# The Groningen Activity Restriction Scale for Measuring Disability: Its Utility in International Comparisons

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ABSTRACT

*Objectives.* The Groningen Activity Restriction Scale (GARS) is a non–disease-specific instrument to measure disability in activities of daily living (ADL) and instrumental activities of daily living (IADL). It was developed in studies of Dutch samples consisting of elderly or chronically ill people. The psychometric properties of the GARS demonstrated in these studies were highly satisfactory. This paper addresses the psychometric properties of the GARS across countries.

*Methods.* Data of 623 patients with recently diagnosed rheumatoid arthritis from four European countries were analyzed by means of a principal components analysis and a Mokken scale analysis for polychotomous items.

*Results.* The results of the analyses were highly satisfactory: there was one strong and reliable general factor representing one underlying dimension of disability in ADL and IADL, and there was a clear hierarchical ordering of the items included in the GARS. The validity of the GARS was strongly suggested by the pattern of associations of the GARS with age, sex, and other existing health status measures.

*Conclusions.* The psychometric characteristics of the GARS, which measures disability in ADL and IADL simultaneously, make this instrument very useful for comparative research across countries. (*Am J Public Health.* 1994;84:1270–1273)

## Introduction

Rheumatoid arthritis is a chronic disease with a varying clinical course. Therefore, measures of the "objective" severity of the disease are always time-dependent. The paroxysmal character of the disease makes it fairly unpredictable for patients themselves and for their significant others. Part of the burden of rheumatoid arthritis is caused by this varying and unpredictable course.[1]

Sooner or later, patients with rheumatoid arthritis experience impairments and "social disability," that is, "dysfunctioning in a social role or in some aspect of social behavior."[2] The relevance of the behavioral consequences of a disease has often been stressed because these consequences are of crucial importance for the daily functioning of the individuals involved.[3] In this article we will confine ourselves to restrictions regarding certain activities and tasks, that is, activities of daily living (ADL) and instrumental activities of daily living (IADL), sometimes referred to as "housekeeping activities of daily living."[4]

ADL functions are essential for an individual's self-care (e.g., washing or dressing oneself), whereas IADL functions are more concerned with self-reliant functioning in a given environment (e.g., shopping, preparing meals).[5] The distinction between these two groups of activities is mainly a consequence of "institutional thinking." In many countries, the delivery of care with respect to these two groups of activities is provided by different professions or agencies (sometimes combined with different types of financing); therefore, these two groups of activities have been distinguished and measured separately.[6,7] From the perspective of the patient, however, ADL functions are no less "instrumental" than IADL functions.

Partly on the basis of existing instruments, Kempen and Suurmeijer developed the Groningen Activity Restriction Scale (GARS).[6,8] The instrument was developed to measure both ADL and IADL disability in community-based studies with respect to the aid and services provided by professional home help and district nursing agencies. The patient's physical condition, of course, plays an important role in this respect, but the patient's personality and contextual and interactional variables may be important as well in the "appraisal of one's abilities."[9,10]

The GARS has been applied in several studies in the Netherlands.[11] It has proven to be a very useful instrument: it makes it possible to (1) more precisely describe the severity of the disablement caused by several chronic conditions, (2) establish changes in disablement over

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time, (3) differentiate more accurately between degrees of disability, and (4) improve the assessment of the need for professional care.

In this article we use data from an international longitudinal study of patients recently diagnosed with rheumatoid arthritis (European Research on Incapacitating Diseases and Social Support [EURIDISS][12]) to analyze the overall psychometric properties of the GARS across countries. More specifically, we test the unidimensionality and hierarchical order of the scale items and explore the scale's construct validity.

**TABLE 1—Items and Response Categories of the Groningen Activity Restriction Scale (GARS)**

Response categories for each item
1. Yes, I can do it fully independently without any difficulty.
2. Yes, I can do it fully independently but with some difficulty.
3. Yes, I can do it fully independently but with great difficulty.
4. No, I cannot do it fully independently, I can only do it with someone's help.
5. No, I cannot do it at all, I need complete help.

Activities of daily living (ADL)
1. Can you, fully independently, dress yourself?
2. Can you, fully independently, get in and out of bed?
3. Can you, fully independently, stand up from sitting in a chair?
4. Can you, fully independently, wash your face and hands?
5. Can you, fully independently, wash and dry your whole body?
6. Can you, fully independently, get on and off the toilet?
7. Can you, fully independently, feed yourself?
8. Can you, fully independently, get around in the house (if necessary, with a cane)?
9. Can you, fully independently, go up and down the stairs?
10. Can you, fully independently, walk outdoors (if necessary, with a cane)?
11. Can you, fully independently, take care of your feet and toenails?

Instrumental activities of daily living (IADL)
12. Can you, fully independently, prepare breakfast or lunch?
13. Can you, fully independently, prepare dinner?
14. Can you, fully independently, do "light" household activities (for example, dusting and tidying up)?
15. Can you, fully independently, do "heavy" household activities (for example, mopping, cleaning the windows, and vacuuming)?
16. Can you, fully independently, wash and iron your clothes?
17. Can you, fully independently, make the beds?
18. Can you, fully independently, do the shopping?

