KCE REPORT 262

Federaal Kenniscentrum voor de Gezondheidszorg
Centre Fédéral d'Expertise des Soins de Santé
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BELRAI SUITE OF INSTRUMENTS: AN EXPLORATORY STUDY ON APPLICABILITY FOR INDIVIDUAL CARE PLANNING AND BUDGET ALLOCATION IN REHABILITATION CARE

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HEALTH SERVICES RESEARCH

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LIST OF ABBREVIATIONS

ABBREVIATION	DEFINITION
AC	Acute Care
ADL	Activities of Daily Living
CAP	Clinical Assessment Protocol
CAR	Centrum voor Ambulante Revalidatie
CMC	Case-Mix Classification
CMI	Case-Mix Index
DRG	Diagnosis Related Group
FIM	Functional Index Measure
FOD	Federale Overheidsdienst
HC	Home Care
IADL	Instrumental Activities of Daily Living
ICF	International Classification of Functioning
INAMI	Institut national d'assurance maladie-invalidité
LTCF	Long Term Care Facility
MDS	Minimum Data Set
NIHDI	National Institute for Health and Disability Insurance
PAC	Post-Acute Care
PC	Palliative Care
PCS	Patient Classification System
QI	Quality Indicator
RAI	Resident Assessment Instrument
RIZIV	Rijksinstituut voor ziekte- en invaliditeitsverzekering
RUG	Resource Utilization Group

SPF	Service Public Fédérale
STRIVE	Staff Time and Resource Intensity Verification
VAZG	Vlaams Agentschap voor Zorg en Gezondheid

SCIENTIFIC REPORT

1 KEY MESSAGES

- There is a need both in the Belgian clinical field of rehabilitation and on the level of the federal and defederated governments for a patient classification system in order to organize care settings for rehabilitation patients and in order to allocate budgets based on patient functional status, rehabilitation needs and care intensity.
- The rehabilitation field is much larger than the competencies transferred to the communities in the 6th State Reform and it is scattered across diverse governmental competencies.
- Many instruments exist to measure multidimensional functional status of patients. Based on scientific comparisons, federal and defederated governments have already taken the decision to implement the interRAI suite of instruments across care settings and anchored this also within the Belgian e-health plan.
- The interRAI suite of instruments is primarily intended as care planning aid, but it can be used for other built-in purposes, such as clinical warning systems, quality measurement, resource utilization registration and indirect purposes, such as reimbursement.
- The interRAI suite of instruments has been subjected to extensive research on validity and reliability across different countries.
- Part of the interRAI suite of instruments has already been translated and adapted to the Belgian situation and has extensively been studied.
- The interRAI suite of instruments covers to a large extent the domains of the International Classification of Functioning (ICF), and matches well with the Functional Independence Measure (FIM).
- The interRAI suite of instruments is applicable to and has been used for individual care planning in the same type of patients as seen in the Belgian (isolated) SP units.
- The interRAI suite of instruments has been used for individual care planning in the same type of patients as seen in the Belgian Centres for ambulant rehabilitation and may be applicable,

although further development seems to be needed. For some rehabilitation groups transferred in the 6th state reform, it is not yet clear which of the currently existing interRAI instruments will be applicable (e.g. deaf children). The applicability of the interRAI suite for these target groups has to be further analysed, and if necessary, additional assessment instruments are to be developed.

- **The Resource Utilization Groups (RUGs) and the case mix index (CMI) based on the interRAI have extensively been studied within and across several countries, mainly for patients in long-term care, home care, or inpatient psychiatry.**
- **The potential of the BelRAI suite of instruments as a budget allocation tool in the Belgian health care context has not yet been examined.**
- **The interRAI suite of instruments and the calculated RUGs have the potential to be used for budget allocation in the Belgian context, but many preparatory steps are needed to implement the instruments in all care settings and to validate scientifically the RUGs in the Belgian context.**
- **The interRAI suite of instruments should not be used primarily nor solely for budget allocation purposes.**
- **The suitability of the interRAI suite of instruments for budget allocation is critically dependent on an adequate ICT environment.**

2 GLOSSARY

InterRAI:
InterRAI (Resident Assessment Instrument) is an international collaborative to improve the quality of life of vulnerable persons through a seamless comprehensive assessment system. (www.interrai.org)
BelRAI:
The Belgian version of the interRAI suite of instruments.
Rehabilitation:
A general health strategy with the aim of enabling persons with health conditions experiencing, or likely to experience, disability to achieve and maintain optimal functioning. This includes the consideration of very different settings or professions who deal with rehabilitation issues. [1]

Nursing facility:
A facility that is primarily engaged in providing skilled nursing care and related services to individuals who require medical or nursing care or rehabilitation services for the rehabilitation of injured, disabled, or sick persons, or on a regular basis, health related care services above the level of custodial care to other than mentally retarded individuals.[2]
Skilled nursing facility:
A facility that is primarily engaged in providing skilled nursing care and related services to individuals who require medical or nursing care or rehabilitation services of injured, disabled, or sick persons.[2]
Resource use:
The measure of the wage-weighted minutes of care used to develop the RUG classification system.[2]
Resource Utilization Group:
A category-based classification system in which nursing facility residents classify into one of 66 or 57 or 47 RUG-IV groups. Residents in each group utilize similar quantities and patterns of resource. Assignment of a resident to a RUG-IV group is based on certain item responses on the MDS 3.0. Medicare Part A uses the 66-group classification.[2]
Case Mix Index:
Weight or numeric score assigned to each Resource Utilization Group (RUG-III, RUG IV) that reflects the relative resources predicted to provide care to a resident. The higher the case mix weight, the greater the resource requirements for the resident.[2]
Case Mix Reimbursement System
A payment system that measures the intensity of care and services required for each resident, and translates these measures into the amount of reimbursement given to the facility for care of a resident. Payment is linked to the intensity of resource use.[2]
Source: https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/NursingHomeQualityInits/MDS30RAIManual.html (2015)[2]

3 INTRODUCTION

Key messages:

- **There is a need both in the Belgian clinical field of rehabilitation and on the level of the federal and the defederated governments for a patient classification system in order to organize care settings for rehabilitation patients and in order to allocate budgets based on patient functional status, rehabilitation needs and care intensity.**
- **Many instruments exist to measure multidimensional functional status of patients. Based on scientific comparisons, federal and defederated governments have already taken the decision to implement the interRAI suite of instruments across care settings and anchored this also within the Belgian e-health plan.**
- **Part of the interRAI suite of instruments has already been translated and adapted to the Belgian situation and has extensively been studied.**
- **The potential of the BelRAI suite of instruments as a budget allocation tool in the Belgian health care context has not yet been examined.**
- **The rehabilitation field is much larger than the competencies transferred to the communities in the 6th State Reform and it is scattered across diverse governmental competencies.**

3.1 Belgian context

A previous KCE-report on musculoskeletal and neurological rehabilitation care services in Belgium reported that a great variety existed in the provision and in the organisation and financing of these care services in Belgium.[3] Recently, the legal organisation of the rehabilitation care services has undergone significant changes. On policy level, the recent **6the State Reform** induced a shift in the landscape of care settings: it was decided to transfer the competencies (and budget) of several health care topics from the federal government to regional communities. From the 1st of July 2014 a certain number of rehabilitation care services (some NIHDI conventions[a] on "long-term care rehabilitation", and the isolated SP categoral hospitals also called "Rehabilitation hospitals") which were formerly funded at the federal level (by the National Health Insurance (NIHDI) by conventions and/or by the FOD/SPF Volksgezondheid/Santé Publique by the Budget Financial Means (BMF)) were transferred[b] to the Communities[4, 5 6, 7] (see Appendix 1 for full list of transferred conventions and transferred isolated SP hospitals)

"Long-term care rehabilitation" was described as « de niet acute of post-acute zorg die op multidisciplinaire wijze wordt verstrekt, ongeacht de instelling waar deze zorgen worden verstrekt in het kader van de interactie ouders-kinderen, in het kader van mentale, sensoriële, verslavings-, stem- en spraakstoornissen, voor hersenverlamden, in het kader van kinderen met respiratoire en neurologische aandoeningen, evenals de niet-acute of post-acute zorg die op multidisciplinaire wijze wordt verstrekt wat betreft motorische stoornissen buiten algemene en universitaire ziekenhuizen en ziekenhuizen waar tegelijkertijd chirurgische en geneeskundige verstrekkingen verricht worden exclusief voor kinderen of voor de behandeling van tumoren.//Les soins non aigus et post-aigus dispensés de façon multidisciplinaire dans le cadre des interactions parents-enfants, dans le cadre des troubles mentaux, sensoriels ou d'assuétude, de la voix et de

a A NIHDI rehabilitation convention is an agreement between the National Institute for Health and Disability Insurance (NIHDI) and a rehabilitation organisation concerning financing of rehabilitation services; different types of convention exist.

b From July 1st 2014 onwards, most of the competencies related to health and health care which so far belonged to the competencies of the Federation Wallonia-Brussels were transferred to the Walloon Region and to the Commission of the French Community of the Region of Brussels-Capital (Commission communautaire française de la Région de Bruxelles-Capitale, Cocof) (http://www.sante.cfwb.be/index.php?id=politique#c7193). In Flandres, the institutions of the region and the community, both under the competency of the Flemish government, have been merged since long (https://www.vlaanderen.be/nl/vlaamse-overheid/organisatie-van-de-vlaamse-overheid/vlaamse-bevoegdheden).

la parole, d'infirmité motrice d'origine cérébrale, pour les enfants atteints d'affections respiratoires et neurologiques, quel que soit l'etablissement où ces soins sont dispensés, ainsi que les soins non aigus ou post-aigus dispensés de façon multidisciplinaire en dehors des hôpitaux généraux, universitaires et hôpitaux où sont effectuées à la fois des prestations chirurgicales et médicales exclusivement pour enfant ou en rapport avec les tumeurs, dans le cadre de troubles moteurs». Specifically it was decided to transfer a series of NIHDI-conventions (see Table 1).

Table 1 – List of transferred NIHDI-conventions

NIHDI convention number starting with	Description	N of involved institutions Source: lists updated on 22/02/16 from www.riziv.be (accessed 24/02/16)			
		Flanders	Wallonia	Brussels	Total
• **770 & 7840:**	Institutions for rehabilitation of people with cerebral palsy	0	3	1	4
• **771:** **(only selection, n=8)**	Institutions for locomotor rehabilitation	4	2	2	8
• **772:**	Psycho-social rehabilitation for adults	12	14	8	34
• **773:**	Addiction care	13	10	6	29
• **7740:**	Children with psychiatric disorders	3	11	3	17
• **7745:**	Functional rehabilitation for parent-children interaction problems	2	0	1	3
• **7746:**	Care for people with autism	3	2	3	8
• **7765:**	Institutions for the rehabilitation of children with respiratory and neurological disorders	1	0	0	1
• **7767:**	Units for respite care	2	0	1	3
• **779:**	Care for people with hearing impairment	0	0	1	1

• **790:**	Services who make multidisciplinary assessments	76	32	12	120
• **953 of 965:**	Centers for ambulant rehabilitation	48	22	9	79
• **969:**	Care for people with visual impairments	4	3	1	8

However, it is important to remark that from a patient point of view, or from a point of view of the total rehabilitation sector that a large part of the rehabilitation care remains under the federal competency. As such all SP-units for rehabilitation situated in acute hospitals (S1- rehabilitation for cardiopulmonary disorders (n=480 beds), S2- musculoskeletal disorders (n=2695 beds), S3-neurological disorders (n=1455 beds), S4-palliative care (n=379 beds), S5-chronic diseases (n=728 beds) and S6-psychogeriatrics (n=1457 beds)[c]) are still a federated matter (with exception of the standardisation ('normering') of those units, which is a defederated matter). Moreover, some typical rehabilitation RIZIV-conventions (e.g. 950 & 951-conventions for musculoskeletal and neurological rehabilitation, some of the 771 conventions for musculoskeletal rehabilitation[d], 7815 conventions for rehabilitation of patients with severe chronic respiratory insufficiency, 7821 conventions for cardiac rehabilitation, 7852 conventions for respiratory support at home) were also not transferred. In Appendix 1.4, an example is given of the institutions that have care capacity for some particular disorders and the competent government is indicated.
In consequence, the rehabilitation field is much larger than currently is transferred to the communities and is scattered across diverse governmental competences.

By the 1st of January 2018 each Community should have chosen a model for the organisation and financing of the rehabilitation services belonging to its own competencies.
The Flemish Community (which submitted the proposal for this research work) aims to set up a streamlined rehabilitation policy with a diversity in provision of rehabilitation services and requested an evidence-based approach to harmonize the current heterogeneous situation in rehabilitation.
The offer of care (and financing) should be developed based on the specific rehabilitations needs of the patients.
The classification of patients in a number of groups according to the care severity/complexity could facilitate a harmonized approach in rehabilitation services.
The organisation and financing by a **patient classification system (PCS**) for the specific category of musculoskeletal and neurological rehabilitation for adults has already been examined in a previous KCE report (2007)[3]. In this report, the authors advised to organize post-acute musculoskeletal and neurological rehabilitation in 3 levels: general, specific and highly specific rehabilitation services, organized in a network. The implementation of this model requires a systematic assessment of patients' rehabilitation needs at certain points in the disease trajectory, and critical is the availability of an

[c] Source FOD Volksgezondheid, Veiligheid van de Voedselketen en Leefmilieu - DG Organisatie Gezondheidszorgvoorzieningen - Dienst Datamanagement, 2013

[d] Not transferred 771-conventions are:

- Centre Neurologique William Lennox, Ottignies
- Centre de réadaptation fonctionnelle Neurologique de l'Hôpital ERASME, Anderlecht
- Les Cliniques universitaires Saint Luc, Service de Médecin Physique et de Rédaptation Cliniques Universitaires Saint-Luc, St.-Lambrechts Woluwe
- U.Z. Gent, Centrum voor Locomotorische en Neurologische Revalidatie, Dienst Motorische revalidatie, Gent
- UZ Leuven, campus Pellenberg, Pellenberg

assessment tool to support patient referral to one of the three levels. Hereto, the KCE studied several existing patient classification systems and advised to choose one and to implement it. They expected that after gathering such data for a few years it would be possible to make calculations suitable for organizing and financing the rehabilitation care for those patients.

Alongside this, several other initiatives regarding patient classification have been set up in Belgium in the past years. E.g., the Flemish Agency for Disabled Persons (VAPH) developed a patient classification instrument based on the care intensity in order to decide who is eligible for financial assistance.[8] But most work has been done on the uniform and comprehensive assessment of functioning of elderly.

Already in 2003, the Federal Ministry of Health called for a study to select a patient classification system that could be applied to the population of elderly across different health care settings.[9-12] The initial studies [13, 14] (the Belgian Interface project) started from the International Classification of Functioning (ICF) as leading perspective to find an instrument that covers well the domains and concepts of the ICF. Based on these two orientation studies [13, 14] it was decided in 2005 to choose the interRAI suite as an instrument that could potentially replace the KATZ-scale to measure care-dependency. This Katz-scale is used for financing purposes in elderly homes. In 2006 an interuniversity research group (KULeuven-ULG Liège) set up "an action plan RAI", to initiate the development of the Belgian version of the interRAI suite, the so-called BelRAI. The decision to choose the interRAI was based on the ability of the tool to assess the individual globally on a functional perspective (ICF), to stimulate interdisciplinary (team) collaboration, to elaborate a care plan, to facilitate a seamless transmission of the patient's information between the different care structures, to enable quality improvement (quality indicators, benchmarking) and its potential for financing.

In subsequent projects following steps towards the implementation of the BelRAI have already been taken and studied[13-57] (i.e. more than 40 scientific publications):

- The translation and adaptation to the Belgian context of several interRAI instruments (BelRAI home care, BelRAI long-term care facilities, BelRAI acute care, BelRAI palliative care).
- The validation of these BelRAI instruments during pilot projects in a selection of Flemish and Walloon care settings (in collaboration with the NIHDI)
- The development of a web application to facilitate the collection and exchange of information in clinical practice
- The development of tablet application to fill out the BelRAI
- The development of a training tool for the care providers
- The development of the BelRAI screener (as a triage system)
- The integration in e-health[e] and the Belgian Commission for the Protection of privacy granted a positive advice for processing the personal data on health status

The BelRAI suite of instruments is currently used in Belgian clinical practice (pilot projects mainly in geriatric care) in several residential care settings, in major home care organisations and 3 university hospitals. By the end of 2015, more than 140.000 assessments had already been done with one of the instruments of the BelRAI suite of instruments.[58]

Very recently the Belgian intergovernmental committee on health care has published three important documents, in which the further use of the BelRAI suite for (individual) care planning and quality monitoring is supported; main decisions in the three documents are:

- to further develop, implement and widen the use of the BelRAI suite of instruments across care settings [12]
- to use the BelRAI suite of instruments within the care for people with a chronic disease [59]
- to extend the use of the BelRAI suite of instruments to all frail persons that are confronted with a complex and multidimensional health care

[e] The Belgian government started in 2008 an e-health platform (https://www.ehealth.fgov.be/nl/over-het-ehealth-platform/missie/het-ehealth-platform) with the aim to support a well-organized electronic service and information exchange for health care providers and organizations and to create all kind of security systems and privacy protection.

problems and to further develop and support the necessary ICT resources for application of the BelRAI [60]

In addition the e-Health action plan states that the utilization of the interRAI instruments (community) mental health modules (+screener), persons with disabilities, children and youth, emergency department screener and post-acute care (rehabilitation) in Belgium need to be studied for further implementation. [61]

The defederated authorities have also opted to implement the BelRAI suite of instruments across all kind of patients and all kind of care settings. Within the development of the Flemish Social Protection ("Vlaamse sociale bescherming") the BelRAI screener has been chosen as screening tool to assess the care needs of the individual and the determination of eligibility for care services.[9-11] Also the French Community has chosen to implement the BelRAI as a dependency measurement within their development of an autonomous care insurance and the setup of a new institute which gathers the defederated competences of health, social protection, disability and family (l'Agence pour une vie de Qualité (L'Agence Wallonne de la Santé, de la Protection sociale, du Handicap et des Familles)). [62]

The German-speaking Community has set up a working group CoBHRA (Common Base register for Healthcare Actors) within the framework of e-health to facilitate the electronic use of the BelRAI.[63]

Overall it can be stated that both the federal and the defederated authorities have chosen for the implementation of the BelRAI suite of instruments for care planning and the organisation of the care services. However, the potential of the BelRAI suite of instruments as a budget allocation tool has not yet been examined.

3.2 Scope of the report

3.2.1 Definition of rehabilitation

A recent paper of the International Society for Physical and Rehabilitation Medicine [1] presents a comprehensive definition of the concept '**rehabilitation**': "*rehabilitation can be thought of as a general health strategy with the aim of enabling persons with health conditions experiencing, or likely to experience, disability to achieve and maintain optimal functioning. This includes the consideration of very different settings or professions who deal with rehabilitation issues*". In the same paper also a conceptual description of **rehabilitation services** is given: "*Rehabilitation services are personal and non-personal intangible products, offered to persons with a health condition experiencing or likely to experience disability or to their informal care-givers, within an organisational setting, in interaction between provider and person, addressing individual functioning needs, that aim at enabling persons to achieve and maintain optimal functioning, considering the integration of other services addressing the individual's needs, including health, social, labour and educational services, and delivered by rehabilitation professionals, or appropriately trained community-based workers*." [1]

This is a very broadly scoped definition; for this report we focused on the rehabilitation of persons admitted to isolated SP-units and to the rehabilitation of persons seen at the Centres for ambulant rehabilitation (CARs) (see next section on Belgian rehabilitation patients and services); hereby we excluded rehabilitation for adult psychiatric disorders and addictions and rehabilitation for other target groups e.g. persons with a visual handicap.

It should be noted that in the scope of this report, **care** refers to all types of services delivered to the patient by all types of staff: nurses, physiotherapists, speech therapists, manual therapists, psychologists, medical doctors, social workers etc.

3.2.2 Belgian rehabilitation patients and services

The sixth state reform induced an artificial split in rehabilitation care services, in which some of these services are now transferred to the Communities and other remain under the funding of the federal government (see introduction). In this report we only looked at the defederated rehabilitation services which include a diverse group of care services (e.g. centres for ambulatory rehabilitation (CARs), psychosocial rehabilitation for adults, care settings for neurological and musculoskeletal rehabilitation, care settings for children with respiratory and neurological disorders, etc) and patients (e.g. autism, addicted persons, persons with hearing/vision impairments, psychiatric disorders in children, etc).

We selected in consensus with the Flemish Agency for Care and Health two main groups of patients (among others on budgetary size):

- the patients treated in Centres for ambulatory rehabilitation (including children) (CARs):

  The main population of the Centres for ambulant rehabilitation (CARs) are children with a mental handicap (IQ<70), complex developmental disorders, autism, or attention deficit disorder (ADHD), and children or adults with hearing disorders. Based on the RIZIV – INAMI data (2012), these five target groups comprise 92.5% of the total CAR population in Flandres, 85.3% in Wallonia, and 94.5% in Brussels (see appendix 1.3). A full list of all target groups and their inclusion criteria can be found on the RIZIV – INAMI website[f], examples of other target groups are e.g. children with acquired brain injuries or cerebral palsy; children with mood disorders or behavioural problems; adults with acquired brain injuries; adults with laryngectomy, glossectomy or specific forms of stutter; adults with schizophrenia or mood disorders.

- the patients treated in the isolated categoral hospitals (Rehabilitation hospitals) [7]:

  The (isolated) SP-units can offer musculoskeletal and neurological rehabilitation, cardio-respiratory rehabilitation, psychogeriatric rehabilitation, rehabilitation for chronic conditions, or palliative care. Some of the isolated SP-units are highly specialized and concentrate on specific diseases as Multiple Sclerosis; some SP-units also admit children.

Other NIHDI conventions for rehabilitation (e.g. adults with an addictive disorder) or target groups defined based on the type of care settings (e.g. respite care) were not considered in this report.

3.2.3 Research questions

During the scoping phase of this project, we looked at the current Belgian situation (see section on Belgian context) and came to the following statements:

- An overall agreement is achieved between all political levels on the applicability of the interRAI/BelRAI suite of instruments for the needs assessment of the individual patient in different care settings, primarily with the aim to support individual patient care planning, but its applicability for the Belgian rehabilitation care services (with its variety in types of care settings and types of patients) is not yet investigated.
- Subsequently to the 6th State reform, there is a demand by the defederated authorities how to allocate the budget for transferred rehabilitation care services.

In line with these statements, the two following research questions were formulated (in consensus with the different stakeholders (see colophon)):

- **Is the interRAI – BelRAI suite of instruments applicable for the assessment of the rehabilitation needs of the individual patients?**
- **Is the interRAI/BelRAI suite of instruments applicable for financing purposes, i.e. the allocation of budget over the different rehabilitation care settings/institutions based on the patients' functioning and his rehabilitation care needs?**

3.3 Methods

We applied a mixed method approach with following elements:

- Consultancy of stakeholders (a broad spectrum of types of care providers, policy makers of all policy levels and their administration, researchers and representatives of the NIHDI) (see colophon for the full list of participants)
- Literature review (combination of searches in literature databases, search in Pubmed with 'related articles'-option and purposefully

f http://www.riziv.fgov.be/nl/themas/kost-terugbetaling/ziekten/mentale-neurologische-stoornissen/Paginas/mentale-stoornissen-gehoor-stem-spraakstoornissen-neurologische-stoornissen-tegemoetkoming-kosten-behandeling-centra-ambula.aspx#.VsC0Bk2D6po

http://www.riziv.fgov.be/fr/themes/cout-remboursement/maladies/troubles-mentaux-neurologiques/Pages/ouie-langage-intervention-couts-centres-reeducation-ambulatoire.aspx#.VsC0H02D6po

searches in Google Scholar and Google advanced options). More details on the methodology behind the literature review can be found in Appendix 3 and Appendix 4.

