

# Evaluations of Home Care interventions for frail older persons using the interRAI Home Care instrument: A systematic review of the literature

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## *Abstract*

*Background/Objectives: This systematic review describes the use of the interRAI Home Care (interRAI HC) instrument, an internationally validated comprehensive geriatric assessment, as a base for the evaluation of home care projects. Because of the evidence base of the instrument and its widespread use, researchers can make a thorough evaluation of projects and interventions in home care and can also have insight in international comparisons. The aim of this systematic review is to identify research that evaluates interventions in the home care setting using this comprehensive geriatric assessment and to describe these evaluations and report the results of the use of this instrument.*

*Design: Two independent reviewers constructed a comprehensive list of Medical Subject Headings, which was designed for 5 explicit categories: (1) interventions; (2) evaluation; (3) home care; (4) interRAI HC; and (5) older person. A systematic literature search was then performed in the main electronic databases Web of Science, EMBASE, MEDLINE, Cochrane, PsycInfo, and CINAHL for the years 1990 to 2013.*

*Setting: Home care.*

*Measurements: Studies were described and the following information was extracted from the articles: mean age and proportion of gender of participants; sample size; location of the study; goal of the study; main findings; main limitations; and results of the evaluation of the interRAI HC instrument.*

*Results: A total of 349 articles were identified. Eighteen studies met our inclusion criteria describing 18 interventions in home care evaluated with the interRAI HC instrument.*

*Conclusions: This systematic review can help researchers to plan evaluation of interventions in home care. The interRAI HC instrument proves to be a comprehensive tool to measure outcomes and can serve as an evaluation instrument for interventions. It can also be used as an intervention itself, when caregivers use the tool and its outcome measures to implement a care plan.*

## Evaluations of Home Care Interventions for Frail Older Persons Using the interRAI Home Care Instrument: A Systematic Review of the Literature

Population aging is perceived as a major challenge for care systems worldwide. The main drivers of public spending on health care for people of 65 years and older are hospital admissions and admissions to long-term care facilities. High quality community care is expected to be a cost-effective solution with a positive effect on the sustainability of health care systems. Usually, interventions in community care vary according to population needs and policy aims. Because frail older persons usually have complex and changing health needs, home care services should be adapted to them [1-3]. This implies the necessity of gathering knowledge on physical, psychological, and social health situation of frail older persons. By means of a comprehensive geriatric assessment (CGA), a suitable evaluation can be made of all essential needs of older persons and their informal caregivers, in order to be able to determine what services are necessary to meet their needs [4-6].

The interRAI assessment instruments are comprehensive geriatric assessment tools, which have been internationally validated in different care settings (home care, long-term residential care, acute care, and so on). These instruments have common items and sections making transfer of information across settings possible as well as some specific items according to the setting. The interRAI instruments have often been used in research, as well as in service development and as a base for care and quality improvement [7-9].

The RAI Home Care instrument 1.0 was first developed in 1994. Initially, it was designed to be compatible with the RAI Long-Term Care Facilities, which was already implemented in nursing homes. The instrument was then revised in 1999, and the version RAI Home Care 2.0 was created. In 2007, after further validations and revisions to be compatible with the other assessment systems, the instrument was named interRAI Home Care (interRAI HC) suite. The interRAI HC suite continues to undergo validity by the interRAI consortium to meet the changing needs of older persons in the community care setting [10,11]. The assessment items include measures in the following areas: personal information, cognitive performance, communication, hearing, vision, mood and behavior, social functioning, physical functioning, continence, disease diagnoses, service utilization, medications, health conditions and preventive health measures, nutrition, skin condition, informal support services, and environmental aspects. The instrument provides outcome measures [interRAI scales and clinical assessment protocols (CAPs)] to help create a care plan for the older person, and these outcome measures also undergo continuous validation [12-16].

This systematic review describes the use of the interRAI HC instrument (versions 1.0, 2.0, and suite) as a base for the evaluation of home care interventions. Because of the evidence base and widespread use of the instrument, researchers can make a thorough evaluation of interventions in home care and can also have insight in international comparisons. The aim of this systematic review is to identify articles that evaluate interventions in the home care setting using this CGA, to describe these evaluations, and report the results of the use of this instrument. Studies in which the use or implementation of this instrument is viewed as an intervention in itself, are also included. The review can help researchers to determine the type of evaluation they need to perform and to determine whether this CGA can bring an added value to the research.

