Incomplete Assessments: Towards a Better Understanding of Causes and Solutions. The Case of the interRAI Home Care Instrument in Belgium

Dirk Vanneste, Johanna De Almeida Mello, Jean Macq, Chantal Van Audenhove, Anja Declercq

1 Lucas, Center for Care Research and Consultancy, Katholieke Universiteit Leuven, Leuven, Belgium, 2 Ecole de Santé Publique, Institut de Recherche Santé et Société, Université Catholique de Louvain, Brussels, Belgium

These authors contributed equally to this work.
* anja.declercq@med.kuleuven.be

Abstract

The chronic diseases, comorbidities and rapidly changing needs of frail older persons increase the complexity of caregiving. A comprehensive, systematic and structured collection of data on the status of the frail older person is presumed to be essential in facilitating decision-making and thus improving the quality of care provided. However, the way in which an assessment is completed has a substantial impact on the quality and value of the results. This study examines the online completion of interRAI Home Care assessments, the possible causes for incomplete assessments and the consequences of these factors with respect to the quality of care received. Our findings indicate high nurse engagement and poor physician participation. We also observed the poor completion of items in predominantly medical-oriented sections characterized by, first, the fact that the assessors felt incapable of answering certain questions, second, the absence of required data or of a competent person to fill out the data, and third, the lack of tools necessary for essential measurements. The incompleteness of assessments has a clear negative influence on outcome generation. Moreover, without the added value of support outcomes, the improvement of care quality can be impeded and information technology can easily be seen as burdensome by the assessors. We have observed that multidisciplinary cooperation is an important prerequisite to establishing high-quality assessments aimed at improving the quality of care.

Introduction

Three decades ago, several studies identified significant and widespread poor quality of care related to the inability to identify the problems and needs of older persons [1, 2]. In 1983, Sidney Katz recognized the need for a uniform and comprehensive assessment in nursing homes [3]. All these observations were to lead to one of the cornerstones of modern geriatric care: the comprehensive geriatric assessment (CGA) [1].
collection of data on the frail older person is supposed to be essential in differentiating between important and less important issues, in unraveling the complex clinical condition of a person, in guiding decision making and hence in improving healthcare processes and the quality of care provided [4–11].

Nowadays, healthcare environments are increasingly confronted with older persons characterized by chronic conditions and/or comorbidities, and in need of complex long-term care [4, 12–14]. The need to receive support from multiple service providers has significant implications for persons with complex care needs [15]. As people migrate through this maze of healthcare providers, the use of standardized, integrated, computerized and person-centered data that are available and understandable to those who must make decisions at the personal, clinical, managerial, and public policy levels has become even more fundamental in providing high-quality care. A lack of information (transfer) may result in increased assessment burden, uncoordinated care and adverse events influencing morbidity, mortality and hospital outcomes [16, 17]. Therefore, clinical information systems that typically have been designed to support single service providers in one setting no longer meet the necessary requirements [18].

The ‘first generation’ assessment instruments used collections of single-domain measures.14 Meanwhile, CGA has evolved. The interRAI suite of instruments, a ‘third generation’, multi-domain suite of compatible assessment instruments released in 2005, makes it possible to share high-quality person-centered information and to compare people, services and outcomes across settings [19–27]. This integrated system is based on:

a. consistent terminology across instruments;

b. a common set of ‘core’ items and definitions that are considered to be important in all care sectors (e.g., cognition, ADL) and the provision of a ‘backbone’ of critical information, ‘optional’ items and sector-specific items having identical observation timeframes and response codes—all items being classified into (care) domains referred to as ‘sections’ [14, 18];

c. a common clinical assessment with an emphasis on functional assessment rather than on diagnosis;

d. a common data collection method based on professional assessment skills;

e. a common theoretical and conceptual basis providing triggers for care plans;

f. algorithms generating decision support outcomes, quality improvement and monitoring measures, guidelines and care planning protocols for sectors serving similar populations;

The instruments are internationally validated, adaptable to multiple care sectors, holistic, client-centered and outcome-oriented, promote interdisciplinarity and improve continuity, efficiency and quality of care [24]. However, the interRAI assessments can only reach their full potential when computer-based information technologies are used [18, 28, 29].

A CGA being of fundamental importance [5, 8–10], the way it is handled and completed highly influences its quality and value. It is obvious that without all the required assessment data, the resulting outcome—measures, guidelines, protocols—provided to caregivers, clinicians, care managers, policymakers, researchers and other stakeholders, will invariably be limited or of poor quality [18, 22]. Therefore, our research focuses both on any sections and items that have been filled out incompletely, as well as on health professionals with a responsibility for ensuring the assessments are completed. We also discuss possible causes for incomplete assessments and consequences related to the output and care planning. To our knowledge, these aspects have never been studied before. This research will bring new insight into important facilitating and impeding conditions for performing a comprehensive assessment.
Methods

Context

In Belgium, the interRAI assessment instruments were adapted to the Belgian healthcare context, and a web application (hereafter referred to as BelRAI) was developed to support the use of the assessments in Belgium’s three official languages: Flemish-Dutch, Walloon-French and German [30–37]. Usability studies show that BelRAI allows caregivers to assess the condition of a frail older person in a multidisciplinary way and to exchange person-centered information over time and between different care providers, safely, anywhere and at any time. The whole system was developed in collaboration with prospective users and stakeholders [38]. Online, the health professional responsible for the completion of the assessment can invite each professional involved in the care for the older person to complete the section(s) of the assessment related to his or her area of expertise. The system reveals conflicting answers and uses an interdependency system with data checks, validations and restrictions in order to prevent users filling out erroneous, inappropriate or inconsistent information and to draw attention to dubious answers. An online support platform—BelRAIWiki—offers ‘one click away’ background information in order to facilitate the assessment procedure and enhance the involvement and training of professionals from various disciplines and healthcare sectors.

In principle, assessments should always be filled out completely (100%). The software used should be programmed in a way that users are obliged to answer all questions. However, due to unavoidable circumstances, this feature was temporarily turned off in the BelRAI software and users were told the assessment should be at least 75% complete. This is intended only as a temporary measure. However, the current situation has made it possible to study which items are most often left blank once the opportunity to do so is created. This kind of knowledge allows for the targeting of specific coding problems during training, not only in Belgium, but in any country where the interRAI instruments are used.

