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Prediction of institutionalization in the elderly. A systematic review

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Abstract

Objective: in the past decades, many studies have examined predictors of nursing home placement (NHP) in the elderly. This study provides a systematic review of predictors of NHP in the general population of developed countries.
Design: relevant articles were identified by searching the databases MEDLINE, Web of Science, Cochrane Library and PSYNDEXplus. Studies based on population-based samples with prospective study design and identification of predictors by multivariate analyses were included. Quality of studies and evidence of predictors were determined.
Results: thirty-six studies were identified; one-third of the studies were of high quality. Predictors with strong evidence were increased age, low self-rated health status, functional and cognitive impairment, dementia, prior NHP and a high number of prescriptions. Predictors with inconsistent results were male gender, low education status, low income, stroke, hypertension, incontinence, depression and prior hospital use.
Conclusions: findings suggested that predictors of NHP are mainly based on underlying cognitive and/or functional impairment, and associated lack of support and assistance in daily living. However, the methodical quality of studies needs improvement. More theoretical embedding of risk models of NHP would help to establish more clarity in complex relationships in using nursing homes.

Keywords: *institutionalization, nursing home placement, nursing home admission, systematic review, old age, NHA, elderly*

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Introduction

Most elderly people prefer to remain in their homes because they are able to maintain the integrity of their social network, preserve environmental landmarks and enjoy a higher quality of life. Furthermore, admission to nursing homes is expensive both in terms of public and private finances. Moreover, institutionalization is associated with several negative outcomes such as increased mortality [1], restricted quality of life as well as questionable quality of care. The adverse outcomes accompanying institutionalization have confirmed the effort to prevent or delay nursing home placement (NHP). An investigation of risk factors leading to institutionalization facilitates the pre-admission assessment of older adults.

In the past decades, many studies considered predictors of institutionalization in the elderly. So far, the international literature has shown some literature reviews [2–4], and a meta-analysis [5] has been conducted, however, with restricted generalisability for the general population. The most current review [2] addresses studies only in the USA between 1985 and 1998, examining predictors of NHP, hospitalization, functional impairment and mortality, but also including highly selected samples of hospitalised elders and nursing home residents, enumerating only the results of studies. Chenier [3]

analysed studies published between 1989 and 1995 examining variables leading to caregiver burden in conjunction with NHP solely for non-demented elders. The critical review of Wingard *et al.* [4] is limited to the years 1965–85 and also included univariate results not adjusting for confounding variables. The present meta-analysis of Gaugler *et al.* [5] is only related to the studies in the USA, which also include studies only addressing functionally disabled elders, limiting representativeness of samples and thereby generalisability of findings for the general population.

In summary, in the international literature, no recent systematic review of predictors of institutionalization exists that helps synthesise findings on the general population of developed countries. We aimed to systematically review all published studies analysing prediction of institutionalization in the elderly with the following objectives: (i) determining methodical quality of studies using a standardised checklist of quality criteria, (ii) identifying potential predictors of institutionalization and (iii) synthesising results showing evidence of each predictor.'

Conceptual framework

To structure the results of the review, we rely on the behavioural model of health service use developed by Andersen [6] as the conceptual framework. The behavioural model [6] suggests that people's use of health services, or NHP, is a function of their 'predisposition' to use services, factors which 'enable' or impede use, and their 'need' for care. 'Predisposing variables' were demographic factors, social characteristics and health beliefs. The 'enabling variables' include both personal/familial and community enabling resources. First, people must have the means and knowledge to get to those services and make use of them. Second, health personnel and facilities must be available for individuals. The 'need component' is specified as the most immediate cause of health service use and involves both perceived and evaluated health status. 'Perceived need' explains individual care-seeking and adherence to medical regimens of individuals, while 'evaluated need' is more closely related to the kind and amount of treatment to be provided.

Methods

We adhered to systematic literature review guidelines [7]. The review process occurred in three steps: obtaining, extracting and assessing data for this study.

