



Research Paper

The brain injury case management taxonomy (BICM-T); a classification of community-based case management interventions for a common language

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Abstract

Background: Case management is a complex intervention. Complexity arises from the interaction of different components: the model (theoretical basis), implementation context (service), population and health condition, focus for the intervention (client and/or their family), case manager's actions (interventions) and the target of case management (integrated care and support, client's community participation). There is a lack of understanding and a common language. To our knowledge there is no classification (taxonomy) for community-based case management.

Objective: To develop a community-based case management in brain injury taxonomy (BICM-T), as a common language and understanding of case management for use in quality analysis, policy, planning and practice.

Methods: The mixed qualitative methods used multiple sources of knowledge including scoping, framing and a nominal group technique to iteratively develop the Beta version (draft) of the taxonomy. A two part developmental evaluation involving case studies and mapping to international frameworks assessed the applicability and acceptability (feasibility) before finalization of the BICM-T.

Results: The BICM-T includes a definition of community-based case management, taxonomy trees, tables and a glossary. The interventions domain tree has 9 main actions (parent category): engagement, holistic assessment, planning, education, training and skills development, emotional and motivational support, advising, coordination, monitoring; 17 linked actions (children category); 8 related actions; 63 relevant terms defined in the glossary.

Conclusions: The BICM-T provides a knowledge map with the definitions and relationships between the core actions (interventions domain). Use of the taxonomy as a common language will benefit practice, quality analysis, evaluation, policy, planning and resource allocation. © 2016 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Keywords: Case management; Care coordination; Taxonomy; Intervention; Quality analysis

Case management (CM) is a complex intervention which makes a unique contribution toward the long term care, community participation and support of a person with a complicated health condition such as brain injury.^{1–3} CM

has multiple components, which interact with each other.^{4–6} The components concern; the model or approach (theoretical background), implementation context (organization or service), case manager's actions

Abbreviations: (BICM-T), Brain injury case management taxonomy; (CM), Case management; (AUD), Australian dollars; (NSW), New South Wales; (LTCSA), Lifetime Care and Support Authority; (WHO), World Health Organization; (ICHI), International Classification of Health Interventions.

The method used for the development of the taxonomy was presented at the International Integrated Care Conference in November 2014, and the abstract of that conference presentation was published in IJIC. There was a poster presentation in 2014 at WHOFIC-Barcelona.

The authors have no conflicts of interest to declare.

There has been one paper presentation on the method at the International Integrated Care Conference in November 2014. There was a poster presentation on the ICHI component of the taxonomy in presentation in 2014 at WHOFIC-Barcelona and a poster presentation in July at the ASS-BI conference in Sydney. These are not considered duplicate publication.

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(interventions), focus of the CM interventions (the person with the health condition, or their family/carers), the target of CM (e.g. activities and participation of the person with the health condition or environmental factors) and the time the case manager is engaged with the recipient (stage of recovery). The issues arising from the complexity in CM are similar to the evaluation of other complex interventions, integrated health care and health care programs.^{7,8} The variability and lack of consensus on language poses challenges for quality analysis, evidence synthesis, policy development and planning for CM.^{5,6,9–11}

Brain injury

In this research, there is a special focus on brain injury, which is an example of a common multi-dimensional and disabling health condition. As such, the taxonomy may be applicable to other multi-dimensional health conditions like dementia, chronic illness or mental health conditions or multi-morbidity.

The differences with definition and reporting of brain injury results in a range of incidence estimates based on hospital data from 91 to 377 per 100,000 population.^{12,13} Brain injury potentially impacts on multiple domains of health and participation, the person's cognitive, physical, psychological, behavioral functioning and participation in life roles. In the USA, 2% of the population are reported to experience life-long disability as a result of traumatic brain injury.¹⁴ In an Australian outcome study of various health domains for people with brain injury ($n = 198$) there were significant impairments of mobility (10%), use of the hands (14%), communication (4%), memory (61%), problem solving (52%), social interaction (20%), and at 3 years post injury less than a third of working age people were employed.¹³

Case management for person's with brain injury demands a complex response by services, programs and interventions.^{1,15,16} In Australia, children and adults with brain injury were estimated to be 6% of users of Government funded specialist disability service¹⁶ with the total life time cost per incidence case of traumatic brain injury estimated to be \$2.5 and \$4.8 million (AUD) for moderate and severe brain injury respectively.¹⁵ People with moderate or severe brain injury require CM. In 2012, a local study at the Lifetime Care and Support Authority (LTCSA) in New South Wales (NSW), Australia; 89% of participants in LTCSA with brain injury received CM services.¹⁷

