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TITLE

Delegation by Allied Health Professionals to Allied Health Assistants: a mixed methods systematic review.

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ABSTRACT

Background: Delegation by Allied Health Professionals (AHPs) to Allied Health Assistants (AHAs) was introduced in response to various challenges affecting modern health care delivery. However, the clinical and cost-effectiveness of using AHAs is relatively unexplored.

Objectives: The aim of this review was to synthesise the available evidence on; firstly, the clinical and cost-effectiveness of interventions delegated by AHPs to AHAs and secondly, AHPs', AHAs' and patients' attitudes and beliefs towards delegation.

Data Sources: MEDLINE, AMED, CINAHL, Cochrane Library, PsycINFO, PEDro, OTseeker and Web of Science databases were searched from inception until January 2019 without restrictions.

Study selection: Primary studies investigating the clinical and cost-effectiveness of any intervention delegated by an AHP, across the spectrum of clinical areas in relation to adult patients, as well as AHPs', AHAs' and patients' attitudes and beliefs about delegation.

Data extraction & Synthesis: Data were extracted by pairs of reviewers. Thematic analysis and synthesis of descriptive and analytical themes was conducted.

Results: Thirteen publications of variable methodological quality were included. Three studies reported quantitative research and ten qualitative research. No study explored the cost-effectiveness. Only one study investigated clinical effectiveness. Training for both AHPs and AHAs and having clear processes in place were identified as important facilitators of delegation.

Conclusion and implications of key findings: Delegation is not standardised across AHPs or within each profession. There are clear knowledge gaps regarding the clinical and cost-effectiveness of delegation by AHPs and patients' attitudes and preferences. Further research is needed to facilitate the standardisation of delegation.

Contribution of the Paper:

- Identification of a lack of evidence in relation to the clinical and cost effectiveness of delegation across Allied Health Professions as well as AHPs', AHAs' and patients' perceptions about delegation.
- Adequate training for both AHPs and AHAs and having clear processes in place are important facilitators of delegation.
- Further research is needed to investigate delegation in AHPs in current clinical practice to inform policy and workforce planning.

Systematic review registration number PROSPERO CRD42019119557

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Key words: Skill mix, Personnel Delegation, Treatment outcome, Cost-Benefit Analysis, Attitude

INTRODUCTION

The Allied Health Professions (AHPs) form the third largest clinical workforce in health and social care in England [1]. The AHPs comprise of 14 distinct occupations including: art therapists, dietitians, drama therapists, music therapists, occupational therapists, operating department practitioners, orthoptists, osteopaths, paramedics, physiotherapists, podiatrists, prosthetists and orthotists, diagnostic and therapeutic radiographers, and speech and language therapists. AHPs work closely with the Allied Health Assistants (AHAs): workers who provide assistance and support to AHPs by whom they are directly or indirectly supervised [2, 3]. The Allied Health Assistant role was developed to address some of the challenges affecting health care service delivery and the Allied Health Professionals (AHPs) workforce. These include an increasingly ageing population and an associated burden of health care; spiralling costs; increased patient expectations and a shortage of registered healthcare professionals [2, 3, 4, 5]. In common with other health care professions and in order to address the pressures that these challenges have placed on the existing workforce, AHAs are being engaged to undertake clinical tasks traditionally performed by AHPs [2, 3, 5]. Since staffing costs usually account for between 60-80% of operating costs in health care, determining the 'right' combination of staff with the right skills is a critical component of successful and efficient health care delivery [6, 7].

