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Developing and utilising a new funding model for home-care services in New Zealand

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Abstract

Worldwide increases in the numbers of older people alongside an accompanying international policy incentive to support ageing-in-place have focussed the importance of home-care services as an alternative to institutionalisation. Despite this, funding models that facilitate a responsive, flexible approach are lacking. Casemix provides one solution, but the transition from the well-established hospital system to community has been problematic. This research seeks to develop a Casemix funding solution for home-care services through meaningful client profile groups and supporting pathways. Unique assessments from 3,135 older people were collected from two health board regions in 2012. Of these, 1,009 arose from older people with non-complex needs using the *inter*RAI-Contact Assessment (CA) and 2,126 from the *inter*RAI-Home-Care (HC) from older people with complex needs. Home-care service hours were collected for 3 months following each assessment and the mean weekly hours were calculated. Data were analysed using a decision tree analysis, whereby mean hours of weekly home-care was the dependent variable with responses from the assessment tools, the independent variables. A total of three main groups were developed from the *inter*RAI-CA, each one further classified into "stable" or "flexible." The classification explained 16% of formal home-care service hour variability. Analysis of the *inter*RAI-HC generated 33 clusters, organised through eight disability "sub" groups and five "lead" groups. The groupings explained 24% of formal home-care services hour variance. Adopting a Casemix system within home-care services can facilitate a more appropriate response to the changing needs of older people.

KEYWORDS

assessment, Casemix funding, home-care services, management and funding

1 | INTRODUCTION

More than NZ$670 million is spent annually across New Zealand on home-care services. Home-care services in New Zealand can be either short or long term and are based on the needs of the individual. They specifically exclude district nursing and allied health (e.g. physiotherapy and occupational therapy). Home-care includes support for housework and personal care and is delivered by non-government organisations, contracted by local health boards. Although long-term home-care services can be accessed by all with a disability lasting longer than 6 months, irrespective of age, most recipients are older (65+). Individuals access services via a central assessment agency and on the whole, services tend to be task-based, rigid, non-responsive and non-targeted (King, Parsons, & Robinson, 2012; King, Parsons,

Robinson, & Jörgensen, 2012). It is widely acknowledged that the traditional approach to delivery of home-care services has limitations in being able to meet the changing needs of older people who require flexible and responsive service provision to meet increasingly complex needs (King, Parsons, Robinson, et al., 2012; Parsons & Parsons, 2012). Consequently, numerous countries have been exploring alternative ways to delivering home-care services.

The new approach is known by various terms across different countries; Function Focused Care in the US (Resnick, Boltz, Galik, & Pretzer-Aboff, 2012; Resnick, Galik, & Boltz, 2013), Active Service Model or Home Independence in Australia (Lewin, Alfonso, & Alan, 2013; Lewin, Concanen, & Youens, 2016; Lewin & Vandermeulen, 2010), Restorative Home Support in New Zealand (King, Parsons, & Robinson, 2012; King, Parsons, Robinson, et al., 2012; Parsons, Sheridan, Rouse, Robinson, & Connolly, 2013; Parsons et al., 2012) and Reablement in the UK (Aspinal, Glasby, Rostgaard, Tuntland, & Westendorp, 2016; Glendinning & Newbronner, 2008; Kent, Payne, Stewart, & Unell, 2005; Legg, Gladman, Drummond, & Davidson, 2015; Newbronner, Baxter, & Chamberlain, 2007; Tessier, Beaulieu, McGinn, & Latulippe, 2016). All have unique attributes and differ in their delivery models from short-term interventions led by non-health professionals such as observed in the UK to long-term mainstream health professional oversight services within New Zealand. More recently, this proactive, person-centred approach is being adopted by other countries, notably Netherlands, Canada, Norway and Denmark. Despite differences, all have in common certain core features, namely that services are goal-oriented, holistic and person-centred and focus on supporting older people to maintain, gain or restore their competences so that they can manage their lives as independently as possible (Aspinal et al., 2016; Legg et al., 2015; Resnick et al., 2012).

The shift to restorative home-care in New Zealand has been regarded as a system-wide quality assurance programme that places equal significance on improving working conditions for unregulated workers and health professional co-ordinators as it places on improving the well-being of clients. Several health boards have already, or are in the process of implementing the new model. Despite the inherent and demonstrated benefits, health boards have repeatedly struggled to find a model of funding that supports an inherently flexible and dynamic approach, a key feature of restorative home support. The reasons for such difficulties are described below.

The traditional method of funding home-care services across the world is via "fee-per-hour." The fee-per-hour model has several distinct disadvantages. First, it discourages client discharge as removing an hour invariably removes income for a support worker who tends to be employed under a casual or indeterminate contract and as such there is little incentive for the worker to report improvements in client functionality. Second, changes in hours of input generally require review or reassessment by an assessment agency and therefore the model results in a less than timely response and an inherent rigidity to service delivery. Furthermore, under the model, hours are assigned as 15-/30-/60-min allocations and it is seldom that client needs reflect those time slots exactly. Consequently, if the funded time allocation exceeds the time required by the older person, home-care workers may fill the slot with other activities or if less than, deliver unfunded support. Although trials have demonstrated that more responsive, high-quality home-care services can be operated within a fee-per-service environment (King, Parsons, Robinson, et al., 2012; Parsons et al., 2013), the same problems remain, such as inflexibility, less than timely response, unfunded support and reluctance to discharge clients.