Taxonomy

In health services and implementation research, complexity has been managed with methods which use broader sources of knowledge, framing and frame analysis. Frame analysis is a method to enumerate and define ideas and themes within a broader topic to support defining new concepts.^{18,19} One type of framing tool is classification, a

taxonomy. The taxonomy organizes knowledge and articulates the relationship between concepts and components, and provides definitions.^{18,20} In health services research taxonomies have been used as a knowledge map to develop consensus and develop a common language in very different areas such as patient safety and reporting of adverse events,²¹ rehabilitation interventions^{22,23} health-related behaviors²⁴ or complex psychological behavioral interventions.²⁵

In studies on CM, either there is too little information to describe what is done (the interventions or activity) or there is significant variability in the terms and descriptions for the same activity.^{11,26–31} For example, the range of terms used in the literature to describe the activity (intervention) of linking or referring the person to health or support services include *managed care*,³² *brokering*,^{33,34} *specialist case management*,³⁵ *systems coordinator*,³⁶ *coordinating*,³⁷ *service broker*³⁸ or *navigator*.³⁹

Aim of the research

The research aims to develop a community-based case management in brain injury taxonomy (BICM-T), for use as a common language in case management quality analysis, policy, planning and practice.

The model and theoretical background for the taxonomy on CM is community-based and person-centered. The person-centered approach holistically considers the clients own context and situation, their strengths, the clients choice and goals for participation in life, their needs and preferences as well as actively supporting them to be involved in planning for supports.⁴⁰

In this paper, we only report on the interventions domain performed by the case manager (throughputs domain). The case management service domain (inputs) is reported elsewhere.

Methods

The University of Sydney conducted the two phase study (Fig. 1). In December 2013, the University of Sydney granted ethics approval. Phase 1 involves the development of the taxonomy and Phase 2 the dissemination and implementation. The taxonomy on CM in brain injury involves two axis or domains of case management; 1) the service domain (inputs), the description of case management services provided by organizations and 2) the interventions domain (throughputs) which are the 'actions' performed by the case manager. Phase 2 has commenced but the methods and results are not reported here.

Phase 1, the development of the taxonomy involved two groups and four steps (refer to Fig. 1). The focus of this report is on Phase 1 and the case management interventions domain of the taxonomy. Step 1 the scoping study method and results are reported elsewhere. The next steps occurred over 14 months and involved two groups; a core group (SL,