Participants

The participants in the study were health professionals (nurses, occupational therapists, social workers, psychologists, physiotherapists, speech therapists, and physicians) caring for older persons—clients—in home care projects [39]. These professionals underwent a two-day training course and a follow-up training course lasting one day on how to fill out an interRAI HC assessment using the BelRAI web application (http://www.belrai.org). The clients were at least 65 years old, frail and eligible to be admitted into a nursing home.

Data collection

Every interRAI HC instrument is filled out upon the inclusion of the frail older person in the home care projects (baseline), based on observation, shared data, and using data obtained by interviewing the older person and the main informal caregiver. While several health professionals of different disciplines could participate in the same assessment, one health professional was responsible for ensuring the completion of the assessment. In this study, we used the data related to the ‘responsible’ health professionals.

Ethical considerations

BelRAI meets the privacy standards of the Sectoral Committee of the Commission for the Protection of Privacy in Belgium [40]. Furthermore, the study was approved by the same Belgian Privacy Commission and by the Ethics committee of the Belgian universities Université Catholique de Louvain and KU Leuven (B40320108337). A formal procedure was implemented in
order to make sure that caregivers could fill out the questionnaires on a secured website [41]. Frail older persons were asked to sign an informed consent agreement. In cases where these persons or clients were not capable of signing this document, a family member or another legal representative signed it on their behalf, as stipulated by Belgian law. Clients were able to withdraw their participation at any time, without any consequences for the care they received. All data were anonymized before the dataset was sent to the researchers for analysis.

Data analysis

All data were derived from first assessments that were at least 75% complete (see above). This arbitrary cut-off was determined at the start of the project for practical and policy reasons. It was reasoned that if a caregiver really intends to use the assessment outcomes, he or she would complete at least 75% of the assessment. An assessment completed for less than 75% lacks sufficient information for the generation of any meaningful output.

As the use of free input fields or text boxes is not required to calculate outcomes, we did not include data related to items such as other diagnoses (I2)—name and International Classification of Disease code—and medication (M1)—name, dose, unit, administration, frequency, pro re nata (PRN), and drug identification number—in our study. Nor did we take into account:

a. ‘administrative’ items such as name (A1a-d), gender (A2), date of birth (A3), marital status (A4), personal identification numbers (A5a), other payment categories (A7k-m), reason for assessment (A8), postal code (A10), substitute decision maker (A18d), treating doctor (A20), education (A22), ethnicity/race/nationality (B3a-g), primary language (B4), last day of stay (T1), living status after discharge (T2), signature (U1) and date (U2);

b. the item indicating recent falls (J12) since it is only assessed during follow-up assessments and not during the first assessment;

c. the item indicating physical restraint (N4) since it is replaced by full bed rails (N6a), trunk restraint (N6b), and chair prevents rising (N6c) in the BelRAI web application;

d. the item indicating the second informal helper (P1a2, P1b2, P1c2 and P1d2) as most clients in the home care projects do not have a second informal caregiver;

e. the items R3, R4 and R5 as these are not assessed if the client did not deteriorate in last 90 days—to gather information on the overall completion score of this section we focused on data relating to care goals met (R1) and self-sufficiency change (R2).

Data analysis was performed in two steps. First, descriptive statistics were calculated to determine to what extent each of the items of the interRAI HC instrument was completed and, second, to see which type of health professional was responsible for the completeness of the assessment. Statistical analysis was performed using STATA 11.1 (StataCorp, College Station, Texas).

Results

From March 2010 until January 2013, 5,117 assessments were completed for at least 75%. The following research is based on data originating from these assessments.

Table 1 shows high completion scores for assessment items regarding Section A—Identification information (≥98.84%), Section B—Intake and initial history (≥98.48%), Section C—Cognition (≥99.18%), Section D—Communication and vision (≥99.43%), Section E—Mood and behavior (≥98.12%), Section F—Psychosocial well-being (≥99.18%), and Section H—Continence (≥99.18%). In Section J—Health conditions—all items have a score between...
| Generic Variable Name | Section Names and Items | Completion % | 95% CI | Affected Outcomes |
|-----------------------|-------------------------|--------------|--------|------------------|
|                       |                         |              |        | Clinical Assessment Protocols | Scales & Screening Algorithms |
| Section A             | Identification information |              |        |                  |                               |
| A9                    | Reference date          | 99.73        | 0.996–0.999 |                  |                               |
| A11b                  | Residential/Living status | 98.84        | 0.986–0.991 |                  |                               |
| A12a                  | Living arrangement      | 99.26        | 0.990–0.995 |                  |                               |
| A12b                  | Lives with someone new  | 98.92        | 0.986–0.992 |                  |                               |
| A12c                  | Better living elsewhere | 99.37        | 0.992–0.996 |                  |                               |
| A13                   | Time since last hospital stay | 99.10        | 0.988–0.994 |                  |                               |
| Section B             | Intake and initial history |              |        |                  |                               |
| B2                    | Date case opened        | 99.41        | 0.938–0.950 |                  |                               |
| B5a                   | History: LTCF           | 98.93        | 0.986–0.992 |                  |                               |
| B5b                   | History: Board and care home, assisted living | 98.85 | 0.986–0.991 |                  |                               |
| B5c                   | History: Psychiatric hospital | 98.48 | 0.981–0.988 |                  |                               |
| B5e                   | History: Mental health residence | 98.81 | 0.985–0.991 |                  |                               |
| Section C             | Cognition               |              |        |                  |                               |
| C1                    | Daily decision-making   | 99.80        | 0.997–0.999 |                  |                               |
| C2a                   | Short-term memory       | 99.57        | 0.993–0.997 |                  |                               |
| C2b                   | Procedural memory       | 99.30        | 0.990–0.995 |                  |                               |
| C2c                   | Situational memory     | 99.41        | 0.992–0.996 |                  |                               |
| C3a                   | Easily distracted       | 99.18        | 0.989–0.994 |                  |                               |
| C3b                   | Disorganized speech     | 99.26        | 0.990–0.995 |                  |                               |
| C3c                   | Mental function varies over day | 99.37 | 0.992–0.996 |                  |                               |
| C4                    | Acute change in mental status | 99.26 | 0.990–0.995 |                  |                               |
| C5                    | Change in decision-making | 99.32 | 0.991–0.995 |                  |                               |
| Section D             | Communication and vision |              |        |                  |                               |
| D1                    | Making self understood  | 99.63        | 0.995–0.998 |                  |                               |
| D2                    | Ability to understand others | 99.65 | 0.995–0.998 |                  |                               |