Attempts to address these issues and develop other methods have occupied significant time and resources and to date, the only viable alternative is the "package of care" approach that is routinely employed within mental health and in more intensive home-care services, particularly for younger people. In New Zealand, this approach emerged in 2002 for a new home-care model for older people assessed with complex needs, who were determined to be at risk of institutionalisation (Parsons et al., 2012). At that time, the funded rate for nursing home-care was NZ$360 per week; and given that these clients were assessed at this level, the provider received the same funding to deliver services to them in their own home. The clinical efficacy was positively evaluated (Parsons et al., 2012, 2017) and the funding model supported tailored services aligned to client goals to be delivered. Older people enrolled in the service were frail and their needs fluctuated daily. The funding model encouraged more appropriate responses such as telephone reminders for medication versus a costlier 30-min visit. Such an approach resulted in encouraging outcomes for the client, their family and the provider. However, the package-of-care approach had only one category (and associated funding value, NZ$360 per week) and given that the client needs were highly variable, there were risks for providers in that their delivered care often outstripped the amount funded and further it was difficult to align best evidence with client needs. In essence, the package-of-care model failed to meet

What is known about this topic

- There is an international desire to make home-care, more client focussed.
- Home-care services are generally funded through an inflexible and non-responsive fee-per-hour approach.
- Casemix is a well-established funding model within inpatient settings, but little success has been achieved with transporting this model into the community.

What this paper adds

- A Casemix model for allocation of home-care services, developed through expert clinical opinion alongside statistical analysis.
- The Casemix categories provide less variability and more consistency within each cluster, which in turn leads to better alignment of resource to client need and consequently more effective cost management.
- The Casemix model includes pathways of care which is operational within New Zealand.

a primary objective of Casemix in that clients within the category were highly heterogeneous and the funding model was therefore unsustainable.

Developing a comprehensive classification system requires a clear understanding of its purpose. The act of classification can be simply described as noting similarities which permit grouping. As Werry asserts, "without classification, we would perceive every observation as unique, which would not help us to prepare for future similar events" (Werry, 1988, p. 50). Classifications aim to achieve economy of memory, that is, rather than retaining detail of individual cases, numerous cases can be recalled under one label. Classifying organises information and thus simplifies the retrieval of information. Most importantly, classifications describe the structure and relationships of each member to each other and simplify those relationships so that general statements can be made about those classes and members (Sokal, 1974).

Health professionals classify, even if informally, whenever they reflect on cases in the past to inform care plans in similar current cases. Standard classifications abound, applied to different aspects of health or healthcare such as diseases, conditions, symptoms, disability and functioning, procedures, treatments and risks. Some classifications categorise the products of healthcare, or the episodes of care, to understand the outputs of the health service. When those "products" are defined partly by the types of patients receiving the care, the system is referred to as a Casemix classification.

Casemix classification is a systematic approach to quantifying the relationship between patient-driven variables and resource use. It places healthcare cases into groups where members of the group are clinically similar and use similar amounts of care. That is, it defines classes based on the best predictors of resource use (or another measure of interest to health management) so that "between class" variation is maximised, while "within class" variation is minimised (Eagar & Hindle, 1994). Through the framework of a Casemix classification, resource use variation due to patient or environmental characteristics can be distinguished from variation due to clinical practice differences. Consequently, these classifications are used to analyse efficiency and effectiveness of care by stratifying cases into similar groups. Casemix has arisen as a well-established method of funding hospital-based health services (Cameron, 1985; Fetter, Shin, Freeman, Averill, & Thompson, 1980; Fries & Cooney, 1985). Casemix funding allows bulk funding to be more appropriately shared and it allows well-defined clinical pathways to be developed. A good Casemix system also gives meaningful clinical descriptions of these individuals. The application of Casemix is broad; it provides the basis, not only for reimbursement but also for benchmarking facilities or programmes. Within a hospital setting in the US, parts of Europe and New Zealand/Australia, the diagnosis of a patient will determine crudely the Casemix category they belong to. A patient within a particular Casemix category will have specific inputs and treatment options and therefore the average cost can be calculated.

For many years, healthcare planners have attempted to implement a similar Casemix system within a community setting. Unfortunately, although diagnoses can be used in an inpatient setting, they are less reliable within the community and client "needs" emerge as more relevant. Internationally, there have been attempts over many years to develop a similar system for community-based services (Goldberg, Delargy, Schmitz, & Moore, 1999), but it was not until the *inter*RAI suite of tools was implemented that such an approach could be more readily explored and applied. *Inter*RAI is an international not-for-profit organisation consisting of clinicians and academics who have developed a series of standardised assessment tools for use across the hospital/community continuum. The electronic data recording of the tool coupled to the requirements for robust assessment makes statistical analysis far easier.

The *inter*RAI-Contact Assessment (*inter*RAI-CA) and Home-Care (*inter*RAI-HC) tools are particularly pertinent to New Zealand and are used to assess the needs of all older people living at home with non-complex and complex support needs respectively. The Resource Utilisation Group (RUG-III) (Fries et al., 1994) is the *inter*RAI native Casemix tool, which has scattered use across North America and was established for long-term institutional care residents. The Casemix system describes relative resource use within different groups. The RUG-III/HC has been developed for use in home-care and utilises the same seven hierarchical levels as RUG-III: Rehabilitation; Extensive services; Special care; Clinically complex; Impaired cognition; Behavioural problems; and Reduced physical functions from the *inter*RAI-HC assessment. RUG-III/HC differs from RUG-III by collapsing several groups and using 74 variables from instrumental activities of daily living (IADL) measures in addition to activities of daily living (ADL) to form 23 groups and was derived from a study of 804 older home-care recipients in Michigan (Björkgren, Fries, & Shugarman, 2000).

