**Reviewer ID:** Jeff Tan/Brodie Sakakibara, John Zhu, Jeremy Mak, Kyle Diab

**Type of Outcome Measure:** Impact on Participation and Autonomy Questionnaire (IPAQ)

<table>
<thead>
<tr>
<th>Author ID</th>
<th>Study Design</th>
<th>Setting</th>
<th>Population (sample size, age) and Group</th>
</tr>
</thead>
</table>
| Cardol et al. 1999 | Cross-sectional | Outpatient clinic of a hospital | N=100 (43 male, 57 female)  
Mean age=47.9±14.6 years  
28 Neuromuscular disease, 4 MS, 2 AIDS, 6 Diabetes mellitus, 3 SCI, 30 Traumatic hand injury, 10 Rheumatic disorder, 4 Stroke, 13 Other |
| Cardol et al. 2001 | Cross-sectional with a test-retest subsample | 2 rehabilitation centers and the rehabilitation department of an academic hospital | N=126 (48 male, 78 female)  
Mean age=52.6±13.4 years  
N=75 for test-retest  
31 Neuromuscular disease, 25 Rheumatoid arthritis, 22 Fibromyalgia, 27 Stroke, 21 SCI |
| Lund et al. 2005 | Cross-sectional | Not specified | N=161 (63 male, 37 female)  
Mean age=52±18.2 years  
62% Paraplegia  
38% Tetraplegia |
| Lund et al. 2007  "Impact on Participation …" | Cross-sectional, to evaluate aspects of internal scale validity, in terms of unidimensionality, reliability of the Swedish version of the IPA by using the Rasch rating scale analysis. | Participants were identified from a database at a SCI rehab unit in Sweden. | N = 161  
Male = 101  
Female = 60  
Mean Age = 52  
Paraplegia = 100  
Tetraplegia = 61 |
| Noonan et al. 2010a  "Comparing the validity…” | Retrospective review with follow up | Vancouver General Hospital Spine Program between 2000 and 2005 | N=545 participants  
Age range: 21-90y  
Mean (SD) age: 51.1 (16.6)  
N=145 SCI participants  
79 men  
mean (SD) age: 48.7 (17.4)  
For the overall (N=545) group with spinal conditions, subgroups are:  
SCI (n=145)  
Spinal column fracture (n=187)  
Spinal degenerative disease (n=213)  
For the 145 SCI participants, there were:  
42 AIS A  
15 AIS B  
18 AIS C  
24 AIS D |
| Noonan et al. | Retrospective review | Vancouver | N=545 participants |
### 1. RELIABILITY

<table>
<thead>
<tr>
<th>Author ID</th>
<th>Internal Consistency</th>
<th>Test-retest, Inter-rater, Intra-rater</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardol M et al. (1999)</td>
<td>Social relationships: $\alpha=0.86$ Self-care and appearance: $\alpha=0.87$ Family role: $\alpha=0.84$ Mobility: $\alpha=0.86$</td>
<td>No data available</td>
</tr>
<tr>
<td>Cardol M et al. (2001)</td>
<td>Autonomy indoors: $\alpha=0.91$ Family role: $\alpha=0.90$ Autonomy outdoors: $\alpha=0.81$ Social relations: $\alpha=0.86$ Work &amp; educational opportunities: $\alpha=0.91$</td>
<td>Weighted kappa ($K_w$) Perceived participation score $K_w = 0.56-0.90$ Problem-experience score $K_w = 0.59-0.87$ Autonomy Indoors: ICC=0.87 Family Role: ICC=0.83 Autonomy Outdoors: ICC=0.91 Social Relations: ICC=0.89</td>
</tr>
<tr>
<td>Sibley et al. 2006</td>
<td>Cronbach's $\alpha$ for: Indoor Autonomy = 0.94 Family Role = 0.90 Outdoor Autonomy = 0.91</td>
<td>For all items, weighted kappa statistics were greater than 0.60, range was 0.64 – 0.92. At the subscale level, 2-wk interval test-retest ICC for:</td>
</tr>
</tbody>
</table>
Social life and relationships = 0.86  
Work and education = 0.90