## Methods

### Literature Search Strategy and Study Selection

Two independent reviewers constructed a comprehensive list of Medical Subject Headings, which was designed for 5 explicit categories: (1) interventions; (2) evaluation; (3) home care; (4) interRAI HC; and (5) older person (Table 1). A systematic literature search was then performed by the same researchers in the main electronic databases Web of Science, EMBASE, MEDLINE, Cochrane, PsycInfo, and CINAHL for the years 1990 to 2013. The study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for reporting systematic reviews [17]. Titles and abstracts of all articles were examined by 2 independent reviewers. Studies were included if they described an intervention in the home care setting, which was evaluated by means of the use of the interRAI HC instrument (RAI HC versions 1.0, 2.0, or the interRAI HC suite). From now on we will simply mention interRAI HC instrument as referring to all of the versions because the differences between the contents of these versions are compatible among themselves [18]. Only peer-reviewed articles are included in this review. Inclusion criteria are (1) the instrument used is the interRAI HC instrument; (2) articles about older persons; (3) articles describing interventions in the home care setting; and (4) articles published in English.

Table 1 Medical Subject Headings (MeSH) Search Terms\*

Search category	MeSH terms
Intervention	Intervention studies, Therapeutics , Preventive Health Services
Evaluation	<i>Evaluat*</i> , <i>Rate*</i> , <i>Assess*</i> , <i>Apprais*</i> , <i>Impact</i> , <i>Effect*</i>
Home care	Community Health Services
interRAI Home Care	Needs assessment, Comprehensive Health Care , <i>RAI</i> , <i>RAI HC</i> , <i>interRAI Home Care</i> , <i>interRAI HC</i> , <i>MDS<sup>a</sup></i> , Instruments (MeSH), Questionnaires (MeSH), Geriatric assessment (MeSH)
Older persons	Aged

\* For a detailed table with MeSH terms, keywords and explosions of the search strategy, please contact the authors.

<sup>a</sup> MDS used to be the abbreviation of Minimum Data Set – name formerly given to the interRAI assessments in the decades of the 80s and 90s.

The full text of potential articles was reviewed and the following data were extracted from the studies: (1) author, year; (2) study design; (3) mean age and proportion of gender of participants; (4) sample size; (5) main outcomes; (6) location; and (1) author, year; (2) goal of the study; (3) main findings; (4) main limitations; (5) results.

## Results

The original literature search performed by 2 independent reviewers identified a total of 347 articles and 2 additional articles were identified through hand searching (Figure 1). Thirty-seven duplicates were removed, resulting in 312 articles that were screened for inclusion. Subsequently, 81 full-text articles were assessed for eligibility and 18 articles met all inclusion criteria, describing 18 interventions in home care evaluated with the interRAI HC instrument.

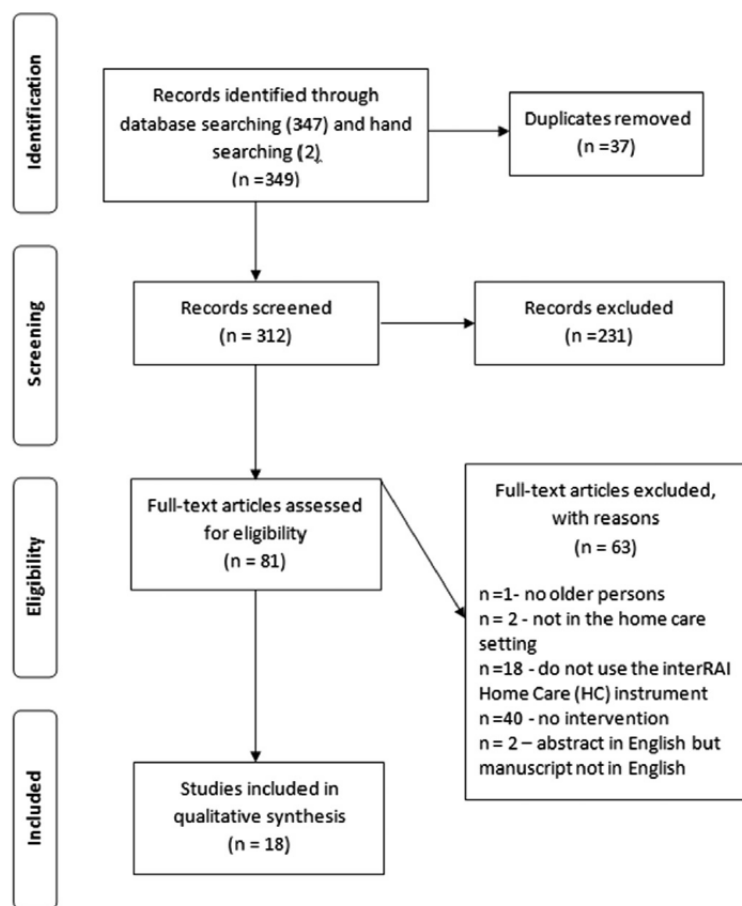


Figure 1 Prisma Flow Diagram

## Description of Interventions

This section highlights the design features of the studies presented in Table 2. All studies evaluate an intervention in home care using the interRAI HC instrument as an evaluation tool. After carefully reading the articles and selecting the studies, researchers put them into categories based on the type of the intervention they describe. Three types of interventions were identified: comprehensive geriatric assessment alone, comprehensive geriatric assessment and case management, and comprehensive geriatric assessment in integrated care system. Two other articles did not belong to these categories and described other types of interventions evaluated with the interRAI HC instrument.