## Methods

### Sampling Procedures

The criteria for inclusion in the EURIDISS study have been published elsewhere.[12] By the end of November 1992, data had been collected on a total of 630 patients with rheumatoid arthritis: 116 French, 292 Dutch, 124 Norwegian, and 98 Swedish patients. The nonresponse rate varied from 12% (the Netherlands) to 30% (France). The patients' mean age was 52 years; mean disease duration was 2.6 years. Thirty-one percent of the patients were men and 69% were women. Because of incomplete data, 7 of these respondents were omitted from the analysis.

### Description of the Groningen Activity Restriction Scale (GARS)

The 18 GARS items and five response categories are presented in Table 1. The items refer to what respondents are *able* to do and not to their actual performance, which is a very important distinction.[13] When an item refers to more than one activity (e.g., item 5), the activity causing the greatest problems to the patient determines the response.

### Statistical Analysis

In the analyses, the two most extreme responses (4 and 5) were combined, partly because response 5 was chosen by only a few patients. Consequently, sum scores could vary from 18 (not disabled) through 72 (severely disabled).

A principal components analysis was carried out on the scale items, both for the countries separately and for the total sample. Next, reliability figures (Cronbach's alpha[14] or rho[15]) were calculated.

The hierarchical order of the ADL and IADL items was tested with the Mokken scale analysis for polychotomous items (MSP).[15,16] MSP is a probabilistic (nonparametric) extension of Guttman scale analysis[17] that can handle three or more rank-ordered response categories per item. The program calculates three different scalability coefficients: $H_i$ for individual items, $H_{ij}$ for item pairs, and $H$ for a set of items as a whole. For a set of items to be accepted as a scale, it is required that all $H_{ij}$'s be greater than .00 and all $H_i$'s be greater than or equal to .30. In that case $H$ will be greater than or equal to .30. The $H$ coefficient refers to the strength of the scale as a whole: if $H$ is from .30 up to .40, the scale is "weak"; if $H$ is from .40 up to .50, the scale is "moderately strong"; if $H$ is equal to or greater than .50, the scale is "strong."

Analyses of variance were carried out to test for differences in GARS scores across countries, age, and sex, and the construct validity of the GARS and its component parts was explored.

## Results

### Results of Factor Analyses

From the principal components analysis on the GARS items, both for the countries separately and for the total sample, it appeared that the first factor was a very strong and reliable one. The sum score of the GARS was directly derived from the raw (i.e., unweighted) scores. The correlation between this sum score and the factor scores (i.e., weighted item scores) was .9938. Therefore, the raw scores can be used when calculating the GARS score. A scree plot of the eigenvalues of the extracted components confirmed the assumption of one underlying dimension: after the first general component (eigenvalue = 8.71), there was a clear "elbow" in the curve of the consecutive eigenvalues.

As mentioned before, the ADL and IADL items are often considered to indicate two specific types of disability. Therefore, we repeated the same analyses as before for the 11 ADL and 7 IADL items separately, for the countries separately and for the total sample. It appeared that both the ADL and IADL items form one strong and reliable general factor; no other factors with an eigenvalue of 1.00 or more could be extracted.

The mean GARS score (range = 29.2–32.6), as well as the mean ADL and IADL scores (range = 15.8– 17.4 and 13.2–15.2, respectively), differed some-

**TABLE 2—Correlations of the GARS and ADL and IADL Scales with the Physical Mobility Subscale from the Nottingham Health Profile (NHP-PM), the Karnofsky Physical Status Scale (KPSS), the Overall Evaluation of Health (OEH), and the Somatic Symptoms Subscale from the General Health Questionnaire (GHQ-SS)**

| | NHP-PM | KPSS | OEH | GHQ-SS |
|---|---|---|---|---|
| GARS | .78 | .68 | −.40 | .25 |
| ADL | .77 | .64 | −.39 | .26 |
| IADL | .71 | .66 | −.37 | .21 |

*Note.* GARS = Groningen Activity Restriction Scale; ADL = activities of daily living; IADL = instrumental activities of daily living.

**TABLE 3—Mokken Scale Analysis for Polychotomous Items on the Groningen Activity Restriction Scale (GARS), for the Combined European Data Set (n = 623)**