Although RUG-III appears to perform well in explaining variability in nursing home costs, the RUG-III/HC has performed less well within home-care service settings. Carpenter et al. (2004) explored the variance from 11 European countries and reported a mean 17%, with a range of 11%–39%. Poss, Hirdes, Fries, McKillop, and Chase (2008) using Canadian data found that 37.3% of variance in cost was obtained from both informal and formal care and this dropped to 20.5% when formal care alone was assessed. There are some international variations, which may reflect the unique contextual environment in which the tool is being applied; however of more significance is the different explanatory variance of informal and formal hours. Given that the Casemix tool is primarily being used to drive funding of formal hours, results applied to the latter are more meaningful. Calver, Holman, and Lewin (2004) analysed data in 2001 for 5,687 clients in Western Australia using unit cost information as the dependent variable. They developed an alternative branching classification model with nine groups, which explained 23.7% of the variance in cost. ADL were the strongest predictor of cost followed by need for clinical services. In a further study, Phillips, Dyer, Janousek, Halperin, and Hawes (2008) collected data on 1,228 individuals of which 779 received personal care or attendant services. These were assessed using an instrument derived from the *inter*RAI-HC and allocated hours based on the perception of the caseworker conducting the assessment. Their results produced a Casemix model with 11 categories explaining 29% of the variance in personal care hours. RUG-III/HC has been evaluated using New Zealand *inter*RAI-HC data; Heppenstall (2015) in a small

study explored the variance of hours from 935 unique *inter*RAI-HC assessments and reported 17.8% for formal hours, 24.4% informal and 29.6% overall.

In summary, considerable efforts have been expended in developing Casemix systems for home-care settings, but to date, no single system appears to have a particular advantage in terms of explanatory power. Furthermore, the dependent variables in the two studies with the highest explanatory power are either inclusive of estimated costs (i.e. informal carer time) or restricted to personal care.

Arguably, the unique value of any good Casemix system is not its ability to fairly distribute funds, but rather to group individuals of similar diagnostics or needs. Achieving this grouping consistently allows the alignment of best evidence interventions to members of each group and appropriate targeting of interventions. This current research project has sought to incorporate such into the development of the Casemix tool. Furthermore, the study seeks to address an inherent weakness of the home-care services Casemix development to date, namely the sole focus on the *inter*RAI-HC and therefore higher complexity of needs.

The *inter*RAI-HC targets older people with complex needs. New Zealand utilises the *inter*RAI system across the continuum from low needs to very high and to date, there have been no developments around other *inter*RAI tools which focus on other aspects of the care needs continuum. This research aims to develop a Casemix tool for older people with long-term support needs using the *inter*RAI-CA and *inter*RAI-HC. A focus will be placed on the development of pathways aligned to the profile groups arising through the Casemix tool.

2 | METHODS

2.1 | Recruitment and data collection

Within New Zealand, older people with long-term support needs lasting longer than 6 months are screened as "non-complex" or "complex" using a filter based on screening of client cognitive ability, mobility and social support circumstances by a central co-ordination centre. Those with non-complex needs are subsequently assessed by a health professional NASC Clinical Assessor in the person's own home using the *inter*RAI-CA (Hirdes et al., 2010). The *inter*RAI-CA consists of 24 detailed questions concerning mobility, cognitive ability and health status and takes between 30 and 60 min to complete. Those older people determined to have complex needs are assessed using a more comprehensive instrument, the *inter*RAI-HC (Morris et al., 1997), with over 100 detailed questions, again undertaken in the person's home often alongside the primary informal carer, taking between 90 and 120 min.

Two of the 20 health board regions in New Zealand were routinely using both the *inter*RAI-CA and *inter*RAI-HC to determine support needs for older people by their NASC services and were approached by the research team to participate in the research. All NASC Clinical Assessors undergo comprehensive training in the use of the two tools and their competency is annually assessed.

Assessments were entered directly into a laptop computer at the time of the client's assessment and were collected over a year (during the first year of the research period, 2012–2015). All assessment data were automatically uploaded into a hosted data set. Hours of input per week from home-care services as well as Allied health (Occupational Therapy, Physiotherapy, Speech and Language Therapy and Social Work interventions) were recorded over a year period and provided to the research team for analysis. Inputs can vary over time and therefore the mean weekly hours of input from the point of assessment up to 3 months post assessment were used in the analysis (only clients for whom there were hours of input recorded were included). Just over half of the older people with complex needs had no hours assigned and this was primarily due to their needs not requiring formal funded home-care, as they either had their support needs addressed by alternative means (e.g. family carer) or they were relocating from their home to aged residential care. For non-complex clients, a small group had no hours assigned and this was later identified as a group who required ongoing oversight by a health professional as opposed to requiring formal home-care services. Mean hours per week of home-care services were used in the analysis as the dependent variable (similar to Calver et al. 2004). Independent variables comprised responses from the two assessment tools.

On completion of the development of the classification system, expert clinicians assigned clinically appropriate responses to the Casemix groups, the methods of which are reported elsewhere (Sajtos, Rouse, Harrison, & Parsons, 2014), but the final pathways are presented here.

