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Interdisciplinary eHealth for the care of people living with traumatic brain injury: A systematic review

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ABSTRACT

Objective: To identify literature which discusses the barriers and enablers of eHealth technology and which evaluates its role in facilitating interdisciplinary team work for the care of people with a traumatic brain injury (TBI).

Design: Systematic review

Data sources: Studies were identified by searching CINAHL, Embase, Medline, PsycINFO, Scopus, and Web of Science.

Study selection: Studies included in the review were required to feature an eHealth intervention which assisted interdisciplinary care for people with TBI.

Data extraction: Descriptive data for each study described the eHealth intervention, interdisciplinary team, outcomes, and barriers and facilitators in implementing eHealth interventions.

Results: The search resulted in 1389 publications, of which 35 were retrieved and scanned in full. Six studies met all the inclusion criteria for the review. Four different eHealth interventions were identified: (i) an electronic goals systems, (ii) telerehabilitation, (iii) videoconferencing, and (iv) a point-of-care team based information system. Various barriers and facilitators were identified in the use of eHealth.

Conclusion: eHealth interventions have been reported to support interdisciplinary teams for the care of TBI. However, there is a substantial gap in existing literature regarding the barriers and enablers which characterise a successful interdisciplinary eHealth model for people with TBI.

INTRODUCTION

Traumatic brain injuries (TBIs) significantly affect society with millions of people worldwide sustaining disability resulting from a TBI [1,2]. Caused by an accident or trauma from an external force, the nature of TBI-related disability is complex [1-3]. TBI-related disability often extends beyond obvious physical impairments to include cognitive impairments such as impaired attention, poor executive functioning, and psychosocial issues, including high rates of depression [1-3]. As a result of these impairments, individuals with a TBI typically transition through a continuum of care from acute admission to intensive rehabilitation and for some, supported living programmes [4]. These services are implemented by teams comprised of medical, nursing, and allied health professionals [1,2,4].

Evidence suggests that organised, interdisciplinary care leads to better outcomes in terms of recovery and increased independence [5]. Interdisciplinary care is defined as the collaboration and integrated practice between multiple professionals with a shared purpose [6,7]. Team members work between their disciplines and contribute to a coordinated, coherent process of assessment, interpretation, intervention planning and implementation [7,8]. This is distinct from multidisciplinary care, where team members work as a team from within the boundaries of their own specific disciplines [7]. People with a TBI demonstrate better outcomes when managed by a specialised interdisciplinary team of health professionals addressing specific issues, such as retraining in activities of daily living, cognitive and behavioural therapies, and management of the individual's pain and wellbeing [4,9]. In recent years, it has been recognised that eHealth has the potential to support interdisciplinary care [10].

eHealth refers to the use of internet and communication technologies (ICT) for the provision of healthcare [11]. This definition encompasses four general categories of technology solutions currently in use – electronic information sharing, practice management tools, service delivery tools, and contribution to health information sources [12]. These services enable interdisciplinary care through the sharing of patient records, clinical decision support, chronic disease management, and provision of services via telehealth and other modalities [12]. Use of eHealth varies between healthcare settings and between the people receiving care [11]. Interventions or services used by interdiscplinary teams may include apps, information-based websites, online discussion groups, or wearable devices that may provide individuals with greater opportunities for personalised healthcare with better collaboration between healthcare professionals and continuity of care [11,12].

Given that there is agreement as to the value of interdisciplinary approaches and eHealth for the provision of care to people with TBI, there appears to be limited research exploring the interdisciplinary use of eHealth for TBI rehabilitation [13-16]. As yet, research in the use of technology for rehabilitation after TBI is predominantly limited to the context of a single discipline and/or technology [17-21]. Yet, interdisciplinary practice is an inherently complex and heterogeneous process as a result of the differing contexts of health care organisations, health care disciplines, and health professionals working together in patient care. This suggests that there may be unique considerations for effective implementation of interdisciplinary eHealth, above and beyond that which is reported in studies of single discipline interventions. Further, research investigating the use of eHealth in other areas of healthcare suggests that the uptake of

technology is variable [22]. Whilst some clinicians and organisations are adopting technology for service delivery, many are reluctant [23]. It appears that health services in rural and remote areas underutilise eHealth applications [24]. This is surprising given it is those services that may benefit most by adopting eHealth due to its potential to overcome barriers of distance and cost especially when patients transition back to their local communities [25,26].

