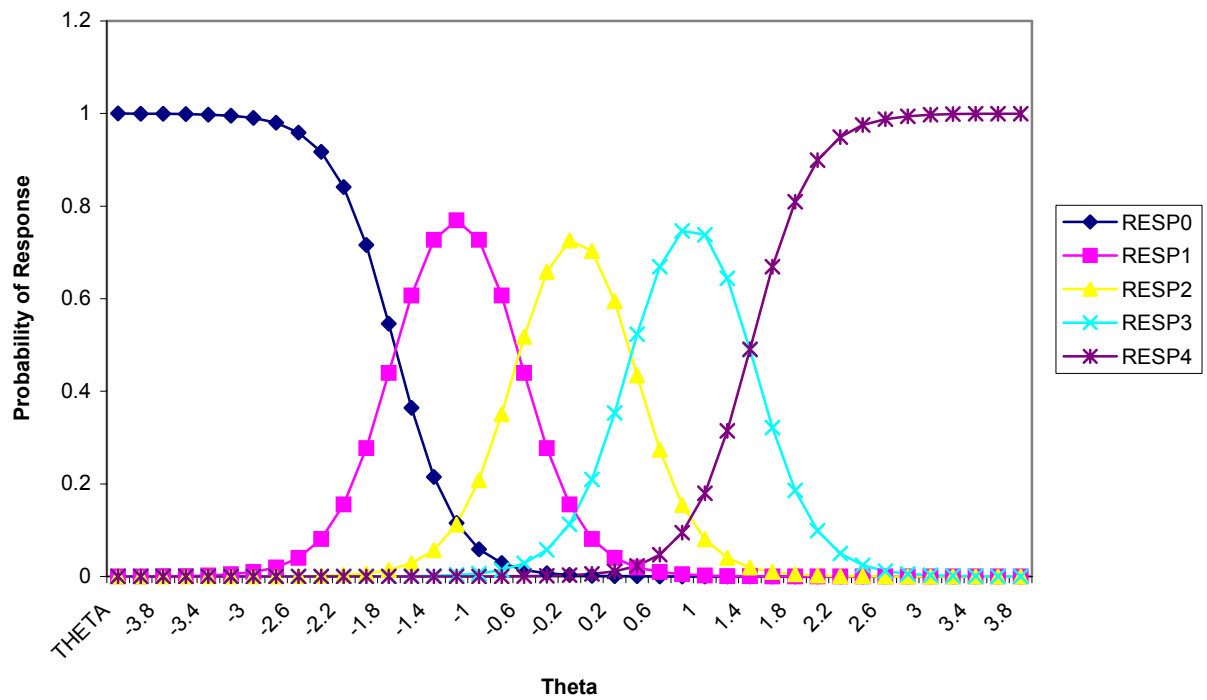


**Item Characteristic Curve for Item 14 (Walking Five Minutes) for the 22-Item ADL Subscale**

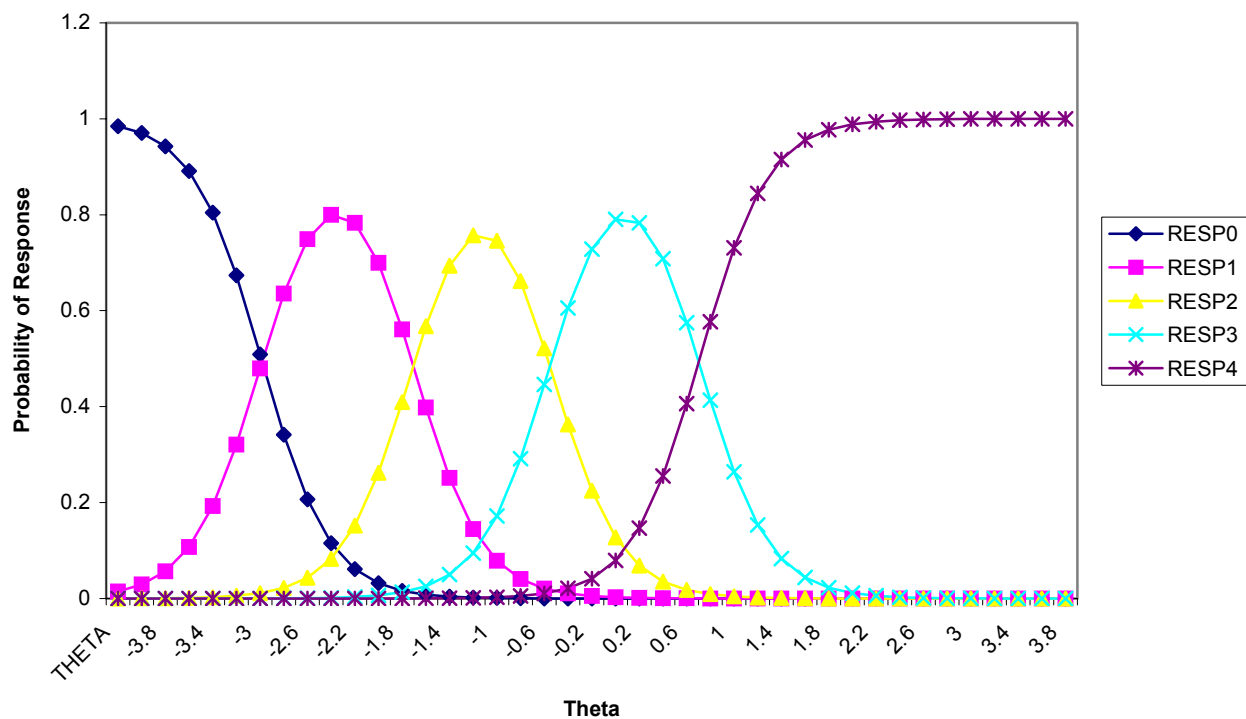




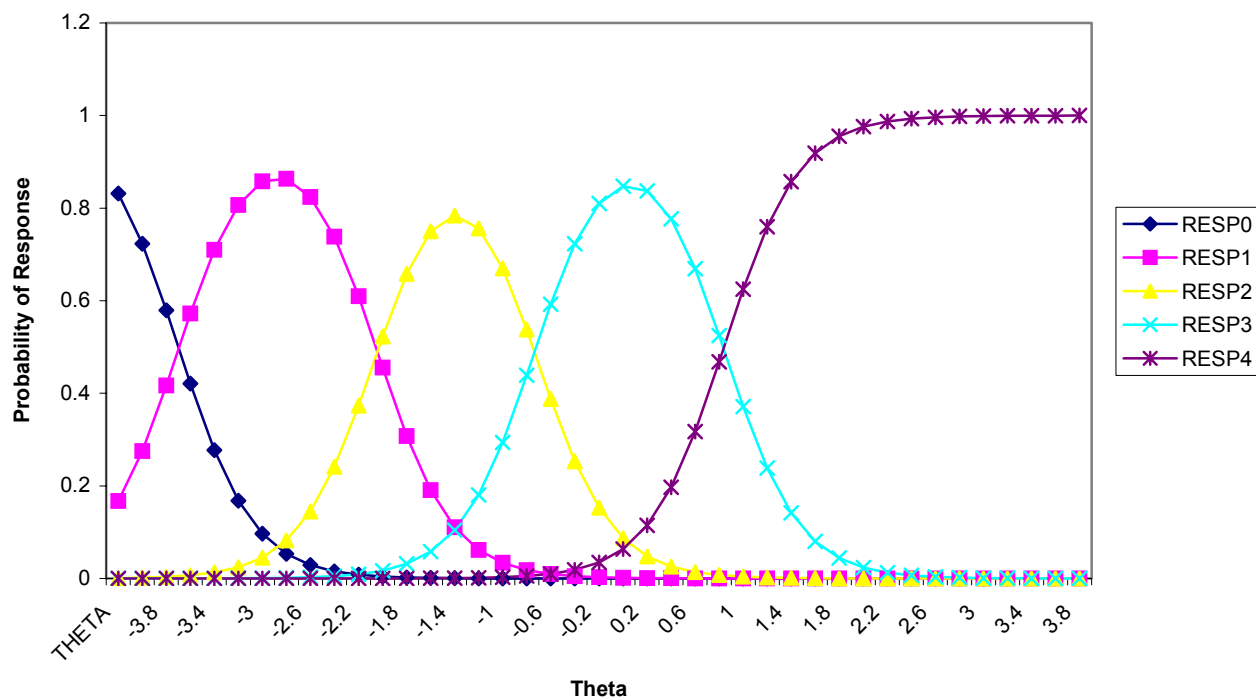