- Discussion/meetings within several gremia (the Belgian intergovernmental committee on health care, conferences on the BelRAI, working group of the Flemish Agency for Care and Health, NIHDI, FPS Health, working group of rehabilitation physicians)
- Policy decision analysis (applied in the scoping phase and in the formulation of the recommendations)
- Site visits (two rehabilitation centres)
- (informal) consultancy by the LUCAS interRAI – BelRAI research team of KULeuven
- Stakeholder meeting in the end-stage of the project to discuss the results and recommendations (all consulted stakeholders gathered in one meeting)

The final version of the report has been validated by three independent reviewers (see colophon).

4 INTERRAI SUITE OF INSTRUMENTS: APPLICABILITY IN REHABILITATION FOR INDIVIDUAL CARE PLANNING

Key messages

- **The interRAI suite of instruments has been subjected to extensive research on validity and reliability across different countries**
- **The interRAI suite of instruments covers to a large extent the domains of the International Classification of Functioning, Disability and Health (ICF), and matches well with the Functional Independence Measurement (FIM)**
- **The interRAI suite of instruments is applicable to and has been used for individual care planning in the same type of patients as seen in the Belgian (isolated) SP units**
- **The interRAI suite of instruments has been used for individual care planning in the same type of patients as seen in the Belgian Centres for ambulant rehabilitation and may be applicable, although further development seems to be needed. For some rehabilitation groups transferred in the 6th state reform, it is not yet clear which of the currently existing interRAI instruments will be applicable (e.g. deaf children). The applicability of the interRAI suite for these target groups has to be further analysed, and if necessary, additional assessment instruments are to be developed.**

4.1 General information on interRAI suite of instruments

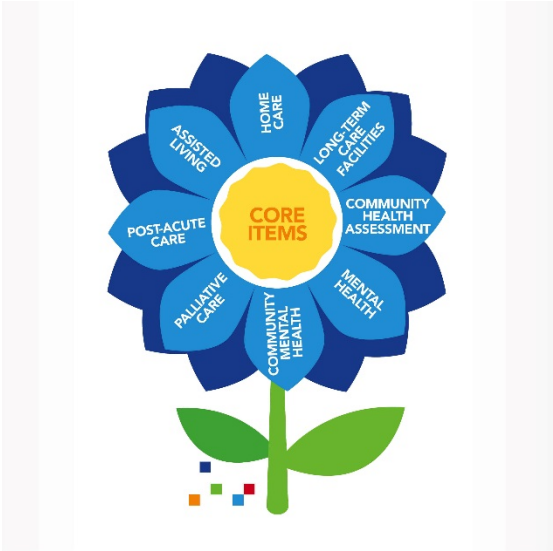
The interRAI suite is not a single instrument but a family/suite of instruments, aimed to support assessment and care planning of persons with chronic illness, frailty, disability, or mental health problems across care settings [64g] (all currently developed instruments are shown in Appendix 2). The instruments have a “core” set of assessment items that are considered

g More information on: http://www.INTERRAI.org/

https://wiki.BELRAI.org/nl/

important in all type of care settings and are designed to work together across care settings. These common items have identical definitions, observation time frames, and scoring. Additional items specific to a particular care population or care setting are then added to the core item set. Currently there are about 20 instruments available for among other acute care (AC), post-acute care (PAC), home care (HC), assisted living (AL), long-term care facilities (LTCF), palliative care (PC), child and youth intellectual/developmental disability (in development), child and youth mental health, pediatric home care, community health assessment (CHA), community mental health (CMH), deafblind, emergency screener for psychiatry, intellectual disability, mental health for correctional facilities and mental health for in-patient psychiatry (see Figure 1 and Figure 2) (full list in Appendix 2).

Figure 1 – Overview of some instruments in the interRAI suite of instruments



Source: Powerpoint presentation Prof. Dr. Declerq (LUCAS, KU Leuven) (http://www.zorgneticuro.be/sites/default/files/general/20160126%20Prof.%20Dr.%20Anja%20Declercq_0.pdf)

The interRAI instrument systems aim to collect information once and use it for many purposes, including clinical decision support, screening algorithms to target priority groups or to identify relative risk of adverse outcomes, monitoring, quality improvement, case-mix classification, manpower planning and resource allocation (see Figure 3).

The interRai suite of instruments is developed and maintained by an international not-for-profit research consortium of about 96 clinicians, researchers and health administrators from 35 countries. It was established in 1992 with a collective vision that "the assembly of accurate clinical information in a common format within and across services sectors and countries enhances both the well-being of frail persons and the efficient and equitable distribution of resources". [64] interRAI instruments have been adopted in several countries around the world (e.g. USA, Canada, Ireland). The instruments are internationally validated (a.o. USA, Canada, Finland, Italy, UK, Belgium etc [49, 50, 53-57, 65-75]), adaptable to multiple care sectors, holistic, client-centered and outcome-oriented. They aim at promoting interdisciplinarity and improving continuity, efficiency and quality of care.

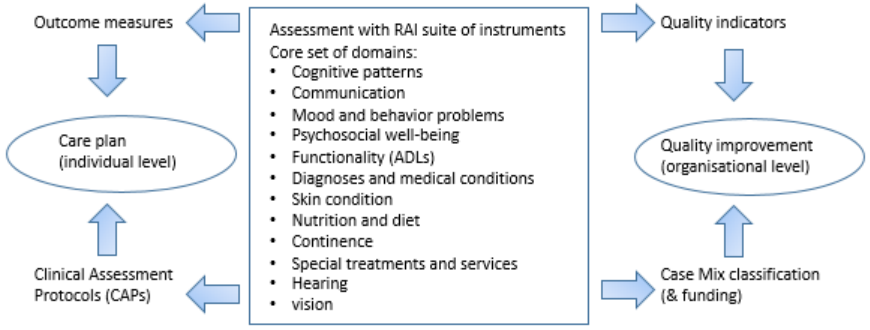
The BelRAI suite of instruments is the Belgian version of the interRAI suite of instruments.

Figure 2 – Overview of the interRAI suite of instruments

InterRAI suite of instruments for adults	InterRAI suite of instruments for children
Acute Care (+ Post-Acute Care supplement)	
Community Health Assessment (+ supplements: Functional, Mental Health, Assisted Living, Deafblind)	
Brief Mental Health Screener Community Mental Health Emergency Screener for Psychiatry Mental Health for Correctional Faciilities Mental Health for In-patient Psychiatry	Child and Youth Mental Health (Adolescent supplement, Developmental Disabilities)
Home Care (+ contact assessment)	Pediatric Home Care
Intellectual Disability	
Long-term Care Facilities	
Palliative Care	
Post-acute Care	
Quality of life (+ wellness)	

Source: http://www.interrai.org/instruments.html

Figure 3 – Overview of the RAI suite of instruments and its applications



Source: figure translated and modified from NedRAI (NedRAI.org)

4.2 interRAI suite of instruments in rehabilitation care

4.2.1 Comparison interRAI suite of instruments versus ICF and FIM

4.2.1.1 interRAI suite of instruments versus ICF

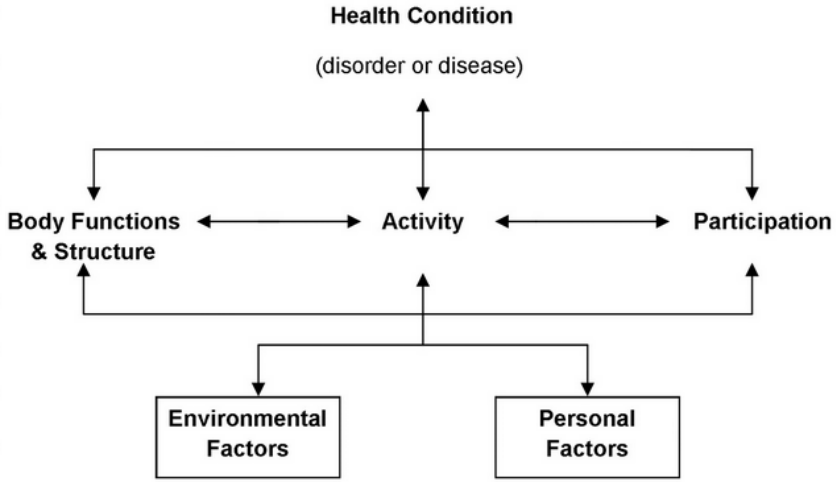
In 2001 the World Health Organization (WHO) introduced the International Classification of Functioning, Disability and Health (ICF) as framework for measuring health and disability at both individual and population levels (http://www.who.int/classifications/icf/en/). It provides a standard language and a conceptual basis for the definition and measurement of health and disability. The aims of the ICF are to:

- provide a scientific basis for understanding and studying health and health-related states, outcomes, determinants, and changes in health status and functioning;
- establish a common language for describing health and health-related states in order to improve communication between different users, such as health care workers, researchers, policy-makers and the public, including people with disabilities;
- permit comparison of data across countries, health care disciplines, services and time; and
- provide a systematic coding scheme for health information systems.

In clinical settings ICF is used for functional status assessment, goal setting and treatment planning and monitoring, as well as outcome measurement.

Globally, the components of the ICF are 'body function' (e.g. functions of the cardiovascular, haematological, immunological and respiratory systems or neuromusculoskeletal and movement-related functions), 'body structure' (e.g. the eye, ear and related structures), 'activities and participation' (e.g. self care or mobility), 'environmental factors' (e.g. support and relationships) and 'personal factors' (e.g. gender, age, profession) (see Figure 4).

Figure 4 – Overview of the different components of the ICF



Source: WHO 2002 (http://www.who.int/classifications/icf/icfbeginnersguide.pdf?ua=1)

The ICF is well-known in many Belgian rehabilitation services; e.g. a working group of Zorgnet Vlaanderen proposed the ICF as starting point to measure patient's functioning and his rehabilitation needs, in order to classify patients and organize rehabilitation services with several echelons.[76, 77] The European Society of Physical and Rehabilitation Medicine aims to generalize the use of ICF among its members (http://www.esprm.net/).

However, there is a plethora of existing instruments that can be applied to measure the multidimensional functioning of the individual patient and for patient classification purposes. Some of these measurement instruments have been converted to ICF codes (e.g. De Vriendt 2011[78]). Several reviews [3, 13, 14, 79-84] have already been performed in which instruments were compared. From all reviews it appeared that there is no single perfect instrument and that each has pro's and cons, also dependent of the purpose for which the instrument is used.

As mentioned above, the rehabilitation experts we consulted during this project, put the question whether interRAI covers well enough the ICF domains and concepts, and especially the concept of participation.

The relationship between ICF and interRAI (home care, long-term care and community health) was analysed in two studies[h] and they came to following conclusions:

- Berg et al. 2009: "Considering all 3-digit ICF codes, interRAI items of the Home Care instrument addressed 43.2% of Body Function and 50.6% of Activities and Participation codes. The conceptual overlap in content, offers an excellent opportunity to operationalize the ICF domains and the codes particularly in the areas of Body Function and Activities and Participation. Use of measures such as the interRAI assessments with common elements across settings facilitates standardized reporting for organizations, regions and nations." [85]. Although 50.6% of the ICF Activity and Participation codes were covered, the authors added that codes not addressed included among other numerous items related to school and work.
- Prodinger 2015: "The linking has shown that except for 6 ICF categories, the 30 ICF categories contained in the ICF Disability Set could be operationalized with items from interRAI assessment instruments. The analysis reveals varying levels of granularity between interRAI and ICF. While certain interRAI items would provide a rather specific way to operationalize ICF categories, other interRAI items serve more as an indicator therefore. In this study, we have disassembled the items contained in the various interRAI assessments to examine whether interRAI can inform the operationalization of the categories contained in the ICF Disability Set. Based on this analysis we have evidence that interRAI is suitable for this purpose. This study provides evidence that in principle items from existing interRAI assessments can be used to operationalize most of the categories contained in the ICF Disability Set. These findings support the comprehensiveness and scope of the interRAI assessments on one

h A search in literature on the comparison between interRAI suite of instruments and the ICF, revealed two studies. No other references were cited by the stakeholders group.

hand, and provide a foundation for further psychometric work toward operationalizing the ICF Disability Set." [86]

In addition, the Belgian Interface-project, commissioned by the Federal Ministry of Health, started with the ICF as leading principle and searched for a suitable patient classification system that could be applied for elderly across different health care settings. It concluded that the interRAI suite of instruments is a valuable option for the multidimensional assessment of patients' function.[13, 14]

From a pragmatic point of view it could be stated that the development of the ICF for organisational or financing purposes is currently in an earlier stage compared to the interRAI. Like the interRAI, the ICF is an instrument that is much more elaborated than the FIM and that can be used across different health care settings. Recently a limited set of ICF categories and environmental factors has been proposed, the ICF Disability Set. It represents the minimal generic set of aspects of functioning in clinical populations for reporting data within and across health conditions, time, clinical settings including rehabilitation, and countries. This set should represent a reference framework for harmonizing existing information on disability across general and clinical populations, or "system-wide".[87].

On the other hand, the important ICF domain of Participation is only partially represented in the interRAI suite (mainly in the assessment system and in the Quality Indicators, but almost absent in the RUGs, personal communication, Anja Declercq).

For children, the main population of the **CARs**, no publications[i] were found that made a direct comparison of the interRAI suite to ICF (or its former version for children and youth, the ICF-CY).

InterRAI suite of instruments versus FIM

Another instrument frequently used in the rehabilitation services is the Functional Independence Measurement (FIM). This is an instrument to measure functional ability of individuals for 18 items across the motor, cognitive and self-care domains. FIM is the most widely accepted functional assessment measure in use in the adult rehabilitation community in Western countries. Based on the FIM, a resource allocation tool for post-acute rehabilitation as prospective payment system has been developed in the US.[3]

This instrument was compared to the interRAI post-acute care by Armstrong et al [88] and they concluded that overall, the interRAI-PAC (post-acute care) was more proficient than the FIM in explaining the variance in rehabilitation outcomes. Also they state that the wider range of items in the PAC has advantages including benefits for more comprehensive assessment, care planning and outcome measurement, and the potential for developing consistent quality indicators and outcome measures. Within the same study population, i.e. Canadian patients in an inpatient rehabilitation setting (average age 78.5 years), Glenny et al concluded that both tools were able to detect improvement, were more responsive in younger patients but had limited ability to discriminate between subjects with higher functional ability. (Glenny & Stolee 2009, Glenny et al 2010, Glenny et al 2012)

The study of Jette et al (2003) included in-as well as outpatients with an average age of 62.7 years in US post acute rehabilitation settings. The results illustrated limitations in the range of content, breadth of coverage and measurement precision in the interRAI MDS data set as well as in the FIM.[89]

Williams et al (1997) described a "cross-walk" between FIM and MDS items for nursing home patients in the USA and demonstrated that patient scores from one instrument could be predicted from the scores of the other one.[90]

For children, the main population of the **CARs**, no publications were found that made a direct comparison of the interRAI suite to commonly used pediatric functional scales, e.g. WeeFIM (Wee Functional Independence Measure).

[i] A search in literature on the comparison between interRAI suite of instruments and the ICF, revealed two studies. No other references were cited by the stakeholders group.

4.2.2 *InterRAI suite of instruments applicable in rehabilitation care patient populations?*

Applicability for individual care planning to the populations found in Belgian rehabilitation care?

With regard to the **Belgian SP rehabilitation care services**, a large variety in types of patients is seen; e.g. in the recent portfolio of the Flemish rehabilitation hospitals [7] it can be seen that they admit among others patients with musculoskeletal deficits, brain injury patients, patients with spinal cord injuries, patients with amputations, stroke patients, cardiopulmonary patients, patients with neurological conditions (as Parkinson's disease, cerebral palsy, ALS, MS), poly-trauma patients, orthopaedic patients etc.

Some (isolated) SP services also look after children with musculoskeletal, neurological or cardiorespiratory disorders, although overall, children are a minority in these services.

Some patient characteristics seen in SP-units are presented in Table 2.

Table 2 – Patient characteristics in SP-units

	SP-units in general hospitals	Isolated SP units
N	32105	9046
Female	62%	60%
Age mean, SD, range	75.6; 12.1; 8-103	70.7; 16.1; 0-102
Male	38%	40%
Age mean, SD, range	70.7; 14.1; 12-101	63.8; 19.1; 0-100

Source: based on MZG-RHM-AZV-SHA data of Technische cel – Cellule technique (TCT; tct.fgov.be); statistics of 2013

To compare it to study populations in which an interRAI instrument has been used, we show below some characteristics of three large studies (see Table 3).

Table 3 – Three large studies in which the interRAI suite of instruments has been used

Studies	N and setting	Age		Female %	Instrument used
CAN strive (CANADA) [72, 91]	Long term care facilities: 2926	< 65	9	70	interRAI LTCF
		65-74	9		
		75-84	33.5		
		85+	48		
	Complex Continuing Care (CCC) hospitals/units: 1510	< 65	22.5	50	
		65-74	15.5		
		75-84	31.4		
		85+	30.5		
	Community Care Access Centres: 21578	mean	75.8	69	interRAI HC
		< 65	18.3		
		65-74	16.9		
		75-84	39.9		
		85+	24.9		

Strive (USA) [92, 93]	10136 (from nursing homes, including in-patient rehabilitation services, skilled nursing facilities, social focus facilities)	79.5	72%	interRAI MDS 3.0
SHELTER (EUROPE) [75]	4156 (nursing homes from 7 countries)	83.4	73%	interRAI LTCF

Our literature review revealed that the interRAI suite of instruments has already been used in typical adult rehabilitation populations such as cerebral palsy patients [94], patients with multiple sclerosis [95], patients in musculoskeletal and geriatric rehabilitation units [88], patients with neurological conditions including Alzheimer's disease, Parkinson's disease, epilepsy, traumatic brain injury, Huntington's disease, MS and amyotrophic lateral sclerosis [96, 97], and in post-acute care patients who were treated for conditions such as knee and hip replacements, fractures, strokes, heart failure and other [90, 98-103]

The age ranges of the populations in these studies are shown in Table 4.

Table 4 – Patient characteristics in retrieved studies (similar to SP-units)

study	Type of patients	Setting	Age	% female	Instrument used
Armstrong 2010 [88]	Patients with musculoskeletal conditions and frail older persons with multiple co-morbidities	Musculoskeletal and geriatric rehabilitation units	Geriatric rehabilitation group: 81.4 (6.7) Musculoskeletal rehabilitation-group: 76.4 (10.2)	65% 67%	interRAI Post-Acute Care
Cary 2015 [103]	Hip fracture patients	Inpatient rehabilitation facilities	81.2 (2.1)	70%	Inpatient Rehabilitation Facility- Patient Assessment Instrument (*not clear to what specific interRAI instrument it relates)
Cheng 2013 [97]	Persons with Dementia, ALS and MS	Home care	Dementia group: 82 ALS group: 63 MS group: 58	Dementia group: 64% ALS group: 54% MS group: 76%	interRai Home Care

Cooper 2013 [94]	Adults with Cerebral Palsy	Home care	18-24 25-44 45-64 64+	17 39 32 12.5	52%	interRAI Home Care
Danila 2014 [96]	Patients with a neurological condition including Alzheimer's disease, Parkinson's disease, epilepsy, traumatic brain injury, multiple sclerosis, cerebral palsy, Huntington's disease, and amyotrophic lateral sclerosis	Nursing homes Home care Complex continuing care Psychiatric hospitals	unclear		unclear	interRAI Home Care interRAI 2.0 interRAI Mental Health
Glenny 2010 [99]	Patients with musculoskeletal conditions and frail older persons with multiple co-morbidities	Musculoskeletal and geriatric rehabilitation units	78.5 (9.3)		67%	interRAI Post-Acute Care
Glenny 2012 [100]	Patients with musculoskeletal conditions and frail older persons with multiple co-morbidities	Musculoskeletal and geriatric rehabilitation units	78.5 (9.3)		67%	interRAI Post-Acute Care
Noyes 2013 [95]	Patients with multiple sclerosis	Skilled nursing facility	unclear		unclear	National minimum data set (*not clear to what specific interRAI instrument it relates)
Raiteri 2009 [101]	Stroke Dementia Other non-specified rehabilitation conditions	Nursing homes Day care	44% above 85		73%	AGED (*not clear to what specific interRAI instrument it relates)

Spector 2011 [102]	Post-acute rehabilitation patients (not further specified)	Skilled nursing homes	unclear	unclear	National minimum data set (*not clear to what specific interRAI instrument it relates)
Williams 1997 [90]	Patients needing rehabilitation after stroke, hip fracture, cardiac diseases, amputation and gastro-intestinal diseases	Nursing homes	80.6 (7.2)	68%	National minimum data set (*not clear to what specific interRAI instrument it relates)

In the literature on the interRAI suite of instruments, we frequently encountered terms as 'intermediate and long term care facilities', or 'post-acute services' and the question is to what extent they include similar patients as seen in the Belgian rehabilitation care services. According to Carpenter et al, 1997[104], nursing homes in the USA accommodate post-acute, rehabilitation and long-stay patients. This statement is also confirmed in a personal communication by Brant Fries (2016): "In the US, a considerable portion of those needing rehabilitation after an acute hospital episode are cared for in nursing homes, and the payment is determined based upon RUG-IV (and formerly, RUG-III)."

In conclusion, we found several studies in which interRAI suite of instruments has been applied in adult patients similar to those in Belgian rehabilitation centers.

As to the children in some of the (isolated) SP services, we refer to the instruments discussed below for the CAR population. Some of these children suffer severe (cardio-) respiratory problems, and it should be studied if the interRAI Pediatric Home Care is sensitive enough to capture all levels of needs of these children, and to differentiate between them.

With regard to the **Belgian Centers for Ambulant Rehabilitation**, we encountered several publications in which one of the interRAI instruments has been used in (ambulant) populations rather similar to the ones in the Belgian CARs [94, 105-112].

Details are given in Table 5.