Literature search

A systematic literature search was conducted. Research studies from 1950 to June 2008 available on electronic databases MEDLINE, Web of Science, Cochrane Library and PSYNDEXplus as well as bibliographies of identified articles were searched. 'Institutionalization', 'nursing home placement' or 'nursing home admission' and 'factor*' or 'predictor*' served as keywords. The search was limited to English and German language studies. The principal author (M.L.) screened abstracts using the following selection criteria: (i) studies using a prospective design to allow for predictive analyses for NHP, (ii) studies considering NHP as outcome criteria and (iii) studies identifying predictors of NHP by use of multivariate analyses (for adjustment of covariates) without separating into subsamples (e.g. analysis of predictors by gender or ethnicity).

Table 1. Synthesised results: predictors with strong, moderate, weak and inconclusive evidence

Predictors	Strong evidence	Moderate evidence	Weak evidence	Inconclusive evidence
Age	x			
Housing, not own house	x			
Ethnicity, white American	x			
Self-rated health status, low	x			
Functional impairment	x			
Cognitive impairment	x			
Dementia	x			
Prior NHP	x			
Number of prescriptions	x			
Employment status, employed		x		
Social network, low contacts		x		
Activity level, low		x		
Diabetes		x		
Marital status, married			x	
Gender, male				x
Living situation, living alone				x
Education, low				x
Income				x
Stroke				x
Hypertension				x
Arthritis				x
Respiratory diseases				x
Incontinence				x
Depression				x
Prior hospital use				x

Levels of evidence: strong = consistent findings in at least 75% of studies in at least three high quality studies; moderate = consistent findings in at least 75% of studies in at least two high quality studies; weak = findings of one high quality study and of at least two moderate to low quality study or consistent findings (≥75%) in at least four or more moderate to low quality studies; inconclusive = inconsistent findings.

Data extraction

Primarily, methodical data on sampling, study design, definition of the outcome criteria and statistical analysis were extracted from all selected studies. The inclusion criteria listed above were then reapplied to ensure accurate study inclusion. Secondly, studies included were examined for the significance/non-significance ($P < 0.05$) of each predictor variable and the direction of the predictor variable's effect on NHP (positive, negative or non-significant effect).

Quality assessment

The quality of studies included was independently assessed by the principal author (M.L.) and a co-author (T.L.) using a modified version of established criteria lists applied in other systematic reviews (Table A1) [8, 9]. Each item was scored

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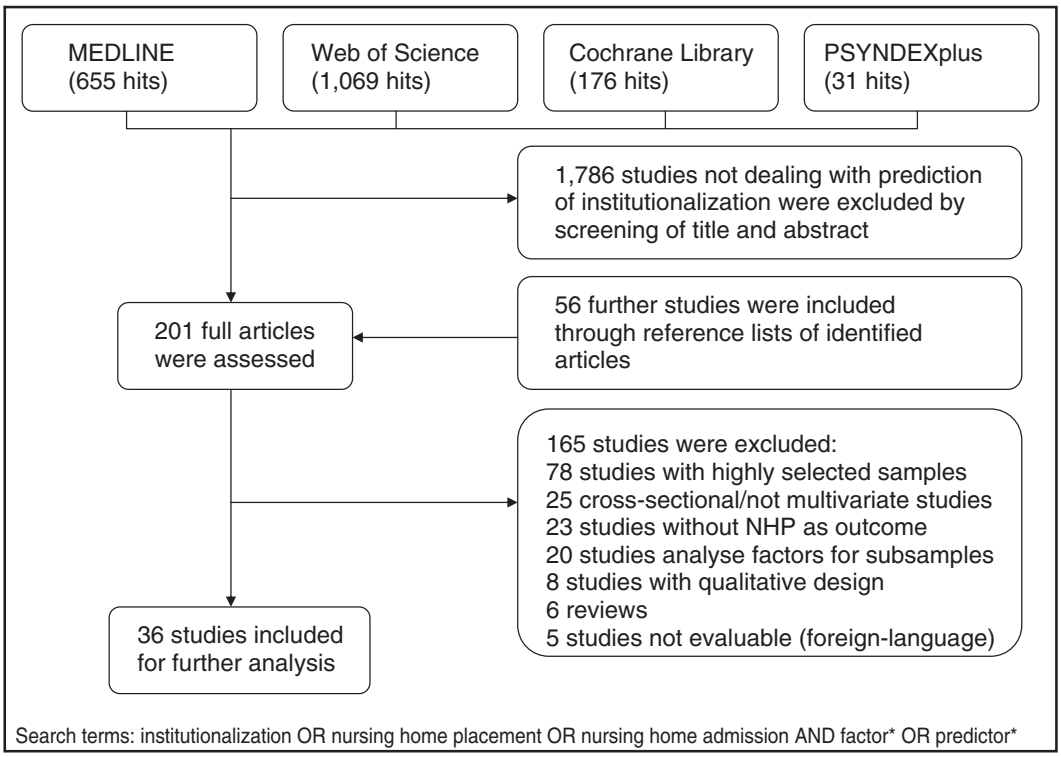