The first category consists of studies that show the implementation of a comprehensive assessment instrument (interRAI HC) or a single assessment process as the pure intervention and report the results of this implementation.

The second category consists of studies that describe the evaluation of case management interventions using the interRAI HC as a tool for care planning, case finding, or for care coordination.

The third category describes the evaluation of interventions that involve the use of the interRAI HC as a case management tool but in a more integrated care system. In this case, the care plan is applied to the practice using multidisciplinary teams and integrated services.



Table 2 Summary of studies evaluating Home Care interventions

Author, Year	Intervention/ Programme	Study design	Age, Mean $\pm$ Standard Deviation  Gender (female %)	Sample Size	Location
Landi et al., 2001 <sup>19</sup>	Comprehensive geriatric assessment	Single-blind randomized controlled trial with one year follow-up	Intervention: 77.4 $\pm$ 9.1 68.2%  Control: 77.1 $\pm$ 9.5  67.0%	187	Two Heath Districts of the Health Care Agency of Bergamo, Italy
Brown et al. 2009 <sup>20</sup>	Assessment implementation	Randomized controlled trial	Intervention: 81.0 66.0%  Control: 81.0  65.0%	311	Bay of Plenty area, New Zealand
Miller et al., 2004 <sup>21</sup>	Implementation of a single	Observational study	Age: not reported  Gender: not reported	89	National Service Framework, England

assessment  
process

Roberts et al., 2006 <sup>22</sup>	Single assessment process by nurses	Prospective descriptive study	85.0 58.0%	863 (124 in-depth assessments)	Southampton, England
Stolle et al., 2011 <sup>23</sup>	Implementation of comprehensive geriatric assessment	Cluster randomized controlled trial	78.9 64.7%	484	Germany
Sorbye et al., 2009 <sup>24</sup>	Implementation of common assessment instrument	Comparative study	82.3 74.0%	4010	11 European countries (Denmark, Finland, Sweden, Norway, Iceland, England, Italy, France, The Netherlands,

					Germany and the Czech Republic)
Igarashi et al., 2009 <sup>25</sup>	Screening by preventive care managers	Quasi-experimental study	Intervention: 80.5 ± 8.9 75.3% Control: 81.2 ± 8.2 69.6%	150	Two cities in Japan (names not mentioned in article)
Diwan et al., 2004 <sup>26</sup>	Care-planning implementation	Observational study	75.0 68.0%	169	Michigan, USA
Chi et al., 2006 <sup>27</sup>	interRAI HC as a case finding instrument	Cluster randomized controlled trial with 1 year follow-up	73.6 ± 5.5 57.4%	925	Hong Kong

Thomas et al., 2007 <sup>28</sup>	Assessment and care plan	Single randomized controlled trial	Intervention group1: 80.7 ± 4.3 62.4% Intervention group2: 80.4 ± 4.4 72.6% Control: 80.7 ± 4.5 67.4%	520	Canada
Shugarman et al., 2002 <sup>29</sup>	Home care and informal caregiver's attitudes	Comparative study	75.2 ± 11.6 69.1%	527	Michigan, USA
Marek et al., 2006 <sup>30</sup>	Nurse care coordination	Quasi-experimental study	Intervention: 77.0 ± 8.1 82.0% Control: 77.3 ± 7.9	85	Missouri, USA

77.0%

Leung et al., 2001 <sup>31</sup>	interRAI HC instrument in case management	Observational study	74.5 ± 7.2 43.1%	130	Hong Kong
Landi et al., 1999 <sup>32</sup>	Integrated Home Care services	Longitudinal study	77.5 ± 11.7 71.3%	115	Vittorio Veneto, Italy
Landi et al., 2001 <sup>33</sup>	New integrated care model	Longitudinal study	77.4 ± 9.7 58.5%	1204	Pieve di Soligo, Bergamo, Orvieto en Lecce, Italy
Marek et al., 2005 <sup>34</sup>	Community-based care with nurse coordination  (Aging in Place program)	Quasi-experimental study	Intervention: 72.0 ± 10.9 71.0%  Control: 72.2 ± 10.6  68.0%	156	Missouri, USA

Fries et al., 2004 <sup>35</sup>	Telephone screening in home care	Comparative study	Age: not reported Gender: not reported	23595	Michigan, USA
Zhu et al., 2007 <sup>36</sup>	Implementation of machine learning algorithms	Comparative study	76.3 ± 13.9 68.9%	24724	Ontario, Canada

## Comprehensive Geriatric Assessment Alone

### Comprehensive geriatric assessment [19]

This article evaluates the impact of the implementation of the interRAI HC instrument on the functional status and hospitalization rates of frail older persons. It is a single-blinded randomized control trial with a 1-year follow-up conducted in 2 districts in Italy. Independently of the group assignment, all eligible patients received case management and care planning. In the intervention group, the case manager assessed the clients with the interRAI HC instrument right after inclusion. The clients in the control group received a conventional geriatric assessment.