**Item Characteristic Curve for Item 15 (Walking Ten Minutes) for the 22-Item ADL Subscale**



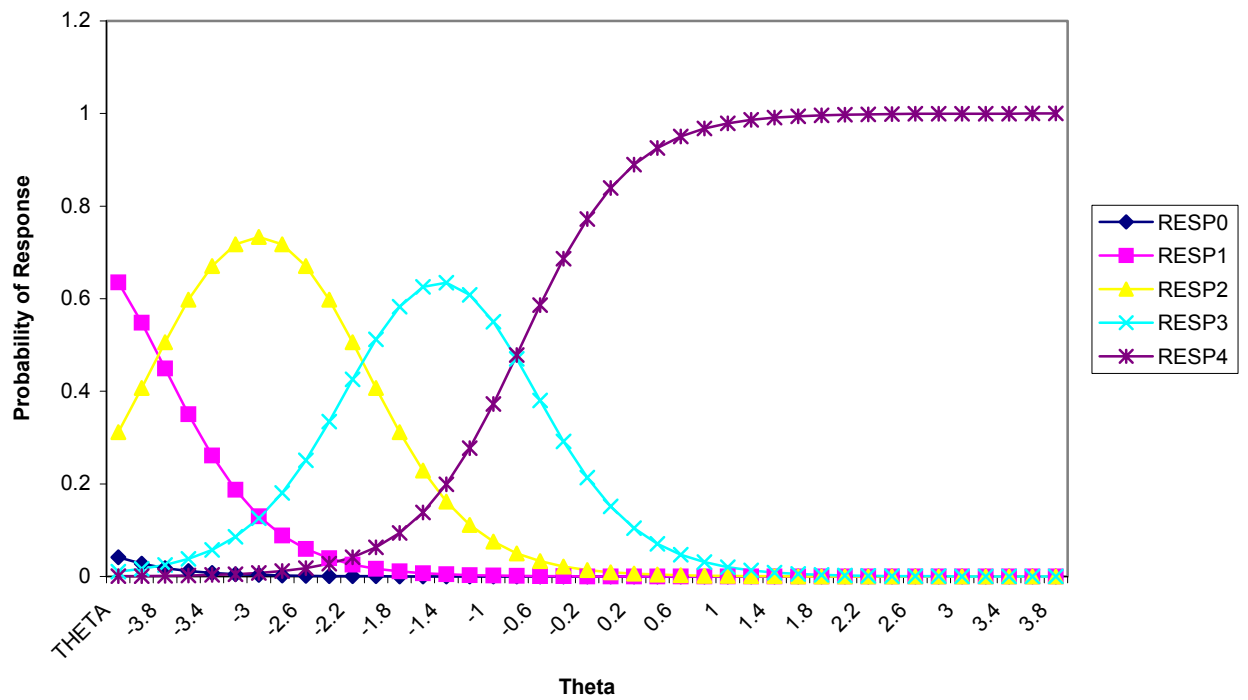
**Item Characteristic Curve for Item 16 (Walking Fifteen Minutes) for the 22-Item  
ADL Subscale**



