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Module Leader: Dr Judi Pettigrew  
Research Supervisor: Dr Rosie Gowran

**11004487**

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## Abstract

### **Outcome measures for wheelchair and seating: A critical appraisal.**

**Authors:** Siobhan Kenny, Dr. Rosemary Joan Gowran

**Background:** Literature suggests that every aspect of wheelchair provision from referral to follow up and management has an impact on overall outcomes for wheelchair service users. The use of outcome measures (OMs) is called for to ensure best practice in this complex area.

**Objectives:** To identify available outcome measures suitable for the evaluation of a wheelchair intervention and critically appraise measures deemed most suitable in terms of achievement of *activity & participation* and impact of the *service on quality of life*.

**Methods:** OMs were identified using databases: Medline, CINHAL, PsychInfo, and Google Scholar. An evaluation was conducted to establish those particularly useful and a critical appraisal was completed on these.

**Results:** The five OMs identified as most relevant were the Wheelchair Outcome Measure (WhOM); Functioning Everyday in a Wheelchair (FEW); Goal Attainment Scale (GAS); Psychosocial Impact of Assistive Devices Scales (PIADS); and the Quebec User Evaluation of Satisfaction with assistive Technology (QUEST). A critical appraisal was completed on these identifying the strengths and limitations of each.

**Conclusion:** No one outcome measure captures all necessary information and trade-offs are inevitable. When choosing an outcome measure for a service, the specific goals of the service evaluation and resources available need to be considered. This research presents a critical appraisal of five outcome measures deemed appropriate for the evaluation of a wheelchair intervention and highlights some areas for consideration so an informed decision can be made

## INTRODUCTION

The importance of getting wheelchair provision right cannot be underestimated. A wheelchair and seating system not only provides postural support and mobility for the individual but is also the gateway for independence and participation within their chosen context and environment (Gowran 2012). Wheelchair provision is a complex process (White 1999; Gowran 2012), yet in Ireland there is no clear pathway of service provision for wheelchairs from assessment to prescription and follow-up evaluation (Kane 2000). There has been a recent call for evidence based practice (EBP), and with this, the use of outcome measures (OMs) within the area of wheelchair provision to promote improved service delivery (Harris & Sprigle 2008; Hammel et al 2012). The service provision process in wheelchair provision is not straightforward, and therefore the capturing of measurable and meaningful outcomes for service users requires careful consideration and evaluation (Harris 2007).

This research seeks to identify OMs that are suitable for use in evaluating wheelchair provision and provide a critical appraisal of those most suitable for this purpose.

The aims of this research are:

- 1) To identify the outcome measures available to evaluate a wheelchair intervention.
- 2) To critically appraise the measures deemed most suitable in terms of their ability to:
  - i) Evaluate the intervention's contribution to the *activity and participation* of the individual.
  - ii) Capture the influence of the *entire service provision* on the *quality of life* of the individual.

## LITERATURE REVIEW

### *Importance of Wheelchair Provision*

The UN Convention of Human Rights for People with Disabilities (2006) holds that the provision of the correct wheelchair doesn't just increase mobility, but opens up the social world to the individual and means the ability to participate in a full and active life. The provision of an appropriate wheelchair for those who need it is primary need and a basic human right, failure of this results in unequal opportunities in daily living (WHO 2008; Gowran et al 2011). The term wheelchair provision is used in this paper and is intended to incorporate the provision of both mobility and seating systems, including postural control

where necessarily and refers to the design, production and service delivery of the wheelchair and seating system in line with the WHO's (2008) definition of wheelchair provision.

An appropriate wheelchair has been defined by the WHO (2008) as one that meets the user's physical and social needs, suits their environmental context, is safe and durable and achieves correct fit and postural control. Wheelchairs are a precursor for social participation and self-actualisation and an essential to almost all of a person's 'life-habits' (Batavia et al 2001, p. 542). At the most basic level, unsuccessful provision will result in the individual being unsatisfied, an outcome that can easily be overlooked (Di Marco et al 2003). For these reasons, it is essential that the fit between the wheelchair, the individual and the environment is right (Rosseau-Harrison et al 2009). As gatekeepers to the process, OTs not only need to evaluate the role they play in providing appropriate wheelchairs, but also the provision of an acceptable service delivery and follow up. As Cook & Hussey (2002) point out, all too often it is thought that the wheelchair intervention ends when the chair is delivered, however, instead this should mark the start of wheelchair use and with it, the start of the evaluation process. In order to evaluate interventions, outcome measures need to be considered (Mortenson & Miller 2008).

### **Outcome Measures**

To ensure EBP, OTs not only need to incorporate research into their practice, but they also need to monitor the interventions they deliver and provide evidence of how they have achieved desired outcomes (Harris & Sprigle 2008). This is achieved through OMs which aim to detect change in desired outcomes and attribute links between these changes and the intervention provided (Greenhalgh et al 1996; Unsworth 2001). OMs are seen as an essential component of practice, yet are not readily incorporated due to a number of reasons including limited time resources, lack of available information and an underestimation of the importance of service evaluation (Duncan 2011, Higgenson et al 1997, Unsworth 2001). However, the call for OMs in an expensive and complex service such as wheelchair provision is growing due to the high cost involved in service provision, but also due to the consequences of inadequate seating provision in terms of cost of quality of life to the individual (Di Marco et al 2003).