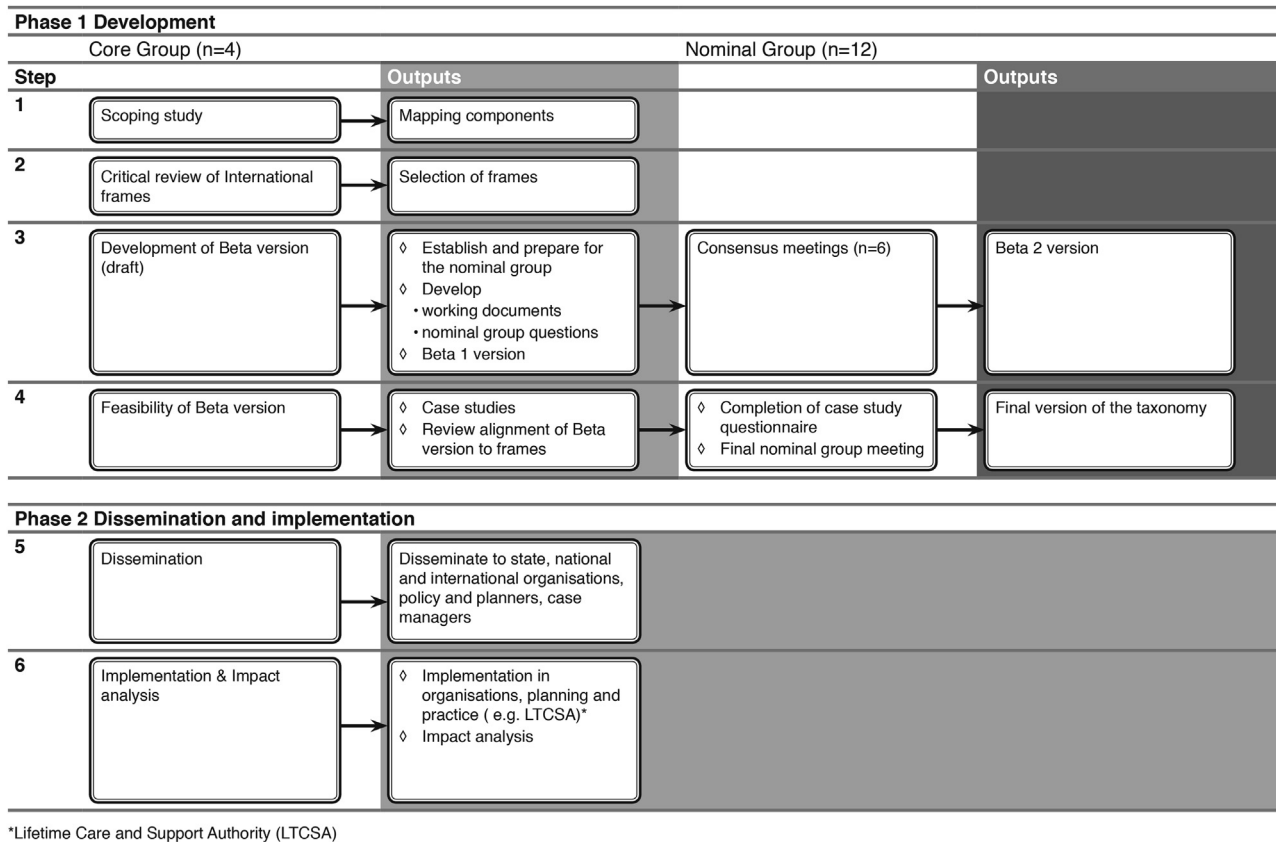


Fig. 1. The phases and steps for the development of the taxonomy of community-based case management in brain injury (BICM-T).

AF, MM, and LSC) and a nominal group of 11 CM experts. Steps 3 and 4 involved an industry partner, funder of community-based CM services for persons who have sustained a moderate or severe traumatic brain injury through a motor vehicle crash in New South Wales (NSW), the Lifetime Care & Support Authority (LTCSA).

Phase 1: Step 2 critical review of international frames

Step 2 used a frame analysis approach to identify the tools and international frameworks to support the key concepts that underpin community-based CM. In addition to the taxonomy, there was a need for frames to accommodate the complexity of the different domains in community-based CM (intervention and service). The core group completed a critical review of potential international frameworks to inform the theoretical background of the taxonomy including: the concepts of health and disability; factors related to the service domain of CM (the inputs); and the factors related to the focus of this report, the intervention domain of CM (the throughputs).

Phase 1: Step 3 development of Beta version (draft)

The core group members developed the Beta 1 version of the taxonomy using the knowledge from the scoping study

and the international frames. The core group prepared the working documents and questions for the nominal group.

The final part of Step 3 was the iterative development of the Beta 2 version of the taxonomy with the nominal group. The nominal group technique allows a more structured approach than, for example, focus groups. The technique also allows the use of prior information and expert knowledge.⁴¹ Expert knowledge is a type of scientific knowledge, which is critical to implementation research.^{18,42} The expert knowledge from a multi-disciplinary group of people enhances the potential for, and use of the taxonomy. The nominal group technique uses an open group discussion and judgment technique to make consensus decisions.^{43–45}

The members of the nominal group ($n = 12$) had expert knowledge of CM practice in brain injury (pediatric and adult), knowledge of different service contexts (public, private, non-government not for profit organizations), geographical context (urban and rural) and came from different professional backgrounds, and experience in policy and planning, funding, business and management.

Phase 1: Step 4 feasibility of the Beta version to develop the final BICM-T

A type of formative evaluation, the developmental evaluation, was undertaken to enhance the feasibility of the taxonomy.^{46,47} Feasibility refers to the extent to which the use

of the taxonomy is appropriate in practice (including policy practice) and clinical situations, when used for a specific objective in a specific way. This analysis included applicability and acceptability. The applicability construct is defined as the usability of an instrument or in this case the taxonomy (or usefulness in terms of its dimensions, the application). Acceptability refers to the ease with which a user can use the instrument, the ‘user-friendliness’ of the taxonomy.^{48–50}

The developmental evaluation activities involved mapping the alignment of the Beta version intervention domain to the international frames, and trialing acceptability of the actions and relevance to the expert case managers using case studies. The core group reviewed the Beta 2 alignment and consistency of the actions with the biopsychosocial concepts of functioning and language in the ICF and ICHI to identify inconsistencies and gaps, in language and relationships between components.