(Continued)
| Generic Variable Namea | Section Names and Items | Completion % | 95% CI | Affected Outcomes | Clinical Assessment Protocols | Scales & Screening Algorithms |
|------------------------|-------------------------|--------------|--------|------------------|-----------------------------|-------------------------------|
| D3a                    | Hearing                 | 99.43        | 0.992–0.996 |                  |                             |                               |
| D4a                    | Vision                  | 99.53        | 0.993–0.997 |                  |                             |                               |
| Section E              | Mood and behavior       |              |         |                  |                             |                               |
| E1a                    | Negative statements     | 99.63        | 0.995–0.998 | ABUSE, ENVIR, MOOD | RUGs, DRS                  |                               |
| E1b                    | Anger                   | 99.49        | 0.993–0.997 | ABUSE, ENVIR, MOOD | RUGs, DRS                  |                               |
| E1c                    | Unrealistic fears       | 99.53        | 0.993–0.997 | ABUSE, ENVIR, MOOD | RUGs, DRS                  |                               |
| E1d                    | Repetitive health complaints | 99.32    | 0.991–0.995 | ABUSE, ENVIR, MOOD | RUGs, DRS                  |                               |
| E1e                    | Anxious complaints      | 99.39        | 0.992–0.996 | ABUSE, COGNIT, ENVIR, MOOD | RUGs, DRS                  |                               |
| E1f                    | Facial expressions      | 99.43        | 0.992–0.996 | ABUSE, ENVIR, MOOD | RUGs, DRS                  |                               |
| E1g                    | Crying                 | 99.12        | 0.989–0.994 | ABUSE, ENVIR, MOOD | RUGs, DRS                  |                               |
| E1h                    | Recurrent statements    | 99.32        | 0.991–0.995 | COGNIT            |                             |                               |
| E1i                    | Withdrawal             | 99.39        | 0.992–0.996 | ABUSE             |                             |                               |
| E1j                    | Reduced social interactions | 99.16   | 0.989–0.994 | ABUSE             |                             |                               |
| E1k                    | Lack of pleasure       | 99.24        | 0.990–0.995 |                  |                             |                               |
| E2a                    | Self-report: Little interest | 98.22     | 0.979–0.986 |                  |                             |                               |
| E2b                    | Self-report: Anxious, restless, uneasy | 98.18 | 0.978–0.985 |                  |                             |                               |
| E2c                    | Self-report: Sad, depressed, hopeless | 98.12 | 0.978–0.985 |                  |                             |                               |
| E3a                    | Wandering              | 99.53        | 0.993–0.997 | RISK, COGNIT, BEHAV | MAPLe, RUGs                |                               |
| E3b                    | Verbal abuse            | 99.53        | 0.993–0.997 | RISK, BEHAV       | MAPLe, RUGs                |                               |
| E3c                    | Physical abuse          | 99.57        | 0.994–0.997 | RISK, COGNIT, BEHAV | MAPLe, RUGs                |                               |
| E3d                    | Socially inappropriate behavior | 99.57      | 0.994–0.997 | RISK, BEHAV       | MAPLe, RUGs                |                               |
| E3e                    | Resists care            | 99.63        | 0.995–0.998 | RISK, BEHAV       | MAPLe, RUGs                |                               |
| E3f                    | Inappropriate sexual behavior | 99.53      | 0.993–0.997 | RISK, BEHAV       | MAPLe, RUGs                |                               |
| Section F              | Psychosocial well-being |              |         |                  |                             |                               |
| F1a                    | Social activities       | 99.63        | 0.995–0.998 |                  |                             |                               |
| F1b                    | Visit by relation or family member | 99.57  | 0.994–0.997 |                  |                             |                               |

(Continued)
Table 1. (Continued)

| Generic Variable Name | Section Names and Items | Completion % | 95% CI       | Affected Outcomes |
|-----------------------|-------------------------|--------------|--------------|------------------|
|                       |                         |              | Clinical Assessment Protocols | Scales & Screening Algorithms |
| F1c                   | Other interaction with relation or family member | 99.65 | 0.995–0.998 |                   |
| F1d                   | Lonely                  | 99.27 | 0.990–0.995 | SOCFUNC          |
| F1e                   | Openly expresses conflict with family | 99.36 | 0.991–0.996 | ABUSE            |
| F1f                   | Fearful of family member | 99.53 | 0.993–0.997 | ABUSE            |
| F1g                   | Neglected or abused     | 99.55 | 0.994–0.997 | ABUSE            |
| F2                    | Change in social activities | 99.18 | 0.989–0.994 | SOCFUNC          |
| F3                    | Length of time alone    | 99.53 | 0.993–0.997 | BRITSU, SOCFUNC  |
| F4                    | Major life stressors    | 99.45 | 0.993–0.997 |                 |

**Section G Functional status**

| G1aa                  | Meal preparation—performance | 99.28 | 0.990–0.995 | RUGs, IADLP      |
| G1ab                  | Meal preparation—capacity    | 95.60 | 0.950–0.962 | BRITSU, IADL     |
| G1ba                  | Ordinary housework—performance | 99.36 | 0.991–0.996 | IADLP            |
| G1bb                  | Ordinary housework—capacity | 95.62 | 0.951–0.962 | BRITSU, IADL     |
| G1ca                  | Managing finances—performance | 99.37 | 0.992–0.996 | IADLP            |
| G1cb                  | Managing finances—capacity   | 95.66 | 0.951–0.962 | IADLC            |
| G1da                  | Managing medications—performance | 99.43 | 0.992–0.996 | RUGs, IADLP      |
| G1db                  | Managing medications—capacity | 95.88 | 0.953–0.964 | MAPLe, IADLC     |
| G1ea                  | Phone use—performance       | 99.37 | 0.992–0.996 | RUGs, IADLP      |
| G1eb                  | Phone use—capacity          | 94.72 | 0.941–0.953 | IADLC            |
| G1fa                  | Stairs—performance          | 99.26 | 0.990–0.995 | PACTIV           |
| G1fb                  | Stairs—capacity             | 91.38 | 0.906–0.922 | ENVIR            |
| G1ga                  | Shopping—performance        | 99.45 | 0.993–0.997 | IADLP            |
| G1gb                  | Shopping—capacity           | 94.45 | 0.938–0.951 | BRITSU, IADL     |
| G1ha                  | Transportation—performance  | 99.14 | 0.989–0.994 | IADLP            |
| G1hb                  | Transportation—capacity      | 91.89 | 0.911–0.926 | BRITSU, IADL     |
| G2a                   | Bathing—performance         | 98.96 | 0.987–0.992 | MAPLe            |