### Assessment implementation [20]

This article evaluates the effect of the accurate identification of older persons' needs by the implementation of a comprehensive geriatric assessment on health service use and costs. This is a randomized controlled trial in 1 area of New Zealand. Participants in the control group were screened with an instrument called Needs Assessment and Service Co-ordination, whereas the intervention group was assessed by the interRAI HC instrument. The range of services available was identical for both groups and all services prescribed and used were reported. These services and costs were then compared.

### Implementation of a single assessment process [21]

This article describes the effects of the implementation of a single assessment process in order to raise assessment standards and promote consistency across the country. The study was carried out in 6 general practitioners' (GPs) surgeries in England. The answers given by clients about their health and social care needs to questions in a contact assessment were compared with answers given by the nurse in the interRAI HC instrument.

### Single assessment process by nurses [22]

The aim of this study was to examine the effect and the resources needed for the implementation of a single assessment process and to use the outcome variables of this assessment (CAP) in the care plan. For each CAP, the nurse assessed the situation of the older person including the measures already in place and verified agreement of any action with the patient and the main caregiver.

#### Implementation of comprehensive geriatric assessment [23]

This article describes a cluster randomized controlled trial for the evaluation of the implementation of the interRAI HC instrument in 69 home care services in Germany. The team of the home care services in the intervention group received training on filling out the instrument and were given support and advice. Baseline data were collected before the training and after a period of 13 months.

#### Implementation of common geriatric assessment instrument [24]

This study aims at making cross-national comparisons from 11 European countries for home care systems and quality of care and for clients' outcomes through the implementation of a common assessment instrument the interRAI HC. Data is collected by trained professionals at baseline, after 6 months and at 12 months. In this review, we include an article that is a review of all 27 articles produced in the study. This review contains the main results of each substudy as well as an overall discussion.

#### Comprehensive Geriatric Assessment and Case Management

##### Screening by preventive care managers [25]

This article reports the evaluation of an intervention consisting in the use of the interRAI HC instrument and on constructing a care plan based on the assessment. Evaluation uses a quasi-experimental design in 2 Japanese cities: city A - intervention group and city B - control group. Two aspects of the client's health were examined: maintaining self-care and having a balanced diet. The skills of the



preventive care managers were assessed both objectively (quality of the care plans) and subjectively (self-rated confidence). Comparisons of the care plans in both groups were made 6 months after baseline.

#### Care planning implementation [26]

This article examines how case managers identify and respond to home care clients' needs in Michigan using the interRAI HC instrument. Two coders were asked to review each client's chart and to make writings about problem and impairment areas as well as client's needs. Thereafter, they examined the output of the interRAI HC instrument (CAPs) triggered by 23 algorithms and evaluated whether there was correspondence between the charts and the triggered CAPs.

#### interRAI HC as a case finding instrument [27]

The aim of this study was to test whether the utilization of the interRAI HC instrument as a case finding tool had a beneficial impact on the older person's physical and mental health status. This is a prospective 1-year follow-up study performed in Hong Kong. At baseline, before clients were seen by the GP, an interRAI HC was filled out by trained professionals and the outcome measures (CAPS) were generated. These were given to the physician who could then formulate the treatment on the basis of these outcomes. In the control group, no CAPs were generated and clients were treated according to the GPs usual practice. Comparisons between these outcomes were then made.

#### Assessment and care plan [28]

This study describes a randomized controlled trial with a 4-year follow-up period in Canada. In intervention group 1, older persons were assessed with the interRAI HC instrument and feedback was given to the clients and their informal caregivers. In intervention group 2, older persons were assessed with the interRAI HC instrument, and the results of the assessments were shared with the older person and the informal caregiver and they were offered referrals to health and social services, if

needed. People in the control group did not receive any type of functional assessment nor advice. Comparisons of the care plan decisions were made for the 3 groups.

#### Home care and informal caregiver's attitudes [29]

This study uses data from 14 regional agencies in Michigan. The participants of the study come from 2 programs designed to expand the availability of home care to older and disabled people. A baseline assessment was completed at 4 days after start of home care services. Follow-up assessments were completed at 45, 90, and 180 days after baseline. The primary outcome variable of interest is hospitalization after baseline. Other measures of interest are informal caregiver's personal burden and interpersonal burden.