As part of a broader research project to develop and validate an evidence-based model of interdisciplinary patient centred eHealth practice, the need for systematic reviews of exemplars of successful implementation of interdisciplinary eHealth delivery was identified. Since both eHealth and interdisciplinary collaboration enable coordinated and efficient service delivery [27], the development of a model of healthcare delivery which combines these two domains could facilitate the best possible outcomes for people, particularly those with TBI. Therefore the aims of this systematic review were to address the following questions for the provision of care for people living with TBI: (a) What is the evidence for eHealth technology used by interdisciplinary teams?; (b) What is the feasibility of interdisciplinary eHealth interactions?; and (c) What are the barriers and enablers of interdisciplinary eHealth interactions. The findings of this review will be used to inform the development of an interdisciplinary eHealth model of practice.

METHODS

A systematic search was conducted in April 2015 to identify studies which described the interdisciplinary nature of eHealth use for the care of people with a TBI. To identify more recent

publications relevant to the review, the search was repeated using Embase and Medline (via OvidSP) in January 2016.

Eligibility criteria

Inclusion criteria included sources that reported on all of the following: (*i*) people of any age with a TBI of any severity, (*ii*) interdisciplinary care from two or more health professionals, and (*iii*) the use of eHealth intervention/s. Excluded were publications that: (*i*) did not include at least one person with TBI as defined above, (*ii*) did not involve an interdisciplinary approach to administering treatment, (*iii*) did not use eHealth, (*iv*) were not written in English, and (*v*) were not peer-reviewed journal articles (e.g. books, conference papers, theses, and case reports).

Search criteria

A search was conducted in the following six electronic databases: CINAHL (via EBSCOhost), Embase, Medline (via OvidSP), PsycINFO (via OvidSP), Scopus, and Web of Science. The search strategy implemented into Medline is presented in Table 1. The keywords listed in Table 1 were used and entry style was modified as required for each database. No restriction was placed on the date of publication. Reference lists of articles which met the inclusion criteria were identified and manually searched for further sources. Titles containing any of the keywords included in Table 1 were highlighted and abstracts and/or full papers were searched to assess the eligibility for inclusion.

Insert Table 1 here

Study selection

Search results were exported for sorting with duplicates removed by the first author. For the remaining references, the exclusion criteria were applied to remove irrelevant articles based on title and abstract. If a decision could not be made based on title and abstract alone, the full text was retrieved and scanned to assess eligibility. If the eligibility of the paper was still unclear after reviewing the full text, the opinions from two independent reviewers (ML, KA) were sought. For the second search, two reviewers (ML, MH) were involved in the screening process. Studies that were mutually agreed upon by all reviewers as eligible were selected to be included in the review. Excluded papers and the reasons for exclusion are listed in Appendix 1.

Data extraction

Extracted data from the relevant articles was tabulated using the variables: (*i*) source (author, year, and country), (*ii*) TBI and other conditions, (*iii*) eHealth component, (i*v*) purpose of study, (*v*) interdisciplinary team, (*vi*) study design, (*vii*) outcomes, and (*viii*) barriers and facilitators of eHealth implementation and adoption.

No standardised tools were used to conduct a formal assessment of the quality of the studies. Considering the heterogeneity of the reported outcomes and the low number of papers included in this review, no further analyses were carried out. Results for this review are presented as descriptive data.

RESULTS

The initial database searches resulted in 1389 papers. A total of 297 duplicates were removed, with 1092 records screened. Based on the exclusion criteria, 1057 papers were removed. The

full-text of 35 papers was analysed, of which only six met the inclusion criteria for this review. Figure 1 provides the PRISMA flow diagram of the selection process. Three papers described case studies of eHealth programs [28-30], one presented a qualitative description [31], another employed an interrupted time series design [32], and the final paper reported an observational study [33]. A summary of the included studies is provided in Table 2.