**Item Characteristic Curve for Item 17 (Home Responsibilities) for the 22-Item ADL Subscale**

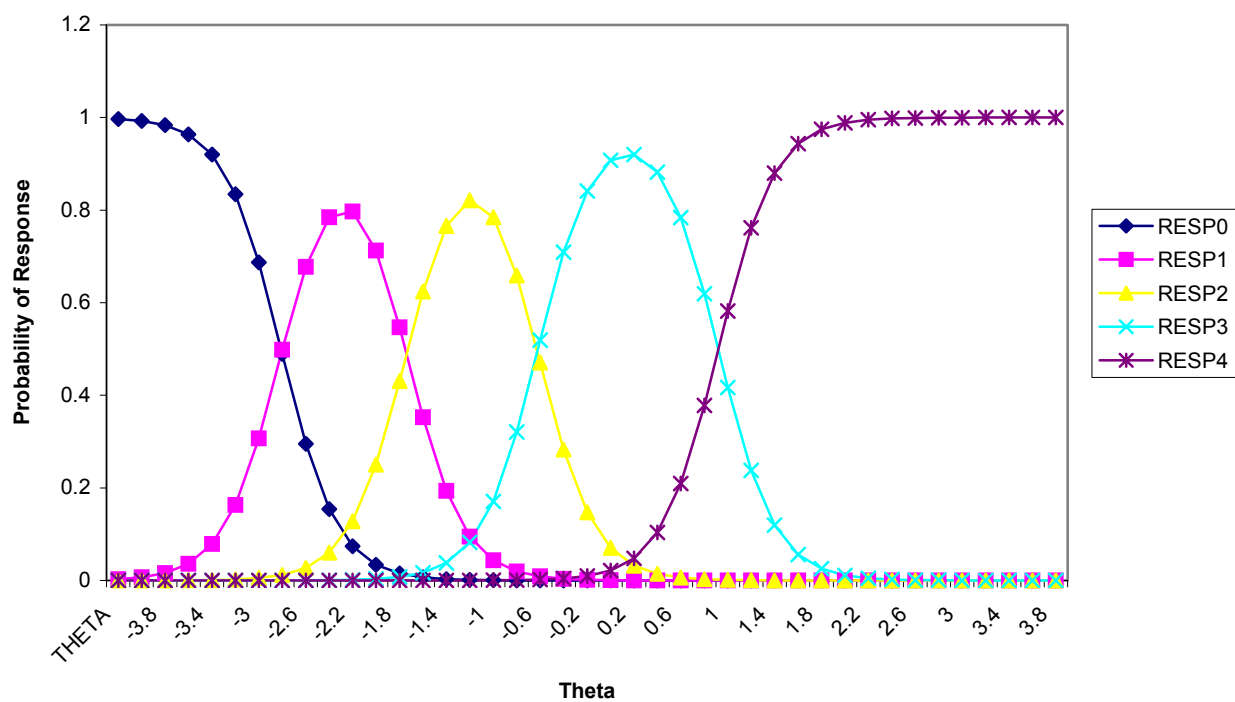


**Item Characteristic Curve for Item 18 (Activities of Daily Living) for the 22-Item ADL Subscale**

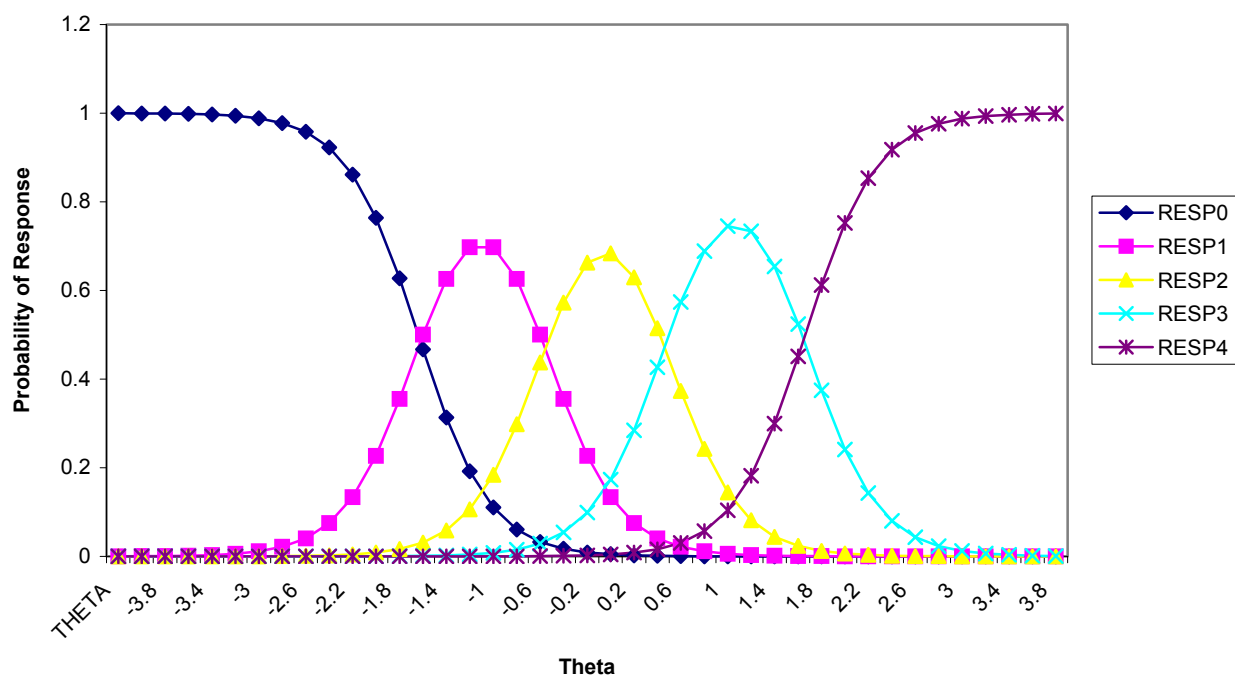