Figure 1. Results of the systematic literature search.

as 1 (met the quality criterion) or as 0 (did not meet the quality criterion). Studies scoring in the 75th percentile or higher on quality (i.e. ≥10) were categorised as 'high quality' studies. Studies scoring between 50% and 75% were rated as 'moderate quality'. Studies scoring <50% were considered 'low quality'. Findings were considered consistent if ≥75% of the studies that investigated a factor showed the same direction in the association. In Table 1 (under 'notes'), the definition of four levels of evidence modified after Mols *et al.* [9] is provided. From each study included, all results (significant/non-significant, positive/negative effects) were covered and summed up for each potential predictor variable, on one side across all studies and on the other side across each quality level (high, moderate, low).

Results

Study characteristics

The results of the systematic literature search are shown in Figure 1. Altogether, 201 potentially relevant articles were identified. Fifty-six of these were found in reference lists of the identified articles. After perusing all full articles, 165 further articles were rejected as not fulfilling the selection criteria. Thirty-six studies [10–51] were assessed and subjected to the detailed analysis (Appendix: Table A3 (Supplementary data are available on the journal website at http://ageing.oxfordjournals.org) for detailed methodical characteristics and findings of studies). Twenty-eight studies were conducted in the USA, three in Europe, two in Australia, two in Canada and one in Hong Kong. The 36 studies included a total of 754,071 individuals. The sample sizes in studies varied from 207 to 487,383. Most studies included nationally or regionally representative samples of individuals aged ≥65 years. The study period ranged from 1 to 20 years with 1 to 10 follow-ups. The majority of studies did not differentiate between short-term and long-term NHP.

Methodical quality

The evaluation of the methodical quality of the 36 studies reviewed by two authors (M.L. and T.L.) yielded the following results. The mean quality score was 8.4 (SD: 0.46, range: 3–14). Thirteen studies (36%) were of high quality, eight studies (22%) of moderate quality and 15 studies (42%) of low quality (Appendix: Table A3, for quality scores of studies). Methodical shortcomings were frequently found due to information on non-respondents, lack of specifications of facility types in NHP definition and lack of data about demented persons included in samples.

Predictors of NHP

Table A2 presents the summarised results of predictors analysed in studies sorted according to the conceptual framework of Andersen [9] and by the methodical quality of studies (high, moderate, low). Relevant results were then synthesised by level of evidence in Table 1 (strong, moderate, weak, inconclusive). In the following section, when available, the minimal and maximal significant results of pre-

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dictors of high quality studies were stated in brackets (as hazard ratios, HR, and odds ratios, OR); otherwise, the single result was given.