Insert Figure 1 here

Insert Table 2 here

Only two of the included studies focused exclusively on the care of people with TBI [32,33]. Consistent with the TBI population, the age range of participants with a TBI varied considerably between the studies, ranging from nine months to 86 years [30-32], while three studies did not specify the age of participants [28,29,33]. The composition of health professionals in interdisciplinary teams also varied between studies, however all included allied health professionals [28-33], and five studies referred to the involvement of family members of people with TBI or significant others in the interdisciplinary process [28-31,33].

eHealth was used to facilitate interdisciplinary care for people with TBI including the use of videoconferencing, an electronic goals system, and a point of care website. Of the six papers, two reported on the use of videoconferencing for interdisciplinary development of care plans [29,33], and four described videoconferencing as a method of providing rehabilitation services between clients, healthcare workers, and specialists [29-31,33]. One study evaluated the implementation of an intra-organisational electronic goals system that allowed functions such as data repository, clinical information, patient management, billing, and service management to be

combined [32]. The final study reported on a web-based clinical information system designed to assist clinical decision making and patient education at the point of care [28].

Role of eHealth in interdisciplinary interactions Videoconferencing facilitated high levels of productivity for interprofessional care plan development [33]. Meetings conducted via videoconferencing were similar in duration to meetings held in-person. Similarly, Savard and colleagues (2003) found that the time spent with patients was similar for in-person as videoconferencing consultations [30]. Videoconferencing was reported to be an effective means for the development of rehabilitation care plans [29,30] and outpatient consultations [28]. Clinicians rated clinical effectiveness of consultations held via videoconferencing as good or excellent, and patients also reported high levels of satisfaction [30]. In some cases, telerehabilitation was considered a part of routine clinical services [29,31], although Kairy and colleagues (2014) reported that telerehabilitation was only used occasionally for consultations and not for long-term follow up with patients [29].

The web-based clinical information site was reported to be frequently used at the point of care and by individuals worldwide at other web-accessible locations [28]. Providers frequently reported the information retrieved from the website as useful for meeting patients' needs [28]. Providers also accessed information outside of their own discipline or specialist area, indicating increased sharing of clinical knowledge [28]. The introduction of an electronic goals system in conjunction with a staff training intervention was observed to have significantly increased and improved the quality of goal statements with improvement in specific and measurable goals [32].

Barriers and facilitators for implementation

Several of the papers reported on barriers regarding material or environmental factors that influenced implementation of interdisciplinary eHealth practices. Audio-visual quality and a lack of dedicated space and equipment were reported to influence the effectiveness of videoconferencing [33]. Ways to address these issues were suggested, such as a multi-directional microphone to improve sound quality and having a dedicated space for videoconferencing [33]. Addressing reimbursement and licensure issues for videoconferencing was also noted as crucial for long-term success [30].

Clinicians' beliefs and assumptions were also reported to be a potential barrier, with some clinicians believing that people might have concerns or a negative reaction to using telerehabilitation [29]. This was particularly the case regarding use of telerehabilitation for psychosocial components of clinical practice however these concerns were not reported by patients or families [29]. Clinicians using the web-based system in the Burrows and colleagues (2001) study also reported lack of skills and confidence in database searching [28]. Inadequate resources were available, including lack of access to appropriately skilled resource personnel, administrative and/or management support for informational needs (i.e. leadership) physical resources such as computers and time [28]. Other barriers to use of telerehabilitation included structural and organisational level factors, such as a shortage of doctors in rural regions to follow up patients locally and lack of procedural guidelines [29].

Organisational and clinical leadership were identified as key enablers of routine adoption of telerehabilitation [29]. Organisations and services that reported telerehabilitation as routine in clinical practice were identified as having governmental agreements with infrastructure access

and support [31]. Telerehabilitation was successfully used to provide outpatient services where a telemedicine team was established to oversee logistics and practical issues [31]. However, there was little exploration of what either of these factors involved [31]. The presence of a capable leader and having well-defined procedures was noted to facilitate effective communication and implementation of eHealth in interdisciplinary clinical practice [33].

Further factors found to facilitate uptake of eHealth practices included clinical staff involvement in the development and championing of training resources, and having a supportive and innovative management structure to support change [32]. Establishing practical guidelines for videoconferencing practice that address timing, the material environment, troubleshooting technical issues, strategies for establishing effective communication, and back-up plans to re-establish communication if technology fails, were also found to facilitate implementation [30]. Hands-on experience using videoconferencing equipment and software led to greater willingness to use telerehabilitation [29]. Staff training, including evidence-based clinical goal setting instructions and instructions for use of the eHealth application, led to a statistically significant increase in outcomes compared to implementation of the electronic system without training [32].

