

# Prognostic factors of disability in older people: a systematic review

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## ABSTRACT

### Aim

To systematically review the evidence on the influence of sociodemographic, lifestyle, and (bio)medical variables on the course of prevalent disability and transition rates to different outcome categories in community-dwelling older people.

### Method

Articles were identified through searches of PubMed, EMBASE, and PsycINFO databases and reference lists of relevant articles. Prospective population studies that assessed disability at baseline and reported on associations between potential prognostic variables and disability were included. Methodological quality of studies was assessed by standardised criteria, after which relevant data were extracted. A synthesis of the available evidence was carried out.

### Results

Nine cohort studies reported transition rates and eight cohort studies presented multivariate analyses on prognostic factors. There was some heterogeneity among studies in definition and assessment of disability. There is moderate to strong evidence that higher age, cognitive impairment, vision impairment, and poor self-rated health are prognostic factors of disability.

### Conclusion

Prognostic factors, partly modifiable, are identified that should be taken into account in targeting treatment and care for older people with disabilities. Further conceptual and methodological standardisation is required in order to enable a meta-analysis and obtain higher levels of evidence.

### Keywords

aged; disability; prognostic factors; review, systematic.

## INTRODUCTION

Due to demographic changes and improved socioeconomic and medical achievements, many populations, especially those in the West, are aging.

As the population gets older, disability becomes one of the greater individual and societal burdens. For mobility disability, Leveille *et al* reported a prevalence of 18.8% for women and 13.3% for men aged 65–69 years. The prevalence in the highest age category (90–95 years) was 83% and 63.4% for women and men, respectively.<sup>1</sup>

The pathway of disability has a complex nature comprising aging, lifestyle factors, and medical conditions. Although the benefits of improved socioeconomic conditions and medical care have prolonged total life expectancy, this is not the case for active life expectancy. In the absence of widespread preventive strategies, the occurrence of precursors of disability, and therefore disability itself, will as yet remain unaltered.<sup>2</sup> Hence, it is important to study prognosis of disability, as the dynamic nature of disability may enable intervention on modifiable (prognostic) factors to alter its course to a more favourable outcome. Recovery from disability has been reported to occur. A better understanding of the disability process may help in targeting effective treatment by defining risk groups for adverse outcomes.

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## How this fits in

Evidence on prognostic factors of disability in the older people is necessary for guiding clinical decision processes. Four factors were found to be associated with disability: higher age, cognitive impairment, vision impairment, and poor self-rated health; of which three can be modified.

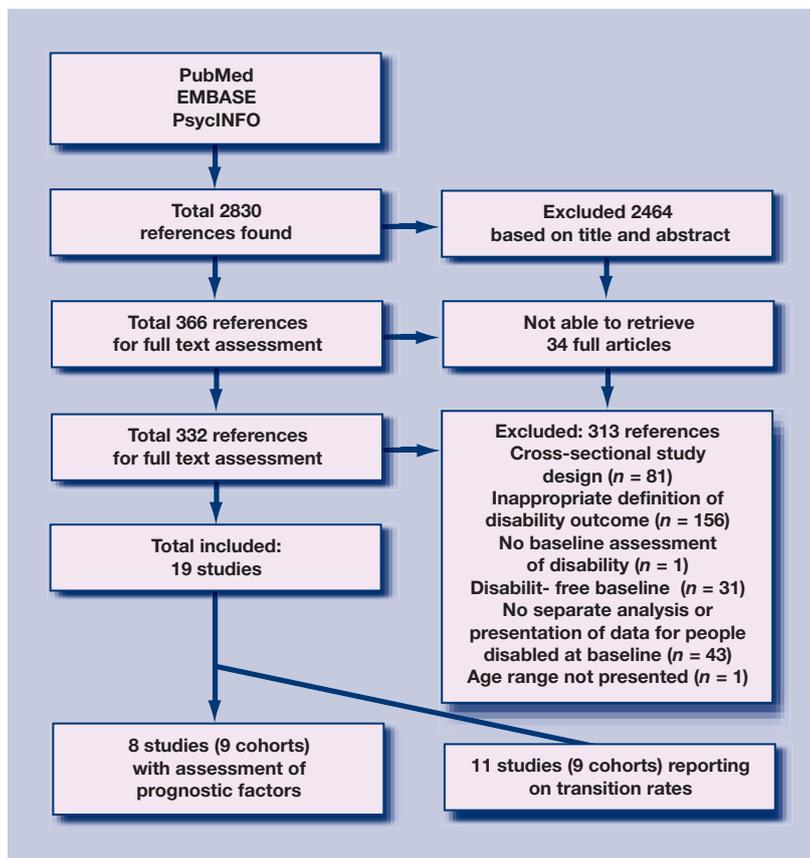
While a systematic review on risk factors of incident disability or functional decline in the older population has been published,<sup>3</sup> prognostic factors have not been reviewed. The study aim was to review systematically and summarise the evidence on prognostic factors of disability in older people to guide clinical decision processes and future research.