**Item to total correlations:**
Indoor Autonomy range = 0.73 – 0.89  
Family role range = 0.73 – 0.84  
(except item 4a = 0.34)  
Outdoor Autonomy range = 0.69 – 0.83  
Social life and relationships range = 0.52 – 0.76  
Work and education range = 0.52 – 0.77

Indoor Autonomy = 0.95  
Family role = 0.97  
Outdoor Autonomy = 0.97  
Social life and relationships = 0.94  
Work and education = 0.91

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**Cronbach’s alpha for:**
- Autonomy Indoors: 0.94  
- Family Role: 0.95  
- Autonomy Outdoors: 0.95  
- Social life and relationships: 0.90  
- Work and Education: 0.96

**10-day interval test-retest ICC for:**
- Autonomy Indoors: 0.84  
- Family Role: 0.88  
- Autonomy Outdoors: 0.85  
- Social life and relationships: 0.83  
- Work and Education: 0.86

**Suttiwo et al. 2013**
Cronbach’s alpha (N=139):  
- Total score: 0.95  
- Subdomains: 0.86-0.80

**2-wk interval test-retest ICC (N=30):**
- Total score: 0.93  
- Subdomains: 0.74-0.92

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**Separation reliability was evaluated in terms of whether the items separated persons into distinct levels of participation. For perceived participation scale, the person separation index was 4.14 (separation reliability = 0.94), indicating that the distribution of persons could be separated into 5 statistically distinct levels. For perceived problems scale, the separation of the persons was 2.13 (separation reliability = 0.82). This indicated that the person distribution could be separated into at least 3 statistically distinct strata.**

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**2. VALIDITY**

<table>
<thead>
<tr>
<th>Author ID</th>
<th>Validity</th>
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<tbody>
<tr>
<td>Cardol et al. 1999</td>
<td>Items of the IPAQ were reviewed by experts from various fields: rehab medicine, rehab research, social medicine, clinical epidemiology, MS patient organization, and consumers of rehabilitation treatment with varying disabilities. Factor analysis with a four-factor solution showed the scale structure could be best interpreted according to the following dimensions: social relationships, autonomy in self-care, mobility and leisure, and family role. This factor solution explained 68% of the total variance, with 33% being explained by social relationships.</td>
</tr>
</tbody>
</table>
| Cardol et al. 2001 | Varimax rotation with a four-factor solution showed the factors could best be interpreted according to the following domains of participation: autonomy indoors, family role, autonomy outdoors and social relations. With this factor solution, 67% of the total variance could be explained, with 43% explained by autonomy indoors. The instrument was updated to represent these results, while adding “work and educational opportunities” as a fifth domain. **Correlations (Pearson’s product-moment) of the IPAQ with instruments measuring a similar construct:**  
IPAQ & London Handicap Scale (LHS):  
IPAQ Social relations domain & LHS Social Integration domain: $r=-0.51$  
IPAQ Autonomy Outdoors domain & LHS Social Integration domain: $r=-0.57$  
Correlations between autonomy indoors, autonomy outdoors and family role (IPAQ) & mobility, occupation and physical independence (LHS) range from $r=-0.42$ to -0.57.  
Correlations between autonomy indoors, family role and autonomy outdoors (IPAQ) and physical domain of SF-
36 range from $r=-0.43$ to $-0.51$.

Correlations of the IPAQ with other instruments measuring different constructs:

Correlations between all domains of IPAQ and domains orientation and economic self-sufficiency range from $r=-0.1$ to $-0.29$.