SL developed four case studies differentiated by injury type (three traumatic brain injury and one with spinal cord injury as a comparator), age (one child and three adults) and different stages post injury (stage one <2 years post injury, stage two >2 years post injury). The comparator case study on spinal cord injury (Case study 1) was included to trial whether there were major differences with another different, but severe and complex health condition. The case studies provided a synopsis of the client’s context and functioning at two periods following injury (Refer to an example [Appendix 1](#) Case study 4). The core group developed the case study questionnaire on the acceptability (relevance) and applicability (degree to which the action is important) of seven of the actions. At the time of the case studies the definition of two actions (advising and education) were not finalized with a consensus definition and excluded from the case studies questionnaire. On the Likert scale acceptability rating the end points were 1 (not relevant) and 4 (extremely relevant). Importance was rated as a percentage of time spent on each action per client per stage of recovery. Each nominal group member completed the case study questionnaire by week 6 (excluding the facilitator and one nominal group member but the inclusion of one observer (MM) $n = 11$).

Following the developmental evaluation, further revisions to the Beta version (definition, glossary and tree) were sent to the nominal group. The final meeting held four months later in Step 4 was to finalize the BICM-T with the nominal group.

Results

Phase 1, Step 2 critical review

The results of Phase 1, Step 1 the scoping study are not reported here. The results of Phase 1, Step 2 the critical review, identified three international frameworks which

informed the taxonomy and assisted to develop the structure, the relationships and language of the taxonomy. The two frameworks discussed here relate to the intervention domain of the taxonomy.

- i. The International Classification of Functioning, Disability and Health (ICF)⁵¹ articulates the biopsychosocial model of health, the interaction of the person’s impairments of body functions and structures, their activity limitations and restrictions for participation. As the ICF defines the domains of health including the influence of the contextual factors (environment and the person) on functioning, the concepts and language in the ICF aligns with the approach taken in community-based and person-centered CM.
- ii. The World Health Organization (WHO) is developing a method of describing and classifying health interventions, the Alpha version of the International Classification of Health Interventions (ICHI).⁵² The ICHI classification provides a standard definition of an intervention (an activity performed for, with or on behalf of a person or a population whose purpose is to improve, assess or modify health, functioning or health conditions). The ICHI defines three main axis for health interventions. These are the target of the intervention (the entities on which the action is carried out for example, the person’s behavior, activities and participation), the action (a deed which is done by an actor to a target during a health care intervention such as therapeutic, managing), and the means (the entities describing the processes and methods by which the action is carried out such as the technique or approach, or method).⁵² In addition to surgical and medical interventions, ICHI includes for the first time, a section on functioning interventions that target a body function, activities or participation, or an environmental factor that affects functioning.^{51,52} As the taxonomy was to provide a description of the multiple interventions (components) performed by a case manager depending on the client and context, the ICHI classification actions was critical to the throughput (intervention) axis of the taxonomy.

Phase 1, Step 3 Beta version

Beta 1 version

In Phase 1, Step 3 there are four parts. The first, was to establish, recruit and prepare for the nominal group.

In the second part of Step 3, the core group developed other documents including the outline for the six nominal group meetings and questions to structure the discussion and systematically work through to consensus decisions. Examples of the questions are; *What is case management?*

What is **not** case management? What is the relation between these components of CM? Have your specific suggestions been incorporated in an adequate way? If not, do you understand the reasons provided not to do so? Do you agree with the definition?

The next part of Step three the Beta 1 version developed by the core group included groups of the key components described in the literature, and the description of the activities performed. In this first version of the taxonomy there were 17 components and 56 actions, definitions of the components and a draft definition of CM.

The final part of Step 3, the nominal group monthly half day meetings commenced in February 2014 facilitated by SL with LSC and MM (observers), and AF (rapporteur). Table 1 presents information on the nominal group members. Participants received the minutes to confirm group decisions and other relevant information prior to each meeting.

Over the next 10 months changes made to the taxonomy as a result of work with the nominal group: consensus on what is and what is not community-based CM (thereby deletion of some actions), changes in terms (such as changing component of the interventions domain to actions), grouping actions ‘like with like,’ establishing associations and relationships between the actions, removing repetition and further refining of definitions which in some instances led to redundant actions. The process was iterative not linear. The Beta 1 version of the taxonomy was refined to involve 13 main actions, 36 actions and 11 related actions.