### **Framework**

Development in the area of OMs for wheelchair provision has seen a recent movement towards the adaption of the International Classification of Functioning (ICF) (WHO 2001) as a framework as it distinguishes between *capacity*, describing what a person can do; and *performance*, describing what a person actually does do, in their natural environment (Harris

2007; Mortenson et al 2008; Hammell 2012). Its sensitivity to the complexities of the person's physical and social environments further contributes to its suitability (Mortenson 2008). Geisbrecht et al (2009) emphasise that using tools that consider this concept is essential. More recently, Hammel et al (2012) found that service users and service providers attributed different levels of importance to the various ICF categories. The importance of the entire service provision experience on the quality of life of the service user also emerged as a finding of this study. Quality of life is an outcome that can often be overlooked; however there is a consensus in rehabilitation that quality of life is often the ultimate objective and therefore needs to be an essential component of assistive technology outcomes research (Pettersson 2007; Cook & Hussey 2002).

### *Previous Research*

While Mortenson et al (2008) have provided an analysis of OMs suitable for use in wheelchair provision, this study looks specifically at wheelchair specific OMs and focuses solely on the integration of the concept of *activity and participation*. It does not include generic assistive technology measures. These warrant inclusion, as concepts such as quality of life and service provision are included in some generic measures that are not present in any existing wheelchair specific measures. Therefore the development of research that includes both wheelchair specific and generic assistive technology OMs is necessary, especially in light of recent calls for the evaluation of the entire service delivery (Hammell 2012). This paper aims to provide this.

## METHODS

This research is part of a larger project, carried out in conjunction with SeatTech – a Dublin specialised seating clinic, which includes a critical appraisal of available outcome measures and two individual case studies using the Wheelchair Outcome Measure (WhOM) and the Goal Attainment Scale (GAS). The critical appraisal will be provided here.

A critical appraisal was deemed most appropriate and achievable over a full systematic review, which was beyond the scope of this research due to time and resource constraints. A critical appraisal, while still aiming to look at the information in a systematic and objective manner does not attempt to do an explicit search of all data, it aims to assess and interpret selected research by considering validity, results and relevance to selected topic (Parks et al 2010).

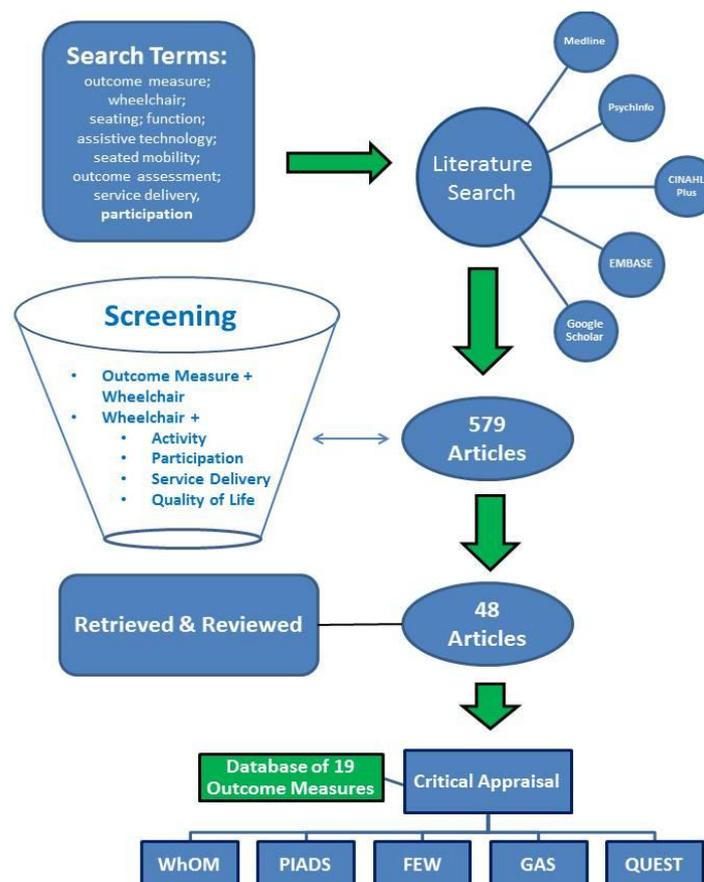


Figure 1: Visual representation of methodology

### **Search Strategy:**

In order to identify the OMs available, a detailed database search was completed using the following databases: MEDLINE, PsychInfo, EMBASE, CINAHL Plus and Google Scholar. The search terms *outcome measure; wheelchair; seating; function; assistive technology; seated mobility; outcome assessment; service delivery*, and *participation* were used. These terms were used because they emerged as the most commonly used phrases in relation to outcome measurement in wheelchair provision from an initial literature review completed during study development. Only articles from the last 15 years were included. In addition to computerised searches, an examination of reference lists was used to identify further relevant studies that may have been overlooked in the computerised search process. The search was completed between April 2012 and December 2012.

### **Identifying Relevant Articles:**

This detailed search identified 579 peer reviewed articles, excluding duplicates. Articles were screened for relevance, initially through reading of titles; if the title was deemed relevant, a review of the abstract was completed. The criteria for retrieval of an abstract included that article must make reference to a) outcome measures AND wheelchair and/or seating; or b) wheelchairs and/or seating AND activity/participation OR service delivery OR quality of life. If the abstract was deemed appropriate, the full article was be retrieved. In total, 48 articles were retrieved and reviewed.