#### Nurse care coordination [30]

This article examines the effect of a nurse care coordination program for people receiving state-funded home care in Missouri. The design of the study is quasi-experimental and compares clients who only receive home care (control group) with clients receiving home care and extra nurse care coordination (intervention group). Data were collected at baseline, at 6 and 12 months by trained registered nurses.

#### InterRAI HC instrument in case management [31]

This study aims to evaluate the use of the interRAI HC instrument as a tool for case management in Hong Kong. Data is collected by case managers and the output variables of the instrument are then analysed to categorize the population into groups based on matched levels of impairment and services. The care plan is then developed and communicated to the multidisciplinary team.

#### Comprehensive Geriatric Assessment in Integrated Care System

### Integrated home care services [32]

This article describes a 6-month follow-up quasi-experimental study based on comprehensive geriatric assessment and case management in 1 Italian district. The goal of the study is to compare the rates of hospitalization before and after the home care program was implemented. Older persons received case management and care planning by the community geriatric evaluation unit and GPs. Case managers performed the assessment with the interRAI HC instrument immediately after request of home care and at least 2 other times during a follow-up period of 6 months.

### New integrated care model [33]

This article describes a 12-month follow-up quasi-experimental study on the impact of a home care project based on comprehensive geriatric assessment and case management on hospital use and cost. This study was conducted by 4 Italian health care agencies adopting an integrated social and medical care program along with a case management approach. Case managers, usually registered nurses with experience in geriatric nursing, performed the assessment with the interRAI HC instrument immediately after request of home care.

### Community-based care with nurse coordination [34]

This comparative study aims to analyze the outcome measures of older people in the community participating in community-based projects with older persons with the same case-mix but who are already institutionalized. This home care project called Aging in Place consists of nurse coordination and Medicare home health services in the state of Missouri. The data of the interRAI HC instrument are collected at baseline and every 6 months over a 30-month period.

### Other Types of Interventions

#### Telephone screening [35]

This study aims to determine the accuracy of a telephone screening system to identify older persons eligible for long-term home care. The study makes a comparison between data from Michigan telephone screens and data from in-person assessments using the interRAI HC instrument. The effectiveness of the telephone screening system is then evaluated.

Machine learning algorithms to guide rehabilitation planning [36]

The goal of this study is to predict which clients have a potential for Activities of Daily Living rehabilitation in home care. Predictions are made by using a support vector machine based on the interRAI HC instrument. The study uses data from 8 home care programs in Ontario and wishes to address the issue that many home care clients who would benefit from rehabilitation services, very often, do not receive them.

Main Results of the Use of interRAI HC

Table 3 describes the goal of each study, their main findings, and main limitations as well as the number of positive or negative results about the interRAI HC instrument.

Table 3 Summary of goals and results of the studies evaluating Home Care interventions

Author, year	Goal	Main findings	Main Limitations	interRAI Home Care: total count of positive (+) or negative evaluation results (-)
Landi et al., 2001 <sup>19</sup>	To evaluate the effect of a new assessment system on the functional status and hospitalization rates of frail older persons	<p>Significant improvement of ADL and cognitive functioning in intervention group</p> <p>Intervention group showed significant increase in in-home services compared to control group</p> <p>Hospital admissions in intervention group happened later than in control group. Also less</p>	<p>Small sample size which did not allow for subgroup analysis</p> <p>Length of hospital stay in both groups appears higher than average in other studies (ex. hospitals in the USA) but population in this study is frail and eligible for integrated home care programs</p>	++++

		<p>admissions to hospital and reduced length of stay in for intervention group</p> <p>Total cost expenditures were 21% less in intervention group</p> <p>Study demonstrate that in-depth evaluation of problematic areas together with structured help for implementation of home care interventions with interRAI HC assessment can be a key factor for the success of home care programs</p>	<p>For this study, all health workers were motivated to fill out the interRAI HC instrument but in the “real world” this can be a problem because staff is not always specifically trained to use the interRAI HC instrument and consequently not motivated</p>	
Brown et al. 2009 <sup>20</sup>	To estimate the health service use and costs	Clients assessed with the interRAIHC instrument	Lack of very reliable data on social and personal	+++

	<p>resulting from the introduction of the interRAI HC instrument</p>	<p>had higher costs for prescribed services and for delivered services.</p> <p>Costs related to interRAIHC are more associated with preventive and diagnostic services, while in the control group the expenditures are more on disability support services.</p>	<p>costs (including privately purchased care) and also hours of care given by informal caregivers</p>	
<p>Miller et al., 2004 <sup>21</sup></p>	<p>To investigate the usefulness of a questionnaire to identify unmet needs in health and social care.</p>	<p>The interRAI HC instrument is viewed as an advantage because the items can be used as triggers (CAPs) for considering appropriate discharges and referrals</p>	<p>Case studies with small sample size</p>	<p>+++</p>