Strong evidence

Predisposing variables. Increased age (HR 1.06/7.72 [16, 21], OR 1.30/8.34 [13, 47]), not having one's own house (HR 1.80, OR 2.61 [29, 47]) and, related to US studies, being white American (HR 1.67/2.00 [10, 20]) appeared to be strong and consistent predictors of NHP. **Need variables.** We found predictors with strong evidence: low self-rated health status (HR 3.40, OR 1.48/1.67 [29, 32, 47]), functional impairment (activities of daily living, ADL: HR 1.32/3.70, OR 1.30/1.78 [13, 26, 29, 41]; instrumental activities of daily living, IADL: HR 1.05/2.50 [10, 20]) and cognitive impairment (HR 1.67, OR 1.44/1.50 [13, 25, 47]). Positive associations were also found for dementia diagnosis (HR 1.54/5.09, OR 16.70 [10, 21, 26]). Related to health service use, prior NHP (OR 1.70/5.84 [13, 32]) and a high number of prescriptions (HR 1.04/1.67, OR 1.15 [16, 25, 32]) were identified as strong predictors of NHP.

Moderate/weak evidence

Predisposing variables. Moderate to weak evidence was found for unmarried persons (single, widowed or divorced; HR 1.54, OR 1.64/1.67 [10, 13, 47]), unemployed (HR 1.64, OR 2.50 [13, 16]) and those with a poor social network (HR 1.18/1.27, OR 1.11/1.80 [13, 21, 25, 26]). **Need variables.** A low activity level (OR 1.97 [41]) and a diagnosis of diabetes (HR 1.20/1.25 [10, 20]) also had a moderate predictive effect on NHP.

Inconclusive evidence

Predisposing variables. Partly significant and non-significant results, or as predictors with both positive and negative effects, were found for male gender (HR 0.79/1.82 [16, 18], OR 0.62/1.20 [13, 47]), living alone, low education (OR 1.06 [41]) and low income (OR 0.83/2.61 [32, 41]). **Need variables.** Related to diseases, the results were inconsistent for stroke, hypertension (HR 1.45 [18]), arthritis (HR 0.82 [10]), respiratory diseases (HR 3.19 [18]), incontinence (HR 1.20/1.66 [10, 18]), depression (HR 1.15/1.85 [18, 25]) and for prior hospitalization (HR 1.39 [16], OR 2.19 [47]).

Post hoc analyses

The methodical characteristics, related particularly to multivariate statistical analyses, may have influenced the findings of the studies. For that reason, we conducted post hoc analyses evaluating the results. Firstly, methodical characteristics such as sample size or lengths of follow-ups by reason of statistical power problems may have influenced the findings of significant predictors. We have analysed the association (Spearman correlation) of sample size and significance of findings for these predictors which were included in at least 10 studies. We found a moderate effect size for correlation coefficient between sample size and significance of findings for gender ($r = 0.44$, $P = 0.034$) and a high effect size for correlation coefficient between sample size and significance of findings for income ($r = 0.73$, $P = 0.026$). No statistically significant correlations were found between lengths of follow-ups and significance of predictors.

Secondly, predictors of NHP of individuals with and without dementia varied widely. Therefore, inclusion of dementia cases in community-based samples analysing predictors of NHP interfered with the results for individuals without dementia [52]. Luppa *et al.* [52] found that the impact of chronic diseases and functional impairment on NHP in a sample without demented individuals considerably increased compared to samples including individuals with and without dementia. In our study, eight of the included studies (22%) informed about inclusion of dementia cases in their samples, and in 20 studies (56%) multivariate analyses were adjusted for cognitive impairment (or for dementia diagnoses) at baseline. However, these studies did not consider that some individuals develop dementia during the study, causing subsequent institutionalization. Among those studies that adjusted for cognitive impairment, 60% reported functional impairment (limitations ADL/IADL) as a positive predictor of NHP, and 25% reported significant effects for chronic diseases such as depression, incontinence or diabetes. When cognitive impairment was not controlled, the percentage of studies reporting significant effects for functional impairment and for chronic diseases dropped to 50% and 19%, respectively. Effects of functional impairment on NHP were higher for studies adjusted for cognitive impairment (ranges of risk ratios: 1.05–3.67 vs 1.03–2.84).