Table 5 – Patient characteristics in retrieved studies (similar to CARs)

study	Type of patients	Setting	Age Mean (SD)	%female	Instrument used
Cooper 2013 [94]	Adults with cerebral palsy	Community	18-24 17 25-44 39 45-64 32 64+ 12.5	52	interRAI Home Care
Guthrie 2011 [105]	Adults with congenital or acquired deafblindness	Community	40.1 (14.8)	59	interRAI Community Health Assessment with Deafblind Supplement
Guthrie 2013 [106]	Adults with congenital or acquired deafblindness	Community	42.7 (17.8)	48	interRAI Community Health Assessment with Deafblind Supplement
Lynch 2015 [107]	Children and adolescents presenting with a variety of difficulties that include behavioural, psychological, and/or emotional challenges and seen in a tertiary care and other mental health settings	The children were both in-patients (n=146) and out-patients (n=469)			interRAI- Child/Youth Mental Health – Developmental Disability
Martin 2007 [108]	Community-dwelling adults with intellectual disability	Community	38.8 (12.7)	41	interRAI-Intellectual Disability
Phillips 2012 [111]	Children seeking or receiving early and Periodic Screening, Diagnostic, and Treatment	Community	4-8 years old: 29.5% 9-12 years old: 24.4% 13-16 years old: 21.1% 17-20 year old: 25%	42	An instrument (PCAF) built on interRAI home care and interRAI long term care facilities; this instrument does not belong to the interRAI suite but the Pediatric

	Almost one-half of them had an intellectual disability of some type; one-quarter had attention deficit hyperactivity disorder (ADHD); over one-quarter had a seizure disorder				Home Care was built starting from it. PCAF only included ADL and I-ADL items and therefore might not be covering all aspects relevant in CARs
Phillips 2015 [110]	Children seeking or receiving early and Periodic Screening, Diagnostic, and Treatment	Community	Not clear	Not clear	interRAI Pediatric Home Care
Phillips 2015 [109]	Children receiving early and Periodic Screening, Diagnostic, and Treatment	Community	12	42	interRAI Pediatric Home Care
Stewart 2013 [112]	Children and youth with intellectual developmental disorder and mental health issues		Description of instrument	Description of instrument	interRAI Child and Youth Mental Health – Developmental Disabilities

As can be seen in Table 5, the interRAI Child/Youth Mental Health – Developmental Disability, interRAI Pediatric Home Care, and the interRAI Child and Youth Mental Health, have been developed and may be applicable with regard to the children in the CARs population. Likewise, the interRAI Community Mental Health, interRAI Intellectual Disabilities, interRAI Community Health Assessment with Deafblind Supplement have been used in the literature for target groups similar to the adult population in the CARS. So far, the scientific literature in the use of the interRAI for the typical target groups of the CAR, mainly children, remains limited (see Table 5). For babies and children with hearing disorders it is not clear which of the currently existing interRAI instruments will be applicable. According to Dawn Guthrie, the main author of the interRAI Deafblind instrument, this instrument has already successfully been used in children from the age of 10 years onwards (personal communication). Further, it remains to be seen which instrument can be used for the children with complex developmental disorders, e.g. complex language disorders or complex learning disorders. With regard to this, it can be studied whether the Pediatric Home Care (PHC) is applicable. Further, the interRAI collaboration currently is developing the interRAI Education. This is an assessment instrument for the comprehensive identification of difficulties observed in educational settings for children and youth 4-18 years. The EDU will include a focus on mental health issues as well as domains important to assess within the school context, such as learning difficulties, speech and language problems, social

difficulties (e.g., bullying), school engagement, developmental concerns (e. g., fine/gross motor), and strengths and resilience.
In Appendix 2.2 an overview of the Belgian rehabilitation groups linked to the available interRAI instruments is presented.
In conclusion, the development of the interRAI suite for the target population of the CARs is less advanced, and more research capacity will probably be needed to make it ready for use as compared to the instruments already available for the SP-population

Implementation of interRAI suite of instruments in rehabilitation care for organisational purposes
In the USA the interRAI assessment is mandated for inpatient rehabilitation services (in Medicare-Medicaid) and is coupled with care quality control and with the reimbursement system for those facilities [113-115]; also the interRAI assessment is mandated for 'intermediate and long term care facilities' and 'skilled nursing facilities' to which a lot of patients are admitted for rehabilitation purposes. Also in some Canadian provinces the interRAI assessment is mandatory for care settings in which rehabilitation therapy is provided and/or for hospital based continuing care [116-118].
Within the interRAI suite of instruments, a special post-acute care version has been developed; according to the interRAI-collaboration "*The interRAI Post-Acute Care (PAC) is designed to support care in rehabilitation or specialist geriatric units. It is available in a free-standing form or as a supplement to the interRAI Acute Care. When the interRAI Acute Care has been completed in the acute phase of care and a patient subsequently enters a post-acute program, a supplement is completed (PAC supplement). This reduces the need to re-collect a considerable number of observations that are available in the interRAI Acute Care and enhances the coordination of care across the transition. Because the emphasis of care changes at this interface, interRAI has developed a separate set of assessment and care planning tools for post-acute care, as well as a separate set of quality indicators*" (http://www.interrai.org/index.php?id=86)

InterRAI suite of instruments as triage system
In the previous KCE report on the organisation and financing of musculoskeletal and neurological rehabilitation an onset was given for the development of a stratified model with a generic, a specific and a highly specific level, organised in a network. In order to refer the patient to the appropriate level of care, a triage system is needed. This need for a classification system which allows the care planning on an organisational level was formulated by the representatives of the rehabilitation physicians during the stakeholders' consultancy rounds.
Within the interRAI suite of instruments, no information could be found if the instruments were also suitable for the care planning on organisational level (as triage system). Several screening algorithms are developed for care planning on individual level, i.e. the score on the screenings instrument determines of the patient needs a full assessment (e.g. the Brief Mental Health Screener). Two other screening tools are also developed, derived from the interRAI home care: the MAPLe (Method for Assigning Priority Levels) and MI Choice[j]. But no screenings tool, applicable for rehabilitation patients, were found.
An answer on the demand of the physicians for a referral system on organisational level, needs more in-depth analysis of the current organisation of care settings and its provided care services (with a patient classification system) and if the interRAI suite of instruments is suitable for this kind of outcome.

[j] More information can be found on www.interrai.org

5 INTERRAI SUITE OF INSTRUMENTS: APPLICABILITY FOR BUDGET ALLOCATION

This section focuses on the applicability of the interRAI suite of instruments for case-mix classification and reimbursement mechanisms.
For this research question, a systematic literature search was performed (see Appendix 3 and Appendix 4).

Key messages

- **The interRAI suite of instruments is primarily intended as a care planning aid, but it can be used for other built-in purposes, such as clinical warning systems, quality measurement, resource utilization and indirect purposes, such as reimbursement.**
- **The Resource Utilization Groups (RUGs) and the case mix index (CMI) based on the interRAI have extensively been studied within and across several countries, mainly for patients in long-term care, home care, or inpatient psychiatry.**
- **The interRAI suite of instruments and the calculated RUGs have the potential to be used for budget allocation in the Belgian context, but many preparatory steps are needed to implement the instruments in all care settings and to validate scientifically the RUGs in the Belgian context.**
- **The interRAI suite of instruments should not be used primarily nor solely for budget allocation purposes.**
- **The suitability of the interRAI suite of instruments for budget allocation is critically dependent on an adequate ICT environment.**

5.1 Definition and elements of a case mix reimbursement system

5.1.1 General definition

A case mix reimbursement system is a payment system that measures the intensity of care and services required for each resident, and translates these measures into the amount of reimbursement given to the facility for care of a resident. Payment is linked to the intensity of resource use.[2]
Essential elements in the definition are:

- Measures of intensity of care (needs)
- Intensity of resource use
- Algorithms to calculate the case mix of patient groups based on care needs and on resource use
- Decisions and algorithms to translate the case mix groups into an amount of reimbursement

In a **case-mix system** individuals are grouped into categories which reflect the relative costs of services and supports they are likely to use. (www.interrai.org) Not only are the groups more or less homogeneous in their use of resources but these groups make also clinical sense, i.e. meaningful clinical descriptions of the individuals in a group.
Such a system may serve many purposes, such as setting staffing levels, risk adjustment in quality measurement and program evaluation, planning for health system redesign and the comparison of populations within and across programs/regions, but the best known application is for healthcare funding.

5.1.2 *Suitability of interRAI suite of instruments as case-mix reimbursement system*

The essential elements, as mentioned in the general definition of a case-mix reimbursement system, can be retrieved in the interRAI case-mix system[2]:

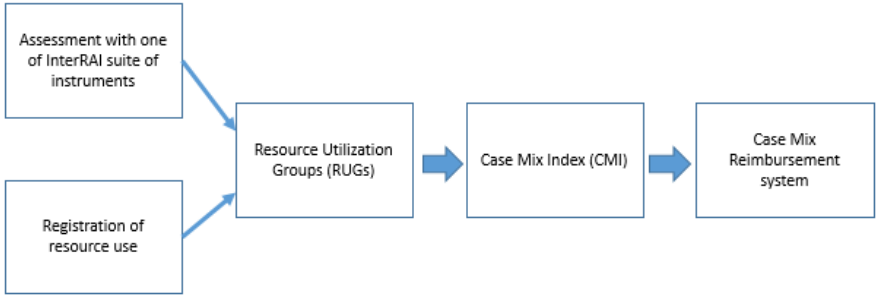
- Measure of intensity of care (needs)
  A subset of assessment items of the interRAI suite of instruments, which consists of resident characteristics (e.g. functional status, diagnosis), and process measures (e.g. intravenous therapy, rehabilitation) is used as clinical input;
- Intensity of resource use
  The resource utilization is determined as the measure of the wage-weighted minutes of care provided to the patient;
- Algorithms to calculate the case mix of patient groups based on care needs and on resource use
  The linkage between the clinical characteristics and the resource utilization leads to the categorization of the patients in **Resource Utilization Groups (RUGs)**, these are groups of patients that utilize similar quantities and patterns of resource (care services);
- Decisions and algorithms to translate the case mix groups into an amount of reimbursement
  The **Case Mix Index (CMI)** is the weight or numeric score assigned to each Resource Utilization Group (RUG-III, RUG IV) that reflects the relative daily resources predicted to provide care to a resident. The higher the case mix weight, the greater the resource requirements for the resident.

Different to the DRG (diagnosis-related groups) systems actually used in hospitals, the interRAI case-mix systems focus on explaining the daily resource use (a per diem system) and the patients' (multidimensional) functional status and major physical conditions are at the basis for explaining the resource use. [119, 120]

The case-mix system itself is not a payment system. The payment system itself may be informed by the case-mix system but other factors are also taken into account (e.g. infrastructure, educational level of staff, materials etc)[91]

In Figure 5 a schematic overview is presented of the different elements in the development of a case mix reimbursement system.

Figure 5 – Schematic overview of the development of a case mix reimbursement system



5.2 Development of the interRAI case mix system

5.2.1 *General process*

For the development of RUGs and CMI, a **large representative patient sample** is needed in which patient (multidimensional) functioning and medical characteristics are measured as well as the care (including all types of health services) they receive (resource use). The two are then statistically analysed by **factor and regression analysis** to see what defining characteristics are for resource use and to classify them into a limited amount of groups that show a comparable amount of resource use. Once these analyses are performed, **algorithms** can be developed to predict resource use and resource use group based on the patient characteristics. Once the algorithms are tested and proved to be good, they can be applied for all future patients and registration of resource use is no longer needed.

The **computations are complex and take many factors into account**; extensive description are available at CMS (USA) and CIHI (Canada).

Current versions of the interRAI case mix systems

Since the development of the interRAI case mix system, several modifications to the system were made. Today, the RUG-III has been validated for patients residing in long-term care facilities or at home, the RUG-IV has only been validated for residents in long-term care facilities and is currently used in the US. In Canada a per diem case-mix model, SCIPP,

has been developed for describing resource use in adult inpatient settings, including acute, long stay, forensic and geriatric psychiatry units.

Regarding **the population in the CARs** (or the children in the SP services), two additional case-mix systems are under development: one for children with intellectual/developmental disabilities (based on the interRAI child and youth intellectual/developmental disability) (personal communication Brant Fries, 29/01/2016) and one for children with significant medical problems[109] (based on the interRAI pediatric home care). Next to the development of paediatric case-mix systems, a case-mix systems is under development for adults with intellectual disabilities (based on the interRAI intellectual disability).

In this section we focused on the RUG case-mix systems, developed for long-term care facilities and home care.

In Appendix 5 an overview of the 8 main RUG-IV LTCF categories is presented with a description of the patient characteristics and with a the subdivision in subgroups based on functional status (ADL-score) and some medical characteristics. The further subdivision on ADL dependency reflect the importance of physical functioning as determinant of resource use.[104]

5.2.2 Registration of the resource use

The resource use is determined by a time registration of all provided care services during a 24hours-period, weighted to the wage of each type of care provider, resulting in a wage-weighted care time. In most studies (found in our literature review) a difference is made between nursing staff time and auxiliary staff time (i.e. care time provided by care providers other than nurses). Time registration was not limited to the direct care time, but also indirect care time (e.g. multidisciplinary discussion on the patient) and even informal care were often taken into account.

Overall could be stated that the majority of the care time was spent by the nursing staff, for example in the study of Fries 1994[121] the nursing home resident received on average 118 minutes of nursing care per day whereas the care time provided by auxiliary staff was only 54.5 minutes per week (an average of 8 minutes per day). In home care patients, the amount of informal care was much higher, indicating the key role of informal carers in ADL and IADL support. Whether a patient lived alone or not, determined also the amount of care time.[121] A slight difference in total care time can be noticed between the countries, but the relative amount of nursing time versus the total care time is similar in all countries. The differences in care time can be explained by differences in care facilities or skill-mix of the care providers.

STRIVE project

Since 1997 a national US study is undertaken on the care time registration in nursing homes (the Staff Time and Resource Intensity Verification (STRIVE) study).[92] Advantages of this kind of study is the large amount of data available to further refine the current RUG system. Analysis of this dataset revealed that, despite the good predictive ability of the RUG-III system, modifications were needed to the RUG-III system, due to the changing nursing care facilities, resulting in the RUG-IV system with 66 groups.

CAN-STRIVE project

A similar study is performed in Canada (the CAN-STRIVE project)[91] in which the resource utilization was determined as the wage-weighted cost of care provided to a resident by nursing staff, rehabilitation staff and other clinical staff. Four types of nursing roles were captured in this study: Registered Nurse (RN), Registered Practical Nurse (RPN), Personal Support Worker (PSW) and health care aide (HCA). Huge heterogeneity of disciplines existed in the clinical staff that carried a 7-day log. The most common types of rehabilitation staff included physical therapist (PT), occupational therapist (OT), speech language pathologist (SLP), and rehab assistants. All the other disciplines were grouped together. This study demonstrates clearly that the time registration studies were not focused on the resource utilization by the nursing staff, but captured the care time provided by different kinds of healthcare professionals.[91]

5.2.3 Validity analysis

The literature review revealed that currently for **the population in the categoral hospitals (SP services)**, the interRAI RUGs have been developed and validated based on patients' assessments with the interRAI home care, interRAI long-term care facilities and interRAI inpatient psychiatry (interRAI MH) (more elaborated description can be found in Appendix 6):

- Long-term care facilities
  The concept of long-term care facility is quite vague between the different countries, resulting in a heterogeneous category of different care services, without a clear differentiation in between them. In the validity studies a variety of patients/care services were found, each defined as care for a patient resident in a long-term care facility: nursing homes, skilled nursing facilities, day care centers, long term care facilities, hospital based continuing care.
  Within the scope of rehabilitation in this report, we specifically looked for studies in rehabilitation services. Some studies were found in which we assumed a similar type of care as in Belgian (SP) rehabilitation services: rehabilitation wards [104], post-acute care [70, 122]
  Examples of countries[k]: Japan[123], Hong Kong[124], Finland[65, 125], Italy[66, 126], UK[127], Czech Republic[122], USA[121], Canada[117]
- Home care
  Only some studies were found on the validation of RUGs in home care setting.
  Examples of countries: USA [128, 129], Canada[72]
- In-patient psychiatric care
  One study was found on the validation of RUGs in in-patient psychiatric care: SCIPP (System for Classification of In-Patient Psychiatry)[130]
  Examples of countries: Canada[130]

With regard to **the patient populations seen in the CARs**, the amount of validity studies is inferior compared to the validity studies in different countries for the adult population in the categoral hospitals:

- Combined vision and hearing impairments: one study [106] was found in adults with combined vision and hearing loss living in the community in which a case-mix funding system was developed based on the community health assessment with the deafblind supplement. No studies were found on the development of a casemix system in children with this kind of impairment.
  Examples of countries: Canada [106]
- Children with chronic health challenges: Phillips 2015developed a case-mix funding system based on the interRAI pediatric home care assessment in children and youth (<21years) with chronic conditions.
  Examples of countries: US [109]

For these instruments it is not clear if they can capture change over time well enough to be useful for budget allocation in the CARs, this remains to be explored in the Belgian validation studies. Indeed, the current CAR reimbursement policy requires a potential for change. However, some other interRAI instruments have already shown to be sensitive to change over time (e.g. LTCF, home care).

To which extent can the resource use be explained by the assessment of multidimensional functional needs?

The link between the multidimensional functional needs assessment and the resource use, can statistically be examined, by measuring the percentage of the variance in resource use explained by the functional status of the patient. This statistical analysis will provide information on the group homogeneity in resource use (the coefficient of variation) and differences among group means. Also the case-mix system should be able to detect the relatively rare heavy care residents.[121]

The present results show that all three RUG-III variants explain about 40% of total resource use in the pooled data. This result is consistent with the US and international research published to date.[91]

A case-mix financing system based on RUGs has also its limitations. The cost calculations are mainly based on the care intensity, i.e. the amount of

[k] More information per country can be found in Appendix 6.

care time spent by the different care providers (and informal caregivers), however other factors, such as non-patient related costs (e.g. infrastructure) are not (or not sufficiently) taken into account in the algorithms of the RUGs and CMI. Another potential risk is the focus on the time registration, which is not always representative for the most appropriate (choice and modalities of) care.

5.3 Implementation of the interRAI case mix reimbursement system

During the final stakeholders meeting the question arose if the countries which performed a validity analysis also implemented the RUG system for resource allocation. We searched for the selected countries (see Appendix 6 for the list of countries) if information was available on their reimbursement policy.

Notwithstanding the good predictive ability of the RUGs shown in several large-scaled studies and countries, not all of these countries have implemented (yet) this kind of case-mix payment system.

Some countries (e.g. Japan[131]) have performed a validity analysis of the RUGs but the implementation of such a financing system has been blocked (temporary) on policy level. Main reason mentioned here was the lack of experience of the care providers in undertaking comprehensive assessments.

Other examples of countries (such as Hong Kong) have implemented the RAI as assessment instrument but not for reimbursement purposes.[132]

The USA and Canada can be considered as two examples of countries that incorporated the RAI assessment and its RUGs in their health policy. However, not all states or provinces apply this casemix system, which might lead to differences between states or provinces on the extent in which the instrument are mandated or are used for reimbursement purposes. Also the recent shift towards the Minimum Data Set 3.0 in which the RAI instruments are now combined with another assessment instrument (OASIS, used in home care) will hamper international comparison of data. Next to regional differences on implementation level and a modified assessment system which combines different assessment instruments, the implementation of the RAI instruments can also depend on the type of care setting. For example the FIM-function-related-groups are often used in in-patient rehabilitation facilities, whereas the interRAI is used for skilled nursing facilities and nursing homes. Currently many states are still in developmental phase of an integrated services delivery system based on a standardized assessment.[133]

Due to this regional and between care settings variety, the USA created in 2014 an instrument on top off to enlarge comparability between different instruments and across settings and reimbursement parties. The Continuity Assessment Record and Evaluation (CARE) [134-140] item set was developed to meet this mandate. Items were selected from the range of existing assessment instruments. The CARE item set is designed to standardize assessment of patients' medical, functional, cognitive, and social support status across acute and post-acute settings, including long-term care hospitals (LTCHs), inpatient rehabilitation facilities (IRFs), skilled nursing facilities (SNFs), and home health agencies (HHAs). The goal was to standardize the items used in each of the existing assessment tools while posing a minimal administrative burden to providers.

Canada is similar to the USA, with different levels of implementation of the interRAI. Some provinces (such as Alberta, Nova Scotia etc) focus more on the purposes of care planning and quality management than on the reimbursement purposes. Only in Ontario, the RUGs for long-term care facilities has been set up. Also the interRAI is often combined with other classifications or case-mix systems for reimbursement, resulting in a complex system with additional administrative burden for the care providers.[141]

Our analysis on the current implementation strategies is quite limited due to the lack of clear information on the current situation in a certain country. For example, it is mentioned that the RAI home care is implemented in different local health agencies in Italy but no clear information was found if these regions also implemented the RUGs for reimbursement purposes.[66, 131] A clear view on the implementation of the RUGs abroad requires a more in-depth analysis per country, which was not the purpose of our report.

5.4 Application of the interRAI case mix reimbursement system in Belgium

5.4.1 Available evidence

Nor the BelRAI-research group nor policy makers and other stakeholders were aware of already existing studies on the applicability of the RUG-III/IV in the Belgian context. No studies were found in our search process in the indexed and grey literature. Due to the lack of studies on the use of the interRAI suite in the Belgian context for budget allocation, it may be concluded that currently there is **no evidence yet that interRAI is suitable to calculate resource utilization groups and reimbursement for the Belgian health care setting**. Therefore, research is needed to examine the suitability of the interRAI for the calculation of Belgian RUGs (see section on the development of a BelRAI case mix reimbursement system).

5.4.2 Preliminary budget allocation and eligibility for services

In the Flemish community, the BelRAI (screener) will be integrated in the Flemish Social Protection ('Vlaamse sociale bescherming') to determine if an individual needs a full assessment and if the person is eligible for additional personal funding, such as additional funding for elderly ('tegemoetkoming hulp aan bejaarden'). This example shows that the BelRAI is not only used as a care planning tool but already some steps are taken in the direction of budget allocation, namely the allocation of additional funding to an individual based on his functional assessment. However, this occurs on individual level and is not yet a type of case-mix budget allocation on the level of the care settings (for which RUGs are needed). This is similar to the budget allocation performed by the VAPH with their own developed assessment instrument (zorgzwaarte-instrument).

In the geriatric care, pilot projects are set up in which the full BelRAI assessment is applied as a decision tool to decide if full geriatric assessment is needed.[31, 32]

5.4.3 Development of a BelRAI case mix reimbursement system

In this section an onset is presented which steps may be needed to examine the applicability of case-mix system in the Belgian rehabilitation sector.

Before a prospective case-mix payment system can be initiated, the two following requirements are needed to implement such a financing mechanism:

- The (further) development and implementation of the BelRAI suite instruments to gather data on patient case-mix
  - The confirmation of the intergovernmental agreement on the development of an implementation plan in all care settings (independently of their funding level) with the primary goal of care planning (for the individual patient)
  - The validation, and if necessary adaptation of the different interRAI instruments for the Belgian context (e.g. interRAI post-acute care)
  - Training and hands-on information for the care providers on the functional assessment instruments
  - Support of ICT in clinical practice and registration of the data in a centralised database
  - An intergovernemental coordination group who will determine the next steps in the implementation of the interRAI suite of instruments
- A validity analysis of the Belgian RUGs and Case-mix Indexes (based on a registration of the resource use)
  - A time registration study of the resource use (including formal and informal care, care time provided by all kinds of health professionals), indicating the wage-weighted staff time as the resource measure.[119] Carpenter 2002[142] reported 3 main approaches to collect data for workload measurement: retrospective task analysis by staff, work sampling of staff by an outside observer and self-reporting by staff.
  - Potential risks in this kind of workload studies are the difficulty to quantify some parts of nurses' tasks (e.g. decision-making), the variations due to environmental factors (can be controlled by using differential care time between residents in the analysis), the provision of several tasks simultaneous, etc.