### METHOD

#### Search strategy and selection criteria

Through searches of PubMed (1966–2006), EMBASE (1980–2006), and PsycINFO (1975–2006), an initial set of publications was identified. The main search terms were ‘elder#’, ‘old age’, ‘old people’, ‘frail’ and ‘disab#’, where # denotes truncated terms. This search was combined with the terms ‘incidence’, ‘mortality’, ‘follow-up studies’, ‘prognos#’, ‘predict#’ and ‘course’, to identify

Figure 1. Identification and selection of studies.



longitudinal studies. Reference lists of included studies were screened for relevant publications.

Based on title and abstract information, two reviewers independently included references in accordance with the inclusion criteria: disability as outcome, longitudinal study design, and population older than 50 years. Full texts of the remaining articles were assessed. For this review only prospective studies with a population that was disabled at baseline were included. Disagreement of reviewers was solved by consensus. Only UK, Dutch, German, French, Danish, Norwegian, Swedish, and Turkish articles were considered.

#### Data extraction and methodological quality assessment

A standard form frequently applied in other systematic reviews of prognostic factors for patients with musculoskeletal disorders was used.<sup>4</sup> Relevant data were extracted from the final set of articles concerning sample characteristics, design characteristics, attrition, assessment of disability, assessment of determinants, and their association measures.

Finally, the methodological quality of each study was scored based on 15 criteria of internal and external validity. The criteria for internal validity were: prospective data collection; follow-up of at least 5 years; attrition less than 20%; standardised or valid measurements of prognostic factors; standardised or valid measurements of outcome measures; appropriate univariate crude estimates of association; and appropriate multivariate analysis techniques. The criteria for external validity were: description of the source population; description of inclusion and exclusion criteria; information on completers versus non-completers; assessment of relevant prognostic factors; description or standardisation of treatment in cohort; assessment of relevant outcome measures; data presentation of prognostic factors; and data presentation of outcome measure. One point was given for each fulfilled criterion. Thus, the assessment resulted in an overall quality score ranging from 0 to 15. Studies with a score of 70% of the maximum obtainable points or higher were rated as high-quality studies.

#### Dependent and independent variables

The dependent variable was disability, defined as experiencing difficulty in activities of daily living (ADL), or instrumental ADL (IADL), or a combination of both. ADL comprises basic activities like bathing, dressing, toileting, transfer, and feeding, while IADL includes activities like transportation, shopping, doing housework, and preparing meals. Definitions of impaired functional status, such as dependency

on assistive devices or persons, were also included. Independent variables of interest were demographic and socioeconomic factors, lifestyle factors, and medical conditions.

### Strength of evidence

As only prospective cohorts of older people with baseline disability were included, it was possible to pool the data if terms of homogeneity were met. In the case of heterogeneity, a synthesis of the best evidence was performed.

The strength of evidence was rated as follows: strong evidence if more than two studies of high quality from separate databases reported a significant association ( $P < 0.05$  or 95% confidence interval [CI] for odds ratios [OR] or relative risks [RRs] not including the value 1.0) in the same direction; moderate evidence if at least two studies of high quality or four studies of low quality reported significant associations in the same direction; limited evidence if only one study of high quality or at least two studies of low quality reported a significant association; conflicting (inconsistent) evidence if less than 75% of reported significant associations were in the same direction or if more than 50% of studies showed non-significant associations; evidence for no association was provided if more than two studies showed a non-significant association. The existence of only one study reporting a non-significant association was rated as no evidence for any association.