**Item Characteristic Curve for Item 19 (Personal Care) for the 22-Item ADL**

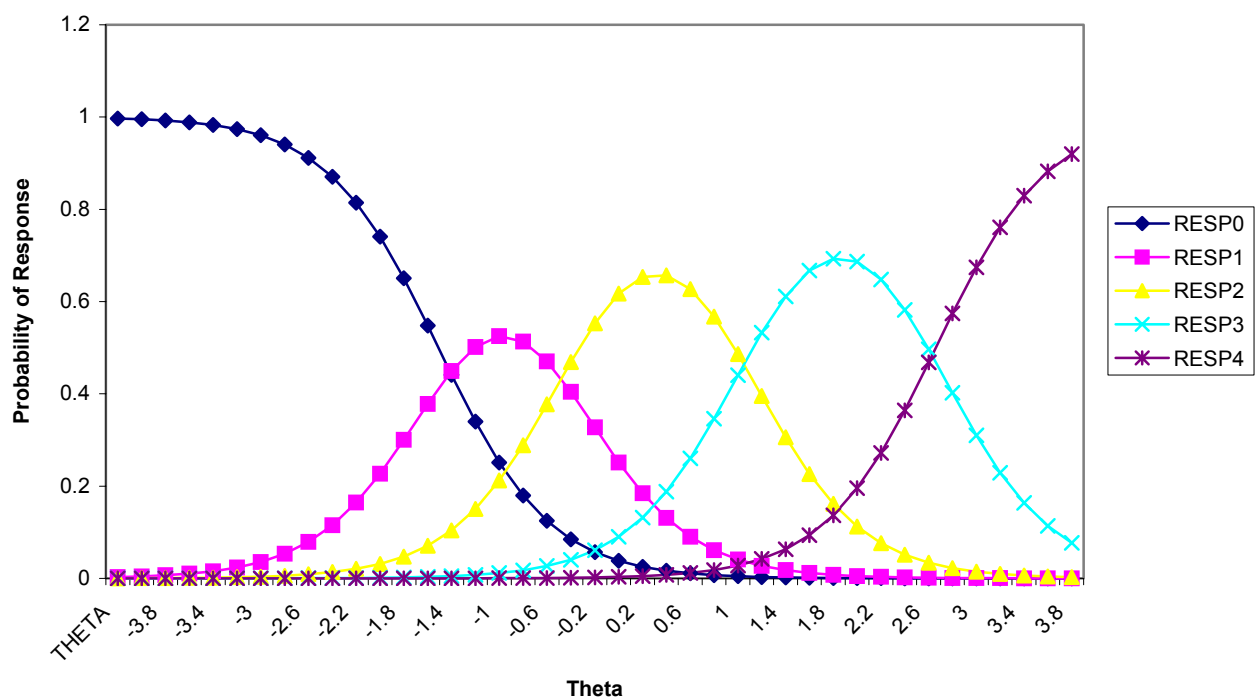
**Subscale**



**Item Characteristic Curve for Item 20 (Light to Moderate Work) for the 22-Item  
ADL Subscale**