### **Available Outcome Measures**

Following a review of articles, a database of OMs available for use in wheelchair provision was compiled and further information on each of these OMs retrieved. Each outcome measure included was classified into a domain of measurement and was evaluated for suitability for inclusion in the critical appraisal. Reasons for exclusion included: lack of available literature, literature unavailable in the English language, poor development of outcome measure, inappropriate domain of measurement and poor psychometric properties.

### **Critical Appraisal**

Following this review, five OMs were deemed suitable for inclusion in the comparative critical appraisal and a thorough search was completed for all available literature on the development and use of these OMs. The five outcome measures that were included were the Wheelchair Outcome Measure (WhOM), the Goal Attainment Scale (GAS), the Functioning Everyday in a Wheelchair (FEW), the Quebec User Satisfaction Evaluation of assistive Technology (QUEST) and the Psychosocial Impact of Assistive Devices (PIADS).

To enable a standardised method of data collection, a checklist was used which involved a standard set of questions applied to each OM, thus providing a framework for the critical

appraisal (Crombie 1996) and structuring the overall synthesis (Parks et al 2010). The checklist used was adapted from Greenhalgh and Connelly (2000) and is included as Appendix 1. Data gathered were collated using Microsoft Excel. Some of the components considered as part of the critical appraisal are discussed below.

#### *Domain of measurement*

This evaluates if the domains and conceptual concepts reported to be measured are actually addressed by the tool. Although the domains of activity and participation are the central factors for consideration, quality of life and service delivery are also evaluated.

#### *Psychometric Properties*

Reliability and validity are considered here. Reliability refers to the consistency achieved by the test. The test-retest reliability records how well the measure achieves the same results between two administrations of the same measure, under the same circumstances. Inter-rater reliability refers to how similar outcomes are predicted to be when administered by two different practitioners (Kaplan 1996).

Validity records if the tool measures the outcome it purports to measure. Content validity looks at the common sense and meaning of the measure (Andreson 2000), and is achieved by using experts to define specificities of the outcome (Kaplan 1996). This will be scored using Mortenson et al's (2008) grading system which looks at the stakeholders involved in the development: 1 = Experts involved in development; 2 = Service users involved in development; 3 = Based on other related instruments.

Construct validity will be reported where available. This is acquired by comparing the area of measurement to other similar, already proven, measures (Andreson 2000).

#### *Responsiveness/Sensitivity*

This measures ability to demonstrate clinically significant or meaningful change over time in the desired outcome (Andreson 2000). The floor and ceiling effect are also to be considered within sensitivity (Andreson 2000).

#### *Client-centredness*

An ideal client-centred OM not only involves the client in the setting of goals, but also involves the client in the process of scoring the achievement of goals. Client-centredness will be evaluated according to client involvement and input in the evaluation.

### *Administration Burden*

This will examine how easy the tool is to administer, re-test, score and interpret. Another important consideration is the burden of the outcome measure to the respondent, including if the length and content are acceptable to those participating (Andresen 2000).

### *Ethical Considerations*

Critical appraisal is a skill that requires the ability to recognise the quality of research and pinpoint shortcomings; however, it is not simply the thrashing of other peoples research (Parks et al 2010). It should be remembered that there are ethical considerations when reviewing other pieces of research and any criticisms should be delivered fairly and with respect.

It should also be remembered that any recommendations provided could influence future choices around OMs made in the area of wheelchair provision. As there is a dearth of publications in this area any recommendations made are likely to be undertaken by those newly embarking on the subject, with this comes a responsibility to report literature, methodology and findings with integrity and respect.

## RESULTS

From the literature search, forty-eight relevant papers were retrieved and reviewed and a list of possible OMs was compiled. In total, nineteen outcome measures were identified: eleven specific to wheelchair outcomes and eight designed for assistive technology. It should be noted that the OMs included were those that emerged from a literature search for use in wheelchair provision. Therefore, this list is not exhaustive to all OMs available for assistive technology.

The list of nineteen OMs were then classified according to the domain of measurement. Those that measure i) *impact of service on quality of life* or ii) *activity and participation* were investigated further. The list below summarises the available OMs, their domain of measurement and, where appropriate, reason for exclusion in further critical appraisal.

**Table 1: Outcome measures identified through literature review**

| Acronym                    | Name  | Reference              | Domain of measurement  | Reason for exclusion  |
|----------------------------|---|------------------------|--|---|
| <b>Wheelchair Specific</b> |   |                        |  |   |
| <b>WhOM</b>                | Wheelchair Outcome Measure                                  | Mortenson et al (2007) | Activity & Participation   | <b>Included</b>   |
| <b>FEW</b>                 | Functioning Everyday with a Wheelchair                      | Mills et al (2002)     | Activity. Evaluation of functional performance.                              | <b>Included</b>   |
| <b>ATOP-M</b>              | Assistive Technology Outcomes Profile - Mobility            | Jutai (2011)           | Activity and Participation   | Measure currently in development  |
| <b>WUFA</b>                | Wheelchair Users Functional Assessment                      | Stanley et al (2003)   | Activity. Element of participation.  | Focuses on wheelchair skills. Does not look at participation or service delivery. |
| <b>USAT-WM</b>             | Usability Scale for Assistive Technology – Wheeled Mobility | Arthanat et al (2007)  | Captures user centred usability of wheeled mobility devices – Participation. | Looks primarily at participation, without attending to activity.                  |
| <b>TAWC</b>                | Tool for Assessing  | Crane et al (2007)     | Wheelchair Comfort   | Focuses solely on wheelchair comfort.   |