2.2 | Data analysis

Decision tree analysis was employed as the principal method to develop two models for: (i) older people with non-complex (*inter*RAI-CA); and (ii) older people with complex needs (*inter*RAI-HC). Chi-square Automatic Interaction Detector (CHAID), within the IBM SPSS Statistics decision tree method was used to build the explanatory models, both using mean weekly home-care service hours as the dependent variable. The independent variables were the responses from the assessment tools. The assessment tools (particularly the *inter*RAI-HC) had multiple domains and an informed decision-making process was required to identify the most likely candidates for analysis. A good Casemix system must be both statistically and clinically sound and clinical decision tree analysis offers an appropriate approach.

Clinical decision tree analysis is a systematic quantitative approach for assessing the relative value of one of more different decision options. Historically, it was developed as a method to help clinicians make decisions on how to manage individual patients (Sox, 1988; Weinstein & Fineberg, 1980). There are five steps in the approach: (1) Identify and define the problem; (2) Structure the problem to develop a decision tree; (3) Populate the decision tree; (4) Analyse the decision tree; and (5) Undertake sensitivity analysis. The approach is particularly valuable as it is inherently informed by findings from literature, primary data collection as well as consultation with experts at all stages (Sox, 1988); elements which were important within this multifaceted environment. Table 1 summarises the approach employed in

this research. The clinical decision tree approach employed in this research was particularly appropriate, as the number of potential independent variables that could be added to the model were extensive. For instance, the *inter*RAI-HC tool has over 600 individual items, any of which potentially could be entered into statistical models. The pragmatic clinical-/evidence-based approach inherent to the clinical decision tree provided a parsimonious way forward.

The ability of a Casemix model to account for variability within and across categories is an important part of its development and evaluation. Most studies use statistical measures to investigate the level of variance and this study follows the same approach. However, Fries et al. (1994) noted that there are two other critical considerations, clinical and incentives. The support of clinical expert opinion is important and was employed throughout the project; the use of incentives to support implementation is the focus of a subsequent paper.

The initial development of the RUG-III/HC (Björkgren et al., 2000) and indeed its consequent validation (Poss et al., 2008) argued for the inclusion of both formal and informal hours. Informal hours were not included in the current research as the reporting of informal hours through the *inter*RAI-HC tool is questionable and cannot be adequately validated and it is also entirely absent from the *inter*RAI-CA. Furthermore, this current research reflects a real-world Casemix tool development and given that most countries do not fund informal carers by an hourly rate, it did not seem appropriate to build such into the statistical model.

2.3 | Ethics

Ethical permission was sought and gained from the Auckland Human and Disability Ethics Committee (Ref: MED/07/68/EXP) prior to commencement of this work. Furthermore, within New Zealand, older people at the time of their assessment consent to allow their assessment data to be used for research purposes (*inter*RAI New Zealand, 2016).

3 | RESULTS

Assessments from 3,135 older people were collected from two regions and results are presented separately for older people with non-complex needs (interRAI-CA) and for older people with complex needs (*inter*RAI-HC).

3.1 | Older people with non-complex needs analysis (*inter*RAI-CA)

Of the 3,135, a total of 1,009 older people with non-complex needs were analysed. Of these, 83 clients did not receive any funded support hours, but were monitored by providers as part of their client load (classified as 1b, Table 3). The clinical decision tree approach informed the selection of likely independent variables (iterations of 22 independent variables) for further investigation. Several models were developed in partnership with clinical experts, with consensus on seven independent variables (support with bathing/showering, washing, dressing, housework, difficulty with stairs, walking and meal preparation). The model developed using these variables generated three "lead" categories: (1) Housework only; (2) Shopping/housework; and (3) Personal care/housework/shopping. Further statistical analysis and clinical insight led to additional delineation of older people with non-complex needs. Older people assessed as having "unstable conditions" or "urgent need for physiotherapy or occupational therapy" were assigned a "flexible" subcategory; those older people not assessed with these needs were classified as "stable" (Figure 1 and Table 3). This model explained 16% (r^2) of the total variation in the mean weekly hours.

Following a client assessment, the clinician progresses through the algorithm (as illustrated in Figure 1). Older people with non-complex needs are placed within one of six possible Casemix categories.

Clients in flexible clusters had more variability around their hours and were represented clinically by the need to vary inputs according to their needs (e.g. a client may be recovering following an acute injury and therefore their hours may be reducing as their independence levels increase). Clients classified as stable had lower variability in hours and needs level remained unchanged. Table 2 describes each of the groups and reports the mean weekly home-care hours and variability. Of note, is the higher variability in the flexible groups and the increase in mean weekly hours as needs levels rise.

These results were re-packaged into a more user-friendly tool, which provided guidance to the home-care service providers in

TABLE 1 Clinical decision tree analysis, key steps

Key steps	Explanation
Identify and define the problem	The existing fee-per-hour model discourages appropriate client discharges, inhibits sustainable employment and lacks flexibility for clients.
Structure the problem so as to develop a decision tree	Distinguish between older people with non-complex and complex needs, by applying a filter based on needs. Selection of relevant variables from the *inter*RAI-CA (for older people with non-complex needs) and *inter*RAI-HC (for older people with complex needs)
Populate the decision tree	Data collection across two locations using the *inter*RAI-CA and HC. Developing the decision tree from analyses using the statistical decision tree.
Analyse the decision tree	Statistical checking and clinical interpretation.
Undertake sensitivity analysis	Older people with non-complex needs refined by "stable" or "flexible." Older people with complex needs further delineated by brittle social support (unstable informal support) and cognitive impairment.