Thirdly, the number of covariates included may also have affected the results of the review. On average, the studies included 12.3 variables as predictors of NHP (SD: 1.33, range: 1–38). Twenty-one studies (58%) included ≥10 variables. Following recommendations [53] for subject-to-variable ratios for regression analyses of at least 10 observations per variable, all studies kept the recommendations (mean ratio: 1,857; range: 30–40,615).

Discussion

The study aimed to systematically review all population-based studies analysing predictors of NHP in the elderly. The strengths of this review, compared to prior literature reviews, were the selection of inclusion criteria allowing a synthesis of findings on predictors of NHP in the general population in developed countries, the evaluation of studies' methodical quality and the determination of each predictor's evidence.

The findings for predictors with strong evidence support the assumption that NHP is basically caused by cognitive and/or functional impairment. There is a strong but one-sided association between cognitive and functional impairment: severe cognitive impairment leads to limita-

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tions in ADL and IADL. But functional impairment does not result coactively in deterioration of cognitive functions. We found that, with adjustment of cognitive impairment, the impact of functional impairment on NHP increased. Thus, if an individual is cognitively unimpaired, the reasons for NHP were found in somatic diseases that caused functional impairment.

In detail, we found, firstly, that dementia diagnosis was a predictor with strong evidence involving both cognitive impairment and functional disability, and was therefore ranked as the strongest predictor of NHP [24]. Secondly, the risk of NHP increased two- to sixfold with a low self-rated health status, preceding NHP and a high number of prescriptions—factors suggesting a close association with existing functional impairment. The findings of predictors with moderate to weak evidence encouraged the assumption of underlying cognitive and functional impairment, and supplementarily posed the assumption that the accompanying absence of a suitable caregiver still increased the risk of NHP; predictors with moderate to weak evidence were unemployment, a low activity level, a poor social network and being unmarried. These predictors increased the risk of NHP twofold at most.

Dementia is considered the most common cause for NHP. Studies showed the risk increasing up to 17-fold, highlighting the overwhelming impact of dementia on NHP, most likely caused by the rapid decrease of an individual's ability to live independently, which is again caused by increasing cognitive impairment and related disabilities in ADL and IADL. Institutionalization rates among individuals suffering dementia considerably exceeded those rates of community-based samples. About half of individuals with dementia were institutionalised after 5–6 years [54], while at most 17% of population-based samples were admitted to a nursing home after 6 years (see Table A3). In the last decades, many studies investigated predictors of NHP in samples exclusively covering individuals suffering dementia. The following consistent predictors were found: severity of dementia; behavioural and psychological dementia-related problems such as aggression, depression, hallucinations and incontinence; and caregiver's burden [8, 54].

Just as dementia diagnosis, a decrease in function alone (as objectively measured by ADL and IADL, and subjectively by self-rated health status) also considerably increased the risk of NHP: 96% of studies found a positive significant effect of functional impairment on risk of NHP. In addition, a significant number of chronic medical conditions were strongly associated with functional impairment. However, severe medical conditions also impact the correlation with functional impairment. Since most included studies adjusted for functional impairment in multivariate analyses, with severity of diseases not usually captured, inconsistent or non-significant results for most of the chronic medical conditions were found. In other words, many medical conditions did not contribute independently to nursing home placement rates. In fact, chronic diseases affected NHP almost completely by their caused functional impairment. Additional consideration of severity of diseases and of multicollinearity between medical conditions and functional impairment would help determine the exact contribution of a disease to risk of NHP. Moreover, a more detailed description of operationalization of functional impairment as in several studies would facilitate a more reliable evaluation of the effects on risk of NHP.