|                                     |  |                      |  |  |
|-------------------------------------|--|----------------------|--|--|
|                                     | Wheelchair Discomfort  |                      |  |  |
| <b>WcS-DAT</b>                      | Wheelchair Seating Discomfort Assessment Tool                    | Crane et al (2004)   | Wheelchair Comfort   | Focuses solely on wheelchair comfort.  |
| <b>WST</b>                          | Wheelchair Skills Test   | Kirby et al (2002)   | Evaluation of Wheelchair Skills (Mobility)                     | Concentration on one construct (activity), does not address participation or service delivery.           |
| <b>Wheelchair Circuit</b>           | Wheelchair Circuit   | Kelkins et al (2002) | Mobility and Exercise capacity.                                | Concentration on one construct (activity), does not address participation or service delivery.           |
| <b>PIDA</b>                         | Power-mobility Indoor Driving Assessment                         | Dawson et al (1994)  | Indoor Driving Skills (Mobility)                               | Concentration on one construct (activity), does not address participation or service delivery.           |
| <b>PCDA</b>                         | Power-mobility Community Driving Assessment                      | Letts et al (2007)   | Community Driving Skills (Mobility)                            | Concentration on one construct (activity), does not address participation or service delivery.           |
| <b>General Assistive Technology</b> |  |                      |  |  |
| <b>QUEST</b>                        | Quebec User Evaluation of Satisfaction with Assistive Technology | Demers et al (2002)  | User satisfaction with Device and Services                     | <b>Included</b>  |
| <b>PIADS</b>                        | Psychosocial Impact of Assistive Devices                         | Jatai & Day (2002)   | Measures the impact of assistive technology on quality of life | <b>Included</b>  |
| <b>OTFACT</b>                       | Occupational Therapy Functional Assessment Compilation Tool      | Jatai et al (2002)   | Functional performance.  | Looks at functional performance, but does not cover activity. Not specific to wheelchairs.               |
| <b>ATOM</b>                         | Assistive Technology Outcome Measure                             | Dharne et al (2006)  | Assesses assistive technology usability and service            | Appropriate for inclusion; however no further literature available beyond publication of original paper. |

|              |   |                          |   |  |
|--------------|---|--------------------------|---|--|
| <b>GAS</b>   | Goal Attainment Scale                       | Kiresuk & Sherman (1968) | Attainment of Client Identified Goals   | <b>Included.</b>   |
| <b>KWAZO</b> | Meaning 'Quality of Care'                   | Dijcks et al (2005)      | Quality of Service in Assistive Technology Provision.   | Study developed in the Netherlands, not enough English language literature available to support inclusion. |
| <b>RNLI</b>  | Reintegration into Normal Living Index      | Tooth et al (2003)       | Satisfaction with reintegration into normal functional activities. Can be used to measure social participation enabled by AT.   | Tool deemed too broad to effectively measure satisfaction with service delivery.                           |
| <b>IPPA</b>  | Individually Prioritised Problem Assessment | Wessels et al (2002)     | Instrument to Assess the Effectiveness of an Assistive Technology Provision. Assesses the impact that problems have on the daily life of the end user and the ability of AT to overcome these problems. | Does not adequately evaluate activity and participation (Harris 2005).                                     |

Of the eleven wheelchair specific OMs, six were not suitable for inclusion as they concentrated solely on one domain of measurement, mainly comfort or wheelchair driving skills. Two measures (WUFA and USAT-WM), while expanding their level of measurement more broadly to activity, did not attempt to measure participation or service delivery. One measure, the ATOP, seemed promising as it attempted to measure both activity and participation, however, this measurement is new and thus is still in development (Hammell 2012). Of the eight assistive technology outcome measures listed, one (OTFACT) examines functional performance, but overlooks activity; one (KWAZO) was developed in the Netherlands and lacks supporting literature in the English language. One measure, the ATOM, appeared to be appropriate for inclusion as it examined both service provision and usability of assistive technology. However upon further investigation; there was no further literature available beyond the original publication.

The outcome measures deemed suitable for inclusion in the critical appraisal were the WhOM, the FEW, the QUEST and the PIADS. Although the GAS does not specifically focus

on activity or service delivery, it is considered appropriate for inclusion as the goal orientated nature of this measure makes it broad enough to capture relevant information, provided the clinician has the necessary skills to set appropriate goals. This measure was also included as it is used in a case study as part of the larger study. The measures included described in Table 2 below.