Effectiveness of clinical practice was reportedly facilitated by the synchronous, real time communication between local clinicians and specialists via videoconferencing, rather than relying on sharing information via written notes or patient reports [30]. This was further supported when clinicians were attentive to the impact of culture on communication, and employed culturally appropriate practice [30]. Web-based information was embraced by

clinicians when the benefits were identifiable, such as information which was readily accessible and easily transported from inpatient settings to patient homes [28].

Clinicians who had limited experience using telerehabilitation expressed reduced confidence in their ability to develop trust and rapport with the client via videoconferencing [29]. Successful relationships in telerehabilitation consultations were enabled when existing collaborative relationships were built upon [29]. That is, relationships that were developed during face-to-face consultations prior to use of telerehabilitation. Effective communication during videoconferencing was reported to be facilitated by the establishment of common objectives, clear roles for all participants, and active involvement of all members of team, including the consumer [33].

Limitations of the included studies

Some methodological limitations need to be noted when considering the evidence derived from these studies. The first relates to study design as three of the studies were single case studies [28-31]. Although single case studies together with in-depth data analysis enable researchers to gain an insight into factors that are likely to impact on the successful implementation of eHealth within the context of the study, the lack of experimental rigour in these studies limits the results being generalised to other clinical contexts. The second limitation relates to the lack of comparison groups. Although Careau and colleagues (2008) reported efficient teamwork was observed through the use of videoconference, the lack of a comparison, for example face-to-face in-person settings, limits the ability to draw conclusions about how videoconferencing might influence the nature of team dynamics during meetings [33]. Our search revealed only successful

examples of interdisciplinary use of eHealth, indicating that there may be some risk of bias in the literature with negative studies are unreported. A lack of clear description about patient outcomes was another limitation observed across several of the studies [28,31,33]. Additionally, the results cannot be used to determine effects on wider organisational and leadership factors that may have influenced outcomes or perceptions of usefulness.

The final limitation observed related to the reporting of outcomes of interdisciplinary care [31,32]. Details of patient outcomes arising from improved interdisciplinary practice, and factors that facilitated or hindered positive outcomes were not reported. Furthermore, the retrospective and brief descriptive nature of the telemedicine program made it difficult to assess the validity of the results [31]. An improvement in the quality of goal setting was reported, however the effect on the quality of the interdisciplinary practice or patient outcomes was not addressed [31].

DISCUSSION

The aims of this systematic review were to identify and describe the types of eHealth technology used by interdisciplinary teams in the care for people living with TBI, the feasibility of their use and to highlight the barriers and enablers of eHealth use. A systematic search identified 1389 sources. However, only six publications met the inclusion criteria indicating a gap in existing literature. Consistent terminology was also lacking in the current research. The term ‘eHealth’ was not used to describe interventions in any of the included papers. Additionally, the terms ‘multidisciplinary’, ‘interprofessional’, and ‘teamwork’ were all used interchangeably with the term ‘interdisciplinary’ used to capture varying degrees of interdisciplinary practice. Due to the

dispersed nature of such research, there is no clear understanding of eHealth and its use in interdisciplinary care.

This gap in the eHealth literature regarding its interdisciplinary use appears to be at odds with its critical role in TBI practice. Interdisciplinary teamwork is essential to the success of a healthcare framework that addresses the holistic nature of TBI [34]. eHealth may enable more effective teamwork amongst health professionals to achieve this goal. Yet, current models of healthcare delivery fail to promote such collaboration using eHealth when carrying out multi-professional tasks [35]. As evidenced in Careau and colleagues' (2008) study, eHealth has the potential to facilitate interdisciplinary communication and cooperation [33]. Everyday forms of technology used for information sharing, such as telephone, email, and the internet were found to support the delivery of integrated health services. However, eHealth extends beyond this for the rehabilitation of people with TBI to include the use of assistive devices, smart sensors, and wearable technologies to facilitate treatment outcomes. Even with the available technologies in place, interdisciplinary involvement in the use of assistive technologies for people with a TBI was reported to be a complicated and extensive process [30]. Therefore, an interdisciplinary eHealth framework needs to be designed to foster successful and continued use of a range of technologies to support clinical practice.