## RESULTS

### Identification and selection of studies

Through database searches and reference list screenings, an initial set of 2830 references was identified. After assessment and exclusion 19 studies remained, of which 11 presented transitions between disability states only and eight reported on prognostic factors of disability (Figure 1). These groups were analysed and are presented separately.

### Data extraction and methodological quality assessment

*Transition.* Studies reporting transition rates represent cohorts from the US, France, Finland, UK, and Spain. Length of follow-up ranged from 12 to 72 months (Supplementary Table 1). There was considerable heterogeneity in the way disability was defined and categorised. The various definitions and presentation of disability comprised ADL only;<sup>5</sup> IADL, considered separately,<sup>6</sup> or in combination with ADL;<sup>7</sup> mobility disability based on two items;<sup>1</sup> and frequency of help being needed in ADL and/or IADL.<sup>8</sup> Categorisation of outcome was dichotomous or categorical. In some studies death was considered

as an outcome category,<sup>6,7</sup> in others it was not.<sup>5,9,10</sup>

In general, the proportion of older people progressing to a worse disability state or death was larger than the proportion of those who recovered from disability. However, recovery from moderate and, to a lesser extent, severe disability was common in the cohorts included. Recovery rates from moderate disability in the youngest age category ranged from 3.4 to 9.0% for men and 7.9 to 11.3% for women, while in the oldest age category these rates ranged from 0 to 1.7% and from 0.7 to 2.6% respectively. Transition from severe disability to no disability ranged from 1.3 to 29.2% for men and from 1.1 to 23.5% for women in the lowest age category. In the highest age category these ranges were 0 to 11.6% for men and from 0 to 6.0% for women.<sup>1,2,6,9</sup>

*Prognostic factors.* Seven studies were included examining prognostic factors (Supplementary Table 2). Cohorts from the US, Netherlands, Israel, Taiwan, Japan, and China were represented in this sample of studies. The methodological quality ranged from 73 to 87% indicating that all studies were of high quality. Outcome was defined differently, from a single category of improvement,<sup>11</sup> to multiple outcome categories such as improved, deteriorated-alive, and deteriorated-dead.<sup>12</sup>

Length of follow-up ranged from 3 to 120 months.<sup>13-15</sup> The sample size ranged from 206 to 5727.<sup>12,16</sup> Associations between outcome and determinants were presented as RRs, ORs, or standardised coefficients. The magnitude of the associations between determinants of recovery from disability and worsening of disability were determined for their statistical significance Supplementary Table 3.

*Level of evidence.* Because of the heterogeneity in length of follow up, definition of outcome, and presentation of the association the data, were not pooled. A best-evidence synthesis was performed instead. Death as an outcome was not taken into consideration as only four of the seven studies included this outcome in multinomial analysis. Furthermore, death cannot be regarded as the end of a spectrum of disability. Based on these seven studies (eight cohorts) there was strong evidence that age and cognitive functioning are prognostic factors of disability. Higher age and cognitive impairment reduced the chances of recovery from disability or increased the risk of deterioration. There was moderate evidence that better self-rated health was associated with a more favourable disability outcome, and that visual impairment decreased the chances of recovery from disability. Evidence for

**Table 1. Prognostic factors and their level of evidence for association.**

Level of evidence	Prognostic factor
Strong evidence for association	Age (older)
	Cognitive function
Moderate evidence for association	Self-rated health
	Visual impairment
Limited evidence for association	Income
	Marital status
	Residence (non-urban)
	Social network characteristics
	Institutional factors
	Hospitalisation
	Body mass index
	Physical activity level
Some evidence for no association	Sex
	Race/ethnicity
	Education
	Smoking
	Alcohol
	Chronic diseases
No evidence	Insurance
	Loneliness
	Emotional support
	Depression
	Hearing impairment
	Joint pain
	Dyspnoea
	Population mortality rate

income, marital status, residence, social network characteristics, institutional factors, hospitalisation, and body mass index as prognostic factors for disability was limited. For several factors some evidence for no association was found: sex, education, ethnicity or race, smoking, alcohol use, and presence of chronic diseases. No evidence for any association was found for insurance, loneliness, emotional support, physical activity levels, depression, hearing impairment, joint pain, dyspnoea, and population mortality rate with the outcome of disability. No conflicting evidence was found (Table 1).