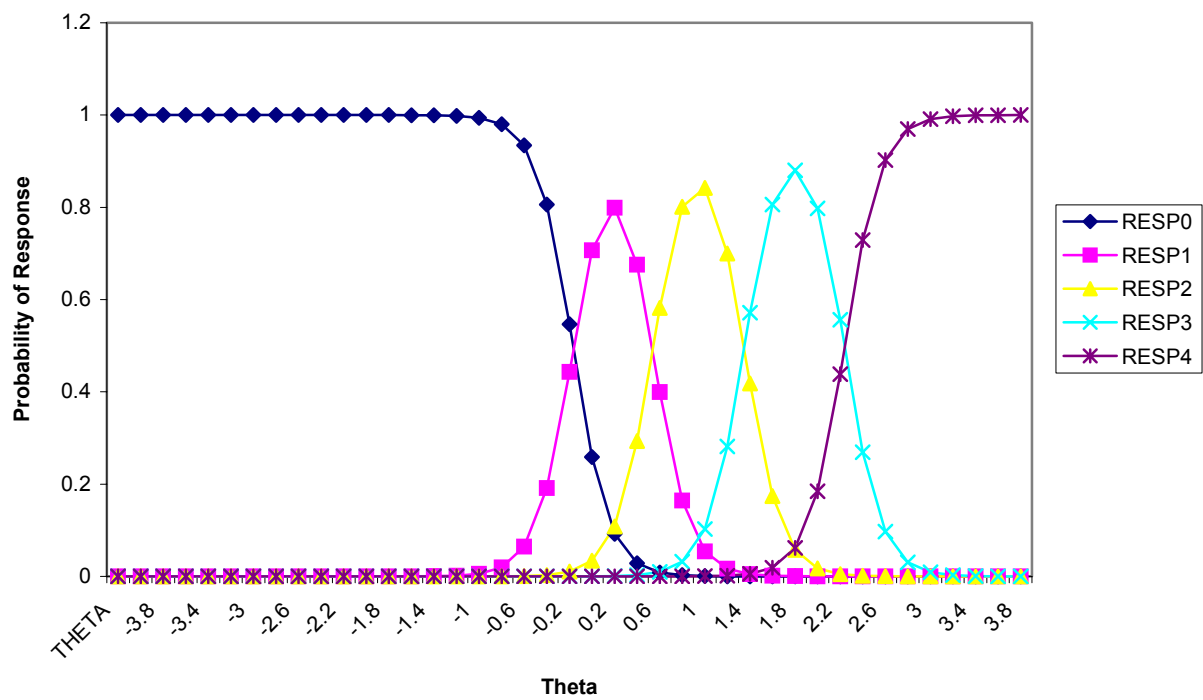
**Item Characteristic Curve for Item 21 (Heavy Work) for the 22-Item ADL Subscale**



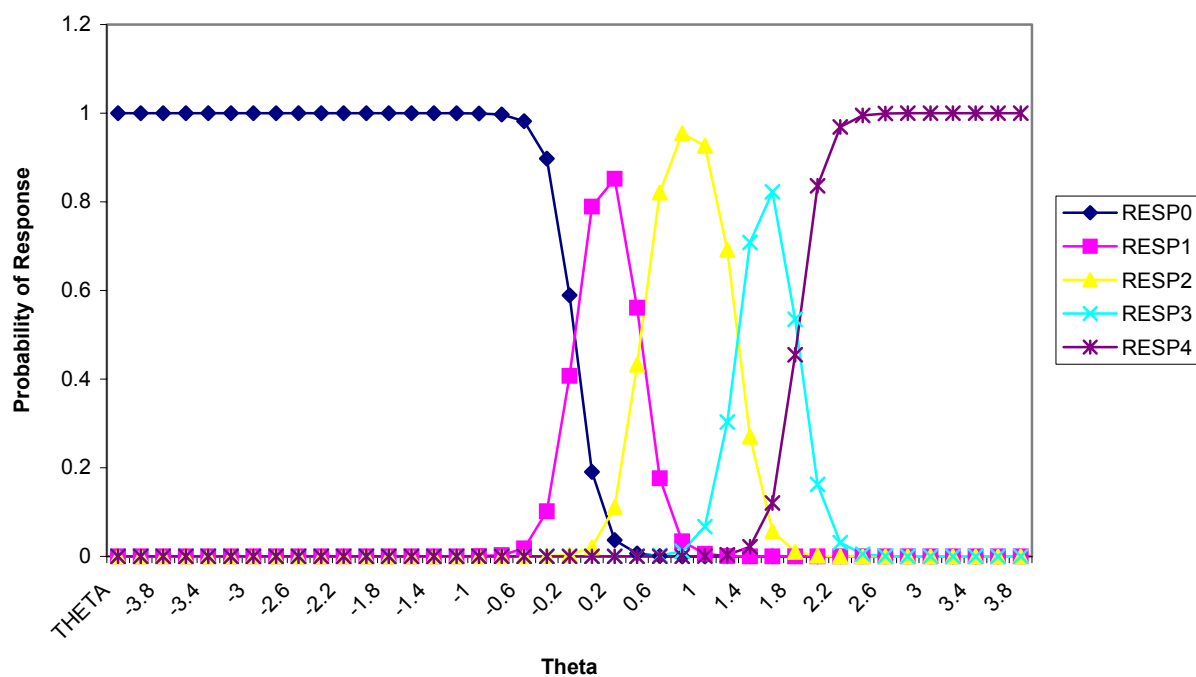
**Item Characteristic Curve for Item 22 (Recreational Activities) for the 22-Item ADL**