| Ordered GARS Items | | Item Mean Scores | Scalability Coefficient for the Individual Items ($H_i$) |
|---|---|---|---|
| 1. Wash face/hands | (ADL) | 1.22 | .49 |
| 2. Feed yourself | (ADL) | 1.24 | .40 |
| 3. Get around inside house | (ADL) | 1.26 | .50 |
| 4. Get on/off toilet | (ADL) | 1.32 | .48 |
| 5. Prepare breakfast/lunch | (IADL) | 1.35 | .47 |
| 6. Get in/out of bed | (ADL) | 1.43 | .47 |
| 7. Stand up from chair | (ADL) | 1.45 | .49 |
| 8. Do light cleaning | (IADL) | 1.54 | .46 |
| 9. Dress yourself | (ADL) | 1.59 | .53 |
| 10. Walk outdoors | (ADL) | 1.60 | .50 |
| 11. Wash/dry body | (ADL) | 1.76 | .51 |
| 12. Prepare dinner | (IADL) | 1.79 | .47 |
| 13. Go up/down stairs | (ADL) | 1.81 | .48 |
| 14. Wash/iron clothes | (IADL) | 2.07 | .47 |
| 15. Take care of feet/toenails | (ADL) | 2.10 | .42 |
| 16. Make beds | (IADL) | 2.35 | .47 |
| 17. Do shopping | (IADL) | 2.49 | .43 |
| 18. Do heavy cleaning | (IADL) | 2.79 | .49 |
| Scalability coefficient *H* of the GARS | | | .47 |
| Reliability coefficient rho | | | .94 |
| Scalability coefficient *H* of the ADL items | | | .52 |
| Reliability coefficient rho | | | .90 |
| Scalability coefficient *H* of the IADL items | | | .51 |
| Reliability coefficient rho | | | .89 |

what between countries. These differences may be due to environmental and cultural differences in the appraisal of activities included in the GARS. Probably because of sex role–specific socialization patterns, women scored significantly higher than men on the IADL scale, although the mean difference was very small (means = 14.8 and 13.6, respectively). On average, older people scored significantly higher on the GARS as a whole and on the ADL and IADL scales; these higher scores support the fact that, in general, older people are more disabled than younger ones[3] (range = 32.5–27.6, 17.5–14.8, and 15.0–12.8, respectively). There were no interaction effects between age, sex, and country.

The validity of the GARS and the ADL and IADL scales was explored by assessing the scale's association with several other instruments measuring physical problems and subjective health. Specifically, we used the Physical Mobility subscale from the Nottingham Health Profile,[18,19] the Karnofsky Performance Status Scale,[20] the Somatic Symptoms subscale from the General Health Questionnaire,[21] and an overall evaluation of health item using a ruler as a visual analogue scale. In the latter case, the patient was asked, "How would you rate your health at the moment? Would you say that it is very poor, that it is excellent, or that it is somewhere in between?"[22] The ruler ran from "very poor" (a score of 1) to "excellent" (a score of 100).

The GARS and the ADL and IADL scales were expected to correlate highest with those measures most comparable to the GARS (the Physical Mobility subscale from the Nottingham Health Profile and the Karnofsky Performance Status Scale) and to correlate lowest with those instruments less comparable to the GARS (the overall evaluation of health item and the Somatic Symptoms subscale from the General Health Questionnaire) (Table 2).

The pattern of correlations encountered yielded additional support for the utility of the GARS. Moreover, from the pattern and size of the correlation coefficients, it appears that there was no difference between the GARS and the ADL and IADL scales, which may be an additional reason to treat the ADL and IADL scales as one scale. (It also appears legitimate to use the ADL and IADL scales separately if necessary.)

### *Results of MSP*

Finally, the hierarchical ordering of the items (in the data sets of the four European countries together) was tested with MSP (Table 3). The items are ordered according to their difficulty, as expressed by the item mean scores. All the $H_i$'s were greater than or equal to .40; the reliability coefficient rho was .94. The *H* coefficient of .47 nearly met the criterion for a strong scale.

## *Conclusions*

The results of the analyses were highly satisfactory. They showed a strong and reliable general first factor, indicating one underlying dimension of disability for ADL, IADL, or both. For institutional reasons, or to differentiate between sex or age groups, the ADL and IADL scales can be used separately.

The GARS turned out to be a rather strong unidimensional, hierarchical scale. The same was even more true for the separate ADL and IADL scales. The fact that the GARS items were hierarchically ordered means that respondents with the same score had the same problems with ADL and IADL. However, Kempen et al. warn against the use of cutpoints or single

questions to categorize patients: "Hierarchical evidence should not be used to justify minimal patient questioning."[23] This has partly to do with the fact that the Mokken model is not sample independent. Differences between samples may be due to language, education, motivation, opportunity, or environmental factors (living arrangements, availability and proximity of services, means of transportation, and so on).[10,13,23–25] However, when the Mokken analysis is applied to a maximally large group, its sample dependence gradually diminishes.

One of the advantages of MSP over the Guttman analysis is that more than two response categories can be used. As a consequence, more accurate distinctions can be made, which are not only more realistic about the daily functioning of patients but also necessary to target support services.[6,8,13,23]

Of course, other instruments have been developed to measure disability in ADL or IADL,[26,27] but the GARS measures both simultaneously, and it is a very reliable and valid scale with hierarchically ordered, polychotomous items. In addition, it is community based and not disease-specific. These characteristics make the GARS very useful for comparative and longitudinal research both across countries and across diseases. □

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A copy of a much more detailed version of this article is available from the first author on request.

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