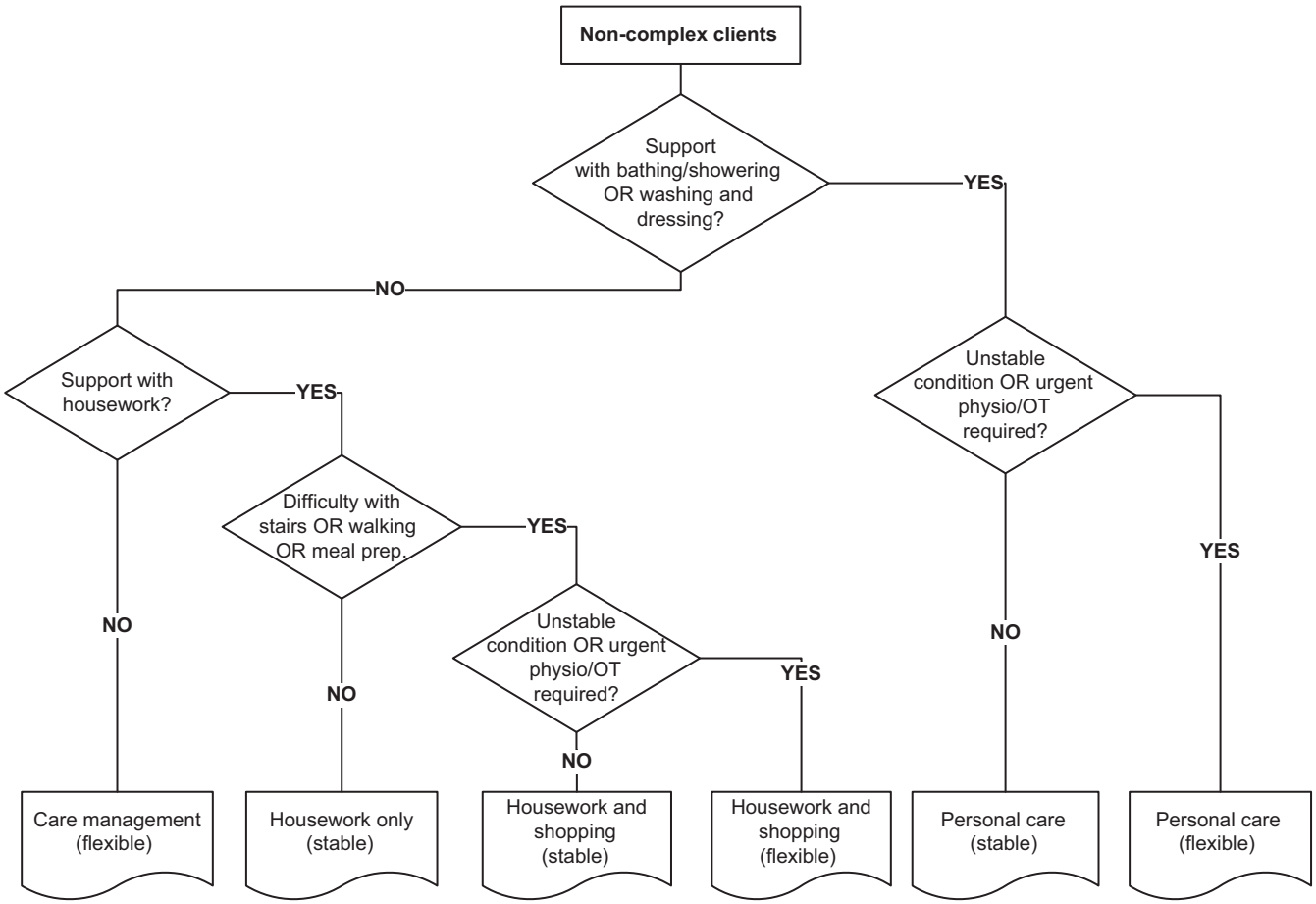


FIGURE 1 The six-cluster Casemix algorithm for older people with non-complex needs

TABLE 2 Mean weekly hours and counts for the six-cluster algorithm for older people with non-complex needs (n = 1,009)

Non-complex cluster	Cluster name	Description	Mean weekly hours (*SE*)	Count
1a	Housework only (stable)	Clients with low-level ADL difficulty requiring support with weekly or two-weekly housework	1.49 (0.07)	446
1b	Care management (flexible)	Oversight of client by health professional co-ordinator from home care services (client may not have formal hours assigned)	1.7 (0.19)	83
2a	Housework and shopping (stable)	Clients who are designated as having difficulty with undertaking their own grocery shopping (a higher level of disability than cluster 2). Shopping entails transport to and from shops, choosing, purchasing and carrying shopping and unpacking at client's home.	2.62 (0.17)	225
2b	Housework and shopping (flexible)	Dependency level as with cluster 3 though client would have had recent acute event and therefore potential for recovery and return to independence is much better.	2.37 (0.27)	76
3a	Personal care (stable)	Clients within this cluster experience difficulties with washing themselves either showering or bathing and require regular weekly input across multiple days to support this activity.	3.78 (0.33)	128
3b	Personal care (flexible)	As with cluster 5 but in addition clients condition is unstable and their weekly inputs may vary according to their condition and close monitoring is required.	3.2 (0.45)	51

operationalising the model. The tool (Table 3) enabled home-care service co-ordinators to readily allocate clients into categories following the assessment. The tool provides broad guidelines as to service provision and service aims. Such an approach enables allocation of resources commensurate with the respective Casemix group.