6 OVERALL DISCUSSION AND CONCLUSION

6.1 Overall discussion

Belgian context

The analysis of the current Belgian situation in rehabilitation care services revealed on political level as well on clinical level a need for a patient classification system (PCS) based on the assessment of the care needs of the patient. Whereas the Belgian clinical field mainly is interested in a PCS for individual care planning and as triage system to different types of care settings, the federal and defederated governments (due to the transferred competencies and budget from the federal government to the defederated authorities within the sixth state reform) are more interested in the organization of care settings and in the allocation of budgets, but both stakeholders are seeking for a patient classification system that is based on patient rehabilitation needs and care intensity.

On political level (federal and defederated levels), a decision has already been taken to implement the interRAI suite of instruments across care settings for patients with a chronic disease. The choice for the interRAI suite of instruments was made based on a scientific comparison of different multidimensional functional assessment instruments. The translation and the adaptation of part of the interRAI suite to the Belgian care settings (the BelRAI suite) has extensively been studied.

The common agreement between all governmental levels to implement the interRAI suite in all care settings is anchored in the Belgian e-health plan.

On a clinical level (namely for musculoskeletal and neurological rehabilitation), it has been proposed to initiate a PCS based on the ICF model. The development of another PCS next to the implementation of the interRAI suite would lead to parallel registration and would increase the administrative burden for the care providers. In order to align both visions on which PCS is the most appropriate for rehabilitation, a comparison was made between the interRAI suite and other multidimensional functional assessment instruments: the interRAI suite of instrument covers to a large extent the domains of the ICF and matches good with the FIM. Further in-depth analysis is needed if additional modules to the existing interRAI instruments are needed to assess the rehabilitation needs of a patient. Ideally this analysis should be based on real data registration of the patients' needs (functional, medical and social) and the provided care.

InterRAI suite of instruments: applicability for organisation of care services and allocation of budgets

The development of the interRAI suite of instruments originated from the USA long term care settings, but is now extended with several instruments applicable in different care settings, but with a common core set of items. For some target groups, specific instruments are still under development. The different instruments of the interRAI suite has been subjected to extensive research on validity and reliability across different countries. In contrast to the ICF which so far is in use for clinical purposes, the interRAI suite of instruments can also be used for other purposes, such as clinical warning system, quality measurement, registration of resource utilization and reimbursement. Although some questions remain whether all aspects of multidimensional patient functioning are fully covered (e.g. the dimension of participation in the society), the interRAI suite is a powerful instrument that has the advantage to assess the functional care needs of the individual resulting in an interdisciplinary and multidimensional care plan be and to be applicable across the different care settings, which will facilitate the collaboration.

In this report we mainly focused on the validity of the RUGs and its use for budget allocation. The validity and robustness of the RUG system as a case-mix payment system has been demonstrated in several countries and different care settings, mainly for long-term care facilities, home care and inpatient psychiatry. For some other target groups RUGs are currently under development.

Therefore the interRAI suite of instruments and the calculated RUGs have the potential to be used for budget allocation in the Belgian context, but many efforts have to be done before to implement the instruments in all care settings and to validate scientifically the RUGs in the Belgian context. This process will take years and health care providers and organizations will need extensive support from the governments in doing so; support is needed on the education level and financial level. Also an adequate ICT-system is a conditione sine qua non for a successful implementation of interRAI suite

and to make them applicable for reimbursement purposes. All patient assessments performed with one the interRAI instruments are stored centrally within the interRAI collaboration, and available for all participators for scientific purposes, allowing benchmarking between organizations and countries. The large central database of interRAI data makes the development of Belgian RUGs much easier than a development de novo with a new instrument.

Potential risks

RUGs:

- A major risk of using a patient classification system initially or solely for financial purposes is to miss its benefits for clinical use. An example of such a misuse of an assessment instrument is the requierement to obtain a certain score on the Katz-scale in order to receive additional financing for nursing care. In this case, the application of the instrument is limited to financial purposes, which increased the administrative burden without facilitating care planning.
- Although the majority of costs related to care are input for a case-mix system, some other costs, which are not included in the determination of the RUGs (e.g. facility costs), should also be taken into account in a payment system.[121] The RUGs casemix does not account completely for all the variation in actual costs of care for postacute patients in Nursing Homes[102]
- The system of calculation of RUGs is based on resource utilisation. This can be, but is not necessarily the most appropriate or evidence-based care.
- Several publications demonstrated the validity of the RUGs in different care settings and in different countries, but the actual overall implementation of such a case-mix reimbursement system is still lacking. The leading countries are Canada and the USA, although also in these countries regional differences in implementation rate exist and modified versions of the interRAI suite of instruments are applied. Other countries, such as Japan, has examined the validity of RUGs in Japanese care settings, but the reliability of these RUGs in clinical practice was much less due to lack of familiarity to perform assessments in patients.

Rehabilitation:

- In the retrieved studies, it was not always clear what kind of care services to what type of patients were provided in the different mentioned care settings (for example can a skilled nursing facility considered as the Belgian interpretation of a rehabilitation service?). Some of these patients are in that type of facilities for rehabilitation purposes.
- The sixth state reform resulted in a scattered landscape of care settings with a mixed funding (by federal or defederated level). The implementation of the BelRAI suite of instruments and its potential use for budget allocation requires a strong consensus between all policy levels.
- Up to now the aspect of participation has not yet been fully developed in the interRAI suite. Nevertheless, this is a very important aspect in rehabilitation, and especially when developing Belgian RUGs, efforts should be made to verify if all relevant aspects related to participation are taken into consideration.

Developmental process behind this report

A major limitation of this report is the restricted analysis of applicability of the interRAI suite of instruments in Belgian care settings. Due to the lack of access to data on patient profiles and on resource use, no quantitative analysis on the RUGs and CMIs could be performed. This exploratory study is restricted to an overview of the validity studies abroad and an onset of research steps needed to validate the RUGs for Belgian care settings.

6.2 Conclusions

In conclusion could be stated that the retrieved studies show that the interRAI suite of instruments has been applied as a **multidimensional assessment instrument** in populations similar to the Belgian rehabilitation patients in the specialised rehabilitation services (Sp services) and in the CARs. In the majority of these studies the patients were assessed with the interRAI home care and the interRAI long-term care facilities instruments. Further analysis of the interRAI post-acute care is needed to determine the added value of this instrument for the rehabilitation patients. Other specific topics, such as participation, more specific measure scales per item need further analysis, in collaboration with the Belgian rehabilitation field.

Specifically for children, more research work is needed on the development of specific instruments for specific groups (e.g. deaf children).
Several conditions for the **implementation** of the BelRAI in the different care domains, are already mentioned in several policy documents, such as the common declaration of Belgian intergovernmental committee on health care (Volksgezondheid 2015), which formulated the following 12 action points:

- Elaboration of the BelRAI suite of instruments
  - Elaboration of the BelRAI with the BelRAI screener and implementation of the current existing BelRAI instruments (HC, LTCF, AC and PC) for all frail persons (after positive result with the BelRAI screener)
  - Analysis of the relevance of the development and implementation of the InterRAI mental health and community mental health
  - Analysis of the relevance of the development and implementation of the modules “persons with a handicap”, “children and youth”, “post-acute care”, “emergency department care”, “rehabilitation”
- Optimalisation of the BelRAI insturments with the collaboration of a user group
- Embedding the implementation of the BelRAI suite of instruments in policy documents of federal and defederated authorities
- Support for the training on the implementation of the BelRAI suite of instruments in clinical practice
- Set up of an communication plan in which all stakeholders are gathered
- Further development of the ICT structure (BelRAI integration cookbook)
- Support for the e-health policy in coordination with the porgram mannager ehealth
- Stimulation of the integration in professional software programs
- Implementation of an application architecture (in software)
- Set up of a project team for the operational management of the project
- Development of a common agreement (“protocolakkoord/protocol d’accord”) between the different policy levels on the organisation of the BelRAI
- A new agreement with the InterRAI organisation

As already mentioned, for children, primarly more research is needed on the development of specific interRAI instruments before the adapation and implementation in the Belgian context.

The research on the **applicability of the RUGs** showed that this kind of case-mix financing system has been validated and applied to a variety of patients and settings in several countries. Before such a budget allocation tool can be implemented in the Belgian (rehabilitation) system, a long way is to go both on clinical level (implementation of the BelRAI suite of instruments in clinical practice) as on research level (further development of the BelRAI suite of instruments and research on resource utilization).
In both synthesis (summaries in Dutch and French) a list of **recommendations** are formulated by the researchers on how the findings of this exploratory study could be translated into action points for the (near and longterm) future.

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APPENDICES

APPENDIX 1. DEFEDERATED REHABILITATION CARE SERVICES

Appendix 1.1. Full list of defederated NIHDI conventions

Source: lists updated on 22/02/16 from www.riziv.be (accessed 24/02/16)

NIHDI-convention group	NIHDI-convention number	Institution	MUNICIPALITY	FLANDERS	WALLONIE	BRUSSEL	TOTAL
770 & 7840 INSTITUTIONS FOR REHABILITATION OF PEOPLE WITH CEREBRAL PALSY				0	3	1	4
Flanders							
Wallonie							
770	77000281	Centre Arthur Regniers	BIENNE-LEZ-HAPPART				
784	78403417	A.S.B.L. Cothan, Unité de Rééducation Fonctionnelle	GOSSELIES				
784	78403318	Centre pour Infirmes Moteurs Cérébraux de la Citadelle	LIEGE				
Brussel							
784	78400348	A.S.B.L. Centre Belge d'Education Thérapeutique pour infirmes moteurs cérébraux (C.B.I.M.C.)	BRUXELLES (ETTERBEEK)				
771 INSTITUTIONS FOR LOCOMOTOR REHABILITATION				4	2	2	8
Flanders							
771	77101142	Nationaal Multiple Sclerose Centrum	MELSBROEK				

771	77101835	Ziekenhuis Inkendaal	VLEZENBEEK
771	77102033	NAH-revalidatiecentrum VZW KMSL	TURNHOUT
771	77102330	Transmuraal MS-team (TMST) Melsbroek	MELSBROEK
Wallonie			
771	77101439	A.S.B.L. Centre Neurologique et de Réadaptation Fonctionnelle	FRAITURE
771	77101538	A.S.B.L. Le Ressort Centre de jour de réadaptation fonctionnelle cognitive pour adultes traumatisés crâniens graves	MAZY
Brussel			
771	77100251	Centre de Traumatologie et de Réadaptation	BRUSSEL
771	77101736	A.S.B.L. La Braise Centre de jour de Réadaptation fonctionnelle pour traumatisés crâniens graves	BRUSSEL

772	**PSYCHO-SOCIAL REHABILITATION FOR ADULTS**		12	14	8	34
Flanders						
772	77201112	Tsedek V.Z.W.	EKEREN (ANTWERPEN)			
772	77202003	Inghelburch	BRUGGE			
772	77202694	Revalidatiecentrum "Hasselt"	MAASMECHELEN			
772	77202793	V.Z.W. Validag	LOMMEL			
772	77202991	De Evenaar	ANTWERPEN			
772	77203189	Walden	BIERBEEK			
772	77203288	De nieuwe horizon	MELLE			
772	77203387	‘t Kader	GEEL			
772	77203684	Centrum voor psychische revalidatie Hedera	IEPER			

772	77203783	Psychosociaal revalidatiecentrum "De Mare"	KORTRIJK
772	77203882	RC de Keerkring	MORTSEL
772	77204278	Revalidatiecentrum TOV in Roeselare	ROESELARE
Wallonie			
772	77201805	La Traversière	NIVELLES
772	77202892	La Fabrique du Pré	NIVELLES
772	77201904	Centre de Rééducation Psycho-sociale "Laurent Marechal"	MOUSCRON
772	77202496	Le Cap	TOURNAI
772	77203585	Impulso	MONS
772	77203981	Centre de rééducation fonctionnelle "ALBA"	LA LOUVIÈRE
772	77201607	L'Ancre	OUPEYE
772	77202102	L'intervalle	VOTTEM
772	77202201	A.S.B.L. Club Andre Baillon	LIÈGE
772	77202397	Association Interrégionale de Guidance et de Santé A.S.B.L. C.R.F. d'EBEN-EMAEL	VOTTEM
772	77202595	Association Interrégionale de Guidance et de Santé A.S.B.L. C.R.F. de BEYNE-HEUSAY	VOTTEM
772	77204080	Centre de Rééducation Socio-professionnelle de l'Est	VERVIERS
772	77203090	Centre de Réhabilitation Psychosomatique de Jour de Mont-Godinne	YVOIR
772	77203486	La Charnière	DAVE
Brussel			
772	77200320	Le Canevas	ELSENE
772	77200320	Section externat de l'Equipe	ANDERLECHT
772	77200419	Le foyer	ANDERLECHT

772	77200518	Le Gué	ST-LAMBRECHTS WOLUWE				
772	77200716	Centre Psychothérapeutique de Nuit	LAKEN				
772	77200815	Centre Psychothérapeutique de Jour	ST-LAMBRECHTS WOLUWE				
772	77200914	Club Antonin Artaud	BRUSSEL				
772	77201706	A.S.B.L. Wolvendael	UKKEL				
773	**ADDICTION CARE**			13	10	6	29
Flanders							
773	77300783	Antwerps Drug Interventie Centrum (A.D.I.C.) V.Z.W.	ANTWERPEN				
773	77300882	De Sleutel internaatsafdelingen	MERELBEKE				
773	77300981	Katarsis vzw	GENK				
773	77301179	Kompas	KORTRIJK				
773	77301476	De Kiem	GAVERE				
773	77301575	Dagcentra De Sleutel Antwerpen-Mechelen-Gent-Brugge	ANTWERPEN				
773	77302070	De Spiegel	KESSEL-LO (LEUVEN)				
773	77302169	MSOC-Gent	GENT				
773	77302268	MSOC Free Clinic	ANTWERPEN				
773	77302367	MSOC Limburg	GENK				
773	77303060	MSOC-Oostende	OOSTENDE				
773	77303258	MSOC Vlaams Brabant	LEUVEN				
773	77303456	Residentieel kortdurend jongerenprogramma van De Sleutel	GENT				

Wallonie			
773	77301080	A.S.B.L. L'Espérance	HAINE SAINT PAUL
773	77301278	A.S.B.L. Trempoline	CHATELET
773	77301674	Allises/Ellipse	CARNIÈRES
773	77301872	Transition	GILLY
773	77302466	Diapason	CHARLEROI
773	77302961	A.S.B.L. PARENTHESE Maison d'accueil socio-sanitaire pour toxicomanes	MONS
773	77300486	Les Hautes Fagnes a.s.b.l.	MALMEDY
773	773013770	CLEAN	BRESSOUX
773	77302763	Projet Start	LIÈGE
773	77303357	A.S.B.L. PHENIX	JAMBES
Brussel			
773	77300288	A.S.B.L. Centre L'Orée	UKKEL
773	77300585	A.S.B.L. Projet Lama	ELSENE
773	77300684	A.S.B.L. Centre Médical "Enaden"	ST.-GILLIS
773	77301971	C.A.T.S.	VORST
773	77302565	La Pièce	ANDERLECHT
773	77303159	M.A.S.S. de Bruxelles	BRUSSEL

7740	**CHILDREN WITH PSYCHIATRIC DISORDERS**		3	11	3	17
Flanders						
7740	77400357	De Appelboom V.Z.W.	GENK			

7740	77400456	De Dauw V.Z.W.	WORTEGEM-PETEGEM
7740	77401743	V.Z.W. Centrum voor Ontwikkelingstherapie (C.O.T.)	ROESELARE
Wallonie			
7740	77400258	La Petite Maison	CHASTRE-VILLEROUX-BLANMONT
7740	77401248	A.S.B.L. Antenne 110	GENVAL
7740	77402040	ASBL Le Chat Botté	INCOURT
7740	77400951	CORTO A.S.B.L.	MONT-SUR-MARCHIENNE
7740	77401347	A.S.B.L. Feux Follets	WANGENIES
7740	77401842	Centre Psychothérapeutique de Jour Charles-Albert FRERE – GHdC asbl	MARCINELLE
7740	77400555	La Manivelle	LIÈGE
7740	77401050	La Ferme du Soleil	SOUMAGNE
7740	77401644	La Coursive	LIÈGE
7740	77401149	Les Goélands	SPY
7740	77401941	Le Creuset - Centre thérapeutique pour enfants et adolescents	SORINNES
Brussel			
7740	77400159	Parhélie a.s.b.l. Centre de psychiatrie pour enfants et adolescents	UKKEL
7740	77401446	A.S.B.L. Lui et Nous	ST.-PIETERS WOLUWE
7740	77401545	A.S.B.L. Cliniques Universitaires Saint-Luc Centre thérapeutique pour adolescents	ST.-LAMBRECHTS WOLUWE

7745	**FUNCTIONAL REHABILITATION FOR PARENT-CHILDREN INTERACTION PROBLEMS**	2	0	1	3

Flanders							
7745	77450342	Vzw Emmaüs Psychiatrisch Ziekenhuis Bethaniënhuis	ZOERSEL				
7745	77450441	PZ Sint-Camillus	SINT-DENIJS-WESTREM				
Wallonie							
Brussel							
7745	77450144	La Lice ASBL	ETTERBEEK				
7746	**CARE FOR PEOPLE WITH AUTISM**			3	2	3	8
Flanders							
7746	77460141	Expertisecentrum voor Autismespectrumstoornissen UZLeuven	LEUVEN				
7746	77460438	Referentiecentrum Autismespectrumstoornissen Antwerpen	ANTWERPEN				
7746	77460537	Referentiecentrum Autismespectrumstoornissen Gent	GENT				
Wallonie							
7746	77460240	Centre de référence en autisme Jean-Charles Salmon	MONS				
7746	77460735	Centre de Référence Autisme de Liège	LIÈGE				
Brussel							
7746	77460339	Centre de référence des troubles du spectre autistique des Cliniques universitaires Saint-Luc	ST-LAMBRECHTS WOLUWE				
7746	77460636	Universitair Ziekenhuis Brussel Campus AZ VUB Campus ZH Inkendaal	BRUSSEL (JETTE)				
7746	77460834	Centre de référence de l'HUDERF pour la prise en charge des troubles autistiques	LAKEN				

7765 INSTITUTIONS FOR THE REHABILITATION OF CHILDREN WITH RESPIRATORY AND NEUROLOGICAL DISORDERS				1	0	0	1
Flanders							
7765	77650280	Revalidatiecentrum voor Kinderen en Jongeren	ZANDHOVEN				
Wallonie							
Brussel							
7767 UNITS FOR RESPITE CARE				2	0	1	3
Flanders							
7767	77670274	VZW Villa Rozerood Respijteenheid Villa Rozerood	DE PANNE				
7767	77670373	VZW Revalidatiecentrum Pulderbos Respijteenheid Limmerik	ZANDHOVEN				
Wallonie							
Brussel							
7767	77670175	ASBL Maison de Répit de Bruxelles-Capitale L'unité des soins de répit "Villa Indigo"	EVERE				
779 CARE FOR PEOPLE WITH HEARING IMPAIRMENT				0	0	1	1
Flanders							
Wallonie							
Brussel							
779	77900106	Comprendre et Parler A.S.B.L.	ST LAMBRECHTS WOLUWE				
790 SERVICES WHO MAKE MULTIDISCIPLINARY ASSESSMENTS				76	32	12	120

Flanders			
790	79005411	MPI Sint-Lodewijk	WETTEREN
790	79005510	MPI Sint-Jozef	ANTWERPEN
790	79005609	Dominiek Savio Instituut	GITS
790	79005708	MPI Ten Dries	LANDEGEM
790	79000263	A.Z. ST.-BLASIUS	DENDERMONDE
790	79000362	STEDELIJK ZIEKENHUIS	ROESELARE
790	79000461	ZIEKENHUIS INKENDAAL	VLEZENBEEK
790	79000560	AZ ST-LUCAS & VOLKSKLINIEK	GENT
790	79000758	AZ ST. AUGUSTINUS	WILRIJK (ANTWERPEN)
790	79000857	ZIEKENHUIS MAAS EN KEMPEN	MAASEIK
790	79000956	REGIONAAL ZIEKENHUIS JAN YPERMAN	IEPER
790	79001055	IMELDAZIEKENHUIS	BONHEIDEN
790	79001253	ZNA Jan Palfijn	MERKSEM (ANTWERPEN)
790	79001451	Revalidatie-, woon- en zorgcentrum "DE MICK"	BRASSCHAAT
790	79001550	U.Z. GENT	GENT
790	79001847	H. HARTZIEKENHUIS	LIER
790	79002045	A.Z. JAN PALFIJN	GENT
790	79002243	ALGEMEEN STEDELIJK ZIEKENHUIS	AALST
790	79002342	A.Z. MARIA MIDDELARES - ST JOZEF	GENT
790	79002441	KONINGIN ELISABETH INSTITUUT	OOSTDUINKERKE
790	79002540	REVALIDATIEZIEKENHUIS REVARTE	EDEGEM

790	79002639	ST. JOZEFKLINIEK	IZEGEM
790	79002738	vzw A.Z. ST. ELISABETH	HERENTALS
790	79002837	REGIONAAL ZIEKENHUIS H. HART	LEUVEN
790	79002936	AZ Sint-Augustinus	VEURNE
790	79003035	REGIONAAL ZIEKENHUIS St. - MARIA	HALLE
790	79003134	ZIEKENHUIS H. SERRUYS	OOSTENDE
790	79003233	ALGEMEEN ZIEKENHUIS OUDENAARDE	OUDENAARDE
790	79003332	ZNA Stuivenberg	ANTWERPEN
790	79003431	ST. REMBERTZIEKENHUIS	TORHOUT
790	79003530	KLINA	BRASSCHAAT
790	79003629	ACADEMISCHE ZIEKENHUIZEN K.U.L.	LEUVEN
790	79003728	REGIONAAL ZIEKENHUIS ST TRUDO	SINT-TRUIDEN
790	79004223	AZ SALVATOR - ST.-URSULA	HASSELT
790	79004421	AZ GROENINGE Campus Maria's Voorzienigheid	KORTRIJK
790	79004619	A.Z. VESALIUS	TONGEREN
790	79004916	ST. FRANCISCUSZIEKENHUIS	HEUSDEN-ZOLDER
790	79005015	AZ GROENINGE Campus O.L.-Vrouw	KORTRIJK
790	79005312	A.Z. H. HART	TIENEN
790	79005510	MPI St Jozef	ANTWERPEN
790	79005609	Dominiek Savio Instituut	GITS
790	79005708	MPI Ten Dries	LANDEGEM
790	79006005	AZ Monica - APRA revalidatiecentrum	ANTWERPEN
790	79010161	BZIO - Bundeling ZorgInitiatieven Oostende vzw Revalidatiecentrum	OOSTENDE