**Subscale**

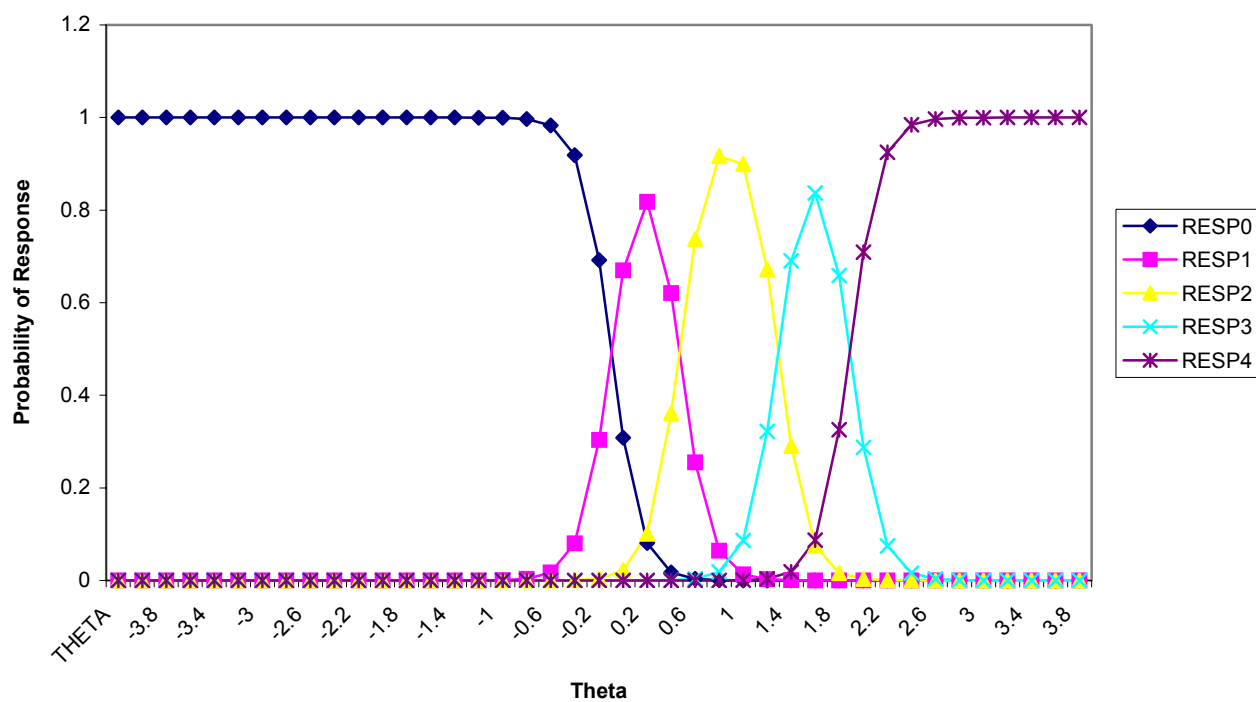




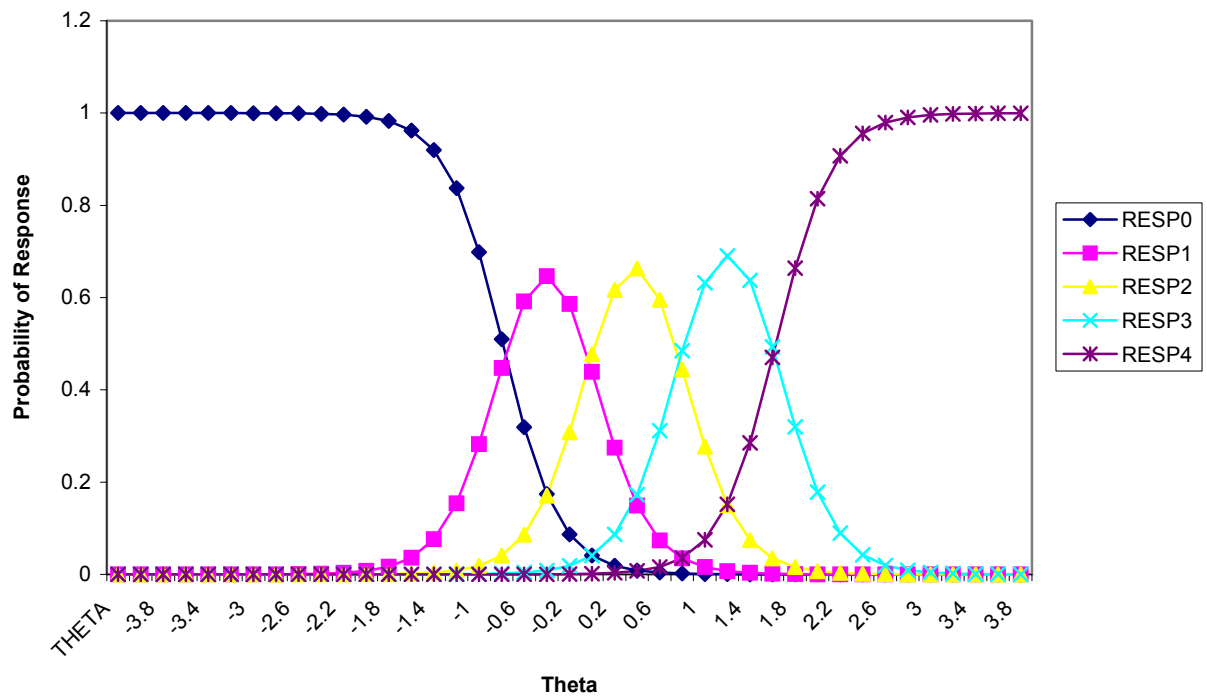
**Item Characteristic Curve for Item 1 (Running) on the Sports Subscale**