TABLE 3 Operationalising the six-cluster algorithm for older people with non-complex needs

Lead	Description	Sub group	Descriptor	Inputs	Focus
Housework only (1)	**Supervision/Assistance/Set-up help required with 'Housework'** – includes doing dishes, dusting, making beds, tidying up, laundry **Note.** Multiple DHBs have discontinued supporting this service. Clients require Community Services Card	A	Housework only (Stable)	? Discontinue	Re-integration into community
		B	Care Management (Flexible)	Oversight from Health Professional from home care services	Close involvement with Primary Care
Shopping & Housework (2)	**Supervision/assistance with:** (i) **stairs** (how a full flight of 12-14 stairs is managed; OR (ii) **Mobility** (moving around on one level); OR (iii) **preparing meals** (planning, assembling, cooking, setting out); OR **weekly grocery shopping** (compiling lists, transport, purchasing, storage) **Note**. Clients require Community Services Card	A	Housework and shopping (Stable)	Low weekly input, annual reviews by Health Prof. coordinator	Cost effective delivery whilst identifying changing needs
		B	Housework and Shopping (Flexible)	Graduated reduction in Home Care hours over time, 3/12 reviews by Health Prof. coordinator	Maximising independence; Discharge or reduce visits
Personal care & Shopping & Housework (3)	**Supervision/assistance with showering / bathing** – full shower/bath including transfers in/out bath / shower. Includes combing hair, brushing teeth, applying make-up, washing and drying face and hands	A	Personal Care (Stable)	Focus on weekly personal care support, 12/12 reviews by Health Prof. Coordinator	Cost effective delivery of responsive service
		B	Personal Care (Flexible	Higher weekly Home Care input, 3/12 reviews by Health Prof. Coordinator, liaison with geriatric services	Identifying changing needs and appropriate response

The algorithm for older people with non-complex needs was agreed by funders and providers and subsequently implemented. The next stage of the research was to follow a similar approach to the development of a Casemix system for older people with complex needs.

3.2 | Older people with complex needs analysis (*inter*RAI-HC)

Data from 1007 (of 2126) unique interRAI-HC assessments with validated home care hours assigned were used in the analysis. As with the non-complex analysis, variables that were believed to have a relationship with home-care service hours were identified through the clinical decision tree process. The selected variables were incorporated into the statistical decision tree and included: Lower body dressing; Bathing; Urinary incontinence; Indoors mobility; Shopping; Cognitive function; Managing finance; Medication management; Informal carer stress; IADL function; Recovery potential; and Meal preparation. The final selection of the decision tree was made through lengthy and careful consideration by the clinical and statistical team. The consensus is the tree presented in Figure 2, which explains 24% of the dependent variable (weekly mean hours).

Within *inter*RAI, independence is represented by a value of "0." In Figure 2, lower body dressing is a pivotal branching point in the algorithm, where values greater than 1 (low to high dependency) flow to the right side of the diagram and lower values (minimal or no dependency) to the left. Within each side, different branches lead to clusters of varying dependency. Table 4 shows for each cluster, a membership description, the mean weekly hours and standard error, the count and the name of the cluster. Generally, the clusters appear to reflect distinct and increasing levels of need based on client dependencies.

Although the eight clusters provided good statistical explanation, the expert clinicians identified other key areas that were absent in the model. Variables for these areas had been included in the analyses and had formed part of several alternative statistical decision trees, but the eight-cluster tree had the highest measure of explained variance. As these areas were thought to have a major impact on care pathways, they were incorporated at a level above the eight "disability" cluster tree and comprised: "brittle social support" (defined as the carer is reporting significant burden and stress), "cognitive impairment" (defined as difficulty with daily decision-making) and "significant rehabilitation" (defined as potential for recovery), as well as an iteration of "brittle social support and cognitive impairment" (Table 5). The "significant rehabilitation" category was a standalone category, as the expert clinicians regarded an intensive rehabilitation pathway as independent to further breakdown by disability, as the trigger for this category was potential for improvement with rehabilitation. Although this results in 33 clusters, the commonality of the eight-cluster disability groups reduces the complexity of this algorithm.

4 | DISCUSSION

This research has developed two homecare Casemix tools, one for older people with non-complex needs and the other for complex needs. Currently, there are no casemix tools available for older people with non-complex needs and this research represents the first time such a tool has been developed. There have been attempts to develop Casemix methodologies for older people with complex needs, derived in the main from the *inter*RAI-HC assessment tool but no tools to date have transitioned from research to mainstream service delivery. The Casemix tool developed for older people with complex needs described in this paper has not only a reasonable *r*-squared value of 24% but is also in regular use across the New Zealand health sector. The specified value of 24% is for formal hours only and therefore compares favourably with research undertaken to date, described in the introduction to this paper.