Social Relations (IPAQ) & Physical Domain SF-36: $r=-0.26$
Social Relations (IPAQ) & Physical Domain SIP: $r=0.16$

Lund et al. 2005

Perceived Participation in Domain & Perceived problems with participation in items:
Autonomy Indoors: $r=0.34-0.59$ (P=.01)
Family Role: $r=0.31-0.65$ (P=.01)
Autonomy Outdoors: $r=0.33-0.69$ (P=.01)
Social Relationships: $r=0.24-0.51$ (P=.01)
Work and Education:
$r=0.16-0.71$ (P=.01, except Mobility, Self-Care, Family Role and Social Relations, P=.05)

Sibley et al. 2006

Confirmatory Factor Analysis: expectations were tested with respect to the number of factors (5 – autonomy indoors, family role, autonomy outdoors, social life and relationships, work and education), which items reflect the given factors, and whether these factors are correlated.
Chi-square = 14.51, P=.01
Root-mean-square error of approximation = 0.10
Normed Fit Index = 0.98;
Comparative Fit Index = 0.99

Correlations between the IPAQ and other instruments (Note: on the IPAQ higher scores denote poorer autonomy):

IPAQ Autonomy Indoors with London Handicap Scale’s:
Mobility (M) = -0.63; Physical Independence (PI) = -0.68; Occupation (Oc) = -0.60; Social integration (SI) = -0.52; Orientation (O) = -0.33; Economic self-sufficiency (Ess) = -0.31.
IPAQ Autonomy Indoors with Functional Limitations Profile’s:
Household Management (HM) = 0.63; Social Integration (SI) = 0.62
Emotion (E) = 0.43
IPAQ Autonomy Indoors with SF-36’s:
Physical Health Component (PHC) = -0.57; Mental Health Component (MHC) = -0.43

IPAQ Family Role with London Handicap Scale’s:
M = -0.59; PI = -0.64; Occ = -0.70; SI = -0.63; O = -0.38; Ess = -0.37.
IPAQ Family Role with Functional Limitations Profile’s:
HM = 0.62; SI = 0.66; E = 0.50
IPA Family Role with SF-36’s:
PHC = -0.68; MHC = -0.42

IPAQ Autonomy Outdoors with London Handicap Scale’s:
M = -0.68; PI = -0.69; Occ = -0.74; SI = -0.62; O = -0.29; Ess = -0.33.
IPAQ Autonomy Outdoors with Functional Limitations Profile’s:
HM = 0.65; SI = 0.66; E = 0.45
IPAQ Autonomy Outdoors with SF-36’s:
PHC = -0.65; MHC = -0.45.

IPAQ Social Life and Relationships with London Handicap Scale’s:
M = -0.48; PI = -0.50; Occ = -0.51; SI = -0.58; O = -0.32; Ess = -0.38.
IPAQ Social Life and Relationships with Functional Limitations Profile’s:
HM = 0.46; SI = 0.53; E = 0.45
IPAQ Social Life and Relationships with SF-36’s:
PHC = -0.46; MHC = -0.43.
### Lund et al. 2007

“The combined results of the goodness-of-fit evaluation and the principal component analysis revealed that the IPA-S when used to evaluate persons with SCI, is comprised of 2 unidimensional scales (perceived participation scale and problems with participation scale). The final perceived participation scale (after removal of the misfitting items) had 27 items and the final perceived problems with participation scale had 6 items.” (p.161)

The hierarchy of items can also be considered to support the construct validity of the scale.