**Table 2: Description of Measures included in Critical Appraisal**

| <b>Outcome Measure</b> | <b>Description</b>   |
|------------------------|--|
| <b>WhOM</b>            | <ul style="list-style-type: none"> <li>- Wheelchair specific</li> <li>- Allows individually meaningful goals</li> <li>- ICF framework - activity and participation</li> <li>- Additions section relating to body structure and function</li> </ul> <p style="text-align: right;">(Mortenson 2007).</p>   |
| <b>FEW</b>             | <ul style="list-style-type: none"> <li>- Wheelchair specific tool</li> <li>- Measures participation from both the user's and clinician's perspective</li> <li>- User rates performance in ten environment and activity based situations</li> <li>- Clinician rates of a series of standardised norm-referenced tasks</li> </ul> <p style="text-align: right;">(Geisbreicht et al 2009; Mills et al 2002)</p> |
| <b>PIADS</b>           | <ul style="list-style-type: none"> <li>- 26 item self-report questionnaire</li> <li>- Aims to detect the impact of assistive technology on functional independence, quality of life and well-being.</li> <li>- Contains three subsets of adaptability, competence and self-esteem</li> </ul> <p style="text-align: right;">(Jatai and Day 2002)</p>  |
| <b>QUEST</b>           | <ul style="list-style-type: none"> <li>- 24 item self-report questionnaire</li> <li>- Measures user satisfaction with assistive technology.</li> <li>- Two subsets: assistive devices &amp; service delivery</li> </ul> <p style="text-align: right;">(Demers et al 1999)</p>  |
| <b>GAS</b>             | <ul style="list-style-type: none"> <li>- Goal orientated</li> <li>- Client sets personally relevant goals &amp; self-rates their achievement of these</li> <li>- Five point scale (-2 to +2)</li> <li>- Weighting of performances is used to calculate a T value with a mean of 50</li> </ul> <p style="text-align: right;">(Ottenbacher &amp; Cussick 1993)</p>   |

## Critical Appraisal

### *Client-Centredness*

Overall, the WhOM and the GAS emerge as the most client-centred due to the fact that they both involve client identified goals set around their individual status and expected performance (Turner Stokes 2009). This allows the evaluation of participation in areas deemed important to the client in an individualised manner. However, the WhOM does include one section evaluated solely by the practitioner.

Although phase one of the FEW was developed using the Canadian Occupational Performance Model (COPM), the final version of the tool contains pre-defined questions which reduces the level of client-centredness, even though the individual self-rates their perceived performance. The PIADS and the QUEST are the least client-centred due to the self-report nature of these OMs.

**Table 3: Reported Psychometric Properties**

|       | <b>Data Constructs</b>   | <b>Test –Retest Reliability</b>   | <b>Inter-rater Reliability</b> | <b>Content Validity<sup>1</sup></b> | <b>Construct Validity</b>  |
|-------|--|---|--------------------------------|-------------------------------------|--|
| WhOM  | 50 participants with Spinal Cord Injury. Prospective test-retest study.      | ICC <sup>2</sup> ,1: 0.90   | ICC2, 2: 0.90                  | 1,2                                 | QUEST (Assistive Devices subset)r≥0.66   |
| GAS   | NA/varied  | Not reported  | ICC 0.86 <sup>3</sup>          | 2                                   | Not Reported   |
| FEW   | Phase 1 involved 20 participants, wheeled mobility & powered mobility users. | ICC: 0.86   | Not reported                   | 2, 3                                | Not reported   |
| PIADS | 83 participants with MS, mobility device users.                              | ICC: 0.90   | ICC: 0.91                      | 2                                   | ICC: 0.81  |
| QUEST | 97 individuals using mobility devices.                                       | ICC:<br><i>Devices: 0.82</i><br><i>Services: 0.82</i><br><i>Overall: 0.91</i> |                                | 1, 2                                | (PIADS)<br><i>Device: r=0.34</i><br><i>Services: r=0.30</i><br><i>Overall: r= 0.45</i> |

The psychometric properties of OMs are reported in Table 3. Both test-retest and inter-rater reliability are reported using inter class correlation (ICC) which measures the interrelatedness of individual ratings across a fixed period of time (Anderson 2000). Generally a score of 0.70 or higher is required to deem a tool reliable (Demers et al 2002).

The WhOM's psychometric properties are strong with an ICC score of 0.90 for test-retest and inter-rater reliability. The construct validity of this measure was good with an r value of ≥0.66.

Psychometric testing of the GAS was difficult to find in the literature, but an ICC of 0.87 was found for inter-rater reliability (Stolee 1992), this is considered good.

<sup>1</sup> 1 = Experts involved in development; 2 = Service users involved in development; 3 = Based on other related instruments

<sup>2</sup> Intra Class Correlation

<sup>3</sup> When used in a geriatric setting

The PIADS performed well on psychometric property testing overall. The FEW has a reported ICC of 0.86 which is good.

The test-retest reliability scores for both the QUEST subsets scored well above acceptability range of 0.70 and are therefore considered good. Both clinicians and service users were involved in giving feedback on earlier versions of the tool development, giving it a strong content validity. However, the construct validity, which was validated against the PIADS emerged as poor, the *services* subset had an especially poor ICC of 0.34.

### *Responsiveness/Sensitivity*

There is a possibility of floor and ceiling effects on the GAS due to the five point scale not allowing the individual to progress beyond +2 or regress past -2 (Ottenbacher & Cusick 1989). Turner Stokes (2009) suggests the use of a seven point scale as one solution to this problem. Despite this drawback, the GAS is reported to be 'highly sensitive to change' (Cox and Amsters 2002).