There are clear limitations in the development of the classification system described herein. The desire to develop clinically meaningful groups that could be used to advance pathways that align with best evidence meant that multiple groups were produced (33 complex

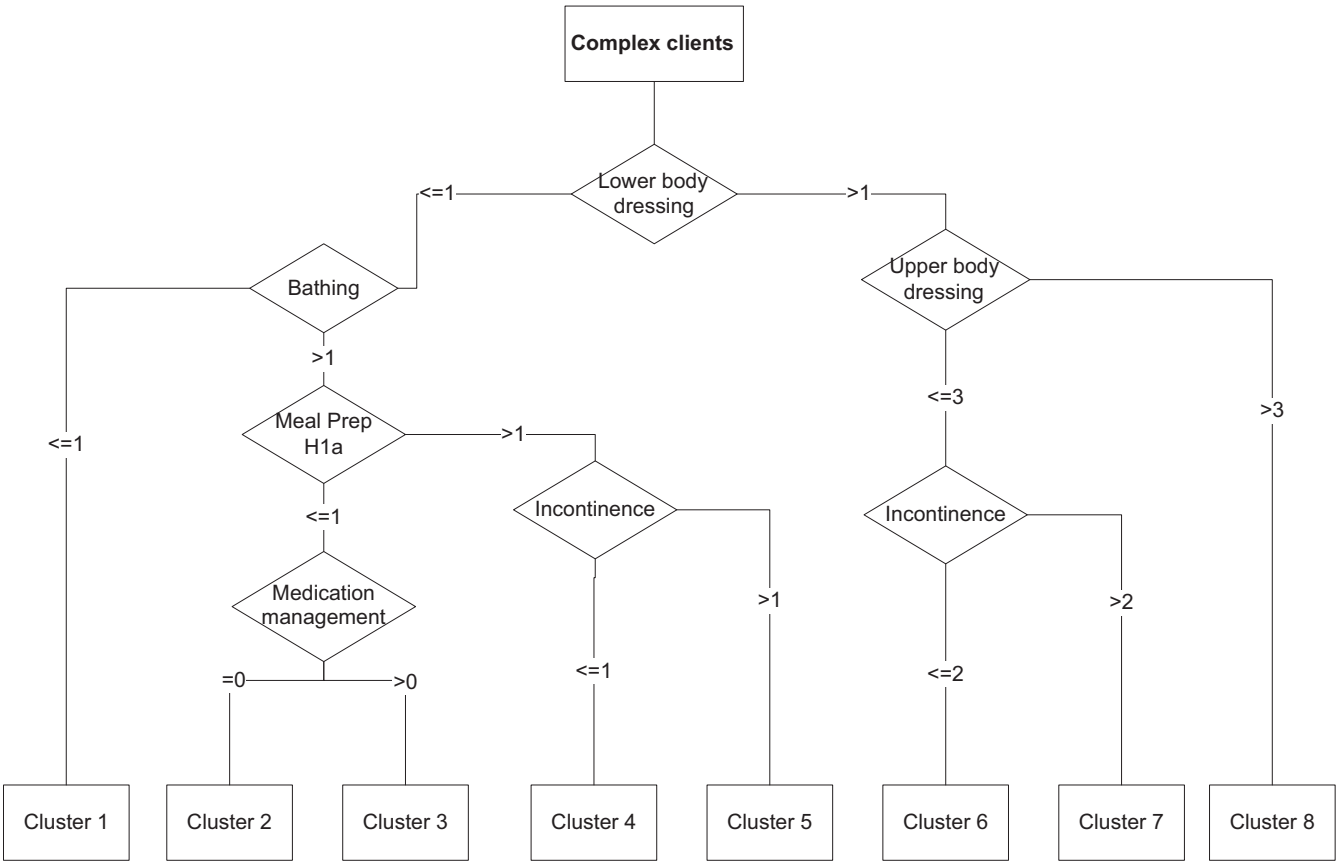


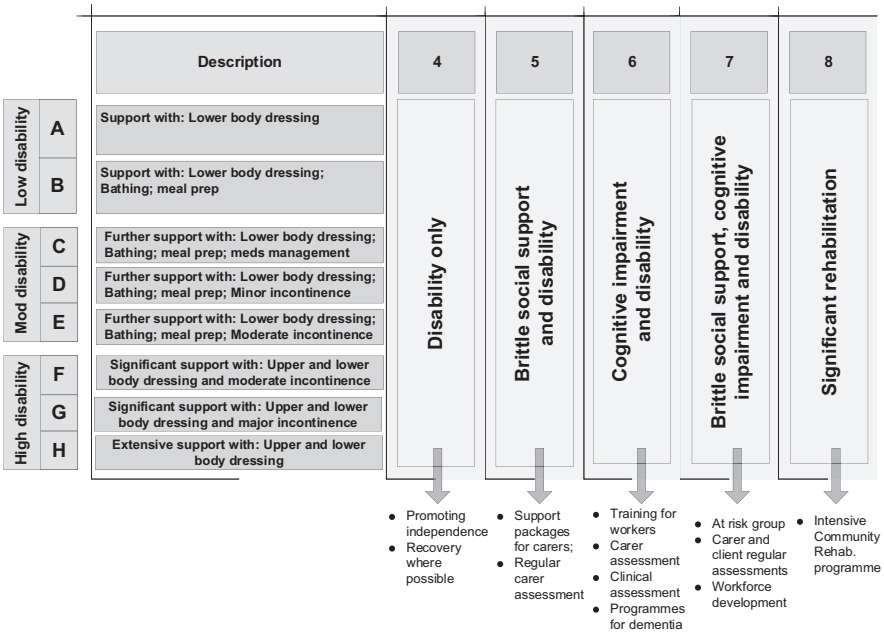
FIGURE 2 The eight-cluster Casemix algorithm for older people with complex needs