If elderly individuals suffered from cognitive and/or functional impairment, the likelihood of admission to a NH increased due to lack of support and assistance in daily living needs, either provided by community-based home care services (formal care) or by a suitable informal caregiver, mostly from the next of kin. Use of community-based home care was not explicitly assessed in studies. Information about the availability or the presence of an informal caregiver was analysed in 72% of studies, but with rather inconsistent operationalization. In summary, studies targeted three different constructs: (i) existence of kin and non-kin either in the household (marital status, living situation) or altogether (i.e. living relatives, number of relatives), (ii) social network size in terms of 'cherished relationships' (i.e. frequencies of contacts, social activities) and (iii) current existing support (i.e. use of care and assistance). The literature assumed three ways the family members provided support, impacting the risk of NHP [33]: personal care directly for the older relative (personal support), assistance in obtaining formal home and community-based services by arranging for services or making financial transfers to pay for such care (organising and financial support) and having ties with beneficial impact on the health and well-being of the elderly individual, and thus an indirect effect on nursing home care demands (emotional support). In studies of this review, only the data on current existing support (iii) addressed these three kinds of support (personal, organising, emotional) suggested by Freedman [33]; however, the kinds of support were not differentiated in studies—so they are still possible objectives for future research. Finding potential helpers by inquiring about other family members (i) or a cherished social network (ii) allowed us only to speculate that support is potentially available in some form for the individual, but not whether the support actually occurred. The results of included studies showed no strong evidence for all three constructs (i–iii). Only with a lack of a spouse and a poor social network did results of moderate to weak evidence result; for all others, the results were inconsistent. This confirmed the assumption that the availability or the presence of informal care did not independently influence the risk of NHP, but rather together with existing cognitive and functional impairment. One should also keep in mind that the use of home care and assistance also may point out a rather increased risk of NHP in contrast to the assumption that it prevents NHP, possibly also contributing to inconsistent results.

Male gender and low income are further frequently discussed predictors of NHP. Findings for male gender and low income as risk factors for NHP were inconsistent. A lot of studies found no significant effect, and a few studies

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found positive or negative effects on risk of NHP. In our post hoc analysis, we showed a moderate correlation of sample size and gender effect, and a high effect size for correlation of sample size and income effect, suggesting that the effects of gender and income on risk of NHP are only of slight value. Contrary to our results, Gaugler *et al.* [5], in his meta-analysis solely of US studies, found an increased risk of NHP for men and low income. However, in the meta-analysis, mainly studies with high sample sizes were included, providing sufficient statistical power to obtain statistically significant results.

Interpretations should take into consideration that—except for one study—all studies used a static set of baseline indicators in their analysis (static model), and thus could not account for changes of baseline characteristics also possibly influencing the subsequent risk of NHP. Only Wolinsky *et al.* [39] evaluated the associations between changes over time in baseline characteristics and NHP; they showed that deterioration in cognitive ADL (e.g. managing money, using telephone) resulted in an increased risk of NHA, which was in addition to the impact of baseline status. In future research, one might address the investigation of more dynamic models, focusing on changes in baseline characteristics over time as predictors of NHA and on changes in enhancement and trajectories of several cognitive and functional issues (e.g. as Wakefield and Holman [55] for hospitalization).

In conclusion, the findings represent a further contribution to the large field of research in the prevention of institutionalization in the elderly with several important clinical implications. However, at the present time, the methodical quality of studies analysing predictors of community-based samples on NHP have not mainly fulfilled the applied quality criteria to a degree that results can be considered as finalised. The same point can be made for predictors of NHP of samples including only individuals with a dementia diagnosis [8, 54]. Nevertheless, the determination of predictors of NHP opens the possibility to develop assessment tools for identification of persons being at risk of NHP, related in detail to the subgroups of (i) demented individuals [8, 54] and of (ii) community dwellings (present study) also considering gender-specific risk factors [56]. Integrating these findings in such a screening tool could help support the development, application and evaluation of effective interventions to preserve physical function and independence in elderly people.

Key points

- Nursing home placement is based on cognitive and functional impairment, and availability of support in daily living.
- Use of quality criteria may help to improve the methodical quality of studies.
- Findings facilitate the development of assessment tools identifying persons at risk of nursing home placement.

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Conflict of interest

None

Supplementary data

Supplementary data mentioned in the text is available to subscribers at the journal website http://ageing.oxfordjournals.org

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