(Continued)
| Generic Variable Name   | Section Names and Items            | Completion % | 95% CI       | Affected Outcomes                                      | Clinical Assessment Protocols | Scales & Screening Algorithms |
|-------------------------|-----------------------------------|--------------|--------------|--------------------------------------------------------|-------------------------------|------------------------------|
| G2b                     | Personal hygiene—performance      | 99.22        | 0.990–0.995  | RISK, RESTR, IADL, ADL                                  | MAPLe, ADLH                  |
| G2c                     | Dressing upper body—performance   | 99.12        | 0.989–0.994  | RISK, RESTR, IADL, ADL                                  | MAPLe, ADLH                  |
| G2d                     | Dressing lower body—performance   | 99.20        | 0.990–0.994  | RISK, RESTR, IADL, ADL                                  | MAPLe, ADLH                  |
| G2e                     | Walking—performance               | 98.60        | 0.983–0.989  | URIN                                                   | PURe                         |
| G2f                     | Locomotion—performance            | 99.14        | 0.989–0.994  | RISK, RESTR, IADL, ADL, PACTIV                         | MAPLe, ADLH                  |
| G2g                     | Transfer toilet—performance       | 98.67        | 0.984–0.990  | RISK, PULCER                                           | MAPLe, RUGs                  |
| G2h                     | Toilet use—performance            | 99.04        | 0.988–0.993  | RESTR, BOWEL, IADL, ADL                                | MAPLe, RUGs, ADLH            |
| G2i                     | Bed mobility—performance          | 98.93        | 0.986–0.992  | BOWEL, PULCER                                          | RUGs, PURe                   |
| G2j                     | Eating—performance                | 99.57        | 0.994–0.997  | RESTR, BOWEL, IADL, ADL, COGNIT, SOCFUNC               | MAPLe, CPS2, RUGs, ADLH      |
| G3                      | Primary mode of locomotion         | 99.22        | 0.990–0.995  | RISK                                                    | MAPLe                       |
| G4                      | Distance walked                   | 97.28        | 0.968–0.977  |                                                        |                              |
| G5                      | Distance wheeled self             | 97.79        | 0.974–0.982  |                                                        |                              |
| G6a                     | Hours of exercise or physical activity | 99.14  | 0.989–0.994  | PACTIV, ENVIR                                          | MAPLe                       |
| G6b                     | Days went out                     | 99.14        | 0.989–0.994  | RISK                                                    | MAPLe                       |
| G7a                     | Person believes can improve       | 98.48        | 0.981–0.988  | IADL, PACTIV                                           |                              |
| G7b                     | Caregiver believes person can improve | 97.91  | 0.975–0.983  | BOWEL, IADL, PACTIV                                    |                              |
| G8a                     | Change in ADL status               | 99.10        | 0.988–0.994  | RISK, URIN, IADL, ADL                                  | MAPLe, CHESS                 |
| G9a                     | Drove car                          | 99.16        | 0.989–0.994  |                                                        |                              |
| G9b                     | Suggestion to limit driving        | 98.55        | 0.982–0.989  |                                                        |                              |
| G12                     | Timed 4-meter walk                 | 87.63        | 0.867–0.885  |                                                        |                              |

**Section H** Continence

- H1 Bladder continence
- H2 Urinary collection device
- H3 Bowel continence
- H4 Pads worn

**Section I** Disease diagnoses

(Continued)
Table 1. (Continued)

| Generic Variable Name | Section Names and Items | Completion % | 95% CI | Affected Outcomes |
|-----------------------|-------------------------|--------------|--------|------------------|
|                       |                         |              |        | Clinical Assessment Protocols | Scales & Screening Algorithms |
| I1a                   | Hip fracture            | 93.77        | 0.931–0.944 | URIN, BOWEL, ADL |
| I1b                   | Other fracture          | 93.64        | 0.930–0.943 |                    |
| I1c                   | Alzheimer’s disease     | 91.18        | 0.910–0.925 | RISK, COGNIT |
| I1d                   | Other dementia          | 91.50        | 0.907–0.923 | MAPLe |
| I1e                   | Hemiplegia              | 92.03        | 0.913–0.928 | RUGs |
| I1f                   | Multiple sclerosis      | 92.36        | 0.916–0.931 | RUGs |
| I1g                   | Paraplegia              | 91.97        | 0.912–0.927 | RUGs |
| I1h                   | Parkinson’s disease     | 91.67        | 0.909–0.924 | RUGs |
| I1i                   | Quadriplegia            | 91.79        | 0.910–0.925 | RUGs |
| I1j                   | Stroke                  | 91.01        | 0.902–0.918 | RUGs |
| I1k                   | Coronary heart disease  | 89.08        | 0.882–0.899 | RUGs |
| I1l                   | Congestive heart failure| 88.89        | 0.880–0.897 | RUGs |
| I1m                   | Chronic obstructive pulmonary disease | 89.80 | 0.890–0.906 | RUGs |
| I1n                   | Anxiety                 | 91.40        | 0.906–0.922 | RUGs |
| I1o                   | Depression              | 90.72        | 0.899–0.915 | RUGs |
| I1p                   | Schizophrenia           | 90.91        | 0.901–0.917 | RUGs |
| I1q                   | Pneumonia               | 91.85        | 0.911–0.926 | URIN, BOWEL, ADL |
| I1r                   | Urinary tract infection | 91.64        | 0.909–0.924 | RUGs |
| I1s                   | Cancer                  | 92.09        | 0.913–0.928 | RUGs |
| I1t                   | Diabetes mellitus       | 91.93        | 0.912–0.927 | RUGs |
| I1w                   | Bipolar disorder        | 90.74        | 0.899–0.915 | RUGs |

Section J

| Health conditions |
|-------------------|
| J1 Falls          | 98.96 | 0.987–0.992 |
| J2a Difficulty standing | 98.96 | 0.987–0.992 |
| J2b Difficulty turning around | 98.87 | 0.986–0.992 |
| J2c Dizziness     | 98.70 | 0.984–0.990 | DEHYD, CARDIO, DRUG |