TABLE 4 Mean weekly hours and counts for the eight-cluster algorithm for older people with complex needs (n = 1,007 with validated homecare hours)

Identifier		Description	Mean hours (SE)	Count	Cluster name
Low needs	Cluster 1	Almost no help required with lower body (<1) and bathing (<1)	1.97 (0.05)	330	Low needs
	Cluster 2	Almost no help required with lower body (<1), meal preparation (<1) and medication management (=0), but help with bathing (>1)	2.98 (0.18)	60	Bathing support
Moderate needs	Cluster 3	Almost no help required with lower body (<1), meal preparation (<1), but help with medication management (>0) and bathing (>1)	3.83 (0.22)	75	Bathing and cognitive processes
	Cluster 4	Almost no help required with lower body (<1), but help with meal preparation (>1), bathing (>1) and slight urinary incontinence (<1)	3.05 (0.21)	71	Meal and bathing support
	Cluster 5	Almost no help required with lower body (<1), but help with meal preparation (>1), bathing (>1) and urinary incontinence (>1)	2.35 (0.17)	51	Meal preparation and bathing support and incontinence
High needs	Cluster 6	Help required with lower body dressing (>1), upper body dressing support (<3) and urinary incontinence (<2)	3.63 (0.15)	205	Dressing lower body support
	Cluster 7	Help required with lower body dressing (>1), upper body dressing support (<3) and urinary incontinence (>2)	4.42 (0.26)	171	Dressing lower body support and incontinence
	Cluster 8	Help required with lower body dressing (>1) and upper body dressing (>3)	6.07 (0.73)	44	Significant disability

and 6 non-complex). The number of clients occupying several of the complex groups was small, which clearly impacted on the variability. That said, healthcare Casemix systems can only be successful if they represent clinically meaningful groupings, which was the intention of the research. A criticism of other Casemix tools in home-care relate to the accuracy, availability and appropriateness of the measurements

TABLE 5 Operationalising the Casemix algorithm for older people with complex needs



(Fries et al., 1994). None of which presented major issues in the current research, as the existing methods to ensure consistency, validity and reliability among health professionals undertaking the assessments meant that the robustness of the data was higher. Furthermore, the current study used 12 months of costing data (home-care service hours and allied health) as opposed to much shorter periods of time, as seen in other research (Björkgren et al., 2000; Poss et al., 2008). Such an approach meant that inputs were more representative of home-care services, as the variation in home-care hours in response to changing needs is more likely to be reflected. A limitation which is clearly observed in other research includes the variability around allocation of hours as a consequence of variabilities in assessments. In this research study, the considerable training of assessors and competency assessment meant that there was greater consistency.

The Casemix model generated in this research arose from a traditional home-care model, which lacked the flexibility and responsiveness to changes in client need intrinsic to the restorative home-care model evaluated elsewhere (King, Parsons, & Robinson, 2012; King, Parsons, Robinson, et al., 2012). Given that the dependent variable is mean weekly hours per client, there is an inherent limitation in this approach in that statistically the categories might reflect the status quo and not the desired future model. These risks were mitigated in several ways. The categories were developed through a combination of statistical and clinical expertise using the clinical decision tree approach and the clinicians were all well-versed in the restorative home-care model. Advice over groupings was made cognisant of future model changes; in other words, the Casemix categories reflected more the anticipated model of care than the traditional method of delivering home care. Furthermore, the Casemix categories were determined by client needs which are present irrespective of any home-care model. Finally, although the absolute hours per category may be influenced by the service provision model, the relativity among categories tends to be steady, which is a basic tenet of Casemix.

The *raison d'être* of the research was to develop a tool that could be readily employed within a healthcare setting and the product thus reflects this intention. These tools are already in place across 8 of the 20 health boards (around 70% of the population) within New Zealand and therefore reflect on the success of the model. The Casemix tool reflects a more action research methodology as the authors did not initially seek out to develop an alternative to the native *inter*RAI tools. Moreover, given the need to develop a whole of continuum solution (non-complex as well as complex), there was no alternative but to identify a classification system for clients with less complex needs. Furthermore, New Zealand clinical opinion on provision of home-care services did not support adoption of the current RUG-III/HC system, preferring to focus on differentiation around carer stress, disability and cognitive impairment as described by Sajtos et al. (2014). A focus on such groups allows health services to develop targeted responses aligned to client needs.

The rationale for the development and implementation of a Casemix funding methodology within home-care services has always been to primarily improve the quality of services delivered to clients in their own homes. Casemix itself does not increase flexibility and responsiveness but it does, at the very least, provide a springboard for development. Indeed, many would argue that funding systems employing a Casemix methodology provide incentives for service providers to manage clients proactively in alignment with the principles of restorative home support. For instance, providers have flexibility around their inputs as long as desired outcomes are achieved. Where funding is

secured over a period of time as seen in Casemix methodologies, staff (particularly vulnerable workers such as carers) have greater security.

This paper represents a very significant step forward in outlining an alternative funding system for home-care services that has not only achieved reasonable statistical explanatory variance but also attained organisational acceptability through its subsequent widespread implementation in New Zealand, a development not seen elsewhere across the world.

CONFLICT OF INTEREST

There are no known conflicts of interest.

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