790	79010260	A.Z. Sint-Jan Brugge-Oostende Campus St. Jan Revalidatiecentrum	BRUGGE
790	79011151	A.Z. Sint-Lucas Brugge Dienst voor Revalidatie Dienst motorische revalidatie	BRUGGE
790	79011547	AZ St Maarten	DUFFEL
790	79011646	H. Hartziekenhuis Roeselare - Menen Campus Wilgenstraat Dienst voor Fysische Geneeskunde - Revalidatie	ROESELARE
790	79011745	A.Z. DAMIAAN VZW Revalidatiecentrum - Campus H. Hart	OOSTENDE
790	79011943	A.Z. Sint-Elisabeth Revalidatiecentrum Dienst motorische revalidatie	ZOTTEGEM
790	79012042	A.Z. ZNA Middelheim Revalidatiecentrum	ANTWERPEN
790	79012339	Jessa Ziekenhuis Dienst Fysische Geneeskunde en Revalidatie	HERK DE STAD
790	79012438	A.Z. Sint-Dimpna Algemeen Revalidatiecentrum	GEEL
790	79012537	Ziekenhuis Oost-Limburg Campus Sint-Barbara revalidatiecentrum	LANAKEN
790	79012735	Onze-Lieve-Vrouwziekenhuis Campus Aalst Revalidatiecentrum	AALST
790	79012834	Revalidatiecentrum voor kinderen - Gasthuisberg	LEUVEN
790	79012933	A.Z. Glorieux Locomotorisch revalidatiecentrum	RONSE
790	79013032	AZ Turnhout Centrum voor motorische en functionele revalidatie	TURNHOUT
790	79013131	AZ GROENINGE Campus St.-Niklaas, Campus St.-Maarten, Campus Maria's Voorzienigheid en Campus OLV Revalidatiecentrum	KORTRIJK
790	79013230	AZ Alma	SIJSELE
790	79013329	Campus Gasthuisberg Dienst motorische revalidatie	LEUVEN
790	79013428	Universitaire Ziekenhuizen K.U.L. Campus Sint – Barbara Dienst motorische revalidatie	PELLENBERG
790	79013527	U.Z. Antwerpen Centrum voor motorische revalidatie	EDEGEM
790	79013626	Revalidatie & MS Centrum	OVERPELT
790	79013824	Sint-Andriesziekenhuis Dienst voor functionele revalidatie	TIELT

790	79013923	AZ Zeno	KNOKKE-HEIST
790	79014022	A.Z. Maria Middelares Campus Maria Middelares Revalidatiecentrum Dienst motorische revalidatie	GENT
790	79014220	AZ Turnhout Campus Sint-Elisabeth Dienst motorische revalidatie	TURNHOUT
790	79014319	A.Z. NIKOLAAS	SINT NIKLAAS
790	79014517	AZ Alma	EEKLO
790	79020257	U.Z. Leuven Campus Gasthuisberg Neuromusculair referentiecentrum	LEUVEN
790	79020455	U.Z. Gent Referentiecentrum voor musculaire aandoeningen	GENT
790	79020950	Nationaal Multiple Sclerose Centrum	MELSBROEK
790	79021049	U.Z. Gent Centrum voor Locomotorische en Neurologische Revalidatie Dienst motorische revalidatie	GENT
790	79020653	U.Z. Antwerpen Neuromusculair referentiecentrum	EDEGEM
790	79021544	Pulderbos Revalidatiecentrum voor Kinderen en Jongeren Neurologische-en Respiratoire Afdeling	ZANDHOVEN
Wallonie			
790	79001649	SILVA medical Site Clinique Docteur Derscheid	WAVRE
790	79011844	Clinique Saint-Pierre Service de Réadaptation et Médecine Physique et Rhumatologie	OTTIGNIES
790	79021247	C.H. Neurologique William Lennox	OTTIGNIES
790	79001352	CENTRE HOSPITALIER DE MOUSCRON Service médecine physique	MOUSCRON
790	79002144	CHU Ambroise Paré Service de Médecine Physique et Réadaptation	MONS
790	79003827	CLINIQUE NOTRE DAME DE GRACE Service de médecine physique et réadaptation	GOSSELIES
790	79004322	C.H.R. ST JOSEPH WARQUIGNIES Service de médecine physique	MONS
790	79004520	Centre Hospitalier de Wallonie picarde	TOURNAI

790	79004817	Policlinique Neutre de Charleroi Service de Médecine Physique et Réadaptation	CHARLEROI
790	79005213	CENTRE HOSPITALIER UNIVERSITAIRE DE TIVOLI Service de médecine physique	LA LOUVIÈRE
790	79005807	Centre Arthur Regniers	BIENNE LEZ HAPPART
790	79010359	Centre Hospitalier de Jolimont – Lobbes (site de Jolimont) Centre de Réadaptation Fonctionnelle et Rheumatologie	HAINE ST PAUL
790	79010458	Grand Hôpital de Charleroi Site I.M.T.R. Service de Réadaptation	LOVERVAL
790	79010755	Grand Hôpital de Charleroi Site Reine Fabiola	MONTIGNIES-SUR-SAMBRE
790	79010854	Centre Hospitalier EpiCURA Centre de Réadaptation Fonctionnelle	BAUDOUR
790	79010953	C.H.U. André Vésale Hôpital L. de Vinci	MONTIGNY-LE-TILLEUL
790	79011448	C.H.U. de Charleroi Hôpital Civil	CHARLEROI
790	79001946	CLINIQUE DE L'IPAL Service de médecine physique	LIÈGE
790	79010557	C.H.C. Clinique de l'Espérance Service de médecine de l'appareil locomoteur Service de Réadaptation	MONTEGNEE
790	79010656	C.H. Peltzer- La Tourelle Site Peltzer Centre de Réadaptation Fonctionnelle	VERVIERS
790	79011250	CHR de la Citadelle	HERSTAL
790	79014121	C.H.U. de Liège Site du Sart Tilman Service de Médecine physique et Réadaptation Domaine	LIÈGE
790	79014418	C.H. du Bois de l'Abbaye et de Hesbaye Site de Seraing Service de médecine physique et de réadaptation fonctionnelle	SERAING
790	79020554	Centre Liégeois pour les Maladies Neuromusculaires Services de Neuropédiatrie et Neurologie	LIÈGE
790	79021148	Centre Neurologique et de Réadaptation Fonctionnelle	FRAITURE

790	79001154	CENTRE HOSPITALIER DE L'ARDENNE	LIBRAMONT
790	79003926	LES CLINIQUES DU SUD Luxembourg Service de Médecine Physique	ARLON
790	79014616	Centre Hospitalier de l'Ardenne	LIBRAMONT
790	79000659	CENTRE HOSPITALIER DE DINANT Service de médecine physique	DINANT
790	79004025	C.H.R. DU VAL DE SAMBRE Service de médecine physique	SAMBREVILLE
790	79004718	CENTRE HOSPITALIER REGIONAL DE NAMUR Service de Médecine Physique et Réadaptation	NAMUR
790	79011052	Cliniques Universitaires de Mont-Godinne. U.C.L. Centre de Réadaptation	YVOIR
Brussel			
790	79000164	Centre Hospitalier VALIDA	ST AGATHA BERCHEM
790	79011349	Hôpital Erasme - U.L.B. Centre de Jour de Réadaptation Fonctionnelle Neurologique	ANDERLECHT
790	79012141	CHU Brugmann Site Victor Horta Rééducation Neurologique	LAKEN
790	79012240	Cliniques de l'Europe Site Ste – Elisabeth Service de Réadaptation	UKKEL
790	79012636	Cliniques Universitaires Saint-Luc Service de Médecine Physique et de Réadaptation	ST LAMBRECHTS WOLUWE
790	79013725	Cliniques Universitaires Saint-Luc Centre de Rééducation neuropsychologique	ST LAMBRECHTS WOLUWE
790	79020158	Universitair Ziekenhuis Brussel Neuromusculair referentiecentrum - De Bijtjes	JETTE
790	79020356	Cliniques Universitaires Saint-Luc Centre de référence neuromusculaire UCL Saint-Luc	ST LAMBRECHTS WOLUWE
790	79020752	Hôpital Erasme (ULB) et H.U.D.E.R.F. Centre de référence pour les maladies neuromusculaires	ANDERLECHT
790	79020851	Centre de Traumatologie et de Réadaptation	LAKEN

790	79021346	Hôpital Erasme (ULB) et H.U.D.E.R.F. Centre de réadaptation fonctionnelle Neurologique	ANDERLECHT
790	79021445	Cliniques Universitaires Saint Luc Service de Médecin Physique et de Rédaptation	ST LAMBRECHTS WOLUWE

953-965	**CENTERS FOR AMBULANT REHABILITATION**		48	22	9	79
Flanders						
953965	95301510	U.Z. Gent Centrum voor gehoor- en spraak revalidatie	GENT			
953965	95306953	Centrum voor Ambulante Revalidatie Sint-Lievenspoort VZW	GENT			
953965	95307349	Revalidatiecentrum voor Spraak-en Gehoorgestoorden "Elora"	NIEUWPOORT			
953965	95308141	Gehoor- en Spraakrevalidatiecentrum "Spermalie"	BRUGGE			
953965	95308240	U.Z. Leuven Sint-Rafael - K.U.L. Revalidatiecentrum voor Gehoor- en Spraakgestoorden.	LEUVEN			
953965	95323779	Revalidatiecentrum TER KOUTER	DEINZE			
953965	95324571	Centrum voor Ambulante Revalidatie Wegwijs vzw	ZOTTEGEM			
953965	95325363	Centrum voor Spraak-, Taal en Leerstoornissen	MAASMECHELEN			
953965	95326551	Antwerps Revalidatiecentrum v.z.w.	ANTWERPEN			
953965	95333479	Centrum voor Ambulante Revalidatie	OOSTAKKER			
953965	95335657	Centrum voor Spraak-, Taal-, Leer- en Gehoorstoornissen	MAASMECHELEN			
953965	95336548	A.Z. Zusters van Barmhartigheid Dienst voor Gehoor-en Spraakgestoorden	RONSE			
953965	95340607	Het Veer Revalidatiecentrum vzw	SINT-NIKLAAS			
953965	95341694	Stappie vzw Centrum voor Ontwikkelings- en Gehoorstoornissen	OOSTENDE			
953965	95342189	U.Z. Antwerpen Universitair revalidatiecentrum voor communicatiestoornissen.	EDEGEM			

953965	95346446	Reva Centrum voor Onderzoek en Behandeling	ROESELARE
953965	95346743	Spraak-,Taal-, Leer en gehoorcentrum "HORIZON" & Revalidatiecentrum	GERAARDSBERGEN
953965	95349416	Centrum voor Spraak- en Taalpathologie	BREE
953965	95349515	CENTRUM voor AMBULANTE REVALIDATIE ST. REMBERT vzw	TORHOUT
953965	95351691	De Klinker Centrum voor Ambulante Revalidatie	HEIST-AAN-ZEE
953965	95351889	Revalidatiecentrum voor taal- en Ontwikkelingsproblemen.	ROESELARE
953965	95357928	De Klinker Centrum voor Ambulante Revalidatie	IEPER
953965	95359314	Revalidatiecentrum Vijfhoek	MECHELEN
953965	95360205	Revalidatiecentrum "Overleie"	KORTRIJK
953965	95360601	Antenne 3000	LEUVEN
953965	95360797	Revalidatiecentrum D.A.T.	TIENEN
953965	95360896	Ambulante Revalidatiecentra Midden Vlaanderen	EEKLO
953965	96506288	Revalidatiecentrum "Turnhout"	TURNHOUT
953965	96508862	Revalidatiecentrum "Levensvreugde"	LOVENJOEL
953965	96510545	Revalidatiecentrum "R. De Hert"	AALST
953965	96518166	Revalidatiecentrum Kapelhof V.Z.W.	ZELE
953965	96518265	Centrum voor ambulante revalidatie "Bolt"	DRONGEN
953965	96519255	Centrum voor Ambulante Revalidatie "De Schakel"	WETTEREN
953965	96524403	Revalidatiecentrum Noorderkempen	WUUSTWEZEL
953965	96524601	Revalidatiecentrum Beveren	BEVEREN-WAAS
953965	96524896	Revalidatiecentrum Accent	HEULE
953965	96526381	Revalidatiecentrum "De Kindervriend"	ROLLEGEM
953965	96526480	Revalidatiecentrum "'t Veld"	AARTRIJKE

953965	96529252	Revalidatiecentrum Buggenhout vzw	BUGGENHOUT
953965	96530440	DE STEIJGER vzw. Revalidatiecentrum voor ontwikkelingsstoornissen	DESTELBERGEN
953965	96541526	Centrum voor Ambulante Revalidatie "Impuls"	GENT
953965	96542318	Waas Revalidatiecentrum Lokeren	LOKEREN
953965	96549642	Centrum voor Functionele Revalidatie	ZELZATE
953965	96557263	VZW Revalidatiecentrum "Land van Halle - Pajottenland"	HALLE
953965	96558352	Revalidatiecentrum "Ter Linde"	BORNEM
953965	96558649	Behandelingscentrum Asse	ZELLIK
953965	96560332	Revalidatiecentrum "Ter Eecken"	OUDENAARDE
953965	96560827	Revalidatiecentrum Zuiderkempen	VEERLE
Wallonie			
953965	95301708	C.H.U. de Tivoli C.R.F. "Ouïe et Parole"	LA LOUVIÈRE
953965	95314673	C.R.F. Ouïe et Parole	MOUSCRON
953965	95329026	Centre Médical de rééducation logopédique	MONS
953965	95334964	C.R.F. Ouïe et Parole	TOURNAI
953965	95347832	Centre de Logopédie et de Psychomotricité	JAMIOULX
953965	95360304	Direction Générale de l'ISPPC Espace Santé	CHARLEROI
953965	96518760	Centre de reeducation ambulatoire « C.E.L. »/ Le Cep & Le Saule	KAIN
953965	96534695	Centre de Réadaptation Fonctionnelle "L'Ancre"	TOURNAI
953965	95316356	Clinique d'audiophonologie - CHU de Liège	LIÈGE
953965	95326848	Centre Médical d'Audiophonologie	MONTEGNEE
953965	95336449	Association Interrégionale de Guidance et de Santé A.S.B.L. CRF de Waremme	VOTTEM

953965	96502627	Centre de Réadaptation de l'Enfant ASBL	LIÈGE
953965	96518067	CRA CRF	VERVIERS
953965	96527965	Centre de Rééducation Fonctionnelle "L'Oiseau Bleu"	ANTHEIT
953965	96529945	Centre Bernadette	GEER
953965	96530044	CPAS de Flémalle	FLÉMALLE
953965	96535190	Centre Henri Wallon	VAUX-SOUS-CHEVREMONT
953965	96539942	Clinique André Renard des Fonds et Services Sociaux Solidaris	HERSTAL
953965	96546573	Centre de Rééducation et de Traitement Psychologique	OUGREE
953965	96560629	Kindertherapiezentrum K.I.T.Z.	EUPEN
953965	95360995	Cliniques Universitaires U.C.L. de Mont-Godinne / Les Perce-Neige	YVOIR
953965	96518661	Cliniques Universitaires U.C.L. de Mont-Godinne	JAMBES
Brussel			
953965	95310418	VZW Revalidatiecentrum het Groen Kruis	BRUSSEL (JETTE)
953965	95336152	Revalidatiecentrum "De Poolster" van de Vlaamse Gemeenschapscommissie	BRUSSEL (SINT-AGATHA-BERCHEM)
953965	95360106	Centrum voor Sensorieel Gehandicapten	BRUSSEL (SINT-LAMBRECHTS-WOLUWE)
953965	95307151	Centre Médical d'Audio-Phonologie	VORST
953965	95307448	Centre pour handicapés sensoriels	UKKEL
953965	95336251	Centre de Rééducation Fonctionnelle "L'Etoile Polaire" organisé par la Commission communautaire française de la Région de Bruxelles-Capitale	BRUSSEL (SINT-LAMBRECHTS-WOLUWE)

953965	95360403	CRF Centre d'Audio-Phonologie et CRF Neurologique pour enfants des Cliniques Saint-Luc	BRUSSEL (SINT-LAMBRECHTS-WOLUWE)				
953965	96506090	Les Blés d'Or	UKKEL				
953965	96560431	Hôpital Erasme - U.L.B. Centre de Réadaptation Fonctionnelle Neurologique Infantile (C.R.F.N.I.)	ANDERLECHT				

969	**CARE FOR PEOPLE WITH VISUAL IMPAIRMENTS**			4	3	1	8
Flanders							
969	96900426	U.Z. Leuven Revalidatiecentrum voor slechtzienden	LEUVEN				
969	96900624	Revalidatiecentrum Oftalmologie	ANTWERPEN				
969	96900822	CENTRUM VOOR VISUELE REVALIDATIE UZ GENT	GENT				
969	96900921	UZ ANTWERPEN (UZA)	EDEGEM				
Wallonie							
969	69600327	Clinique Saint-Pierre - ophtalmologie	OTTIGNIES				
969	96900228	ASBL "Les Amis des Aveugles"	GHLIN				
969	96900129	ASBL La Lumière	LIÈGE				
Brussel							
969	96900525	CHU Brugmann - Service Horus	LAKEN				

Appendix 1.2. Transferred isolated Sp services

Table 6 – Transferred isolated Sp services

Categoral hospital
Flemish Community
De Dennen, Malle
MS Centrum, Melsbroek
Inkendaal, Vlezenbeek
Lemberge, Merelbeke
MS Centrum, Overpelt
KEI, Oostduinkerke
BZIO, Oostende
RevArte, Edegem SP bedden; G-bedden
French speaking community
/
German speaking community
/
Brussels
/

Appendix 1.3. Most important target populations in Belgian Centers for Ambulatory Rehabilitation (CAR/CRA)

Source: RIZIV – INAMI, data of 2012

Flanders: five largest groups: 92,7% of Total (N=6961)

19.4%	G02	Mental handicap (children)
17.9%	G03	Autism (children)
32.5%	G04	Complex Developmental disorders (children)
15,00%	G05	Attention Deficit Hyperactivity Disorder (children)
7.9%	GHst	Hearing disorders (G08-G09-G10-G11 of convention) (children, adults)

Wallonia: five largest groups: 85.3% of Total (N=1929)

37.5%	G02	Mental handicap (children)
9.7%	G03	Autism (children)
15.3%	G04	Complex Developmental disorders (children)
5.4%	G05	Attention Deficit Hyperactivity Disorder (children)
17.2%	GHst	Hearing disorders (G08-G09-G10-G11 of convention) (children, adults)

Brussels: five largest groups: 94.5% of Total (N=935)

22.9%	G02	Mental handicap (children)
10.5%	G03	Autism (children)
13.8%	G04	Complex Developmental disorders (children)
3.9%	G05	Attention Deficit Hyperactivity Disorder (children)
43.4%	GHst	Hearing disorders (G08-G09-G10-G11 of convention) (children, adults)

For all target populations of Belgian CAR/CRA, see:
http://www.riziv.fgov.be/nl/themas/kost-terugbetaling/ziekten/mentale-neurologische-stoornissen/Paginas/mentale-stoornissen-gehoor-stem-spraakstoornissen-neurologische-stoornissen-tegemoetkoming-kosten-behandeling-centra-ambula.aspx#.VsC0Bk2D6po
http://www.riziv.fgov.be/fr/themes/cout-remboursement/maladies/troubles-mentaux-neurologiques/Pages/ouie-langage-intervention-couts-centres-reeducation-ambulatoire.aspx#.VsC0H02D6po
http://www.revalidatie.be/nl/revalidatie/inhoud/centra/verwijzers

Appendix 1.4. Illustrations of rehabilitation organisations for 3 types of diseases/impairment

The NIHDI has a webpage on which they give an overview per disease/impairment type of institutions where patients can go to for rehabilitation purposes. Below an oversight is given of organizations, ordered by ZIP-code, for 3 types of impairment, and for each the number of the NIHDI-convention is given (those marked in red are transferred to the communities and those marked in yellow remained on the federal level).

In order to demonstrate the complexity of the field, the organization that present themselves as “de vlaamse revalidatieziekenhuizen” (Nolis 2015), are marked in green.