### Noonan et al. 2010a

Relationships between the participation domains and other study variables were hypothesized to assess known-group validity. The study variables assessed were motor score (SCI group), traumatic vs non-traumatic injury (SCI group), level of spinal injury, presence of back pain, age and gender. The known-group validity indices (number of hypotheses supported/ number of hypotheses tested) was 95% (20/21)

**Item intra-domain correlation range (the correlation between the item and the total score of that domain):**
- Autonomy Indoors: 0.73-0.88
- Family Role: 0.66-0.87
- Autonomy outdoors: 0.84-0.89
- Social life & relationships: 0.60-0.83
- Work & Education: 0.81-0.92

**Item inter-domain correlation range (the correlation between the item and the other 4 domains):**
- Autonomy Indoors: 0.52-0.71
- Family Role: 0.55-0.80
- Autonomy outdoors: 0.65-0.80
- Social life & relationships: 0.45-0.70
- Work & Education: 0.61-0.80

### Suttiwong et al. 2013

Spearman’s r of IPAQ (Thai) subdomains with WHOQOL-BREF (Thai) subscales (N=30):
- IPAQ Autonomy indoors: -0.56~0.30
- IPAQ Family role: -0.36~0.55
- IPAQ Autonomy outdoors: -0.49~0.65
- IPAQ Social life and relationships: -0.33~0.40
- IPAQ Work and education: -0.33~0.37

### 3. RESPONSIVENESS – no data available

### 4. FLOOR/CEILING EFFECT

<table>
<thead>
<tr>
<th>Author ID</th>
<th>Floor/ceiling effect</th>
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</thead>
</table>
| Lund et al. 2007 | Notable floor (12 persons) and ceiling (15 persons) effects in the problems with participation scale - in accordance with this, the test information function and SEs for persons indicated insufficient sensitivity. Low sensitivity was not apparent with the perceived participation scale – slight ceiling effects were noted with 6 persons. In contrast the perceived problems scale may only be sensitive enough to identify those with and without perceived problems (or with mild vs. severe problems)  
Note: 161 participants so this doesn’t really meet our qualification for ceiling/floor effects - >20% subjects have the highest or lowest score |
| Noonan et al. 2010a | Ceiling effects for the IPAQ subscales in people with spinal conditions (details above).  
% patients with best possible score:  
Autonomy Indoors = 49.5%  
Family Role = 29.4% |
Autonomy Outdoors = 31.0%
Social life and relationships = 41.1%
Work and Education = 38.2%

### 5. INTERPRETABILITY

<table>
<thead>
<tr>
<th>Author ID</th>
<th>Interpretability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sibley et al. 2006</td>
<td>SCI sample (Outpatients): median (IQR) score</td>
</tr>
<tr>
<td>IPAQ domain</td>
<td>Median (IQR) score</td>
</tr>
<tr>
<td>Autonomy indoors</td>
<td>0.29 (0.1-1.2)</td>
</tr>
<tr>
<td>Family role</td>
<td>1.14 (0.6-1.6)</td>
</tr>
<tr>
<td>Autonomy outdoors</td>
<td>1.20 (0.7-2.0)</td>
</tr>
<tr>
<td>Social life &amp; relationships</td>
<td>0.58 (0.2-1.2)</td>
</tr>
<tr>
<td>Work &amp; Education</td>
<td>0.92 (0.4-1.8)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Noonan et al. 2010a</th>
<th>Overall mean(SD) IPAQ Subscale scores in people with spinal conditions (details above):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autonomy Indoors</td>
<td>0.55 (0.77)</td>
</tr>
<tr>
<td>Family Role</td>
<td>0.99 (0.97)</td>
</tr>
<tr>
<td>Autonomy Outdoors</td>
<td>1.14 (1.14)</td>
</tr>
<tr>
<td>Social life and relationships</td>
<td>0.62 (0.70)</td>
</tr>
<tr>
<td>Work and Education</td>
<td>0.99 (1.12)</td>
</tr>
</tbody>
</table>

SEM IPAQ subscale scores:
Autonomy Indoors: 0.25
Family Role: 0.30
Autonomy Outdoors: 0.42
Social life and relationships: 0.28
Work and Education: 0.35

MDC IPAQ subscale scores:
Autonomy Indoors: 0.70
Family Role: 0.83
Autonomy Outdoors: 1.18
Social life and relationships: 0.76
Work and Education: 0.96