(Continued)
Table 1. (Continued)

| Generic Variable Name* | Section Names and Items | Completion % | 95% CI | Affected Outcomes |
|------------------------|-------------------------|--------------|--------|-----------------|
| J2d                    | Unsteady gait           | 98.81        | 0.985–0.991 | ENVIR           |
| J2e                    | Chest pain              | 98.50        | 0.982–0.988 | CARDIO, DRUG    |
| J2f                    | Difficulty clearing airway | 98.28    | 0.979–0.986 |                |
| J2g                    | Abnormal thought process | 98.59       | 0.983–0.989 | ENVIR           |
| J2h                    | Delusions               | 98.69        | 0.984–0.990 | ENVIR RUGs      |
| J2i                    | Hallucinations          | 98.57        | 0.982–0.989 | ENVIR RUGs      |
| J2j                    | Aphasia                 | 97.91        | 0.975–0.983 |                |
| J2k                    | Constipation            | 98.36        | 0.980–0.987 | DEHYD           |
| J2l                    | Diarrhea                | 98.34        | 0.980–0.987 | URIN, DEHYD     |
| J2m                    | Acid reflux             | 98.32        | 0.980–0.987 |                |
| J2n                    | Vomiting                | 97.91        | 0.975–0.983 | DEHYD RUGs, CHESS |
| J2o                    | Difficulty falling asleep | 98.46     | 0.981–0.988 |                |
| J2p                    | Too much sleep          | 98.44        | 0.981–0.988 |                |
| J2q                    | Fever                   | 98.38        | 0.980–0.987 | DEHYD RUGs      |
| J2r                    | Gastrointestinal/Genitourinary bleeding | 96.74 | 0.962–0.972 | RUGs            |
| J2s                    | Peripheral edema        | 97.81        | 0.974–0.982 | DRUG CHESS      |
| J2t                    | Aspiration              | 98.53        | 0.982–0.989 |                |
| J2mm                   | Poor hygiene            | 98.53        | 0.982–0.989 | ABUSE           |
| J3                     | Dyspnea                 | 97.62        | 0.972–0.980 | CARDIO, DRUG CHESS, PURS |
| J4                     | Fatigue                 | 98.51        | 0.982–0.988 |                |
| J5a                    | Pain frequency          | 98.75        | 0.984–0.991 | PAIN PURS, PAIN |
| J5b                    | Pain intensity          | 97.48        | 0.970–0.979 | PAIN            |
| J5c                    | Pain consistency        | 97.17        | 0.967–0.976 |                |
| J5d                    | Breakthrough pain       | 97.46        | 0.970–0.979 |                |
| J5e                    | Pain control            | 97.69        | 0.973–0.981 |                |

(Continued)
Table 1. (Continued)

| Generic Variable Name* | Section Names and Items                  | Completion % | 95% CI       | Affected Outcomes        |
|------------------------|------------------------------------------|--------------|--------------|--------------------------|
|                        | Clinical Assessment Protocols Scales & Screening Algorithms |              |              |                          |
| J6a                    | Unstable conditions                      | 98.71        | 0.984–0.990  | ABUSE, ENVIR             |
| J6b                    | Flare-up                                 | 98.67        | 0.984–0.990  | ADL                      |
| J6c                    | End-stage disease                        | 98.55        | 0.982–0.989  | ADL, COGNIT, NUTR        | RUGs, CHESS |
| J7                     | Self-rated health                        | 98.65        | 0.983–0.990  | ABUSE, ENVIR, DRUG       |
| J8a                    | Tobacco                                  | 99.41        | 0.992–0.996  | ADD                      |
| J8b                    | Alcohol                                  | 98.92        | 0.986–0.992  | ADD                      |

**Section K** Oral and nutritional status

| K1ab                   | Height—cm                                | 80.55        | 0.795–0.816  | ABUSE, NUTR              | BMI            |
| K1bb                   | Weight—kilograms                         | 81.16        | 0.801–0.822  | ABUSE, NUTR              | BMI            |
| K2a                    | Weight loss                              | 98.30        | 0.979–0.987  | ABUSE, DEHYD             | RUGs, CHESS, PURS |
| K2b                    | Fluid intake                             | 97.56        | 0.971–0.980  | ABUSE, DEHYD             |               |
| K2c                    | Dehydrated                               | 97.58        | 0.972–0.980  | DEHYD                    | RUGs, CHESS    |
| K2h                    | Fluid output exceeds input               | 97.30        | 0.969–0.977  |                         |               |
| K3                     | Mode of nutritional intake               | 98.87        | 0.986–0.992  | FEEDTB                   | MAPLe, RUGs    |
| K4a                    | Dentures                                | 96.66        | 0.962–0.972  |                         |               |
| K4b                    | Broken teeth                             | 96.70        | 0.962–0.972  |                         |               |
| K4c                    | Difficulty chewing                       | 97.42        | 0.970–0.979  |                         |               |
| K4d                    | Dry mouth                                | 97.17        | 0.967–0.976  |                         |               |

**Section L** Skin condition

| L1                      | Most severe pressure ulcer               | 98.83        | 0.985–0.991  | PULCER                   | MAPLe, RUGs    |
| L2                      | Prior pressure ulcer                     | 98.42        | 0.981–0.988  | PULCER                   | PURS           |
| L3                      | Other skin ulcer                         | 98.44        | 0.981–0.988  | PULCER                   | RUGs           |
| L4                      | Major skin problems                      | 98.44        | 0.981–0.988  |                         | RUGs           |
| L5                      | Skin tears or cuts                       | 98.48        | 0.981–0.988  |                         | RUGs           |
| L6                      | Other skin condition or changes           | 98.46        | 0.981–0.988  |                         | RUGs           |
| L7                      | Foot problems                            | 97.97        | 0.976–0.984  |                         |               |