FEDERAL DEFEDERATED MEMBER of the FLEMISH REHABILITATION HOSPITALS

Organization	addres	Zip	municipality	Locomotor and neurological impairments l	Cerebral palsym	Rehabilitation for patients with severe chronic pulmonary diseasen
CHU Brugmann Rééducation Neurologique **Centre de Traumatologie et de Réadaptation**	Place A. Van Gehuchten 4	1020	BRUXELLES (LAEKEN)	9.50.240.69 7.71.002.51		
Hôpital Universitaire des Enfants Reine Fabiola	Avenue J.J. Crocq 15	1020	BRUXELLES (LAEKEN)		7.89.505.75	
A.S.B.L. Centre Belge d'Education Thérapeutique pour infirmes moteurs cérébraux (C.B.I.M.C.)	Rue Père Eudore Devroye 14	1040	BRUXELLES (ETTERBEEK)		7.84.003.48	

l http://www.riziv.fgov.be/nl/themas/kost-terugbetaling/ziekten/locomotorische-handicaps/Paginas/behandeling-revalidatiecentra.aspx#.VrmqzVJbjsD

m http://www.riziv.fgov.be/nl/themas/kost-terugbetaling/ziekten/locomotorische-handicaps/Paginas/hersenverlamming-cerebral-palsy.aspx#.VrnnCFJbjsA
http://www.riziv.fgov.be/SiteCollectionDocuments/lijst_centra_met_overeenkomst_770_nl.pdf
http://www.riziv.fgov.be/SiteCollectionDocuments/lijst_centra_met_overeenkomst_784_nl.pdf

n http://www.riziv.fgov.be/SiteCollectionDocuments/lijst_centra_met_overeenkomst_7815_nl.pdf

A.S.B.L. La Braise, Centre de jour de Réadaptation fonctionnelle pour traumatisés crâniens graves	Rue de la Vigne 56	1070	BRUXELLES (ANDERLECHT)	7.71.017.36	
Clinique Ste Anne St-Remi	Boulevard J. Graindorlaan 66	1070	BRUXELLES (ANDERLECHT)	9.51.116.66	
Hôpital Erasme Centre de Jour de Réadaptation Fonctionnelle Neurologique	Route de Lennik 806	1070	BRUXELLES (ANDERLECHT)	9.50.076.39 7.71.021.32	
Hôpitaux Iris Sud	Rue Docteur Huet 79	1070	BRUXELLES (ANDERLECHT)	9.51.127.55	
Centre hospitalier Valida	Avenue Josse Goffin 180	1082	BRUSSEL (SINT-AGATHA-BERCHEM)	9.51.128.54	
Cliniques de l'Europe, Service de Réadaptation	Avenue de Fré 206	1180	BRUXELLES (UCCLE)	9.50.250.59	
Cliniques Universitaires Saint-Luc, Service de Médecine Physique et de Réadaptation / Centre de Rééducation neuro-psychologique **Centre de référence en infirmité motrice d'origine cérébrale de l'UCL**	Avenue Hippocrate 10	1200	BRUXELLES (WOLUWE-SAINT-LAMBERT)	9.50.281.28 9.50.444.59 7.71.022.31	7.89.502.78
Centre Neurologique William Lennox Adultes	Allée de Clerlande 6	1340	OTTIGNIES	7.71.016.37	
Clinique Saint-Pierre, Service de Réadaptation	Avenue Reine Fabiola 9	1340	OTTIGNIES	9.50.215.94	

et Médecine Physique et Rhumatologie				
SILVA medical, Site Clinique de la Forêt de Soignies	Chaussée de Tervuren	1410	WATERLOO	9.51.122.60
Regionaal Ziekenhuis Sint-Maria	Ziekenhuislaan 100	1500	HALLE	9.51.120.62
Ziekenhuis Inkendaal	Inkendaalstraat 1	1602	VLEZENBEEK	7.71.018.35
Nationaal Multiple Sclerose Centrum	A. Vanheylenstraat 16	1820	MELSBROEK	7.71.011.42 7.71.023.30
AZ Monica, APRA Revalidatie	Harmoniestraat 68	2018	ANTWERPEN	9.51.106.76
ZNA Middelheim, Revalidatiecentrum, Dienst motorische revalidatie	Lindendreef 1	2020	ANTWERPEN	9.50.232.77
Ziekenhuisnetwerk Antwerpen	Lange Beeldekensstraat 267	2060	ANTWERPEN	9.51.109.73
Pulderbos - Revalidatiecentrum voor kinderen en jongeren v.z.w.	Reebergenlaan 4	2242	ZANDHOVEN	
AZ Turnhout, Campus Sint-Jozef, Centrum voor motorische en functionele revalidatie	Steenweg op Merksplas 44	2300	TURNHOUT	9.50.376.30 9.50.533.67
NAH-revalidatiecentrum VZW KMSL	Korte Begijnenstraat 22	2300	TURNHOUT	7.71.020.33
Woonzorg- en revalidatiecentrum De Dennen vzw	Nooitrust 18	2390	MALLE	

A.Z. Sint-Dimpna, Algemeen Revalidatiecentrum	J.B. Stessenstraat 2	2440	GEEL	9.50.269.40		
AZ Sint Maarten Campus Rooienberg	Rooienberg 25	2570	DUFFEL	9.50.126.86		
Dienst voor fysische geneeskunde en revalidatie van het A.Z. Sint-Augustinus	Oosterveldlaan 24	2610	WILRIJK (ANTWERPEN)	9.51.114.68		
Revalidatieziekenhuis Revarte	Drie Eikenstraat 659	2650	EDEGEM	9.51.102.80		
U.Z. Antwerpen, Centrum voor motorische revalidatie **Cerebral Palsy eferentiecentrum (CePRA) van het UZ Antwerpen**	Wilrijkstraat 10	2650	EDEGEM	9.50.421.82	7.89.504.76	
Imeldaziekenhuis	Imeldalaan 9	2820	BONHEIDEN	9.51.117.65		
AZ KLINA	Augustijnslei 100	2930	BRASSCHAAT	9.51.101.81		
Regionaal Ziekenhuis H. Hart	Naamsestraat 105	3000	LEUVEN	9.51.129.53		
U.Z. Leuven, Campus Gasthuisberg **CP-referentiecentrum** **Afdeling voor Respiratoire Revalidatie**	Herestraat 49	3000	LEUVEN	9.50.358.48	7.89.501.79	7.81.501.28

U.Z. Leuven, campus St. Raphaël, Dienst motorische revalidatie	Kapucijnenvoer 33	3000	LEUVEN	9.50.408.95		
U.Z. Leuven, campus Pellenberg, Centrum voor Motorische Revalidatie, Dienst motorische revalidatie	Weligerveld 1	3212	PELLENBERG	9.50.409.94 7.71.019.34		
RZ Tienen	Kliniekstraat 45	3300	TIENEN	9.51.118.64		
Algemeen Ziekenhuis Salvator - St. Ursula	Salvatorstraat 20	3500	HASSELT	9.51.115.67		
Jessa Ziekenhuis, Campus St-Ursula	Diestsesteenweg 8	3540	HERK-DE-STAD	9.50.260.49		
Ziekenhuis Oost-Limburg, campus St. Barbara, Revalidatiecentrum	Bessemerstraat 478	3620	LANAKEN	9.50.274.35		
Ziekenhuis Maas en Kempen	Mgr. Koningsstraat 10	3680	MAASEIK	9.51.119.63		
Regionaal Ziekenhuis Sint-Trudo	Diestersteenweg 100	3800	SINT-TRUIDEN	9.51.131.51		
Mariaziekenhuis	Maesensveld 1	3900	OVERPELT	9.51.107.75		
Revalidatie & MS Centrum	Boemerangstraat 2	3900	OVERPELT	9.50.441.62		
Centre pour Infirmes Moteurs Cérébraux de la Citadelle	Quai de Wallonie 3	4000	LIEGE		7.84.033.18	
C.H.C. asbl	Rue de Hesbaye 75	4000	LIEGE	9.50.009.09		
C.H.U. de Liège, Service de Médecine physique et Réadaptation	Avenue de l'hôpital B35	4000	LIEGE	9.50.522.78		7.81.504.25
CHR de la Citadelle	Boulevard du 12ème de ligne, 1	4000	LIEGE	9.50.067.48		

Les Cliniques de l'IPAL	Rue Basse-Wez 301	4020	LIEGE	9.51.110.72	
C.H. du Bois de l'Abbaye et de Hesbaye, Service de médecine physique et de réadaptation fonctionnelle	Rue Laplace	4100	SERAING	9.50.538.62	
A.S.B.L. Centre Neurologique et de Réadaptation Fonctionnelle / Centre de rééducation fonctionnelle de la Sclérose en Plaques	Champ des Alouettes 30	4557	FRAITURE	7.71.014.39 9.51.124.58	
C.H. Peltzer- La Tourelle, Centre de Réadaptation Fonctionnelle	Rue du Parc 29	4800	VERVIERS	9.50.010.08	
ASBL Le Ressort, Centre de jour de réadaptation fonctionnelle cognitive pour adultes traumatisés crâniens graves	Rue Marsannay-la - Côte 3	5032	MAZY	7.71.015.38	
CHU Godinne	Avenue G. Thérasse 1	5530	GODINNE	9.50.061.54	
Direction Générale de l'ISPPC, Espace Santé	Boulevard Zoé Drion	6000	CHARLEROI	9.50.056.59 9.50.079.36	
A.S.B.L. Cothan, Unité de Rééducation Fonctionnelle	Rue de la Madeleine 21	6041	GOSSELIES		7.84.034.17
Clinique Notre-Dame de Grâce	Chaussée de Nivelles 212	6041	GOSSELIES	9.51.121.61	
Grand Hôpital de Charleroi, Site Reine Fabiola	Rue Marguerite Depasse 6	6060	GILLY (CHARLEROI)	9.50.028.87	

Hôpitaux Saint-Joseph - Sainte Thérèse et IMTR	Rue de la Duchère 6	6060	GILLY (CHARLEROI)	9.50.007.11		
Centre Arthur Regniers-Province de Hainaut	Rue Bar. E. Drory V. D. Eynde, 2	6543	BIENNE-LEZ-HAPPART		7.70.002.81	
C.H.A.VIVALIA	Avenue de Houffalize 35	6800	LIBRAMONT	9.50.540.60		7.81.503.26
Centre Hospitalier de Jolimont – Lobbes, (site de Jolimont), Centre de Réadaptation Fonctionnelle et Rheumatologie	Rue Ferrer 159	7100	HAINE-SAINT-PAUL	9.50.006.12		
Clinique Louis Caty, Centre de Réadaptation Fonctionnelle, Dignité et Travail	Rue Louis Caty 118	7331	BAUDOUR	9.50.042.73		
Centre Hospitalier de Wallonie picarde, Site Notre Dame	Avenue Delmée	7500	TOURNAI	9.51.130.52		
A.Z. Sint-Jan	Ruddershove 10	8000	BRUGGE	9.50.004.14		
A.Z. ZENO	Graaf Jansdijk 162	8300	KNOKKE-HEIST	9.50.516.84		
A.Z. Sint-Lucas, Dienst voor Revalidatie, Dienst motorische revalidatie	Sint-Lucaslaan 29	8310	ASSEBROEK (BRUGGE)	9.50.065.50		
AZ ALMA, Campus Sijsele	Gentse Steenweg 132	8340	SIJSELE	9.50.390.16		
A.Z. DAMIAAN VZW, Revalidatiecentrum - Campus H. Hart	Gouwelozestraat 100	8400	OOSTENDE	9.50.133.79		
BZIO - Bundeling ZorgInitiatieven Oostende vzw, Revalidatiecentrum	Zeedijk 286 - 288	8400	OOSTENDE	9.50.002.16		

H. Serruys ziekenhuis AV	Kairostraat 84	8400	OOSTENDE	9.51.112.70		
AZ GROENINGE - Campus Reepkaai, Revalidatiecentrum	Reepkaai 4	8500	KORTRIJK	9.50.386.20		
Sp-revalidatiecentrum vzw Godtsvelde	Hospitaalstraat 29	8610	KORTEMARK	9.51.105.77		
Koningin Elisabeth Instituut	De wittelaan 1	8670	OOSTDUINKERKE	9.51.108.74		
Sint-Andriesziekenhuis, Dienst voor functionele revalidatie	Bruggestraat 84	8700	TIELT	9.50.458.45		
Heilig Hartziekenhuis Roeselare – Menen, Dienst voor Fysische Geneeskunde - Revalidatie	Wilgenstraat 2	8800	ROESELARE	9.50.128.84		
Stedelijk Ziekenhuis Roeselare	Bruggesteenweg 90	8800	ROESELARE	9.51.103.79		
Sint-Rembertziekenhuis	Sint-Rembertlaan 21	8820	TORHOUT	9.51.126.56		
vzw Sint-Jozefskliniek	Roeselaarsestraat 47	8870	IZEGEM	9.51.104.78		
VZW Regionaal Ziekenhuis Jan Yperman	Briekestraat 12	8900	IEPER	9.51.111.71		
A.Z. Maria Middelares, Revalidatiecentrum, Dienst motorische revalidatie	Buitenring Sint-Denijs 30	9000	GENT	9.50.521.79		
U.Z. Gent, Centrum voor Locomotorische en Neurologische Revalidatie, Dienst motorische revalidatie	De Pintelaan 185	9000	GENT	7.71.012.41	7.89.503.77	7.81.502.27

CP-Referentiecentrum West				
Centrum voor Respiratoire Revalidatie				
A.Z. NIKOLAAS, Dienst voor functionele revalidatie	Moerlandstraat 1	9100	SINT-NIKLAAS	9.50.537.63
Algemeen Stedelijk Ziekenhuis	Merestraat 80	9300	AALST	9.51.125.57
Onze-Lieve-Vrouwziekenhuis Aalst, Revalidatiecentrum	Moorselbaan 164	9300	AALST	9.50.288.21
AZ Glorieux, Locomotorisch revalidatiecentrum	Glorieuxlaan 55	9600	RONSE	9.50.365.41
A.Z. Sint-Elisabeth, Revalidatiecentrum, Dienst motorische revalidatie	Godveerdegemstraat 59	9620	ZOTTEGEM	9.50.227.82
Provinciaal Zorgcentrum Lemberge	Salisburylaan 100	9820	MERELBEKE	
AZ ALMA, Campus Eeklo	Moeie 18	9900	EEKLO	9.50.539.61

APPENDIX 2. INTERRAI SUITE OF INSTRUMENTS IN REHABILITATION

Appendix 2.1. Available interRAI instruments and target groups

	Available instruments within the interRAI suite (www.interrai.org accessed 030216)	acronym	Target group (www.interrai.org accessed 030216)	Available instruments within the BelRAI suite (http://wiki.belrai.org/nl/ , accessed 030216)
1	Acute Care	AC	older or disabled persons admitted to any acute hospital service for inpatient treatment targeted to receive comprehensive assessment. The interRAI AC is suited to acute geriatric assessment units, geriatric consultation services, and for targeted use in general medical and surgical wards The interRAI PAC or the interRAI AC with the PAC supplement is suited to all patients entering an inpatient post-acute program of care	interRAI Acute Care België
2	Adolescent supplement	AS	For youth 12-18 years (as well as younger children engaged in higher risk behaviors typical of adolescents) with mental health, intellectual and developmental needs who are receiving community-based or inpatient/residential services	Modules Mental Health, Community Mental Health, screener Mental Health, Handicapped Persons, Children and Youth, Post-Acute Care (rehabilitation), Emergency Department Screener will be evaluated for further development (Belgian Intergovernmental Committee Health Care on use of the BelRAI suite across care settings [12]
3	Assisted Living	AL	The interRAI Assisted Living (AL) has most recently been released as a supplement to the Community Health Assessment (CHA). The CHA-AL evaluates the needs, strengths, and preferences of persons served by various types of residential care facilities. The items identify functional, medical, and social issues that are either presently limiting the quality of life or functional status of the person or that are likely to become limiting for the person, if unaddressed	
4	Brief Mental Health Screener (BMHS)	BMHS	The interRAI Brief Mental Health Screener (BMHS) is based on and intended to complement the interRAI Mental Health (MH) Assessment System for In-Patient Psychiatry, the interRAI	Modules Mental Health, Community Mental Health, screener Mental Health, Handicapped Persons, Children and

			Community Mental Health (CMH) Assessment System, and the interRAI Emergency Screener for Psychiatry (ESP). The interRAI BMHS was developed to assist front-line police officers and community service providers to identify and respond to persons with mental health concerns. It is designed as a brief screener only, with two versions of the form. The interRAI BMHS-Police is intended for use by front-line police officers and the interRAI BMHS-General is designed for use by community organizations (for example, neighborhood outreach programs, emergency medical services). - See more at: https://catalog.interrai.org/BMHS-brief-mental-health-screener-assessment-form-and-users-manual#sthash.a2OYBCpJ.dpuf	Youth, Post-Acute Care (rehabilitation), Emergency Department Screener will be evaluated for further development (Belgian Intergovernmental Committee Health Care on use of the BelRAI suite across care settings [12]
5	Child and Youth Intellectual/Developmental Disability	CYIDD	ChYIDD is for use by community-based or inpatient/residential services with children and youth between 4-18 years whose intellectual functioning is below 70 with intellectual and developmental issues (e.g., Autism, Downs Syndrome). (In development, personal communication Shannon Stewart)	Modules Mental Health, Community Mental Health, screener Mental Health, Handicapped Persons, Children and Youth, Post-Acute Care (rehabilitation), Emergency Department Screener will be evaluated for further development (Belgian Intergovernmental Committee Health Care on use of the BelRAI suite across care settings [12]
6	Child and Youth Mental Health	CYMH	Assesses psychiatric, social, environmental, medical issues for children and youth between 4-18 years receiving community-based or inpatient/residential services. Also available: Child and Youth Mental Health – Developmental Disabilities (ChYMH-DD): Assesses psychiatric, social, environmental, medical issues for children and youth between 4-20 years receiving community-based or inpatient/residential services, whose level of intellectual functioning is below 70 or where it is deemed more appropriate than the ChYMH based on clinical judgement.	Modules Mental Health, Community Mental Health, screener Mental Health, Handicapped Persons, Children and Youth, Post-Acute Care (rehabilitation), Emergency Department Screener will be evaluated for further development (Belgian Intergovernmental Committee Health Care on use of the BelRAI suite across care settings [12]
7	Community Health Assessment	CHA	The interRAI Community Health Assessment (interRAI CHA) instrument and its accompanying supplements comprise a robust assessment system. Everyone receives the core assessment called CHA; only those with specific problem sets receive one or more of the four supplements. This modularized approach to	

			assessment lets a person's needs and preferences be tracked using the fewest number of assessment items possible. Further, it allows for the assessment of persons living in a range of settings, from independent residences through assisted living. This flexibility provides the ability to track persons as they move along the continuum of care, while requiring staff to learn only one assessment system. All persons are to be assessed with the interRAI CHA, which includes the items required to trigger four types of supplements described briefly below. The CHA triggers seventeen of the twenty-seven interRAI Generation 2 CAPs; the CHA and the Functional Supplement together trigger the entire set of CAPs as well as a variety of other interRAI scales and quality indicators. CHA Supplements •The interRAI Functional Supplement (interRAI CHA-FS) includes an expanded set of functional and clinical items that informs and guides comprehensive care and service planning for more challenged persons in community-based settings. •The interRAI Mental Health Supplement (interRAI CHA-MH) includes an expanded item set on mental health- related diagnoses, symptoms, treatments, and life experiences. The items in this supplement describe the performance and capacity of the person in a variety of domains, with the majority of items serving as specific triggers for care planning. As with the interRAI CHA-FS, the goal is to use this information to identify individual needs and appropriate interventions. •The interRAI Assisted Living Supplement (interRAI CHA-AL) evaluates the needs, strengths, and preferences of persons served by various types of residential care facilities. The items identify functional, medical, and social issues that are either presently limiting the quality of life or functional status of the person or that are likely to become limiting for the person, if unaddressed.	

			•The interRAI Deafblind Supplement (interRAI CHA-Db) is a standardized set of items that evaluate the strengths, preferences, and needs of persons with dual sensory loss. The items in this supplement extend the CHA's assessment of the dimensions of vision and hearing to address patterns of impairment and change in these senses for persons with both congenital and acquired deafblindness. The CHA-Db also includes items on communication systems, orientation and mobility, and use of interpreters and intervenors.	
8	Community Mental Health	CMH	The interRAI Community Mental Health (CMH) Assessment is a standardized assessment system for by clinicians in community mental health settings. This instrument is designed to incorporate the person's needs, strengths and preferences when assessing the key domains of function, mental and physical health, social support and service use	Modules Mental Health, Community Mental Health, screener Mental Health, Handicapped Persons, Children and Youth, Post-Acute Care (rehabilitation), Emergency Department Screener will be evaluated for further development (Belgian Intergovernmental Committee Health Care on use of the BelRAI suite across care settings [12]
9	Contact Assessment	CA	The interRAI Contact Assessment (interRAI CA) Screener was created to provide information to support the home care intake process. The interRAI CA is not a substitute for the comprehensive interRAI HC Assessment. It records only the most essential information needed at the time of intake to support decisions related to the need for more comprehensive assessment, the urgency for home care service provision, and the need for specialized services (for example, rehabilitation).	
10	Deafblind	DB	The interRAI Deafblind (Db) has most recently been released as a supplement to the Community Health Assessment (CHA). CHA-Db is a standardized set of items that evaluate the strengths, preferences, and needs of persons with dual sensory loss. The items in this supplement extend the CHA's assessment of the dimensions of vision and hearing to address patterns of impairment and change in these senses for persons with both congenital and acquired deafblindness. The CHA-Db also includes	Modules Mental Health, Community Mental Health, screener Mental Health, Handicapped Persons, Children and Youth, Post-Acute Care (rehabilitation), Emergency Department Screener will be evaluated for further development (Belgian Intergovernmental Committee Health Care on use of the BelRAI suite across care settings [12]

			items on communication systems, orientation and mobility, and use of interpreters and intervenors	
11	Emergency Screener for Psychiatry	ESP	The interRAI Emergency Screener for Psychiatry (ESP) is a short screening tool for acute mental health emergency screening with a 24-hour observation period. The interRAI ESP is compatible with the interRAI MH and interRAI CMH. It can be used in hospital settings, emergency departments and mobile crisis teams. This ESP has additional response categories focusing on the immediate presence of indicators relevant to risk appraisal and care planning related to safety (for example, harm to self, others). The interRAI ESP also provides decision support for placement and bed utilization.	Modules Mental Health, Community Mental Health, screener Mental Health, Handicapped Persons, Children and Youth, Post-Acute Care (rehabilitation), Emergency Department Screener will be evaluated for further development (Belgian Intergovernmental Committee Health Care on use of the BelRAI suite across care settings [12]
12	Home Care	HC	The interRAI HC was developed for use with adults in home and community-based settings. The instrument is generally used with the frail elderly or persons with disabilities who are seeking or receiving formal health care and supportive services It focuses on the person's functioning and quality of life by assessing needs, strengths, and preferences, and facilitates referrals when appropriate. When used over time, it provides the basis for an outcome-based assessment of the person's response to care or services. The interRAI HC can be used to assess persons with chronic needs for care as well as those with post-acute care needs (for example, after hospitalization or in a hospital-at-home situation). The RUG-III case-mix system is developed and validated for use in home care settings.	interRAI Home Care België
13	Intellectual Disability	ID	The interRAI Intellectual Disability Assessment System (ID) is a comprehensive, standardized instrument for evaluating the needs, strengths, and preferences of persons with intellectual or developmental disabilities. It is intended to be used with adults of all ages in community, residential, and institutional settings.	Modules Mental Health, Community Mental Health, screener Mental Health, Handicapped Persons, Children and Youth, Post-Acute Care (rehabilitation), Emergency Department Screener will be evaluated for further development (Belgian Intergovernmental Committee Health Care on use of the BelRAI suite across care settings [12]

14	Long-Term Care Facilities	LTCF	The interRAI Long-Term Care Facilities (LTCF) Assessment System is a comprehensive, standardized system for evaluating the needs, strengths, and preferences of persons in chronic care and nursing home institutional settings. Completing an LTCF assessment enables a health care provider to assess key domains of function, mental and physical health, social support, and service use The RUG-III and IV case-mix systems is developed and validated for use in institutional long-term care settings.	interRAI LTCF België
15	Mental Health for Correctional Facilities	MHCF	The interRAI CF is an assessment system for use in correctional inmate populations. It combines individual items and scales from the interRAI MH and its Forensic Supplement. Designed specifically to be used in jails, correctional centers, and prisons, it measures mental health symptoms and describes the mental health care needs of inmates. The interRAI CF is designed to be used by correctional services professional staff, including psychiatrists, psychologists, nursing staff and social workers	Modules Mental Health, Community Mental Health, screener Mental Health, Handicapped Persons, Children and Youth, Post-Acute Care (rehabilitation), Emergency Department Screener will be evaluated for further development (Belgian Intergovernmental Committee Health Care on use of the BelRAI suite across care settings [12]
16	Mental Health for In-Patient Psychiatry	MHIPP	The interRAI Mental Health (MH) Assessment System is a comprehensive standardized instrument for evaluating the needs, strengths and preferences of adults with mental illness in in-patient psychiatric settings. This instrument allows for assessment of key domains of function, mental and physical health, social support and service use; with particular items identifying those who could benefit from further evaluation of specific problems to help prevent risk of further decline and improve functioning. A per diem case-mix model, SCIPP, has been developed for describing resource use in adult inpatient psychiatric settings, including acute, long stay, forensic, and geriatric psychiatry units.	Modules Mental Health, Community Mental Health, screener Mental Health, Handicapped Persons, Children and Youth, Post-Acute Care (rehabilitation), Emergency Department Screener will be evaluated for further development (Belgian Intergovernmental Committee Health Care on use of the BelRAI suite across care settings [12]
17	Palliative Care	PC	The interRAI Palliative Care (PC) Assessment System was developed to provide a comprehensive assessment of the strengths, preferences, and needs of adults in both hospice and palliative care. The interRAI PC Assessment System is intended to be used in both facility-based and community-based programs. There are two versions of the assessment. The interRAI PC Assessment	interRAI Palliative Care België

			contains the full assessment, whereas the Hospice Assessment consists of a subset of items from the interRAI PC Assessment Form and is more appropriate for persons with shorter prognoses. There is no set standard for when or under what circumstances the different versions would be used	
18	Pediatric Home Care	PHC	The interRAI Pediatric Home Care Assessment (PEDS-HC) is a standardized assessment tool developed for use in programs serving children with special health care challenges. The PEDS-HC instrument is designed to be used to assess the home care challenges of children and youths ranging in age from 4 through 20 (in the USA) who are seeking or receiving long-term services or supports.	Modules Mental Health, Community Mental Health, screener Mental Health, Handicapped Persons, Children and Youth, Post-Acute Care (rehabilitation), Emergency Department Screener will be evaluated for further development (Belgian Intergovernmental Committee Health Care on use of the BelRAI suite across care settings [12]
19	Post-Acute Care	PAC	The interRAI Post-Acute Care (PAC) is designed to support care in rehabilitation or specialist geriatric units. It is available in a free-standing form or as a supplement to the interRAI AC. When the interRAI AC has been completed in the acute phase of care and a patient subsequently enters a post-acute program, a supplement is completed (PAC supplement). The target population consists of older or disabled persons admitted to any acute hospital service for inpatient treatment targeted to receive comprehensive assessment. The interRAI AC is suited to acute geriatric assessment units, geriatric consultation services, and for targeted use in general medical and surgical wards. interRAI supports its use for patients who are traditionally targeted for comprehensive geriatric assessment and management in the acute hospital setting. The interRAI PAC or the interRAI AC with the PAC supplement is suited to all patients entering an inpatient post-acute program of care.	Modules Mental Health, Community Mental Health, screener Mental Health, Handicapped Persons, Children and Youth, Post-Acute Care (rehabilitation), Emergency Department Screener will be evaluated for further development (Belgian Intergovernmental Committee Health Care on use of the BelRAI suite across care settings [12]
20	Quality of Life	QL	In order to support more fully the principles of self-determination and empowerment, interRAI recently released a series of site-specific Subjective Quality of Life (QoL) instruments. These short	

			surveys are designed to give persons enrolled in formal care programs the opportunity to share their perceptions on a variety of quality-of-life domains not otherwise addressed in our assessment systems, including relationships, environment, comfort, food, and participation in meaningful activities	
21	Wellness	WE	The Wellness Assessment is designed to assist older persons to develop individualized “healthy aging” plans. Unlike other interRAI instruments, all items on the Wellness tool are self-rated and systematically capture the person’s preferences and satisfaction with current activities. This information is later discussed with a healthy aging coach, who assists the person to develop measurable and realistic lifestyle change goals. Core areas for self-evaluation include exercise and physical fitness, nutrition, social relationships, emotional well-being, recreational and occupational pursuits, and spiritual needs. Findings from the Wellness Assessment also can be summarized across a residential community, enabling the organization to get timely feedback on the quality, depth, and effectiveness of services and programs that support the social lives of their clientele	
				BelRAI-screener