Interdisciplinary eHealth may have additional benefits in terms of promoting cost-effectiveness and accessibility of service provision in TBI. As people with TBI require a diverse range of treatments and support, this can place a significant financial burden on health resources [35]. Thus managing TBI can be a cost-sensitive task with concerns about efficiency and accessibility

of treatment posing a major problem for the current state of healthcare [30]. Traditional face-to-face consultation and rehabilitation has shown to be time costly, as well as financially and physically demanding to execute, presenting as a barrier to accessing holistic care [33]. To reduce those burdens, Kairy and colleagues (2014) noted that videoconferencing technologies have been implemented in almost every Norwegian community and are used to hold outpatient consultations nationally to those who live at a distance from the hospital [29]. The aforementioned concerns are particularly an issue in rural and remote locations where barriers to access, availability, costs and quality are exacerbated by a lack of human resources and infrastructure [29]. Likewise, individuals living in rural and remote locations may experience a vast range of inequalities from socioeconomic status, life expectancy, quality of life, living conditions, and access to universal healthcare services [37]. As such, due to the scarcity of qualified health professionals, carers, infrastructure, and inequalities in rural and remote communities, efficient use of all available resources and services is a priority [10]. As demonstrated across all six papers, the implementation of eHealth has the potential to bridge the gap by providing services that alleviate the costs and stress on individuals and their families, while contributing to more efficient and effective treatment and teamwork among professionals. The evidence presented reaffirmed the need for a model of interdisciplinary teamwork to guide the implementation of an eHealth strategy. Optimally, this framework would address barriers and facilitators of eHealth use identified in the literature, including skills, knowledge, and attitudes of healthcare professionals; education and training in eHealth; and organisational and policy factors.

Several of the studies reviewed in this study identified the varying degrees of knowledge and individual skill levels of clinicians as a barrier to the implementation of eHealth [22, 23]. Consequently, ongoing education is considered a key component to the success of eHealth interventions particularly for the initial uptake of eHealth [28]. As illustrated by Burrows and colleagues (2001), eHealth use increased and higher rates of teamwork were observed after the introduction of training [28]. This was also the case in the study which observed an increase in the use of an electronic goals system with the addition of staff training [32]. Bartfai and Boman (2014) discussed the need for a teaching and training plan which can be adapted to each individual or unique situation [36]. Moreover, training and resource materials can be made available through technology in such forms as a website so that other members of the interdisciplinary team such as the patients and their family and carers can easily access information [36].

The literature also reveals the need for clinical advocates and support from management following training in order to maintain effective use [34]. Establishing an interdisciplinary framework to guide and manage various forms of health professional training, which may take into consideration suggestions for organisation structure and policies, are required and will ensure it addresses the needs of clinicians appropriately.

Overall, there was little consideration in the literature of the organisational and policy factors which might influence the success or productivity of eHealth interventions. Only half of the included papers investigated eHealth interventions across multiple organisations, and even in these instances, critical consideration of the barriers and facilitators in each context was limited.

This is a surprising finding given that ensuring a holistic view of a person with TBI requires the involvement of many team members across organisations, for example, private practitioners, community workers, and family members. To facilitate greater adoption of eHealth technology, models that reflect contemporary eHealth practice across the continuum of care are needed. Equally, further research into the enablers and barriers of eHealth across a range of contexts is required.

A more comprehensive understanding of how eHealth is implemented in interdisciplinary teams is required in order in order to address barriers and facilitate enablers to support these teams working in the field of TBI rehabilitation. Consequently, the findings of this review have been used to inform qualitative research exploring healthcare professionals' experiences and attitudes towards use of eHealth in supporting interdisciplinary practice. This research endeavours to build towards the creation of an evidence-based model of interdisciplinary eHealth practice to ensure efficient services and better outcomes for people with TBI and their families.

CONCLUSION

There is a substantial gap in existing literature regarding the barriers and enablers encompassing a successful interdisciplinary eHealth model for people with TBI. Nonetheless, the studies reviewed suggest that eHealth has a role in facilitating person-centred integrated care. Developments in technology are ongoing and will continue to provide diverse applications to healthcare. However, research in eHealth is currently limited and as a result the use of eHealth is not at its full potential. Considering both the synchronous and asynchronous nature of technology, eHealth initiatives are equipped with the capability and flexibility to support

interdisciplinary care teams working with individuals and their families who are living with complex chronic conditions such as TBI. Universally accessible, cost-effective, quality care can only be achieved through interdisciplinary practices supported by effective use of eHealth, particularly in rural and remote locations. The lack of consistent terminology and established models of care inhibit the development, verification, and implementation of eHealth practices. Further research is needed to establish an interdisciplinary eHealth model of holistic care for those living with a TBI.