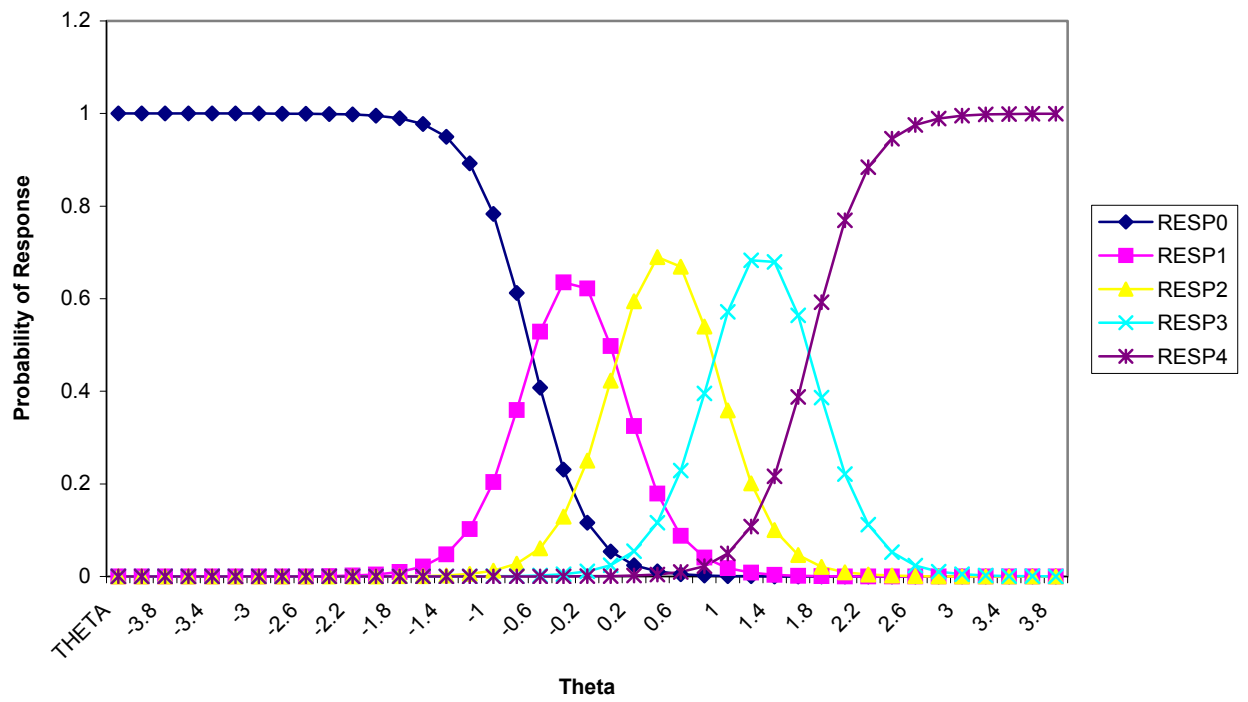
**Item Characteristic Curve for Item 2 (Jumping) for the Sports Subscale**



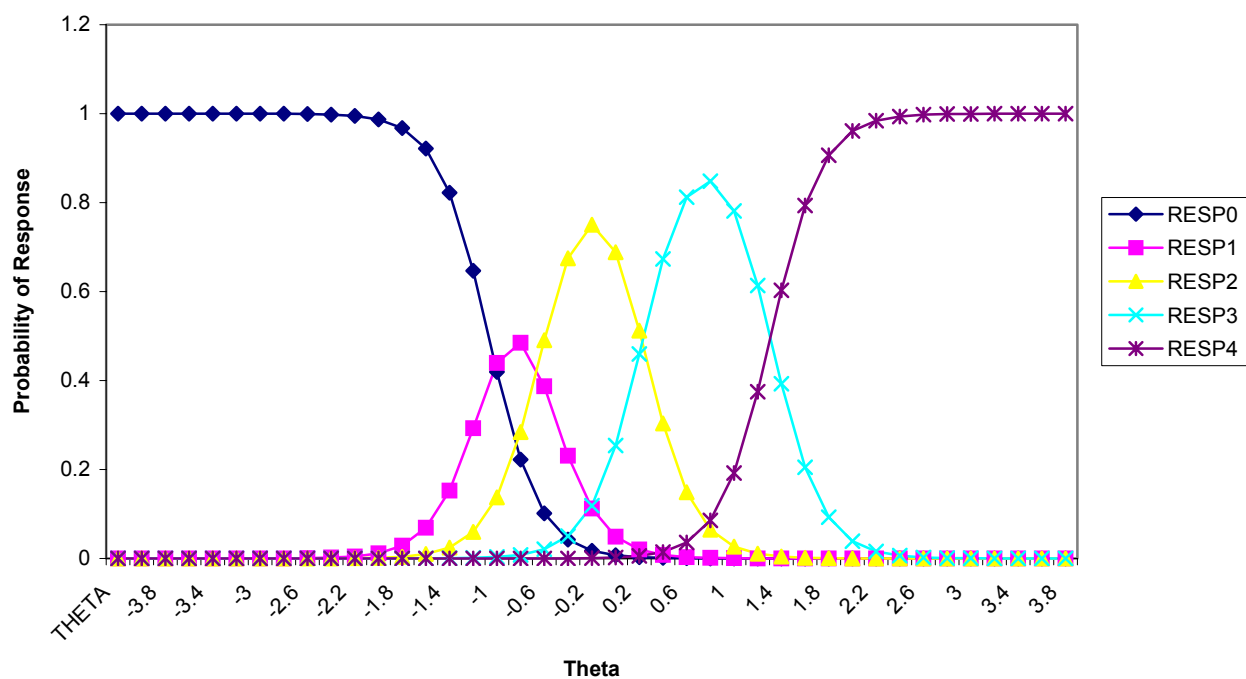
**Item Characteristic Curve for Item 3 (Landing) for the Sports Subscale**