**DISCUSSION**

This article describes the first systematic review on potential prognostic factors of disability. Strong evidence was found that age and cognitive functioning are important prognostic factors. Self-rated health and visual impairment are prognostic for disability outcome as well, though to a lesser degree. Higher age increases the chances of becoming disabled or, once disabled, of deteriorating. High age also decreases the likelihood of recovering from disability. Although age and cognitive functioning are not modifiable prognostic factors, they must be

taken into account in targeting care as they indicate high-risk for increasing disability. Visual impairment is modifiable to some extent; in some cases it may be relieved by surgery, use of ophthalmological devices, or even by good lighting conditions in the home. The reported effect of self-rated health on incidence and prognosis of disability is somewhat unclear. On the one hand, perception of health itself might have a contribution to health outcome, becoming a self-fulfilling prophecy. On the other hand it might indicate unrecognised conditions or a combination of conditions that lead to a certain health outcome.

For other sociodemographic, environmental, lifestyle, and health variables there is, as yet, limited or no evidence for their association with disability outcome. This may well be due to the small number of studies that assessed these variables, hence these results should be interpreted with caution. This caution might especially apply to physical activity levels as they are plausibly of importance for musculoskeletal impairment and hence for disability.

Some evidence was found for no association at different levels for sex, ethnicity, education, smoking, alcohol use, and the presence of chronic diseases. Although, in general, relatively more women become disabled than men, and relatively more men die than women, it seems that once disabled, an individual's sex is of no importance for the course of the disability, when adjusted for other factors. Chronic diseases play a role in the incidence of disability. Once prevalent, the course of disability is not much altered by their presence at baseline.

**Methodological quality**

Most studies in this review, representing large cohorts, proved to be of a high methodological quality in general. This was also the case with respect to internal validity items. An explanation for this relatively uniform high quality may lie in the choice of inclusion criteria for this review, making it only possible for longitudinal, prospective studies to be included. As these are mostly larger cohorts where great effort is put into their investigation, this may influence their methodological quality in a positive manner.

**Strengths and limitations of the study**

An important strength of this review is that prognostic factors are now systematically summarised, showing evidence available and the areas in which research is still lacking. Although the initial search was relatively sensitive and produced over 2000 titles on disability, the possibility exists that relevant publications or unpublished studies that would have added to the evidence were missed.

Although different countries are represented in the sample, studies published in languages other than English, Dutch, German, French, Danish, Norwegian, Swedish, and Turkish were excluded, which may have caused loss of evidence.

Although disability was defined mostly in terms of ADL or IADL, there was considerable heterogeneity in the way disability and age were categorised, affecting transition rates. Besides the fact that recovery rates were lower in older age categories and occurred more often in people with moderate disability than in those with severe disability, findings, especially with respect to sex differences, were not very consistent.

### Implications for future research

Although there are other studies with disability-free or mixed baseline status, as yet there are not many studies on factors that influence the prognosis of disability once it is present. In this review of descriptive longitudinal studies some prognostic factors, such as age and cognitive functioning, were identified with strong-to-moderate evidence based on sufficient numbers of studies on the association. The finding that there is, as yet, limited evidence for the contribution of other plausible and modifiable factors, like body mass index and physical activity, may have more implications for future research, as these factors should be studied more frequently in older people with disabilities. If the number of studies were increased strong evidence justifying interventional strategies in people with disabilities may be found, however, those limited to no evidence could be found, rather justifying preventive strategies in non-disabled older people. Besides tracking this evidence, the next level of research would be to summarise the evidence for existing preventive and interventional treatment programmes and randomised controlled trials, as this was beyond the scope of the review. Finally, although extensively used concepts like ADL and IADL give a common basis for many investigators, heterogeneity in the way they are implemented in research still exists. Further standardisation of assessment and analysis of disability and its prognostic factors in future research is still needed.

### Supplementary information

Additional information accompanies this paper at: <http://www.rcgp.org.uk/bjgp-supinfo>

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### Ethics committee

Not applicable

### Competing interests

The authors have stated that there are none.

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