Insert Appendix 1 here

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Figure 1. PRISMA flow diagram of selection process

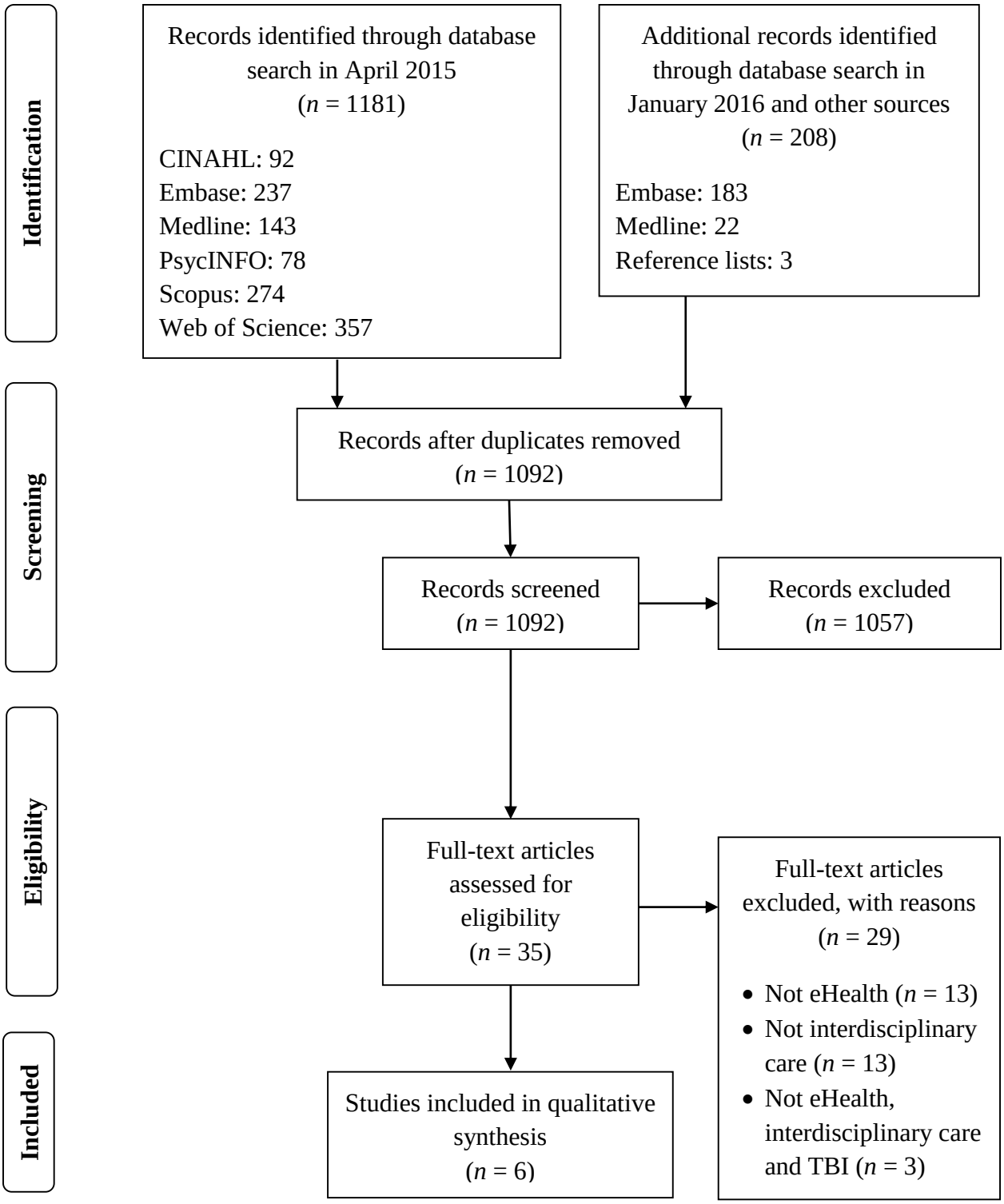

Table 1. Medline search strategy

Step	Key words
1	exp Brain Injuries/
2	(ABI or acquired brain injur* or brain injur* or brain damage or concussion* or head injur* or intracranial injur* or TBI or traumatic brain injur*).mp.
3	1 or 2
4	exp Telecommunications/ or exp Videoconferencing/ or exp Telemedicine/
5	(apps or digital or eHealth or elearning or electronic health record* or emedicine or ePrescribing or etherap* or health technolog* or ICT or instant messag* or information technolog* or internet or mhealth or MMS or mobile* or online or podcast* or smartphone* or SMS or social media or technolog* or telecare or telehealth or telemedicine or telerehabilitation or telecommunication* or teleconferenc* or videoconferenc* or virtual or web*based or website*).mp.
6	4 or 5
7	exp Patient Care Team/ or exp Interprofessional Relations/
8	(interdisciplinarity or interdisciplinary or collaborat* or multidisciplinary or team* or transdisciplinary or interprofessional).mp.
9	7 or 8
10	3 and 6 and 9

Table 2. Description of included studies

Authors (year) / Country	**Health conditions**	**eHealth intervention**	**Purpose of study**	**Health professionals**	**Study design**	**Outcomes**	**Barriers and Facilitators**
Becker et al (2014)[25]/ Norway	TBI Stroke Other ABIs	Telerehabilitation for outpatient services	Describe services provided at a cognitive rehabilitation unit at a regional rehabilitation centre in Norway	Medical Specialist Neuropsychologists OTs PTs SLPs Nurses Nursing assistant Cognitive testing assistant Social worker Team coordinator	Qualitative description	Outpatient services that incorporate telemedicine for assessment and follow-up of patients are increasing	Facilitator: established telemedicine team to oversee logistics and practical issues.

				Team manager			
Burrows et al (2001)[22] / USA	TBI Spinal cord injury	Point-of-care, team-based information system (PoinTIS)	Evaluate a rehabilitation prototype of a PoinTIS and train healthcare providers to use this prototype for their spinal cord injury and traumatic brain injury patient care and education activities	PTs Nurses Psychologists SLPs Recreational therapists Physician assistants Rehabilitation assistants	Single case study of a website	PoinTIS is a successful model that responds to the technological and social developments that are fuelled by information technology, bioinformatics, and networked information	Barriers: lack of skills and confidence in data base searches, inadequate resources available (skilled personnel, administrative and management support, e.g., Leadership, time, and computers).