		<p>The authors acknowledge the need for primary and secondary care to work together, also on transfer of information. Therefore the need for a single assessment process, with an electronic basis for a reliable, holistic and consistent assessment</p> <p>A whole assessment may not be necessary for every patient but a mechanism needs to be in place to trigger those in need for a more in-depth assessment</p>		
Roberts et al., 2006 <sup>22</sup>	To evaluate the feasibility and benefits of carrying out the single assessment	People scoring 4 or higher in the Sherbrooke questionnaire were	High refusal rate (60%) for the interRAI HC by the participants with a	+ -



	<p>process based on the interRAI HC instrument</p>	<p>viewed as eligible for a comprehensive assessment (interRAI HC)</p> <p>52% of participants with interRAI HC assessments triggered CAPs for specific problems or risk areas</p> <p>An inventory of the time spent for preparation and filling out the instrument was made (2.7h for GPs, 1h for clerical staff, 3h for the secretary and 2.5 for the nurse)</p>	<p>Sherbrooke score higher than 4</p> <p>These non-responders could not be followed-up and were potentially the most frail and in need of assessment</p>	
<p>Stolle et al., 2011<sup>23</sup></p>	<p>To measure the effect of the interRAI HC instrument on clinical and functional outcomes</p>	<p>Results show positive effects of the interRAI HC instrument for ADL and IADL change (but results were not statistically</p>	<p>Low number of clients per home care agency participating in the study</p> <p>Implementation of interRAI HC instrument</p>	<p>+</p> <p>-</p>

		<p>significant). No evidence of improvement for cognitive performance change and quality of life</p> <p>Institutionalization and hospitalization rates are lower in intervention group but show no significant differences</p> <p>In the intervention groups, there were more improvement in the documentation of the nursing process (more care plans and these are more up-to-date (but no significant results)</p>	<p>lasted longer than expected</p> <p>The way of implementing and using the instrument differed by home care agencies. Some used the instrument and also its outcomes (CAPs, quality indicators, etc) and others did not</p>	
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<p>Sorbye et al., 2009 <sup>24</sup></p>	<p>To implement a common assessment instrument across countries in order to make comparisons on quality of care and care outcomes</p>	<p>The ADHOC project contributed to partially close the gap of information on users of home care services in Europe</p> <p>Cross-countries comparisons were made possible on health outcomes, social status and structure of services in Europe</p> <p>Identification of the most frequent problems related to home care: no therapy available for ADL improvement for people with rehabilitation potential, inadequate pain control and no</p>	<p>The differences in countries profiles and home care structure has to be taken into account when interpreting results. The ADHOC project focused primarily on the description of home care services users and systems and is aware that differences in the outcomes can be due to background characteristics</p>	<p>+++</p>
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		vaccination against influenza		
Igarashi et al., 2009 <sup>25</sup>	To determine whether the implementation of preventive care management using a version of the interRAI HC instrument improves health-related behaviors of older adults and the skills of preventive care managers	Intervention group shows better results for self-care and for quality of care plans  Positive correlation between confidence in assessing client's needs and proficiency in understanding the assessment instrument	Differences between the cities involved in the study may have caused bias	++++
Diwan et al., 2004 <sup>26</sup>	To examine how case managers identify and respond to home care clients' needs.	Many problem domains are not identified by the case managers, especially in the domains of health conditions, continence and sensory performance. Functional areas (ADL),	Screening happened for one State and may not be able to be generalized to other populations  Small sample size  The responses examined were those noted in the	+

		<p>environmental issues, brittle support are often identified by case managers</p> <p>The social function and depression areas are the ones with the most unmet needs, followed by visual function and communication</p>	<p>chart of case managers. It is possible that they made/planned interventions without taking notes but not very likely</p>	
Chi et al., 2006 <sup>27</sup>	To investigate the effect of the interRAIHC instrument as a case finding instrument for older clients in Hong Kong	<p>Mood symptoms improved significantly more in the intervention group. IADL deteriorated less in intervention group than in control group. Bowel incontinence deteriorated more in the intervention group.</p>	<p>Authors acknowledge that the period of one year is too short to evaluate changes in health status because some problems are due to chronic diseases. They believe that mood status and behavior are more</p>	-

		Limited effectiveness of the interRAI HC instrument as a case finding tool	<p>susceptible to change at a short period of time.</p> <p>Population was not frail enough at baseline and this made it difficult to show improvement in the population.</p>	
Thomas et al., 2007 <sup>28</sup>	To determine whether frail older people can still stay at home with the help of comprehensive geriatric assessment	<p>Intervention group 2 (who accepted offers of referral from the assessor) were more likely to receive formal home care than the control group</p> <p>Rates of uptake of home care and institutionalization were very low in the three groups and self-rated</p>	<p>Study should be performed in a more frail population</p> <p>Authors did not assess whether there was adequate provision of home care or if the provision matched the client's needs</p> <p>Two outcomes that were not measured were visits</p>	-