Appendix 2.2. Rehabilitation groups and suitable interRAI instruments

Major target groups of rehabilitation hospitals Source: [7]	Potentially applicable instrument of the interRAI-suite #	Potentially applicable instrument of the available instruments in the Belrai-suite
Cardio pulmonary	AC, AL, CHA, HC, LTCF, PAC, PHC	interRAI Acute Care België, interRAI Home Care België, interRAI LTCF België
Locomotor	AC, AL, CHA, HC, LTCF, PAC, PHC	interRAI Acute Care België, interRAI Home Care België, interRAI LTCF België
Neurological	AC, AL, CHA, HC, LTCF, PAC, PHC	interRAI Acute Care België, interRAI Home Care België, interRAI LTCF België
Psychogeriatry	AC, AL, CHA, HC, LTCF, PAC	interRAI Acute Care België, interRAI Home Care België, interRAI LTCF België
Major target groups of centres for ambulant rehabilitation (see Appendix 1.3)		
- children with ADHD, autism, mental handicap, complex developmental deficits **- children with hearing problems** **- children with cerebral palsy** **- children with non congenital brain injuries** **- children with mood disorders** **- children with behavioral problems**	AS, CYMH & CYMH-DD, DF, PHC	
- adults with non congenital brain injuries **- adults with laryngectomy, glossectomy,** **- adults with specific forms of stutter** **-adults with hearing impairments** **-adults with schizophrenia** **-adults with mood disorders**	CHA, CMH (and BMHS), DB, HC, ID, PAC	interRAI Home Care België

 # the choice for a suitable interRAI instrument largely depends on the setting where the patient is

APPENDIX 3. METHODOLOGY BEHIND THE LITERATURE SEARCH

An exploratory literature review was performed in the months May-August 2015.

Appendix 3.1. Research aim

To find evidence about classification systems for patients (seen in Centers for ambulant rehabilitation (CARS), SP-units and rehabilitation centers) that are used/tested for (governmental) resource allocation and discuss this literature on validity and feasibility.

Appendix 3.2. Search strategy

A three-steps search procedure will be followed. Firstly, 6 literature databases will be searched with rather specific strategies (Patient AND intervention AND Outcome). Key articles will be selected form this sample. In a second step; the key articles will be entered into Pubmed and we will search Pubmed with the 'related articles'-option for each of them; also the key articles will be entered into Google Scholar (by means of the publish or perish program) to see what other (grey) publications have cited the key-articles. Finally, the internet is searched by means of the Google advanced search options to find additional grey publications.

All hits from the first 6 databases will be entered into Endnote, deduplicated and then screened by one researcher on relevance firstly based on title/abstract, followed by screening based on full-text.

The google search will be performed with Mozilla-Firefox with active Zotero-add-on. Results will be screened by one researcher, based on description and as much as possible on full text, and only possible relevant publications will be stored in the Zotero-add-on. The publications withheld will then be merged to the Endnote-database.

First, a search strategy for Pubmed was developed and discussed by two reviewers on sensitivity and specificity and checked if key publications were in the search results. A PICO-format was used to develop the search strategy. With regard to the P(atient), we looked at the type of patients that are seen in CARs, SP an addiction revalidation centres, based on the websites of the different institutions involved and based on the statistics of the CARS, as delivered by VAZG. After consultation with the stakeholders, it was decided to focus on the SP services and the CARs (the two major transferred rehabilitation settings). The literature on the addiction clinics was not further explored.

With regard to the I(ntervention) we used terms that are related to classifying patients into categories. And for the O(utcome) we applied terms related to resource use, resource allocation or payment systems.

We restricted the search to publications from 2007 on, to have recent material and since KCE published in 2007 a report on classification systems for locomotor and neurological rehabilitation. The full search strategy can be retrieved in Appendix 4.

From this Pubmed search strategy, strategies for were developed/adapted by the KCE-information specialist for the following literature databases:

- Medline
- CINAHL
- Cochrane Library
- Econlit
- Embase

To find literature specific on INTERRAI, additional searches were performed:

- In Google:
  - INTERRAI AND ("resource allocation" OR "payment system" OR "prospective payment" OR RUG OR reimbursement) AND (rehabilitation OR postacute OR "post acute") filetype:pdf AND daterange:2454102-2457389
  - (INTERRAI OR BELRAI OR "BEL-RAI") AND revalidatie filetype:pdf AND daterange:2454102-2457389
- Websites:
  - CMS (USA) https://www.cms.gov/
  - CIHI (CAN) https://www.cihi.ca/en
  - INTERRAI http://bibliography.INTERRAI.org/
- Citing search with Harzings 'publish or perish' on relevant articles

Results of the extra searches were immediately assessed by one researcher on usefulness for the project and only possible relevant documents were downloaded and added to end-note library.

Appendix 3.3. Selection criteria

Inclusion criteria for initial sifting:

- It concerns one or more of the patient groups that are seen in CARS, SP, rehabilitation centers or addiction-clinics
- It concerns some way of classifying patients
- And the described/studied classification system is analyzed in relation to (governmental) resource allocation
- Dates from 2007 or later
- Written in English, Dutch, French or German
- All types of study designs

After initial sifting on title/abstracts, full-texts were obtained and screened on the same criteria. However, after consultation of the stakeholders it was decided to focus on the two major transferred types of rehabilitation settings, namely the SP rehabilitation services and the CARs. The literature related to the addiction clinics was not further explored.

Hereafter documents were categorized whether they discussed

- patient classification system
- patient classification system AND INTERRAI
- patient classification system AND INTERRAI AND resource utilization groups
- patient classification system AND INTERRAI AND resource utilization groups AND Belgium

Appendix 3.4. Results

Appendix 3.4.1. Search results

Databases searches resulted in 2991 references (see Figure 6). One reviewer sifted out all clear irrelevant references, leaving 437 references. Two reviewers judged independently the title/abstract of these 437 references on possible relevancy. 25 references were then assessed full-text.

Twenty-two of those 25 documents were about some kind of patient classification. The papers covered a large variety of classification systems (FIM, AN-SNAP, INTERRAI, rehabilitation complexity scale, diagnosis related groups, ICF and other). The papers originated from many countries.

Seven documents [82, 95, 101, 102, 115, 117, 143] were about “patient classification AND INTERRAI suite of instruments AND Resource Utilization Groups”. One of these documents [82] is a review discussing and comparing several classification instruments.

Country-origin of the other papers are USA [82, 95, 102, 115, 143] Canada [117, 144] and Italy [101].

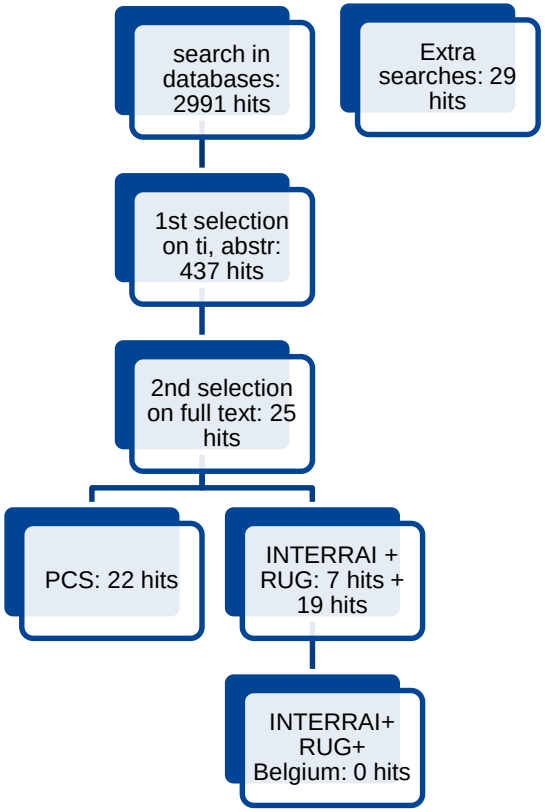
The extra searches resulted in an additional 29 potential relevant documents. In this set 19 documents [92, 113, 114, 116, 118, 133-140, 145-150] were about “patient classification AND INTERRAI suite of instruments AND Resource Utilization Groups”, all except one from Finland [146], originating from the USA or Canada.

These documents show that there algorithms to calculate from INTERRAI-items resource utilization groups (RUGs), that can be and are used for reimbursement purposes. There are different versions of the algorithm, the most recent called “RUG IV” (for Long-term care facilities). Patients are classified into 7 main categories, each with subdivisions; dependent of the RUG-version, there are 44 to 66 different resource utilization groups[o].

None of the retrieved documents from both search ways could be categorized as discussing “patient classification AND INTERRAI AND resource utilization AND Belgium”.

[o] meer info o.a. op http://wiki.belrai.org/nl/Wiki.jsp?page=RUGS

Figure 6 – Flowchart of search strategy



APPENDIX 4. SEARCH STRATEGIES

Appendix 4.1. Pubmed search

PICO	Ambulatory rehabilitation (“CARS”)	Inpatient Rehabilitation services (“CATEGORALE ZIEKENHUIZEN”)	Addiction	CARS *OR* SP *OR* addiction
Patients	("Mental Disorders Diagnosed in Childhood"[Mesh] OR "Autistic Disorder"[Mesh] OR autism OR ADHD [tiab] OR "attention-deficit/hyperactivity disorder" OR ("behavior problems" AND children) OR (developmental* AND (disabilit* OR problem* OR disorder*) OR "development disorder"))	("Rehabilitation"[Mesh] OR "Rehabilitation Nursing"[Mesh] OR "Rehabilitation Centers"[Mesh] OR rehabilitation [ti] OR "Neuromuscular Diseases"[Mesh] OR "Musculoskeletal System"[Mesh] OR "Musculoskeletal Diseases"[Mesh] OR "Nervous System Diseases"[Mesh] OR "Stroke"[Mesh] OR "Cardiovascular Diseases"[Mesh] OR "post acute care" OR "postacute care")	("Substance-Related Disorders"[Mesh] OR addict*[ti])	("Mental Disorders Diagnosed in Childhood"[Mesh] OR "Autistic Disorder"[Mesh] OR autism OR ADHD [tiab] OR “attention-deficit/hyperactivity disorder” OR (“behavior problems” AND children) OR (developmental* AND (disabilit* OR problem* OR disorder*) OR “development disorder”) OR ("Rehabilitation"[Mesh] OR "Rehabilitation Nursing"[Mesh] OR "Rehabilitation Centers"[Mesh] OR rehabilitation [ti] OR "Neuromuscular Diseases"[Mesh] OR "Musculoskeletal System"[Mesh] OR "Musculoskeletal Diseases"[Mesh] OR "Nervous System Diseases"[Mesh] OR "Stroke"[Mesh] OR "Cardiovascular Diseases"[Mesh] OR “post acute care” OR “postacute care”) OR ("Substance-Related Disorders"[Mesh] OR addict*[ti])
	AND			
Intervention	("Patient Acuity"[Mesh] OR "Triage"[MeSH] OR "patient classification" OR "patient complexity" OR "patient profile" OR "patient profiles" OR acuity OR "case-mix" OR casemix OR "Rehabilitee Management Categories" OR "Rehabilitation Management Categories" OR "function related groups" OR interrai OR ICF)			
C	-			
	AND			

Outcome	("Resource Allocation"[Mesh] OR "Costs and Cost Analysis"[Mesh] OR "Prospective Payment System"[Mesh] OR "Reimbursement Mechanisms"[Mesh] OR "Workload"[Mesh] OR "resource use" OR "resource utilization" OR "resource utilisation" OR "service use" OR "service utilization" OR "service utilisation" OR "healthcare use" OR "healthcare utilization" OR "healthcare utilisation" OR "care use" OR "care utilization" OR "care utilisation" OR "resource allocation" OR budget OR "payment systems" OR cost*)

N hits	179	4257	211	4497
N hits (limit ≥ 2007)	80	2294	93	2402

This search-strategy results in 2402 hits on May, 28th 2015

From this Pubmed search strategy, strategies for other databases will be developed/adapted by the KCE-information specialist.

Appendix 4.2. Medline search

Database: Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) <1946 to Present>

Search Strategy:

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1 exp Mental Disorders Diagnosed in Childhood/ (148572)
2 exp Autistic Disorder/ (16708)
3 autism.ab,ti. (23784)
4 ADHD.ab,ti. (15859)
5 "attention deficit/hyperactivity disorder".ab,ti. (16250)
6 ("behavior problems" and children).ab,ti. (2744)
7 (developmental* adj5 (disabilit* or problem* or disorder*)).ab,ti. (15844)
8 "development disorder".ab,ti. (107)
9 exp Rehabilitation/ (156314)
10 exp Rehabilitation Nursing/ (1175)
11 exp Rehabilitation Centers/ (12532)
12 rehabilitation.ti. (47150)
13 exp Neuromuscular Diseases/ (249109)
14 exp Musculoskeletal System/ (1219871)

15 exp Musculoskeletal Diseases/ (863131)
16 exp Nervous System Diseases/ (2143342)
17 exp Stroke/ (92755)
18 exp Cardiovascular Diseases/ (1946829)
19 "post acute care".ab,ti. (384)
20 "postacute care".ab,ti. (283)
21 exp Substance-Related Disorders/ (233755)
22 addict*.ti. (17174)
23 or/1-22 (5397784)
24 exp Patient Acuity/ (181881)
25 exp Triage/ (8413)
26 "patient classification".ab,ti. (862)
27 "patient complexity".ab,ti. (129)
28 "patient profile".ab,ti. (716)
29 "patient profiles".ab,ti. (702)
30 acuity.ab,ti. (54593)
31 case-mix.ab,ti. (4359)
32 casemix.ab,ti. (550)
33 "Rehabilitee Management Categories".ab,ti. (3)
34 "Rehabilitation Management Categories".ab,ti. (1)
35 "function related groups".ab,ti. (22)
36 interrai.ab,ti. (121)
37 ICF.ab,ti. (2744)
38 or/24-37 (252409)
39 exp Resource Allocation/ (15355)
40 exp "Costs and Cost Analysis"/ (188712)
41 exp Prospective Payment System/ (13968)
42 exp Reimbursement Mechanisms/ (31865)
43 exp Workload/ (16296)
44 (resource? adj2 allocation).ab,ti. (6573)

45 budget.ab,ti. (14172)
46 "payment systems".ab,ti. (711)
47 cost*.ab,ti. (394972)
48 ((resource? or service? or healthcare or care) adj3 ("use" or utilisation or utilization)).ab,ti. (62044)
49 reimbursement.ab,ti. (15813)
50 or/39-49 (590492)
51 23 and 38 and 50 (4740)
52 limit 51 to yr="2007 -Current" (2524)
53 remove duplicates from 52 (2414)

Appendix 4.3. Embase search

The search in Embase was performed on the 19the of June 2015.

No.	Query	Results
#56	#54 AND [2007-2015]/py NOT ([conference abstract]/lim OR [conference paper]/lim OR [conference review]/lim OR [editorial]/lim)	324
#55	#54 AND [2007-2015]/py	1321
#54	#53 NOT [medline]/lim	1485
#53	#25 AND #41 AND #52	3823
#52	#42 OR #43 OR #44 OR #45 OR #46 OR #47 OR #48 OR #49 OR #50 OR #51	799505
#51	cost*:ab,ti	515518
#50	'payment systems':ab,ti	782
#49	budget:ab,ti	18413
#48	(resource* NEAR/2 allocation):ab,ti	8013
#47	((resource* OR service* OR healthcare OR care) NEAR/3 (use OR utilisation OR utilization)):ab,ti	81230
#46	'workload'/exp	30507
#45	'reimbursement'/exp OR reimbursement:ab,ti	48641
#44	'prospective payment'/exp	7810
#43	'cost'/exp	270135
#42	'resource allocation'/exp	16172
#41	#26 OR #27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34 OR #35 OR #36 OR #37 OR #38 OR #39 OR #40	161657

#40	icf:ab,ti	3734
#39	interrai:ab,ti	141
#38	'function related groups':ab,ti	23
#37	'rehabilitation management categories':ab,ti	0
#36	'rehabilitee management categories':ab,ti	3
#35	casemix:ab,ti	743
#34	'case mix':ab,ti	5518
#33	acuity:ab,ti	64479
#32	'patient profiles':ab,ti	1103
#31	'patient profile':ab,ti	1170
#30	'patient complexity':ab,ti	193
#29	'patient classification':ab,ti	1027
#28	'patient coding'/exp	14226
#27	'emergency health service'/exp	71547
#26	'patient acuity'/exp	279
#25	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR#20 OR #21 OR #22 OR #23 OR #24	8284469
#24	addict*:ti	23259
#23	'addiction'/exp	239601
#22	'postacute care':ab,ti	305
#21	'post acute care':ab,ti	582
#20	'cardiovascular disease'/exp	3249687
#19	'cerebrovascular accident'/exp	222856
#18	'neurologic disease'/exp	2701280
#17	'musculoskeletal disease'/exp	1720423
#16	'musculoskeletal system'/exp	1513821
#15	'neuromuscular disease'/exp	146067
#14	rehabilitation:ti	64103
#13	'rehabilitation center'/exp	10222
#12	'rehabilitation nursing'/exp	1123
#11	'rehabilitation'/exp	264189

#10	'development disorder':ab,ti	182
#9	(developmental* NEAR/5 (disabilit* OR problem* OR disorder*)):ab,ti	20589
#8	'behavior problems':ab,ti AND children:ab,ti	3292
#7	'attention-deficit/hyperactivity disorder':ab,ti	19607
#6	'developmental disorder'/exp	28516
#5	'attention deficit disorder'/exp	40674
#4	adhd:ab,ti	21468
#3	autism:ab,ti	30426
#2	'autism'/exp	43330
#1	'mental disease'/exp	1676809

Appendix 4.4. CINAHL search

The search in CINAHL was performed on the 23rd of June 2015.

Nr	Query	Limiters	Results
S53	S23 AND S38 AND S50	Limiters - Published Date: 20070101-20151231; Exclude MEDLINE records	67
S52	S23 AND S38 AND S50	Limiters - Published Date: 20070101-20151231	260
S51	S23 AND S38 AND S50		483
S50	S39 OR S40 OR S41 OR S42 OR S43 OR S44 OR S45 OR S46 OR S47 OR S48 OR S49		187 365
S49	TI reimbursement OR AB reimbursement		6501
S48	TI cost* OR AB cost*		85 590
S47	TI "payment systems" OR AB "payment systems"		235
S46	TI budget OR AB budget		4891
S45	TI (resource* N2 allocation) OR AB (resource* N2 allocation)		1889
S44	TI ((resource* OR service* OR healthcare OR care) N3 (use OR utilisation OR utilization)) OR AB ((resource* OR service* OR healthcare OR care) N3 (use OR utilisation OR utilization))		28 821
S43	MH "Workload+"		10 054

S42	MH "Reimbursement Mechanisms+"	14 478
S41	MH "Prospective Payment System+"	5090
S40	MH "Costs and Cost Analysis+"	79 258
S39	MH "Resource Allocation+"	9055
S38	S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37	16 195
S37	TI ICF OR AB ICF	1495
S36	TI interrai OR AB interrai	87
S35	TI "function related groups" OR AB "function related groups"	17
S34	TI "Rehabilitation Management Categories" OR AB "Rehabilitation Management Categories"	0
S33	TI "Rehabilitee Management Categories" OR AB "Rehabilitee Management Categories"	4
S32	TI casemix OR AB casemix	242
S31	TI case-mix OR AB case-mix	1271
S30	TI acuity OR AB acuity	4186
S29	TI "patient profiles" OR AB "patient profiles"	157
S28	TI "patient profile" OR AB "patient profile"	164
S27	TI "patient complexity" OR AB "patient complexity"	66
S26	TI "patient classification" OR AB "patient classification"	438
S25	(MH "Triage")	6687
S24	(MH "Patient Classification")	2720
S23	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22	1 217 327
S22	TI addict*	6581
S21	(MH "Substance Use Disorders+")	108 647
S20	TI postacute care OR AB postacute care	256

S19	TI post acute care OR AB post acute care	426
S18	(MH "Cardiovascular Diseases+")	378 149
S17	(MH "Stroke+")	44 320
S16	(MH "Nervous System Diseases+")	493 061
S15	(MH "Musculoskeletal Diseases+")	171 523
S14	(MH "Musculoskeletal System+")	158 173
S13	(MH "Neuromuscular Diseases+")	50 587
S12	TI rehabilitation	27 283
S11	(MH "Rehabilitation Centers+")	6346
S10	(MH "Rehabilitation Nursing+")	2201
S9	(MH "Rehabilitation+")	195 980
S8	TI development disorder OR AB development disorder	741
S7	TI ((developmental* N5 (disabilit* or problem* or disorder*))) OR AB ((developmental* N5 (disabilit* or problem* or disorder*)))	5413
S6	TI (("behavior problems" and children)) OR AB (("behavior problems" and children))	744
S5	TI attention deficit hyperactivity disorder OR AB "attention deficit/hyperactivity disorder"	4626
S4	TI adhd OR AB ADHD	5620
S3	TI autism OR AB autism	11 252
S2	(MH "Autistic Disorder")	13 858
S1	MH Mental Disorders Diagnosed in Childhood	1474

Appendix 4.5. Additional searches specific on INTERRAI

In Google:

- Interrai AND ("resource allocation" OR "payment system" OR "prospective payment" OR RUG OR reimbursement) AND (rehabilitation OR postacute OR “post acute”) filetype:pdf AND daterange:2454102-2457389
- (Interrai OR BELRAI OR “BEL-RAI”) AND revalidatie filetype:pdf AND daterange:2454102-2457389
- Websites of CMS (USA) https://www.cms.gov/ and CIHI (CAN) https://www.cihi.ca/en and interrai http://bibliography.interrai.org/ (on this many OLD articles about validation of RUGs derived from RAI, but nothing recent)

CITING search with publish or perish on relevant articles.