							Facilitators: identifiable benefits (e.g., readily accessible information and easily transported inpatient setting to patient homes).
Careau et al (2008)[27] / Canada	TBI	Videoconferencing	Document the workings of a rehabilitation team in a videoconference setting and to note the pros and cons of videoconferencing in the	Clinic coordinators Counsellor Physical educators OTs Nurses Physicians	Observational study	Efficient teamwork was observed during videoconferences Most common advantage: good visual contact Most common disadvantage:	Barriers: audio-visual quality, and lack of dedicated space and equipment. Facilitators: leadership, well defined

			development of interprofessional care plans	Music therapists Neuropsychologists SLPs PTs Social workers Specialised educators Community partners People with TBI and their relatives		poor sound quality	procedures, establishing common objectives, clear roles of participants, active involvement of team members (both the healthcare professional and patient).
Hassett et al (2015)[26]/ Australia	TBI	Electronic goals systems Staff training	Investigate whether the introduction of an electronic goals system followed by staff training improved the	Case managers OTs PTs Clinical psychologists	Interrupted time series	An electronic goals system combined with staff training improved the quality, rating, framing and	Facilitators: involvement of clinical staff to develop training resources, staff training, staff to advocate its

			quality, rating, framing and structure of goals written by a community-based brain injury rehabilitation team	Neuropsychologists Rehabilitation psychologist Social workers SLPs Diversional therapist		structure of goal statements	use, and supportive and innovative management structure.
Kairy et al (2014)[23] / Canada	TBI Spinal cord injury	Telemedicine program	Examine how telerehabilitation becomes part of existing and new clinical routines and to identify factors that enable or constrain its routine use	OTs Social workers SLPs Orientation counsellors Neuropsychologists Clinical coordinators	Single case study with a qualitative evaluation	Telerehabilitation was successfully incorporated into routine clinical practices for activities. For specialised clinical consultations or long-term patient follow-up,	Barriers: negative beliefs and assumptions by clinicians, structural and organisational factors (e.g., shortage of doctors in rural areas), lack of