		<p>health and perceived self-efficacy remained stable and high</p> <p>Authors think that the interventions in groups 1 and 2 were not effective because of ceiling effects due to the relatively good health of the older persons in the study</p>	<p>to emergency departments and informal caregiver burden</p>	
Shugarman et al., 2002 <sup>29</sup>	<p>To investigate the relationship between informal caregiver's attitudes and the risk of hospitalization of older persons taking part of programs designed to expand the availability of home care to older and disabled people</p>	<p>Informal caregiver dissatisfaction with the current level of support received by the older person is significantly associated with hospitalization.</p> <p>Informal caregiver's distress is significantly associated with death.</p>	<p>No data available about date of hospitalization or length of stay</p>	+

Marek et al., 2006 <sup>30</sup>	To evaluate the clinical outcomes of a nurse care coordination program	<p>At 6 months, no significant differences were found but at 12 months the intervention group had less pain and less dyspnea and functioned at better ADL functioning levels than the control group</p> <p>Authors believe that at least 12 months are needed to show effect for nurse care coordination of frail older clients</p>	<p>Small study sample from a single state in the USA. Authors acknowledge the need for larger studies across different states.</p>	+++
Leung et al., 2001 <sup>31</sup>	To evaluate the use of the interRAI HC instrument in the development of care plans by a case manager	<p>Added value of comprehensive geriatric instrument in categorizing the levels of impairment of clients and link them to necessary</p>	Small study sample	++++



		<p>services regarding their holistic needs.</p> <p>Elimination of problem of multiple assessment because case managers communicated the results of the interRAI HC instrument with the multidisciplinary team</p>		
Landi et al., 1999 <sup>32</sup>	To examine the effect of a home care program based on comprehensive geriatric assessment and case management on hospital use and costs	<p>Hospitalization rates reduced from 56 to 46 (<math>p &lt; 0.001</math>)</p> <p>Length of stay in hospital declined sharply from <math>16 \pm 11</math> days to <math>10 \pm 11</math> days (<math>p = 0.01</math>), so did total costs of hospital-based</p>	Findings could reflect a historical trend toward reduced rate of hospitalization and length of stay but this is not likely in a limited time frame	++

		care (from \$4365 to \$2435 – p<0.001))		
Landi et al., 2001 <sup>33</sup>	<p>To test the effectiveness of the interRAI HC instrument on standardized home care programs with case management</p> <p>To measure the effects of the utilization of this instrument in hospital use and costs</p>	<p>Significant reduction of the number of hospitalizations associated with reduction of length of stay.</p> <p>Total 27% cost reduction.</p>	<p>The findings might reflect a historical trend toward a reduced rate of hospitalization and reduction of length of stay, but this is not an expected effect because it is been 5 years since the legislation in Italy has been changed.</p> <p>For this study, all health workers were motivated to fill out the interRAI HC instrument but in the “real world” this can be a problem because staff is not always specifically</p>	+++

			trained to use the interRAI HC instrument and consequently no motivated	
Marek et al., 2005 <sup>34</sup>	To compare clinical outcomes of older persons at home with older persons already institutionalized	Participants of the home care project had favorable outcomes compared to the other group  ADL, cognitive functioning and depression improved and then declined at a slower rate than in the comparison group  At baseline, the intervention group had higher incidence of incontinence but after	Individual matching strategy was needed to ensure participants in the two groups were comparable. This matching happened for 82% of the clients in the study  This program was only conducted in one agency and it cannot be generalized	++

		intervention started, incidence became higher at the comparison group		
Fries et al., 2004 <sup>35</sup>	To determine the accuracy of a telephone screening system to identify persons eligible for home- and community-based long-term care	<p>The telephone screening is an effective method to avoid costly in-person assessment for non-eligible individuals</p> <p>No particular items of the screen are responsible for mismatches, but telephone answers are consistently “more impaired” than in-person assessment answers</p> <p>Telephone assessment cannot replace in-person assessment for clients who would be eligible for home care</p>	<p>Screening happened for one State and may not be able to be generalized to other populations</p> <p>No study was made on the reliability or validity testing of the interRAI HC assessment made by phone</p>	+

Zhu et al., 2007 <sup>36</sup>	To investigate the potential of machine learning algorithms to target older clients for rehabilitation at home care	<p>The support vector machine predicts rehabilitation potential better than the use of the ADL CAP</p> <p>The results provide a method to improve the prediction value of the ADL CAP to be used in home care so that people who really are in need of rehabilitation, receive his type of services</p>	Some reservations about the use of these methods include the interpretability of these results and the resulting potential for clinical resistance to a “black box” approach. The authors try to address these issues with clarity in the article	+

Fourteen studies mention only positive results about the instrument, whereas 4 articles mention 1 negative result each. Nine studies describe the instrument as an effective tool to identify the needs of older people so that it can be used as a tool for preventive care management [19,21,22,25,26,31-33].