Beta 2 version

The next and final part of Step 3, to develop Beta 2 version occurred after the 4th nominal group meeting. In between meetings 4 and 5 the core group undertook a review of the

conceptual and language consistency across the taxonomy and alignment with the international frames of both the ICHI and ICF. Over meetings 5 and 6 of the nominal group, the Beta 2 version of the action relationships and definitions were refined, and the taxonomy interventions further reduced to 9 main actions, 22 actions and 8 related actions. The definition of community-based CM was finalized and a draft glossary of 60 terms. This version of the taxonomy (interventions and service trees) were first presented at the World Congress on Integrated Care in 2014.⁵³

Phase 1, Step 4 feasibility of Beta version

In Step 4, and meeting six of the nominal group, the feasibility analysis through two developmental evaluation activities were completed. There was alignment with the ICHI on a number of titles for action and definitions including preparation, education, monitoring, advising and emotional support and gaps with respect to three main actions and eight main actions (in particular actions of engagement, coordination and planning).

The second evaluation activity, the case studies questionnaire confirmed the relevance of the taxonomy for CM experts. Table 2 provides the mean percentage of time, standard deviation and the mean relevance rating, standard deviations across the 11 case managers for the four case studies in Stages 1 and 2.

In Fig. 2 provides the average change from stage 1 to stage 2 of relevance rating by the case managers. A negative score indicates that the action is rated as less relevant at stage 2 of the case study than in stage 1, a positive score indicates the action is perceived to be more relevant in stage 2.

Table 1
Nominal group of case management experts

	Name	Professional background	Client group ^b	Areas of expert knowledge					Service context ^c	Geographic ^d
				Practice	Policy planning	Management	Funding			
1	Dianne Croker	Occupational therapy	A	x	x	x	x	Pub, Pr	U, R	
2	Margaret Doyle	Speech pathology	A	x	x	x		Pub	U	
3	Marion Fisher	Speech pathology	C	x	x	x		Pub, Pr	U	
4	Rebbekah Loukas	Psychology	A	x	x	x		NFP	U	
5	Suzanne Lulham	Physiotherapy & law	B		x	x	x	Pub, Pr	U, R	
6	Elizabeth Shannon	Physiotherapy	A	x				Pr	U	
7	Jo Suhanic	Social work	B	x	x			Pub	U, R	
8	Deb Toffolo	Speech pathology	B	x	x	x		Pr	U	
9	Karen Williams	Nursing	B	x				Pr	R	
10	Janine Wood	Speech pathology	B	x	x			Pub	U, R	
11	Denise Young	Social work	B	x	x	x		Pub	R	
12	Sue Lukersmith ^a	Occupational therapy	B	x	x	x	x	Pub, Pr	U	

^a Facilitator.

^b Client group: Adult = A, Children = C, both adult and children = B.

^c Service context: Public (Pub), Private (Pr), Not-for profit (NFP).

^d Geographic; Urban (U) rural (R).

Table 2
Percentage of time and relevance of the actions in each case study per stage