(Continued)
### Table 1. (Continued)

| Generic Variable Name | Section Names and Items | Completion % | 95% CI | Affected Outcomes |
|-----------------------|-------------------------|--------------|--------|-------------------|
| **Section M**         | Medication              |              |        |                   |
| M2                    | Drug allergy            | 89.49        | 0.886– 0.903 |
| M3                    | Drug adherence          | 90.76        | 0.900– 0.916 | ABUSE |
| **Section N**         | Treatments and procedures |              |        |                   |
| N1a                   | Influenza vaccine       | 92.34        | 0.916– 0.931 |
| N1b                   | Pneumovax vaccine       | 88.61        | 0.877– 0.895 |
| N1c                   | Mammogram               | 91.01\(^b\)  | 0.901– 0.920|
| N1d                   | Blood pressure          | 94.68        | 0.941– 0.953 |
| N1e                   | Dental exam             | 91.89        | 0.911– 0.926 |
| N1f                   | Hearing exam            | 91.78        | 0.910– 0.925 |
| N1g                   | Eye exam                | 92.16        | 0.914– 0.929 |
| N1h                   | Colonoscopy             | 92.28        | 0.915– 0.930 |
| N2a                   | Chemotherapy            | 96.15        | 0.956– 0.967 | RUGs |
| N2b                   | Dialysis                | 95.84        | 0.953– 0.964 | RUGs |
| N2c                   | Infection control segregation | 96.03 | 0.955– 0.966 | |
| N2d                   | IV medication           | 95.97        | 0.954– 0.965 | RUGs |
| N2e                   | Oxygen therapy          | 96.13        | 0.956– 0.967 | RUGs |
| N2f                   | Radiation               | 96.97        | 0.954– 0.965 | RUGs |
| N2g                   | Suctioning              | 96.03        | 0.955– 0.966 | RUGs |
| N2h                   | Tracheostomy care       | 95.97        | 0.954– 0.965 | RUGs |
| N2i                   | Transfusion             | 95.92        | 0.954– 0.965 | RUGs |
| N2j                   | Ventilator or respirator| 95.94        | 0.954– 0.965 | RUGs |
| N2k                   | Wound care              | 95.80        | 0.952– 0.963 | PULCER |
| N2l                   | Scheduled toileting program | 95.37 | 0.948– 0.959 | URIN  |
| N2m                   | Palliative care program | 95.18        | 0.946– 0.958 | |
| N2n                   | Turning/Repositioning program | 95.35 | 0.948– 0.959 | RUGs  |

(Continued)
| Generic Variable Name | Section Names and Items | Completion % | 95% CI | Affected Outcomes |
|-----------------------|-------------------------|--------------|--------|------------------|
|                       |                         |              |        | Clinical Assessment Protocols | Scales & Screening Algorithms |
| N3aa                  | Home health aides—days | 94.27        | 0.936–0.949 |                 |                  |
| N3ab                  | Home health aides—minutes | 58.00       | 0.566–0.594 |                 |                  |
| N3ba                  | Home nurse—days         | 96.42        | 0.959–0.969 |                 |                  |
| N3bb                  | Home nurse—minutes      | 69.14        | 0.679–0.704 |                 |                  |
| N3ca                  | Homemaking services—days | 93.57       | 0.929–0.942 |                 |                  |
| N3cb                  | Homemaking services—minutes | 58.43      | 0.571–0.598 |                 |                  |
| N3da                  | Meals—days              | 92.10        | 0.914–0.928 |                 |                  |
| N3ea                  | Physical therapy—days   | 92.09        | 0.913–0.928 | ADL              | RUGs             |
| N3eb                  | Physical therapy—minutes | 50.44       | 0.491–0.518 |                 | RUGs             |
| N3fa                  | Occupational therapy—days | 90.13      | 0.893–0.909 |                 | RUGs             |
| N3fb                  | Occupational therapy—minutes | 39.73    | 0.384–0.411 |                 | RUGs             |
| N3ga                  | Speech therapy—days     | 89.99        | 0.892–0.908 |                 | RUGs             |
| N3gb                  | Speech therapy—minutes  | 37.97        | 0.366–0.393 |                 | RUGs             |
| N3ha                  | Psychological therapy—days | 89.88      | 0.891–0.907 |                 |                  |
| N3hb                  | Psychological therapy—minutes | 38.21   | 0.369–0.395 |                 |                  |
| N5a                   | Overnight hospital stay  | 94.61        | 0.940–0.952 | ADL              |                  |
| N5b                   | Emergency room visit    | 93.14        | 0.924–0.938 |                 |                  |
| N5c                   | Physician visit—90 day  | 92.75        | 0.920–0.935 |                 |                  |
| N6a                   | Full bed rails          | 98.48        | 0.981–0.988 |                 |                  |
| N6b                   | Trunk restraint          | 98.46        | 0.981–0.988 | RESTR            |                  |
| N6c                   | Chair prevents rising   | 98.28        | 0.979–0.986 |                 | RESTR            |

**Section O Responsibility**

O1a Legal guardian 95.97 0.954–0.965

**Section P Social supports**

P1a1 Informal help-relationship—1 99.74 0.996–0.999 BRITSU

P1b1 Lives with person—1 98.94 0.986–0.992

(Continued)
| Generic Variable Name | Section Names and Items | Completion | 95% CI     | Affected Outcomes |
|-----------------------|-------------------------|------------|------------|------------------|
|                       |                         | %          |            |                  |
|                       |                         | 0.988–0.994|            |                  |
|                       |                         | 0.994–0.994|            |                  |
|                       |                         | 0.984–0.991|            |                  |
|                       |                         | 0.990–0.991|            |                  |
|                       |                         | 0.978–0.986|            |                  |
|                       |                         | 0.979–0.987|            |                  |
|                       |                         | 0.985–0.991|            | ENVIR, MAPLe     |
|                       |                         | 0.985–0.991|            | ENVIR, MAPLe     |
|                       |                         | 0.982–0.989|            | ENVIR, MAPLe     |
|                       |                         | 0.979–0.986|            | MAPLe            |
|                       |                         | 0.982–0.986|            | ENVIR, MAPLe     |
|                       |                         | 0.977–0.984|            |                  |
|                       |                         | 0.977–0.985|            |                  |
|                       |                         | 0.971–0.979|            |                  |
|                       |                         | 0.971–0.979|            |                  |
|                       |                         | 0.976–0.984|            |                  |
|                       |                         | 0.977–0.985|            |                  |
|                       |                         | 0.971–0.979|            |                  |
|                       |                         | 0.976–0.984|            |                  |
|                       |                         | 0.405–0.432|            |                  |
|                       |                         | 0.666–0.692|            | BOWEL, ADL, COGNIT, DRUG |
|                       |                         | 0.332–0.358|            |                  |
|                       |                         | 0.332–0.358|            |                  |
|                       |                         | 0.332–0.358|            |                  |

Table 1. (Continued)
96.74% (gastrointestinal/genitourinary bleeding) and 99.41% (tobacco). Also, Section L—Skin condition (C21 98.42%; L7 = 97.97%) and Section P—Social supports (C21 98.23%) have high completion percentages. Most items of Section Q—Environmental assessment have high completion scores (C21 98.07%; Q3b, Q3C, and Q4 97.52%).