In several studies where case management and the implementation of the interRAI HC were viewed as the intervention itself, positive results were found [25,26,29-31]. Except in 2 studies, the use of the instrument proved limited effectiveness as a case finding instrument [27,28]. However, authors of those studies think this could be due to the profile of the population in the study that was mostly not frail enough to need a comprehensive geriatric assessment. They believe this may have limited the effectiveness of the instrument.

In 7 studies, authors agree that the interRAI HC helps to create better care plans [19,23,25,26,30-33]. Some studies mention that the use of the interRAI HC can reduce costs by means of reducing hospital admissions and the length of stay [19,32,33]. Several articles [19-21,24,29-31,33,34] mention the advantage of standardization of the instrument to be used in a whole country or in several countries as a tool for quality of care and benchmarking. About the usability of the instrument, 9 studies agree that training is necessary and that the implementation of such a comprehensive assessment requires time and effort [19,22,23,25,28,33,35]. Some authors mention the evidence basis of the assessment and the triggers (CAPs) for problems and risk situations as a useful tool to help care planning [19,21,24-26,31-34,36].

Another important advantage mentioned in the studies is that the instrument contributes to more communication between care givers and a closer collaboration of professionals [19,25,30-33].

Discussion

This systematic review identified 18 studies describing interventions in home care using the interRAI HC instrument as an evaluation tool. All studies aimed at evaluating interventions in home care using this comprehensive geriatric instrument, but in 6 of these studies the intervention was the pure implementation of the instrument itself.

In 14 studies, the use of the interRAI HC instrument was evaluated as useful, showing positive results in general (Table 3). In 4 studies, the effectiveness of the instrument could not be proven, although some authors think this was maybe due to the design of the study. In general, authors agree that a comprehensive geriatric assessment such as the interRAI HC instrument, can help in the evaluation of care and interventions and that the standardization of the instrument improves collaboration between professionals and allows for benchmarking.

Interventions in home care described in the articles mostly showed features of case management projects based on the application of a comprehensive geriatric assessment to help professionals make a care plan. Studies showed the effectiveness of the interRAI HC as a case finding instrument and to identify the needs of older persons. The use of this instrument coupled with case management can reduce hospital admissions, length of stay, and thus, reduce costs. The models presented in this review are, however, still not applied at a larger scale. Most interventions are limited to some regions of a country and have not yet been implemented in complete countries. The Aged in Home Care project [24] in 11 countries in Europe was also limited to some areas of each country. A harmonization of the way to collect data in Europe by means of a standardized assessment was pointed out in this article as necessary and useful, but most European countries still seem to have a long way to go.

Nowadays, using the term “integrated care planning” is trending. This can be seen as developing structured multidisciplinary care plans, which describe in detail what

the essential steps in the care of patients should be. The interRAI assessment tools provide evidence of reliability in long-term care settings such as home care and residential care, which can bring improvement in the systematic collection of clinical data for audit and for promoting change in practice as well as a way to achieve integrated care planning and continuity of care [37].

Most studies view home care as a better option for older persons with complex care needs, but also a certain level of autonomy. One study [34] even showed that the clinical outcomes at follow-up for people in the community are better when compared with people with the same case-mix in a nursing home. This points out that enhanced community care with case management for frail older people is a good alternative for institutionalization and that this can provide satisfactory outcomes.

This systematic review can help researchers to plan evaluation of interventions in home care. The interRAI HC instrument proves to be a comprehensive tool to measure outcomes and can serve as an evaluation instrument for interventions. It can also be used as an intervention itself, when caregivers use the tool and its outcome measures to implement a care plan.

#### Future Research

This systematic review can be a base for future research into effectiveness of home care interventions because it provides an overview of evaluations of home care interventions for frail older people. It is recommended that researchers find the most suitable design for their evaluation, but it is common in home care that constraints can limit the possibility for randomization. The use of a comprehensive geriatric assessment such as the interRAI HC instrument showed to be an asset because it can measure different dimensions of the whole home care client's situation increasing the possibility for choosing several potential outcome



measures. Future research into home care interventions could focus on the use of this instrument for care planning and as a measurement of quality of care.

#### Limitations

The present study has some limitations that should be considered. Only studies published in English were included, and gray literature was not searched. Furthermore, the current review focused on the interRAI HC instrument and discarded other comprehensive assessment instruments. This choice was based on the knowledge that the interRAI instruments show high validity and reliability and are widely used for evaluation and for care planning in several countries. As a result, other studies not including this instrument were excluded from this review.

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