Case study	1	2	3	4
Action	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
% of time				
Stage 1				
Engage	15.5 (6.1)	16.4 (6.0)	18.2 (9.00)	20.0 (9.2)
Assess	10.9 (6.3)	11.4 (4.5)	12.7 (4.7)	12.3 (5.6)
Plan	22.7 (6.1)	14.3 (7.6)	15.0 (6.3)	19.1 (5.8)
Train	9.5 (3.5)	8.9 (6.5)	13.9 (7.1)	14.1 (5.8)
Support	11.4 (3.9)	9.5 (4.7)	14.3 (4.2)	12.7 (5.2)
Coordinate	22.3 (10.1)	26.4 (11.2)	13.6 (3.9)	11.8 (7.8)
Monitor	8.6 (5.0)	13.2 (5.6)	12.3 (4.7)	10.9 (4.9)
Stage 2				
Engage	6.8 (3.4)	10 (6.3)	9.1 (6.3)	10.5 (8.2)
Assess	7.7 (6.1)	10.5 (5.7)	8.2 (4.0)	11.2 (6.6)
Plan	37.3 (25.2)	15.9 (6.6)	17.7 (5.2)	23.2 (6.4)
Train	8.6 (6.7)	15.9 (9.4)	15.0 (8.1)	10.6 (4.7)
Support	14.1 (8.0)	11.8 (4.6)	19.5 (4.2)	18.2 (7.2)
Coordinate	12.3 (9.3)	22.7 (13.7)	18.2 (7.2)	14.1 (5.8)
Monitor	12.4 (11.8)	14.1 (7.0)	12.6 (4.5)	12.3 (5.2)
Relevance rating				
Stage 1				
Engage	3.8 (0.4)	3.7 (0.5)	3.8 (0.4)	2.8 (0.8)
Assess	3.4 (0.9)	3.0 (0.6)	3.2 (0.6)	2.7 (0.6)
Plan	4.0 (0.0)	3.4 (0.7)	3.5 (0.5)	3.6 (0.5)
Train	2.8 (0.9)	2.6 (1.0)	3.4 (0.7)	3.4 (0.7)
Support	3.3 (0.6)	3.1 (0.8)	3.6 (0.5)	3.5 (0.5)
Coordinate	3.6 (0.5)	3.8 (0.4)	3.2 (0.6)	3.5 (0.7)
Monitor	3.3 (1.0)	3.5 (0.5)	3.3 (0.6)	3.4 (0.5)
Stage 2				
Engage	2.7 (0.9)	3.0 (0.8)	4.0 (0.5)	3.0 (0.5)
Assess	2.5 (1.2)	3.1 (0.7)	3.0 (0.9)	3.0 (0.8)
Plan	3.5 (0.7)	3.5 (0.5)	4.0 (0.4)	4.0 (0.0)
Train	2.5 (1.0)	3.3 (1.0)	3.0 (0.8)	3.0 (0.8)
Support	2.9 (0.9)	3.3 (0.8)	3.0 (0.5)	4.0 (0.7)
Coordinate	2.8 (1.2)	3.6 (0.7)	3.0 (0.9)	3.0 (0.6)
Monitor	2.6 (1.1)	3.6 (0.7)	3.0 (0.6)	3.0 (0.5)

Final version of the taxonomy

The information gained from these two evaluations in Step 4 resulted in further revisions to the Beta 2 version in the discussions at nominal group meetings five, six and seven. The delay for the 7th nominal group meeting held

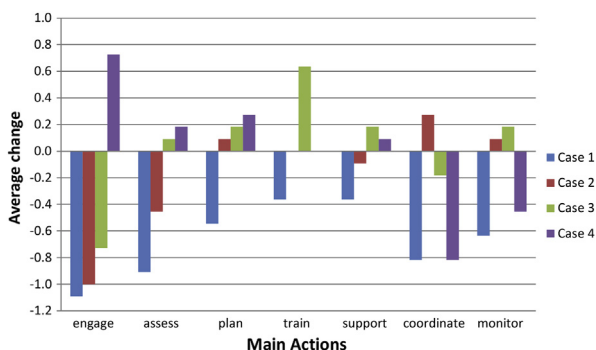


Fig. 2. Change in relevance between Stages 1 and 2 per case study.

four months later, provided time for reflection by the group members and the opportunity to develop the final version of the taxonomy (BICM-T).

The interventions domains of CM (throughputs) of the BICM-T contains 9 main actions (parent category), 17 actions (children category) and 8 related actions. Fig. 3 shows the intervention tree. The taxonomy interventions table (Appendix 2) provides the definitions of the key actions. The glossary (Appendix 3) provides 63 definitions of the actions, key concepts and terms in the taxonomy.