Lower completion scores are shown in items of Section G—Functional status, Section I—Disease diagnoses, Section K—Oral and nutritional status, Section M—Medications, Section N—Treatment and procedures, Section O—Responsibility, and Section R—Discharge potential and overall status. To gain more insight into the completion of these sections, we address the completion scores of the individual items.

Particularly in Section G—Functional status, lower completion percentages are seen for the IADL capacity items of meal preparation (95.60%), ordinary housework (95.62%), managing finances (95.66%), managing medications (95.88%), phone use (94.72%), stairs (91.38%), shopping (94.45%) and transportation (91.89%). On the other hand, the IADL performance items score higher completion percentages (C21 99.14%). While high scores are shown for ADL and the other items, we observe a lower completion score for the timed 4- meter walk item (87.63%).

For all the items of Section I—Disease diagnoses—we note a lower completion percentage between 88.89% (congestive heart failure) and 93.77% (hip fracture).

In Section K—Oral and nutritional status—the items height and weight have low completion percentages of 80.55% and 81.16%, respectively. The other items score between 96.66% (dentures) and 98.87% (mode of nutritional intake).

We observe a low score in Section M—Medications with item completion rates of 89.49% (drug allergy) and 90.76% (drug adherence).

In Section N—Treatment and procedures—the completion of the observed minutes for home health aides (58.00%), home nurse (69.14%), homemaking services (58.43%), physical therapy (50.44%), occupational therapy (39.73%), speech therapy (37.97%) and psychological therapy (38.21%) is very low. Other low completion scores are 92.34% (influenza vaccine), 88.61% (pneumovax vaccine), 91.01% (mammogram, corrected for only females), 94.68% (influenza vaccine).

### Table 1. (Continued)

| Generic Variable Name | Section Names and Items | Completion % | 95% CI | Affected Outcomes |
|-----------------------|-------------------------|--------------|--------|------------------|
| RS                    | Onset of precipitating event | 35.96<sup>c</sup> | 0.337–0.363 | |

Clinical Assessment Protocols (CAPs): BRITSU = Brittle Support, ABUSE = Abusive Relationship, RISK = Institutional Risk, RESTR = Physical Restraints, COMMUN = Communication, FEEDTB = Feeding Tube, URIN = Urinary Incontinence, BOWEL = Bowel Conditions, IADL = Instrumental Activities of Daily Living, ADL = Activities of Daily Living, COGNIT = Cognitive Loss, SOCFUNC = Social Relationship, DELIR = Delirium, DEHYD = Dehydration, ENVIR = Home Environment Optimization, MOOD = Mood, BEHAV = Behavior, PACTIV = Physical Activities Promotion, PULCER = Pressure Ulcer, FALLS = Falls, CARDIO = Cardio-Respiratory Conditions, DRUG = Medications, PAIN = Pain, NUTR = Undernutrition, ADD = Addict. Scales and Screening Algorithms: AGE = Age Years Scale, MAPLe = Method for Assigning Priority Levels, CPS2 = Cognitive Performance Scale 2, RUGs = Resource Utilization Groups, CHESS = Changes in Health, End-Stage Disease, Signs, and Symptoms Scale, COMM = Communication Scale, DRS = Depression Rating Scale, ADLH = Activities of Daily Living Hierarchy, IADLC/P = Instrumental Activities of Daily Living Capacity/Performance, PURS = Pressure Ulcer Risk Scale, PAIN = Pain, BMI = Body Mass Index.

<sup>a</sup>Code
<sup>b</sup>Corrected for only females.
<sup>c</sup>Items assessed in cases of deterioration of the client in last 90 days (Item R2).

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(blood pressure), 91.89% (dental exam), 91.78% (hearing exam), 92.16% (eye exam), 92.28% (colonoscopy), 94.27% (home health aides/days), 93.57% (homemaking services/days), 92.10% (meals/days), 92.09% (physical therapy/days), 90.13% (occupational therapy/days), 89.99% (speech therapy/days), 89.88% (psychological therapy/days), 94.61% (overnight hospital stay), 93.14% (emergency room visit) and 92.75% (physician visit/90 day). Completion scores between 95.18% and 96.97% are shown for chemotherapy, dialysis, infection control segregation, IV medication, oxygen therapy, radiation, suctioning, tracheostomy care, transfusion, ventilator or respirator, wound care, scheduled toileting program, palliative care program, turning/repositioning program, and home nurse/days. However, full bed rails, trunk restraint and chair prevents rising have scores between 98.28% and 98.48%.

In Section O—Responsibility—we note a completion score of 95.97% for the item legal guardian.

The two first items, care goals met and self-sufficiency change, of Section R—Discharge potential and overall status—show a completion score of 41.88% and 67.91%, respectively. In cases of deterioration of the client in last 90 days (R2 code = 2), independent ADL areas and independent IADL areas score 34.45% and 34.53%, onset of precipitating event scores 34.53%.

Health professionals of different disciplines, nurses (62.18%), occupational therapists (21.46%), social workers (9.87%), psychologists (4.77%), physiotherapists (1.43%), speech therapists (0.28%), and physicians (0.02%) ensured the completion of 5,117 questionnaires in total (Table 2).

Discussion
Possible causes of incomplete assessments
Based on our data, individual items in several sections of the interRAI HC assessment instrument have lower completion scores. Possible causes can be found in the fact that first, the assessors felt incapable of answering certain questions, second, the absence of required data or a competent person, and third, the insufficient presence of tools necessary for carrying out essential measurements.