The PIADS scale ranges from -3 to +3 allowing the capture of any negative influence on quality of life (Garden 2006). However, the lack of sensitivity of this measure has been reported in relation to capturing change in wheelchair provision (Devitt et al 2003).

User reports on the responsiveness of the QUEST indicate that the tool does not capture issues such as frustration (Demers et al 2002) which may be common issues arising during the wheelchair provision process.

The reliability or sensitivity of the WhOM or the FEW have not been reported.

**Table 4: Administrative Burden**

|              | Time Taken to Administer (as reported by authors) | Time reported to administer by other authors (if different)  | Mode of Administration                                  | Training/Education Required   |
|--------------|---|--|---|---|
| <b>WhOM</b>  | 30 minutes  | NA   | Administered by clinician                               | Manual Use  |
| <b>GAS</b>   | 1 hour  | Time-taken to produce T-Score using complicated formula must be considered here as it adds to administration burden. | Collaborative goal setting between client and clinician | Training recommended to maximise inter-rater reliability of tool. Skill required for realistic goal setting. The use of the formula to determine T-scores is complicated and requires a certain level of 'reading – up' to understand it. |
| <b>FEW</b>   | ≤ 15 minutes                                      | NA   | Administered by clinician                               | Manual Use  |
| <b>PIADS</b> | 5 – 10 minutes                                    | 25 minutes   | Self-report   | None  |
| <b>QUEST</b> | 10-15 minutes                                     | NA   | Self-Report   | None  |

While it is reported that the PIADS takes just 5-10 minutes to administer (Jutai et al 2002), a study evaluating this tool quoted 25 minutes for administration time (Devitt et al 2003). The FEW is considered to be easily accessible as it takes less than 15 minutes to administer, but the respondent burden was considered to be high because of complicated nature of some questions (Mortensen et al 2008). The administration time for the QUEST is reported as 15 minutes; however users have reported that this measure contained clear questions (Demers et al 2002). The GAS is estimated to take 45 minutes to goal-set, 8 minutes to re-test and 7 minutes to calculate a T-score (Cusick et al 2006).

## DISCUSSION

### *Domain of Measurement*

The OMs included in this critical appraisal consider the concepts of *activity and participation* or *quality of life impact of the entire service provision*. The concept of participation and activity is addressed (to some level) in three of the measures: the WhOM, the FEW and the GAS. Participation and activity are core concepts in the WhOM and this measure is developed around these domains. As the FEW is designed to capture functional performance, it is centred on the activity component of the ICF (Geisbreicht 2009) but captures participation at a subjective level (Mortensen 2008). The GAS, while not designed specifically for this purpose, potentially assesses activity when used in the context of a wheelchair intervention, provided the client's goals involve an element of activity.

The PIADS, does not attend to the concepts of activity and participation, but ably addresses quality of life through three subsets of *competency, adaptability* and *self-esteem*. Some elements of the competency subscale do address aspects of activity as questions in this category cover areas such as productivity, performance and independence (Day et al 1996). The QUEST addresses user satisfaction with assistive technology, the device subset does not address participation, however the presence of a *services* subset addresses user's satisfaction with service delivery, which no other measure included here covers.

### *Client-centredness*

For an outcome measure to be client-centred there needs to be a mutual goal setting process between the client and the practitioner, focusing on the client's self-perception of their occupational performance and evaluating outcomes that are important to the client (Pollock 1993; Dedding et al 2004). As mentioned above, the GAS and the WhOM emerged as being the most client-centred as they involve the clients self-identified and self-prioritised goals. The WhOM was used to determine the satisfaction of participation of wheelchair users with spinal cord injury (SCI), the fact that participants could self-identify their goals was quoted as a strength of the study. This resulted in 'very unique' participant outcomes being identified such as wheelchair archery and photography (Rushton et al 2010, p. 696). This demonstrates the strength of client-centred nature of the WhOM, and the identification of such occupations as wheelchair archery highlights how environmental influences can be incorporated into the outcome measurement process.

Similarly, the GAS has been used to evaluate a spinal outreach team in rural Australia. It was sensitive to the individual nature of clients' needs and 'highly client-focused' (Cox and Amsters 2002, p. 259). The FEW makes associations with the client-centred philosophy by using the COPM in phase one of its development. However, this measure relies on a standard set of tasks to evaluate functional performance and therefore does not fit perfectly in terms of client-centredness. Although the PIADS is a self-report questionnaire, and therefore does not focus on self-identified goals, Devitt et al (2003) argues that using the PIADS as a service evaluation would enhance client-centred practice through the introduction of quality of life outcomes.

### *Psychometric Properties*

The OMs presented represent various levels of excellence in psychometric properties. The strongest evidence is available for WhOM as both reliability and validity are clearly available and a strong reliability and construct validity are reported. For other OMs, there was a lack of availability of reliability and validity in the context of wheelchair provision and even in general. For example, construct validity could not be found for the GAS and test-retest validity could only be found in alternative settings not relevant to wheelchair provision.

However, a critical examination of the measures presented is warranted. While good validity and reliability are presented for the WhOM, the participant profile in this study was made up entirely of participants with SCI. This is not representative of the entire population of wheelchair users who may have differing wheelchair needs and outcomes. The PIADS scored well overall and while the original psychometric testing featured mainly eyeglass and contact lenses users, the translated English-French version was validated on multiple sclerosis (MS) patients who used mobility devices (Demers et al 2002), this supports validity and reliability within a wheelchair setting.