**Item Characteristic Curve for Item 4 (Starting and Stopping) for the Sports subscale**

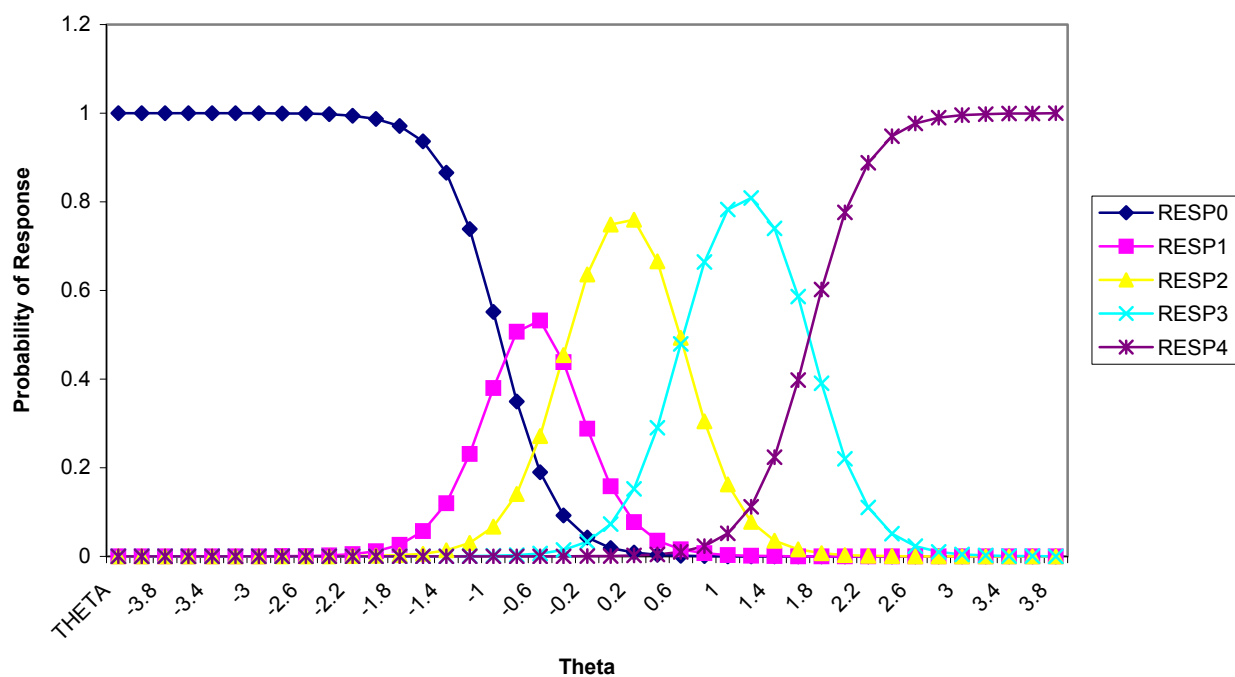


**Item Characteristic Curve for Item 5 (Cutting and Lateral Movements) for the Sports Subscale**

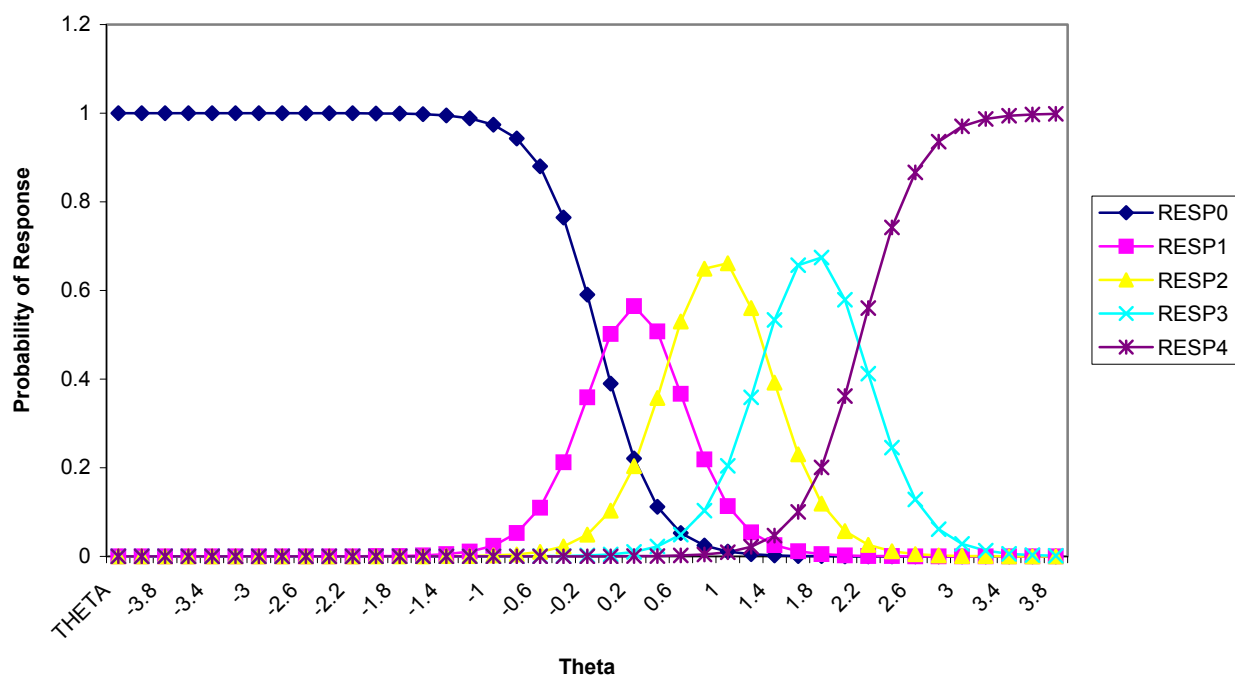


**Item Characteristic Curve for Item 6 (Low Impact Activities) for the Sports**

**Subscale**



**Item Characteristic Curve for Item 7 (Ability to Use Normal Technique) for the Sports Subscale**



**Item Characteristic Curve for Item 8 (Ability Participate as Long as You Like) for the Sports Subscale**