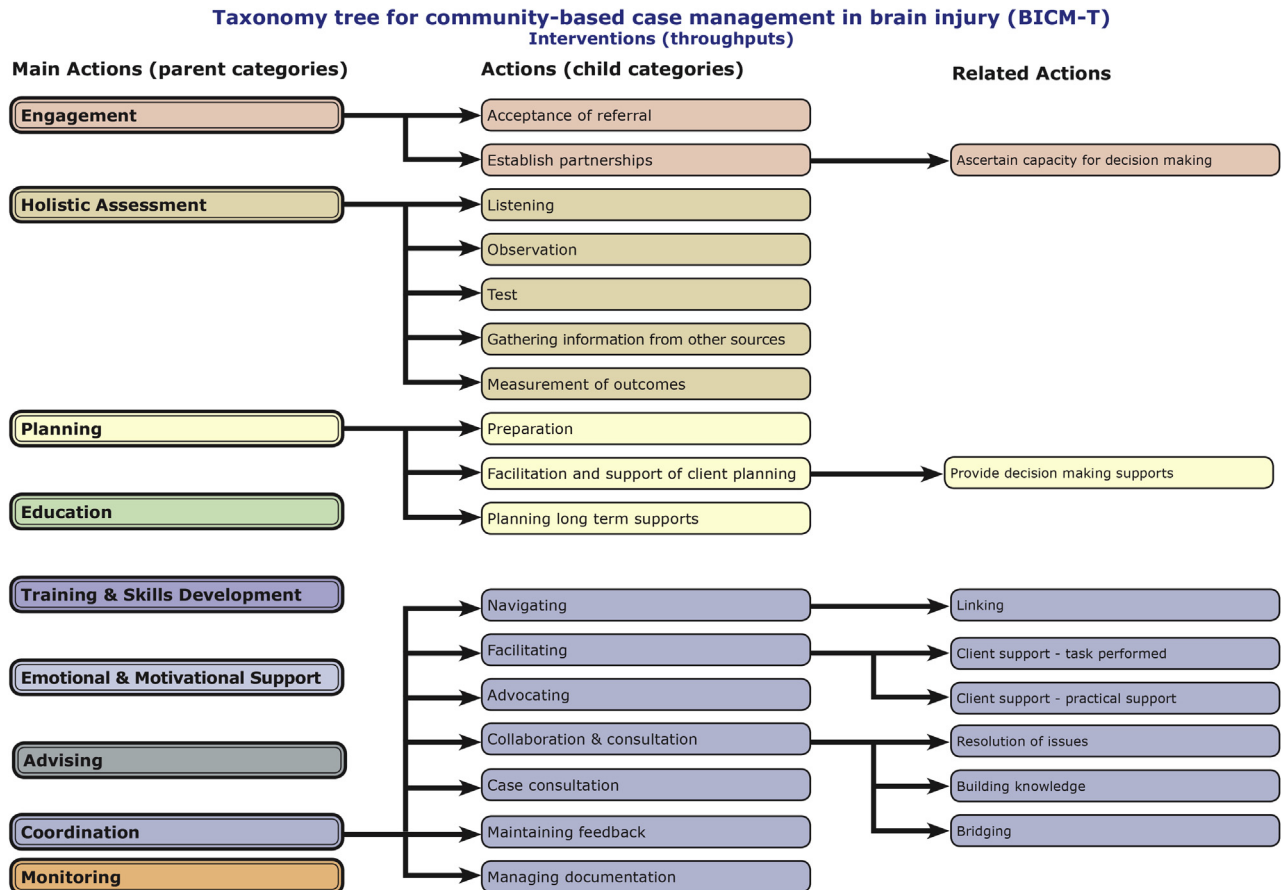
Discussion

The case studies evaluation confirmed the applicability and acceptability of the main actions in the taxonomy. As expected the percentage of time spent in each main action varied according to the case study context but was consistent across case managers. Variation only occurred in case manager estimates of time ($SD > 10.0$) with the actions of coordination (Case study 1 and 2 in stage 1, Case study 2 in stage 2), planning (Case study 1, stage 2) and monitoring (Case study 1, stage 2). Case study 1 was the spinal cord injury comparator of a 32 year old woman with spinal cord injury, a 3 year old daughter and in stage 2 (5 years after her injury), was considering having a second child. The variations in time may relate to the contextual complexities rather than her health condition.

The relevance results show a high level of acceptability (relevance – 3 relevant or 4 highly relevant) of the 7 main actions evaluated (engagement, holistic assessment, planning, training and skills development, coordination and monitoring) across all case studies in both stages. There was no main action that rated as irrelevant (mean rating < 2) at any stage for any case study.

A high ranking of relevance does not necessarily mean a higher percentage of time. The percentage of time compared to relevance appears to vary depending on the case study and the client's situation. For example, the most time spent for Case study 4 in stage 2 was planning at mean of 23.2% (a time when this 15 year old boy was planning for post school activities). The main actions for Case study 2 in stage 2 coordinating and monitoring (both ranked mean = 3.6) had a difference in time spent (mean = 22.7 for coordinating and mean = 14.1 for monitoring). Case study 2 is a 56 year old man who lives in a group home with 24/7 formal care so whilst monitoring is important, there are others involved who assume some of this role.