While the GAS has appealing face validity in many settings outside of seating (Stolee et al 1999), some authors have warned against comparing outcomes with similar standardized tools to examine construct validity, due to the individualised nature of the GAS and its intent to measure change in individual circumstances rather than make population comparisons (Ottenbacher & Cusick 1993). Inter-rater and test-retest reliability are not reported readily throughout the literature, although one reference to inter-rater reliability places the GAS with an ICC of 0.86 (Stolee et al 1999). However, this study was completed with a geriatric population, so care must be taken when interpreting this score for use within a wheelchair

provision service. Cox et al (2002) suggest that reliability can be maximised through staff training resulting in the setting of appropriate goals, leading to increased objectivity.

While the FEW does display good psychometric properties, its small sample size of 20 participants limits its generalizability. However, the participants did have a range of conditions including cerebral palsy, spina bifida and polio, representing a range of wheelchair users and including a population that may have complex seating needs, including postural support.

In a paper exploring the validity and reliability of the QUEST for use with wheeled mobility (Demers et al 2002a), the rigour was reduced within this population when compared to its use in a less specific setting. This suggests that the broad nature of the tool is not suited to capture the complexities of wheelchair provision. Also of note is the poor construct validity score obtained by the *services* subset. This is discouraging in the context of evaluating wheelchair service provision, as this subset is the most relevant for evaluating the impact of the entire service.

### *Responsiveness/Sensitivity*

The GAS is reported to be sensitive due to its individualised nature where change is measured in areas that are important to the individual. This eliminates the disjunction between the areas of importance to the client and those covered in standard measures (Turner Stokes 2009; Cox and Amsters 2002). The sensitivity of the WhOM is not reported, but the possibility of the identification of unique participation outcomes in areas deemed important to the client suggests the potential to be highly responsive to the change. However, this was not mentioned in development studies of the WhOM or any other literature. An investigation into the responsiveness of the WhOM is warranted due to the obvious potential this measure has in this area.

Harris & Springle (2008) have criticised the PIADS for its lack of sensitivity in the area of wheelchairs and suggested that this was due to the fact that the PIADS was originally developed with eyeglass and contact lenses users where the influence on quality of life is clear and easily identified. In wheelchair provision, the impact can be more subtle and harder to detect, especially when detecting change between old and replacement wheelchairs.

Demers et al (2002a) evaluate the responsiveness of the QUEST and argues that unlike the PIADS, this measure is person neutral and does not capture any 'intra-individual' factors such as psychosocial attributes or coping strategies. It is suggested that the focus of the

measure is to capture the relationship between the client and the assistive technology in question. However, it is naïve to think that it is ever just the person and the equipment involved in any interaction. Contextual, social and environmental factors will always influence interactions between an individual and the equipment they use, and this is especially the case when it comes to wheelchair provision (WHO 2001; Gowran 2012).

### *Administration*

In a recent Irish study using the FEW to evaluate users' perspectives of service delivery within a seating clinic, limitations identified included difficulty in administration due to complex language used and its complicated format (Dillon et al 2012). This finding was supported by Mortenson et al (2008). Another difficulty found was the lack of room within the tool to record positive feedback (Dillon et al 2012).

In a study evaluating the clinical utility of the PIADS for use with wheelchair users with MS it was found to be easily administered. The checklist format meant important information could easily be recorded, and graphs easily produced. One limitation that arose from this study was that individuals with cognitive difficulties struggled with difficultly phrased questions (Devitt et al 2003). Petterson et al (2010) used the PIADS to evaluate a wheelchair service and felt that the questionnaire involved too many items and noted repetition in the questions asked.

The presence of a formula in the GAS has been linked to difficulty in its administration. The publication of 'practical guidelines' for the administration of this tool highlights the need for clarification (Turner Stokes 2009) - this publication suggests that using a weighted score can be difficult and suggests that using an 'unweighted' score can make the administration simpler (p. 367).

### *Limitations of the Study and Further Research*

As this research was part of a larger study, one limitation was the obligatory inclusion of the WhOM and the GAS which were used in individual case studies. While the WhOM fits well under the selection criteria detailed above, the GAS may not have otherwise been included. Including this measure, while beneficial in some ways, meant that less detail could be achieved in the appraisal of the other measures.

Although a critical review of the literature is necessary, the practical evaluation of OMs is also crucial. Therefore a link with the findings of this research and those of the case studies included in the larger project is necessary and should be considered as the next phase of this project.

As highlighted above, one area for further research development would be the inclusion of the measures in a qualitative study evaluating their use in a practical context. While the larger study goes in some way to address this, it involves only two single case studies. Further research on the on the use of OMs in wheelchair provision in terms of change over time and environmental contexts is therefore warranted.

### *Implications for Practice*

While making recommendations for one OM over the other is impossible, this research makes the necessary information available for the appropriate choice to be made according to the particular needs of a service, therefore promoting the use of OMs in this setting. However, the incorporation of an OM into a service should mean that the OM becomes part of the process rather than an additional at the end of the service provision.