						telerehabilitation was not successfully incorporated Factors that facilitated or prevented the integration telerehabilitation in routine practices stemmed from both the structure and the agent	procedural guidelines. Facilitators: organisational and clinical leadership, existing collaborative relationships are built upon.
Savard et al (2003)[24] / USA	TBI Stroke PD	Videoconferencing	Describe two clinical programs that utilise videoconferencing to provide rehabilitation specialist	Medical Specialists PTs OTs SLPs	Case study	Care of individuals with neurologic issues can be augmented and supported via specialty	Facilitators: establishing practical guidelines (to address timing, material environment,

	Spinal cord injury CP Spinal muscular atrophy ALS MS MD Shoulder dystocia		consultations to individuals living in remote areas	Recreational specialists Equipment specialists Orthotists		consultation using telehealth technology	troubleshooting, effective communication strategies, back up plans), addressing reimbursement and licencing issues.

Abbreviations: ABI = Acquired Brain Injury; ALS = Amyotrphic Lateral Sclerosis; CP = Cerebral palsy; MS = Multiple Sclerosis; MD = Muscular dystrophy; OT = Occupational therapists; PD = Parkinson's disease; PT = Physiotherapists; SLP = Speech-language pathologist; TBI = Traumatic Brain Injury.

Appendix 1. Exclusion table in order of author

Authors (Year) [reference] / country	**TBI**	**eHealth**	**IDT**	**Study design**
Cernich et al (2010) [32] / USA	YES	NO	YES	Literature review
Chua et al (2007) [29] / USA	YES	NO	NO	Systematic review
Collins and Kennedy (2008) [33] / USA	YES	NO	YES	Case study
Cruz et al (2013) [34] / Portugal	NO	NO	NO	Clinical trial
Doarn et al (2010) [35] / USA	TBI	YES	NO	N/A (Meeting report)
Dou et al (2004) [36] / China	YES	YES	NO	Questionnaire
Evans (2012) [37] / UK	YES	NO	YES	Literature review
Hassan et al (2013) [38] / Malaysia	YES	YES	NO	Observational cohort study
Keck and Doarn (2014) [39] / USA	YES	YES	NO	Systematic review
Lefebvre et al (2007) [28] / Canada	YES	NO	YES	Mixed methods
Murphy (2004) [31] / USA	YES	NO	YES	N/A (Commentary paper)
Newby and Groom (2009) [40] / UK	YES	YES	NO	Pilot study
Ricker et al (2002) [41] / USA	YES	YES	NO	Questionnaire
Rogante et al (2010) [42] / Italy	YES	YES	NO	Systematic review
Rotondi et al (2005) [43] / USA	YES	YES	NO	Longitudinal
Schopp et al (2000) [9] / USA	YES	YES	NO	Clinical trials
Sherburne (1986) [44] / USA	YES	NO	YES	Case study

Skorning et al (2012) [45] / Germany	YES	NO	NO	Controlled simulation study
Stephens et al (2015) [46] / USA	YES	NO	YES	Literature review
Tam et al (2003) [47] / Hong Kong	YES	YES	NO	Case study
Togher (2012) [48] / Australia	YES	NO	YES	N/A (Commentary paper)
Togher (2013) [49] / Australia	YES	NO	YES	Clinical trial
Togher et al (2014) [14] / Australia	YES	YES	NO	Systematic review
Turner-Stokes et al (2015) [50] / Australia	YES	NO	YES	Systematic review
Verburg et al (2003) [51] / Canada	YES	YES	NO	Case study
Wade et al (2005) [52] / USA	YES	YES	NO	Longitudinal
Wade et al (2005) [53] / USA	YES	YES	NO	Longitudinal
Warden et al (2000) [54] / USA	YES	NO	YES	Randomised control trial
Wilkins et al (2014) [55] / USA	YES	NO	YES	Retrospective cohort study

Abbreviations: IDT = Interdisciplinary team; TBI = Traumatic Brain Injury.