Results of these searches are immediately assessed by one researcher on usefulness for the project and only possible relevant documents are downloaded and added to end-note library.

APPENDIX 5. RESOURCE UTILIZATION GROUPS (RUG-IV 66 GROUPS) IN INTERRAI-LTCF

Major RUG-IV category	Patient characteristics	Number of subgroups
Rehabilitation + extensive services	ADL dependency score >2 + physical therapy, occupational therapy and/or speech language pathology services + complex clinical care (tracheostomy care, ventilator/respirator, infection isolation)	5 levels (ultra high, very high, high, medium, low) Each level 2 subgroups based on ADL-score (except low level only 1 subgroup)
Rehabilitation	+ physical therapy, occupational therapy and/or speech language pathology services	5 levels (ultra high, very high, high, medium, low) Each level 3 subgroups based on ADL-score (except low level only 2 subgroups)
Extensive services	ADL dependency score >2 + complex clinical care (tracheostomy care, ventilator/respirator, infection isolation)	3 subgroups based on ADL-score
Special care high	ADL dependency score >2 + complex clinical care or one of following medical condition: comatose, septicaemia, diabetes with insulin injections and insulin order changes, quadriplegia with ADL-score >5, COPD with shortness of breath when lying flat, fever with pneumonia/vomiting/weight loss/tube feeding meeting intake requirement, parenteral/IV feeding, respiratory therapy	2 levels based on depression score Each level 4 subgroups based on ADL-score

Special care low	ADL dependency score >2 + complex clinical care or one of following medical condition: CP with ADL-score >5, MS with ADL-score >5, Parkinson's disease with ADL-score >5, respiratory failure and oxygen therapy, tube feeding meeting intake requirement, ulcer treatment stage II, III, IV, foot infections, radiation therapy, dialysis	2 levels based on depression score Each level 4 subgroups based on ADL-score
Clinically complex	Complex clinical care or one of following conditions requiring skilled nursing management, interventions or treatments: pneumonia, hemiplegia with ADL-score >5, surgical wounds or open lesions with treatment, burns, chemotherapy, oxygen therapy, IV medications, transfusions	2 levels based on depression score Each level 5 subgroups based on ADL-score
Behavioral symptoms and cognitive performance	ADL dependency score <5 + behavioral or cognitive performance symptoms	2 levels based on nursing rehabilitation score Each level 2 subgroups based on ADL-score
Reduces physical function	Support needed with activities of daily living and general supervision	2 levels based on nursing rehabilitation score Each level 5 subgroups based on ADL-score

APPENDIX 6. VALIDITY ANALYSIS OF RUG-III IN A SELECTION OF COUNTRIES

United States of America (USA)

Fries et al[121] demonstrated the **validity** of the RUG-III with 44 distinct groups in nursing home residents. Data contained the assessment of a sample of 7658 residents in 7 states and detailed measurement of nursing staff time over a 24-hour period and therapy staff time over a 1-week period. Interobserver reliability analysis demonstrated an average Spearman-Brown coefficient of 0.76, indicating a high interobserver agreement.

The RUG III system achieved 55.5% variance explanation of total per diem costs among the individual residents. The variance explanation for only nursing staff costs is lower (41.2%). The addition of facility or unit identifiers as covariates increased the variance explanation to 68% and 71 % respectively. The researchers demonstrated also that an increase in the Case-mix Index (CMI) (i.e. the normalized average resource use ((total) nursing plus auxiliary) per RUG) is determined by the higher hierarchical categories, a poorer ADL functioning, the provision of nursing rehabilitation services, signs of depression, provision of more rehabilitation.

The **time study**, in which the resident-specific and resident non-specific time spent by nursing staff and auxiliary staff were registered, revealed that the nursing home resident received care for about 118 minutes per day by the nursing staff. The care time provided by the auxiliary staff was 54.5 minutes per week (an average of 8 minutes per day).

The authors conclude that the RUG-III system is an improvement compared to the RUG-II system and shall be implemented for nursing home payment. Next to budget allocation, this version can also be used for management purposes, staffing level determination and quality assurance.

Bjorkgren et al (2000)[128] examined the validity of the RUG-III in a sample of 804 community-based individuals (home care).

For the **validity** analysis, the IADL performance variables were used to explain the variance, instead of the variance of weighted formal and informal care time. Only 3 IADLs (of the 14 IADLs) were effective in improving variance explanation, resulting in a variance explanation of 33.7%. Whether the client lived alone or not was included as dummy variable, indicating that clients living alone received about 35% less total weighted care time.

Time registration of both formal and informal care time revealed a mean formal care time of 4hours 16 minutes per week and a corresponding mean informal care time of 30 hours 21 minutes. After wage-weighting, formal care accounted for about 28% of total cost.

This validation analysis in home care setting found that informal care plays a key role in ADL and IADL support, i.e. the proportion of informal care tends to increase with greater functional dependency. Also the fact that clients are living alone or not, is linked to the amount of received informal care time. The authors conclude that the RAI-home care is suitable for implementing a case-mix classification.

Since 1997 a national nursing home time study, the Staff Time and Resource Intensity Verification (STRIVE) study, was undertaken to collect and analyse the care time spent by nursing home staff.[92] During the data collection phase a transition was made from Minimum Data Set (MDS) 2.0 to MDS 3.0, which is not anymore the solely assessment with the RAI instruments but a modified version combined with the OASIS assessment (used in home healh care) (see bullet on CARE items set in the implementation section). The data set from the STRIVE-project is used for the validation of the RUG-III and IV systems. The validity analysis indicated that the RUG-III 53groups has a good baseline predictive ability, however the changing nursing facility care patters over time required a refinement of the RUG-III to a RUG-IV system. Variance explanation of wage weighted staff time measures of resource use was substantially higher in the RUG IV system compared to the RUG-III system (nursing wage weighted staff time: 41.5% versus 30.0% and nursing plus therapy wage weighted staff time: 62.0% versus 53.0% respectively). Also the RUG-IV could better differentiate between groups, demonstrating its ability to identify rare but costly residents. The STRIVE data was also used to develop Case Mix indices (CMIs) for each of the 66 RUG-IV groups. Next to the validity analyses, also other analyses were performed on the daily cost of prescription drugs and the inter-rater reliability on the new assessments items in the MDS 3.0. A detailed report can be found via the reference.

Martin et al (2011) examined specifically the applicability of the RUG-III system in persons with intellectual disabilities residing in nursing homes (within the STRIVE project) (n= 236) and found an explanatory variance of 33.3% in wage-weighted nursing time among persons with intellectual disability compared to 29.6% among other residents.[129] Based on their analyses the authors came to the conclusion that RUG-III is also applicable in nursing home residents with an intellectual disability and may even be used as a basis for the development of a resource intensity classification systems in other settings with a similar type of support for persons with intellectual disability.

Implementation

In the USA the RUGs are implemented as case mix system but more recent studies on the current situation mentioned following considerations:

- In the USA, other classification/RUGs are applied for reimbursement besides those of the interRAI, depending of the type of facility patients are in, depending of the insurance patients qualify, or depending of the state or province. E.g. in the USA the FIM-function-related-groups are applied for patients residing in inpatient-rehabilitation-facilities (whatever that may be) and the interRAI for skilled nursing facilities and nursing homes. From both instruments (FIM, interRAI) ‘resource use groups’ are calculated and can/are used for reimbursement purposes
- There might be differences from state to state or from province to province. In both countries differences exist between states/provinces on the extent the instruments are mandated and or used for reimbursement purposes.The assessment instruments and the processes used in determining eligibility and developing care plans vary from state-to-state and within states, from program-to-program. Most of these programs measure the same types of concepts – health status, functional status, social supports, and other factors important to supporting the safe care and treatment of these populations. While the concepts are common, the individual items and instruments to measure a concept across programs within states, and across states within common programs, differ in terms of item definition or response codes.

As a result, for an individual served by multiple programs, the same type of data may be collected multiple times with different items. This increases burden on both the participant and the state data systems. Instead of collecting information once and using it multiple times, the data must be collected repeatedly for each program. Further, these differences prohibit the electronic transfer of information across programs and make it difficult to compare populations, relative service use, or outcomes across funding sources or across states.[141]

- Due to this regional and between care settings variety, the USA created a new instrument that can be used across settings and reimbursement parties. The Continuity Assessment Record and Evaluation (CARE) [134-140] item set was developed to meet this mandate. Items were selected from the range of existing assessment instruments. The CARE item set is designed to standardize assessment of patients' medical, functional, cognitive, and social support status across acute and post-acute settings, including long-term care hospitals (LTCHs), inpatient rehabilitation facilities (IRFs), skilled nursing facilities (SNFs), and home health agencies (HHAs). The goal was to standardize the items used in each of the existing assessment tools while posing a minimal administrative burden to providers.
- The Medicare/medicaid nursing facility program mandates the use of the same automated assessment for all resident, however such a requirement does not exist for Medicaid-funded or other state-funded home and community-based services. Each state designed its own assessment system, resulting in a variety of assessment tools. Currently, many states are developing an integrated service delivery system for the provision of both medical services and long-term care services, based on a standardized automated assessment.[133]

Japan

The **validity** of the RUG-III system is also examined in long-term care facilities in Japan (n=871 patients).[123] Nevertheless the differences in health care system in Japan compared to that in the US (e.g. higher institutionalization rate, less availability of nursing homes) the authors found an acceptable level of inter-observer reliability and a variance explanation of resource consumption of 42.4% for unweighted time (43.8% for wage-weighted time). The latter increased to 54.3% using facility identifiers as covariates and to 62.7% with the wards as covariates. Although similarities were found between the CMI in Japan versus in the USA, the differentiation between the RUGs was less clear in Japan. Exploring the current care provision and payment mechanisms in the Japanese long-term care facilities, showed a great variability in clinical categories and in revenue within facility types.

The **time study** revealed a lower amount of care time, mainly due to less time spent by the nursing staff, compared to the USA (96.3 minutes versus 126 minutes per day respectively).

This study demonstrated that despite the differences in the organisation of the healthcare system, the RUG-III system is still valid but more in-depth analysis on the current discrepancies within facility types is needed before this kind of case mix payment system can be implemented.

In 1995 the results of a larger validity have been published: in a sample of 1255 patients the variance explanation increased to 65%.[151] Between 1993 and 1995 a national project involving more than 6000 patients was set up for validity purposes, but the full report has never been published.[131]

Implementation

An editorial of the same author gives some information on the current implementation of the RUG-III in Japan: "Although RUG-III attained the same high level of validation in these research projects it previously had in the United States, the Japanese government did not move forward with introducing RUG-III into LTC facilities because officials did not have enough confidence that they could overcome providers' opposition to a case-mix payment system. It had been hard enough to introduce flat-rate payments, and making this further step seemed premature, at the least. Moreover, the RUG-III validation projects had revealed how little experience LTC facility staff had in undertaking comprehensive assessments. Any case-mix grouping based on such assessment data would not be reliable, so focusing on quality rather than costs appeared to be the more appropriate goal." [131]

Hong Kong

The reliability and **validity** of the RUG-III has also been examined in Hong Kong nursing homes (n= 1127 residents): an excellent inter-rater reliability was found (κ=0.76) and the RUG-III with 44 groups explained 28.8% of the variance of nursing staff (21.2% of the variance of all staff time) and 27.0% for wage-weighted nursing staff time (14.1% of the variance of all wage-adjusted staff time).[124]

The **time** registration revealed a mean total staff time of 123.6 minutes per 24-hour period, of which 101.1 minutes by nursing staff and 22.5 minutes by auxiliary staff.

Implementation

Since 2001, the interRAI assessment tools for geriatric care are implemented but no clear information could be found of the RUGs were applied for budget allocation. Nevertheless the good reliability and validity of the RUG-III, Chou et al (1998) suggested to develop a more sophisticated case-mix system to reflect the heterogeneity of care levels among residents.[132]

Canada

A pilot study in Ontario[152] compared the effectiveness of three classifications systems (the Alberta resident Classification System (ARCS), the RUG-III system and the Function Related Groups (FRG) based on the Functional Independence Measure (FIM)) and the authors came to the conclusion that the RUG-III system should be implemented for activity measurement and funding of chronic care patients.

Poss et al (2008)[72] examined the **validity** of the RUG-III for home care in 21 578 individuals: explained variance for costs combining formal and informal care cost was 37.3% (20.5% for formal cost alone). Similar results were found compared to the validity analysis of RUG-III- home care in the United States[128], concluding that RUG-III home care is suitable for adults in home care that stay on service about 60 days or longer.

Registration of care **time** spent on informal and formal care was measured in the time study and revealed that 21.7hours (on the last 7days) are spent on informal care. The total hours spent on formal care are not presented.

Similar to the United States, Canada performed also a project on the staff time and resource use, i.e. the Canadian Staff Time and Resource Intensity Verification (CAN-STRIVE) project. This project aimed to validate the RUG-III for hospitals/ units and long-term care facilities and RUG-III for home care. The Canadian Institute for Health Information (CIHI) established the Continuing Care Reporting System (CCRS) to support national implementation and to function as national data repository. [91]

An evaluation over time (between 1996 and 2003) of the Continuing Care Reporting System (CCRS) in complex continuing care hospitals/units (CCC) and long-term care homes (LTC) (in Ontario) showed an increase over time in rehabilitation minutes for both CCC (from 66 min to 143 min) and LTC (from 16 min to 42 min). In all years, the mean CMIs were notably higher for CCC compared with LTC, reflecting differences in populations and in the intensity of provided interventions.[70]

Guthrie et al (2011) examined the validity of the interRAI Community Health Assessment and the Deafblind Supplement as a case-mix funding model for adults with vision and hearing loss or dual sensory loss (n=182) and found that the model can differentiate resource intensity across 9 main groups. Excellent explained variance has been demonstrated (67.7% for total costs and 62.4% for formal costs), indicating a better performance than the case-mix models developed for home care and long-term care.[105]

Implementation

The RAI assessment system for long-term care facilities and the related RUG-III system has been set up in two provinces, Ontario and Saskatchewan. However, only Ontario has been using the RUG-II for reimbursement for both complex continuing care hospitals/units (comparable to skilled nursing facilities in the United States) and long-term care facilities (since 2001). Other provinces, like Nova Scotia, Manitoba, British Columbia and the Yukon, have also evaluated the RAI assessment system, but appear to be more focused on its applications for care planning and quality management rather than for funding purposes.[153]

In Ontario, the RAI-home care was mandated for all adult long-stay home care recipients in 2002, but the RUG-III for home care has not been used for payment. [73]

Since 2009, the RAI long-term care and the RUG-III system will be implemented for long-term care funding in the province of Alberta, however staff time data is still under development (see CANSTRIVE project) and the long-term care specialty units are not yet funded via patient/care-based funding.[116]

As mentioned in the section on the implementation of the RUG case-mix system in the USA, Canada deals with similar issues on lack of implementation of a uniform system all over the different provinces. Also the interRAI is often combined with other classifications or case-mix systems for reimbursement, resulting in a complex system with additional administrative burden for the care providers.[141]

Finland

Björkgren et al (1999)[65] examined the reliability and validity of an adapted 22-group version of RUG-III for use in long-term care facilities in Finland (n=1964 residents). The reliability was demonstrated by the inter-observer agreement on the determination of the clinical categories (adequate or good agreement, overall mean Kappa 0.59) and on cost weights (acceptable

(r=0.78) to high agreement (r=0.93) depending on the familiarity of the assessors with the patient).
A variance explanation of 38.2% for total wage-weighted patient specific time confirmed the **validity** of the RUG-III system in the Finnish population. Adjusting for ward identifiers, age, gender and length of stay improved the explanatory power to 49.9%.
Similar to Japan, the **time study** indicated a smaller amount of care time spent in comparison to the USA: mean staff time of 76.4 min per 24h, of which 72.3min were spent by nursing staff and only 4.1min by auxiliary staff, and a case-mix adjusted mean staff time of 86min.
The good reliability and validity results demonstrate the transferability of the RUG-III system for long-term care facilities between healthcare systems.

Implementation

In a benchmarking project (the STAKES project) data on staffing, expenditure, well-being of the staff and experienced quality of care was collected in addition to the RAI data derived from the RAI-long-term care facilities (starting from 2000), RAI-home care (starting from 2003) and RAI-acute care (starting from 2005).[154] However, no clear quantitative data could be extracted from the powerpoint-presentation. Due to language restrictions, no policy reports could be reported here. Therefore, it is unclear in which degree the interRAI suite of instruments is already nationally implemented in Finland.

Italy

The RUG-III system (with 44 groups) is also validated in Italian intermediate- and long-term care facilities (n=999 residents in 11 institutions)[66](reliability and **validity** analysis): an average intra-class correlation coefficient of 0.85 for both inter-rater and test-retest reliability, and an explained variance of 45% for wage-weighted nursing care and of 61% for wage-weighted rehabilitation care (with a 65% of variance in the use of any type of heath personnel resources).
The **time study** revealed a higher amount of time spent to care in comparison to the data from the USA: a total care time of 183.43 minutes (versus 126 minutes in the USA) of which 146.98 minutes were spent on nursing care (versus 118 minutes in the USA) and 22.82 minutes on rehabilitation care (versus 22.82 minutes in the USA).[121]
Comparison between different types of institutions for each given classification group found large differences in the amount of care provided, indicating the need for a reimbursement system based on the patients' characteristics and needs rather than on the type of facility. The authors conclude that their study results show the reliability of the RUG-III system to estimate the nursing and rehabilitation resource use and that the implementation of such a classification system may improve the management and quality control of long-term care in Italy.
A similar validity analysis has been performed in 3981 nursing home residents in Tuscany[126]. The authors found that the classification in RUGs revealed a considerable variation in clinical practice between the different local health authorities, marked by a variable amount of care needed by the residents across structures, a great variability in the level of staffing among the nursing homes (which was not related to the amount of care needed by the residents) and a variability of the ratios of staff resources to residents' care needs greater than CMI variability. The authors assumed that these variabilities indicated differences in the quality of care among these nursing homes.
Italian researchers compared the amount of provided care to older people in nursing homes (n= 552) versus day care settings (n=111) and evaluated the correlations between scores of two assessment instruments (RUG-III versus AGED (applied in the region of Liguria)). Due to language restrictions, the results here presented are limited to the available information in the abstract. Nevertheless the higher correlation between total time of care and AGED compared to the RUG, the latter could be the basis for the reimbursement by the National Health Service. The authors found also that both case-mix systems underestimated the presence of cognitive and behavioural disorders.[101]

Implementation

Since 1997, a project on the implementation of the RAI-home care is going on in the different local Health Agencies. In 2003, 25 (or 10%) has implemented this model. However, no data beyond the validity analysis were found on how Italy and its different regions have implemented the RUGs for budgetary purposes.
(http://www.milbank.org/uploads/documents/interRAI/030222interRAI.html#italy)

United Kingdom

In a **validity**-analysis in 193 nursing home residents in England on the combination of RAI assessment variables and the RUG-III case-mix system, the RUGs explained 56% of the variance in care time (p=0.0001).[142] A similar validity study performed by Carpenter 1995 in 1675 geriatric patients, showed a variance explanation of 45% in acute and rehabilitation wards and 23% in long-stay wards.[155]

The **time study** focused on the care time spent by registered general nurses (RGN) and care assistants (CA). Based on the amount of care provided a distinction could be made between residents with enhanced nursing care (RAI-categories: rehabilitation, extensive services, special care, clinically complex) and residents with standard nursing care (RAI-categories: impaired cognition, behaviour problems, physical function): the resident in the enhance nursing care group received 1.4 times more direct RGN and CA care, 2.3 times more indirect RGN care and 1.1 times more CA care. On average, these residents received 48.1 min of RGN care compared to 31.1min for residents with standard nursing care. The authors concluded that the RUG-III system has been well validated and that the system can differentiate groups of nursing homes residents who receive different amounts of care.

A sub analysis was found on the linkage between an increasing number of RUG-III assessments and an increasing total episode CMI in a sample of 336 elderly patients admitted to rehabilitation wards.[104] The variability found in resource use (reflected in the CMI) in patients with a same length of stay is attributable both to the clinical characteristics and the provided rehabilitation.

Despite the validation of the RUG-III system in acute and rehabilitation wards in England and Wales[155], Urquhart et al (1999)[127] have a different opinion on its applicability in the long-term care services in the UK, due to differences in patient population and the nature of care between US nursing homes and British continuing-care settings. Therefore the authors developed a modified version of the RUG-III system, i.e. the Scottish health services resource utilization groups (SHRUG), and examined its inter-rater reliability and validity in 2783 long-stay patients (aged 65years and older) residing in NHS continuing-care wards in 50 Scottish hospitals. Based on an inter-rater variability ranging from 68% to 97% for individual variables, an 67% consistency for the 5 categories of the SHRUG with the relative weights range from 0.56 to 1.41 between these categories and an explanatory variance of 35% in costs, the authors concluded that SHRUG is a useful instrument to assess the resource needs of elderly people in long-term care.

Implementation

No information could be found.

Switzerland

In our literature search no studies could be retrieved on validity analyses of the RUGs in Switzerland, nor on the implementation of such a case mix financing system. One of the validators suggested some studies in German on the current use of interRAI suite of instruments. From the late 1990s on the geriatric nursing assessment has been used in nursing homes. In the study of Gattinger et al (2014) the level of nursing care required for residents in nursing homes was assessed by the Minimum Data Set (MDS) of RAI and by the BESA Catalogue 2010, performed by nurses of the facility or by system experts. The comparison between the assessors revealed significant different in tariff level allocation. No information could be found on the national (or regional) implementation of the RUGs for budget allocation.

Czech Republic

Due to language restrictions, all presented results are derived from the abstract. The **validity** analysis of the RUG-III for post-acute and long-term care in 1162 residents from 18 institutions, found a 59% variance explanation of total per diem costs of nursing and therapy/rehabilitation care. The resource use within groups was relatively homogeneous.[122]

The results of the **time** study are only presented by the CMIs per group, indicating a sevenfold difference in resource use between groups.

Conclusion of the authors: “the RUG-III represent a suitable case-mix system for nonacute institutional care.”

Implementation

No data were found on the implementation phase in the healthcare system of the Czech Republic.