The assessment of the functional status of the client seems to be more demanding. Items concerning IADL capacity—Section G—were completed less well. These items require thorough observation and thinking by the assessor with regard to the frail older person’s presumed ability to carry out an activity [27]. In the home care sector, where contact with clients tends to be shorter than in the institutional care sector and where observation is more difficult to put into practice, this may be less evident [37]. Due to the fact that the data comes from baseline assessments, many were performed during the first visit of the caregiver in the clients’ home. Caregivers can perhaps not observe the client during a sufficient period of time and base their assessment on the interview with the client and informal caregiver. Other reasons may be that health professionals (for example, newcomers) have received inadequate training to perform assessments, that they receive insufficient information from other caregivers, or lack the time required to assess the situation correctly. Continuing education and training programs concerning the theoretical and practical aspects of the assessment instrument can contribute to a more successful completion of these and other sections. For home care organizations which are more fragmented and diverse, these training sessions are also a good opportunity to enhance communication and collaboration [38]. In addition to this, a significant expenditure of resources with regard to adequate staffing in healthcare environments and enough available time in view of performing assessments is a major advantage. It is possible that the Section R items—Discharge potential and overall status—have been completed less well for the same reasons.
Sections dealing with mainly medically-oriented data, including disease diagnoses (Section I), drug allergy and adherence (Section M), and (preventive) treatments and procedures (Section N) exhibit (completion) deficits. Table 2 shows that nurses play a leading role in checking, initiating and inviting other caregivers to help complete, validate, and finalize a client’s interRAI HC assessment. This is less the case for occupational therapists, social workers, psychologists, physiotherapists and speech therapists. Physicians occasionally assist in the completion of the questionnaires but rarely (0.02%) do they assume the responsibility for ensuring the completion of the assessment. It seems possible that medically-oriented sections are less thoroughly completed because in a home care situation non-physicians do not always have access to the necessary medical information. In our view, it is essential that physicians are motivated to cooperate and to share crucial information.

The assessment of the timed 4-meter walk (Section G) is intended to record an objective benchmark for comparison of the client’s performance upon subsequent reassessments. The assessment of client’s current weight and height (Section K) allows for the monitoring of nutrition, hydration status, and weight stability over time. Items concerning services and therapies (Section N) require the recording of the duration of these activities of minutes. These measurements need calibrated tools such as a stopwatch, scale, and measuring device. Perhaps this is a problem in the home care sector, since these sections also have a low percentage of completion.

Consequences of incomplete assessments

A comprehensive, systematic and structured collection of data of the frail older person is presumed to be essential in improving the quality of care [4, 6, 7]. Assessments are of fundamental importance but the usefulness and value of such assessments is closely linked to any decision-making or interventions that result from the assessments [1]. Furthermore, the use of such an instrument very much determines the quality of the assessment. It is obvious that without the required data, the guidelines and care planning protocols, decision support outcomes, and quality improvement and monitoring measures cannot be calculated. The absence of outcomes may complicate the care planning process and even prevent the improvement of care quality. Also, the assessment process can easily be seen as additional work.

InterRAI Clinical Assessment Protocols (CAPs) [21, 42] are designed to assist caregivers in interpreting all the assessed information. They help to determine risk or priority areas for care. In the next to right-most column in Table 1 we indicate the affected CAPs in the case of missing or incomplete information. The right-most column in the same Table shows the affected

| 'Responsible' Health Professionals | Proportion % (N = 5,117) | 95% CI |
|-----------------------------------|--------------------------|--------|
| Nurses                           | 62.18                     | 0.6086–0.6351 |
| Occupational therapists          | 21.46                     | 0.2033–0.2258 |
| Social workers                   | 9.87                      | 0.0905–0.1069 |
| Psychologists                    | 4.77                      | 0.0418–0.0535 |
| Physiotherapists                 | 1.43                      | 0.0110–0.0175 |
| Speech therapists                | 0.28                      | 0.0013–0.0042 |
| Physicians                       | 0.02                      | -0.0002–0.0006 |

CI = confidence interval

*These health professionals have assumed responsibility for ensuring the completion of the assessments.

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Understanding Incomplete Assessments Better

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interRAI scales, status and outcome measures [43–45], case-mix classification [46, 47], and screening algorithms [48]. For instance, if information about meal preparation—capacity—(Section G) is insufficient, then calculation of the Instrumental Activities of Daily Living (IADL) CAP, Brittle Support (BRITSU) CAP, Instrumental Activities of Daily Living Capacity (IADLC) scale, and Method for Assigning Priority Levels (MAPLe) will be impossible. Data on stairs—performance—, locomotion—performance—, hours of exercise or physical activity, person believes can improve, and caregiver believes can improve, are needed to calculate the Physical Activities Promotion (PACTIV) CAP. If information about hip fracture (Section I) is insufficient, then calculation of the Urinary Incontinence (URIN) CAP, Bowel Conditions (BOWEL) CAP, and Activities of Daily Living (ADL) CAP will be impossible. Information about height and weight (Section K) is needed to calculate the BMI.

Limitations
First, the sample is not representative for all older people living at home because clients were recruited at the time of entry into the home care projects. Second, each project is evaluated (amongst other factors) based on the assessment outcomes, which may influence the way in which the assessors completed the assessments. Third, as we are dealing with projects, the assessors may have known the clients for only a short period of time, and thus insufficiently.

Conclusions
When a CGA is completed in a coordinated and multidisciplinary way, whereby the items are filled out by all involved health professionals on the basis of their expertise or experience, we can assume that the assessment reflects the real situation of the client. In this way, the assessment can meet the objective of developing an overall care plan and ensuring long-term follow-up. Without the required data on record, outcomes cannot be calculated and it must be clear that an incomplete assessment cannot fully contribute to improvements in diagnostic accuracy, care optimization and quality of care. Moreover, incomplete assessments may result in uncoordinated care and subsequent adverse events.

Multidisciplinarity is an important precondition for establishing high-quality assessments and related outcomes that offer more insight into the complexity of the healthcare process and a higher quality of care. Ignorance of the rationale of a multidimensional assessment system and process can impede caregivers in cooperating or induce resistance to change [49]. By contrast, a good understanding of such tools and systems can prevent them being seen as unnecessarily burdensome, as opposed to an integral part of the decision-making process [4]. Health professionals, including physicians and managers should be convinced that the use and full completion of a comprehensive information system contributes to integrated quality care. It is important to continuously inform the intended users of the benefits and to motivate all stakeholders to increase their involvement and collaboration [29, 38]. This is certainly the case in a more fragmented home care sector, where information technology presents a significant opportunity to upgrade the existing communication strategy.

It seems also appropriate that extra attention should be paid to these theoretical and practical aspects of the assessment process during the education and training of health professionals and to the allocation of the necessary resources.

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Author Contributions
Conceived and designed the experiments: DV JDAM. Performed the experiments: DV JDAM. Analyzed the data: DV JDAM JM. Wrote the paper: DV JDAM CVA AD.

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