There was higher consistency ($SD < 1.0$) in case managers relevance rating across the two stages in two case studies where there was significant support from family and friends (Case study 3 who is a 38 year old man and Case study 4 a 15 year old boy living with his supportive parents). It is possible that anticipating the role of the case manager may have been easier in these two case studies.



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A taxonomy of community-based case management in brain injury.

Fig. 3. Intervention tree.

The action engagement is less relevant in stage 2 for Case studies 1, 2 and 3 but more relevant for Case study 4. In Case study 4 stage 1, the client is at school, whereas in stage 2 he is a young adult and so the engagement has shifted focus from the parent to the client. The action training, in Stage 2, is more important for the case manager with Case study 2 as there were issues around poor carer training and transfer of skills with a communication device. In terms of changes between stages 1 and 2 for all cases, appear aligned to changes in the client circumstances.

We used rigorous mixed qualitative methodology using different sources of knowledge to iteratively develop the taxonomy. This included a scoping study of the literature (results not reported here), a critical review of international frames and expert knowledge and consensus decision-making through a nominal group technique. Implementation research and analysis of complex interventions should seek consideration of real world conditions including expert and practice knowledge, rather than removing their influence.^{18,42} Our purposeful involvement of an industry partner organization (LTCSA) and experts in CM policy, planning and practice, to develop the taxonomy enhances

the overall usability and practicality of the taxonomy in brain injury, and potentially other conditions and contexts.

In the development of the taxonomy, there was a focus on a common multi-dimensional health condition, brain injury in the development phase. While enhancing the potential for the taxonomy to be applicable and acceptable for other health conditions and contexts, the potential use of the taxonomy with other health conditions (e.g. mental health, severe physical impairment, long term chronic conditions including diabetes), contexts and different models of CM requires further analysis.

There are benefits of the BICM-T to CM practice, standards evaluation and quality analysis, policy and planning, economic evaluation, case mix typology and research. The taxonomy will support better understanding between stakeholders and organizations, models of CM, roles and responsibilities and the cycle of need for CM with respect to health condition, context and time. The taxonomy provides a common language and is a tool for CM best practice and quality analysis including establishing, professional standards, guidelines, outcome measurement and research. In terms of case mix, there are differences in CM actions with respect

to health condition, client context and environmental barriers. For example the CM interventions early post injury or diagnosis, compared to a time when the client's condition and participation is stable, compared to times of crisis or key life events. Similarly, the requirements for CM interventions for adults compared to a child living with their parent. Identifying skill requirements for specific actions assists appropriate training, competency requirements for case managers, and client referral to appropriate providers.

The benefit of the taxonomy is to provide clarity for practitioners and researchers in quality analysis. The taxonomy provides a common language around the intervention (actions), descriptions and their relationship, thereby outcome measurement and comparisons, research on effectiveness. As a number of researchers have identified, the poor description of complex interventions such as CM impedes quality analysis^{9,23,27} and is particularly relevant for complex interventions such as CM.^{4,26,54}

For policy makers and planners, the taxonomy is a tool to support resource allocation. The taxonomy provides a framework to enable differentiation and description of roles and responsibilities. For example, the difference in the role and responsibilities within a service funding organization undertaking CM actions (broker model; referring the client to services and outsourcing services), compared to a case manager employed by an organization, providing direct community-based CM services. The taxonomy enables articulation of responsibilities, expectations and potentially costs for different actions at a macro, meso and micro level. Whilst only the intervention (throughputs) domain is reported here, the use of the taxonomy throughputs (interventions) and inputs (service) domains also enables mapping of service and CM intervention capacity to identify gaps and support service planning at a macro level as has occurred in other areas of long term care.⁴¹

To our knowledge, this is the first taxonomy of community-based CM. While there are other descriptions of the components of CM and definitions,^{30,31,55} our intervention domain tree of the taxonomy provides the definitions and relationships between the core interventions, the actions performed by case managers. These are the main actions (the parent categories), actions linked to these (the children categories), and related actions. Use of the taxonomy may benefit practice, quality analysis and evaluation, policy and planning, funding, business management and resource allocation.

Future research in Phase 2 of the study involves dissemination and analysis of the impact of dissemination of the taxonomy at state, national and international contexts and transfer to other health conditions and areas. The impact analysis includes assessment of how people in these different contexts may have incorporated the taxonomy in their 'new' knowledge (for example use in reports) or whether there has further levels of impact towards knowledge to action (for example application of the knowledge into programs or organizational structures, policy, planning).

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Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.dhjo.2015.09.006>.

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