## SUMMARY & CONCLUSION

### Summary

This research aims to present the OMs available to evaluate a wheelchair intervention and critically appraise those that were most suitable under the constructs of *activity and participation* and *impact of entire service on quality of life*. What has emerged is that there is a plethora of outcome measures available, however locating the most appropriate outcome measure is challenging as they address different constructs, cover alternative domains and have a variety of strengths, but also limitations. Table 5 below provides a summary of the strengths and limitations of the five outcome measures included.

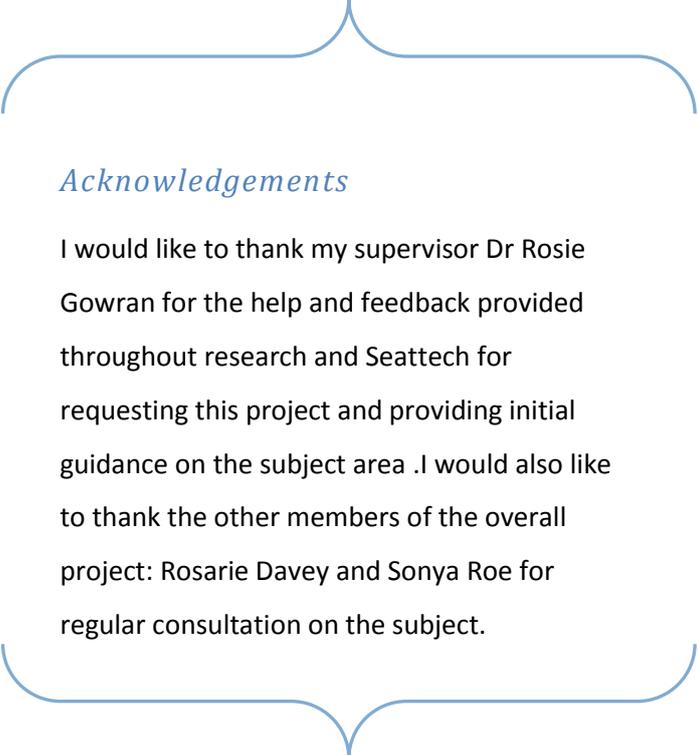
**Table 5: Summary of Strengths and Limitations of Each Outcome Measure**

| Measure | Strengths  | Limitations   |
|---------|--|---|
| WhOM    | Client Centred;<br>Strong psychometric properties;<br>Wheelchair specific  | Limited literature outside of development articles  |
| GAS     | Client centred;<br>Sensitive to change due to individualised nature of tool;<br>Broad enough to fit most contexts                        | Lacks validity in wheelchair population;<br>Requires training to promote inter-rater reliability;<br>Skills required to enable appropriate goal setting;<br>Use of formula can be complicated |
| FEW     | Good content reliability and content validity;<br>Users subjectively rates their performance, derived from COPM which is well recognised | Complex language & difficult format used;<br>No opportunity to record positive feedback   |
| PIADS   | Good reliability and validity;<br>Easy to administer   | Lack of sensitivity in wheelchair population;<br>Long format & repetitive questions   |
| QUEST   | Addresses service delivery;<br>Easy to administer & clear and concise questions  | Poor validation of services subset  |

## *Conclusion*

Choosing to incorporate an OM into a service provision, and the selection of an OM that meets the needs of a service is not a decision to be taken lightly. Several factors play an important role in the successful incorporation of an OM into any OT practice and wheelchair provision is no different. Those involved need to be active agents in the choice of OMs for their service. An assessment of the specific outcomes that need to be evaluated is necessary as, as this research has highlighted, no OM can collect all necessary information. Those involved need to take an active role in research and trial of potential OMs to ensure a fit for their service and for this to be successful, there needs to be support and buy in from all of those involved. For the introduction of an OM to be successful, those involved need to have the time and skills to investigate, trial and select OMs that are suitable for the unique needs of their service (Devitt et al 2003).

The area of wheelchair provision is complex and not amenable to straightforward or simple explanations. In turn there is no simple answer to the problem of outcome measurement in this area. What has emerged from this research is that no one outcome measure can capture all information needed to evaluate a service experience and trade-offs are inevitable. This research has highlighted some of the areas for consideration, identified the OMs available and evaluated some of the strengths and limitations of the most appropriate tools, so that the clinician can make an informed choice about the OM most suited to their practice.



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## Appendix 1: Checklist for Data Collection<sup>4</sup>

| Item   | Outcome Measure |
|--|-----------------|
| When was outcome measure developed?                    |                 |
| Purpose of outcome measure?                            |                 |
| What outcomes are measured?                            |                 |
| Framework?   |                 |
| What format does outcome measure take?                 |                 |
| How long does it take to administer?                   |                 |
| What is the method of administration?                  |                 |
| How is outcome measure scored and analysed?            |                 |
| Availability?  |                 |
| Previous use of outcome measure?                       |                 |
| Evidence of reliability?                               |                 |
| Evidence of validity?                                  |                 |
| Criterion validity?                                    |                 |
| Is outcome measure client centred?                     |                 |
| Incorporation of views of carer/other stakeholders?    |                 |
| Usability in practice setting?                         |                 |
| Training required?                                     |                 |
| Clear guidelines on administration of outcome measure? |                 |
| Is measure standardised or non-standardised?           |                 |
| Strengths?   |                 |
| Limitations?   |                 |
| Overall comments:                                      |                 |
|  |                 |

<sup>4</sup> Adapted from Greenhalgh and Connelly (2000)