There has been a lack of regulation and registration for AHAs, and as a result, many of these positions have evolved with variations in the title, and an inconsistent understanding of the role as well as the educational and supervision requirements. Subsequently, the specific duties of AHAs vary greatly between services, creating problems with the delegation of tasks [8]. This latter trend may lead to AHAs not being able to fully utilise their clinical skills, which may result in job dissatisfaction as well as disparity in the clinical service provided to patients of equal clinical needs [9]. Therefore, it is important to develop an understanding of the views of AHPs, AHAs and patients about delegation. Furthermore, where AHAs are being utilised clinically, questions have been posed in relation to the clinical effectiveness of treatment provided by AHAs and, more specifically, if it is as clinically effective as the treatment provided by registered clinicians for the same group of patients [10]. Research on the clinical and cost-effectiveness of using AHAs is relatively unexplored and lags behind the fields of nursing and medicine in terms of delegation [11]. This systematic review aimed to synthesise the best available evidence on the clinical and cost-effectiveness of interventions delegated by AHPs to AHAs and to explore AHPs', AHAs' and patients' attitudes and beliefs in relation to delegation.

METHODS

Protocol and Registration

The protocol for this systematic review is registered with the international prospective register of systematic reviews - PROSPERO (Registration number CRD42019119557). This systematic review has been conducted and reported according to PRISMA guidelines [12].

Research Questions

The research questions of this systematic review are:

- **"What is the clinical and cost-effectiveness of delegation to Allied Health Assistants (AHAs) by Allied Health Professionals (AHPs)?"**

- **“What are the AHPs' and AHAs' views and opinions about delegation?”**
- **“What are the patients' views and opinions about delegation?”.**

Eligibility criteria

Inclusion criteria

Studies were included if they involved:

i. AHPs that delegate to AHAs. AHPs include the following professions: art therapists, drama therapists, music therapists, chiropodists/podiatrists, dietitians, occupational therapists, operating department practitioners, orthoptists, osteopaths, paramedics, physiotherapists, prosthetists and orthotists, radiographers and speech and language therapists.

AND

ii. Any intervention delegated by an AHP, across the spectrum of clinical areas in relation to adult patients (18 years old or older) e.g. musculoskeletal, neurology, respiratory etc.;

AND

iii. a Generic outcome measures such as quality of life, patient specific outcomes in relation to pain and function, and disease specific outcome measures;

OR

iii. b Cost-effectiveness, health care costs e.g. direct and indirect costs of delegated care;

OR

iii. c AHPs’, AHAs’ and patients’ attitudes, beliefs, perceptions towards, and understanding of delegation;

OR

iii. d Patient safety such as missed red flags diagnoses or serious adverse events.

AND

iv. RCTs, non-randomised controlled trials, observational studies and descriptive and qualitative studies.

Exclusion criteria

Studies were excluded if they involved:

i. Any interventions delegated by non-AHPs such as nurses, doctors and dentists;

ii. Any patient population under 18 years old;

iii. Single case studies, editorials and non-peer reviewed publications;

iv. No outcome of interest.

Searches

A comprehensive search strategy utilising both textword and subject headings and including terms related to delegation and AHPs was developed (see Supplementary Table 1 for OVID MEDLINE search strategy). Following consultation with a medical librarian and guidance from one of the authors who is a systematic review expert (NC), the following electronic databases were searched by PS: MEDLINE, AMED, CINAHL, Cochrane Library (systematic reviews and controlled trials registers), PsycINFO, PEDro, OTseeker and Web of Science (WoS). All databases were searched without time or language restrictions, from database inception to January 2019. In addition, reference checking and citation tracking of included articles were conducted.

Selection process

Initially, papers were screened by title by a single reviewer (PS) using Rayyan software [13], and those clearly irrelevant were excluded. Abstracts of remaining articles were then screened against eligibility criteria independently by pairs of reviewers (PS and AB or SJ or BS) in an Excel spreadsheet. Full texts were subsequently assessed for eligibility using the same process as for abstracts. Any disagreements regarding eligibility, at each stage of the selection process, were resolved through discussion between pairs of reviewers or by consensus in research team meetings.

Data extraction and quality assessment

Data extraction was conducted independently by pairs of reviewers using a data collection pro forma (in Microsoft Excel). This was designed, piloted and tested by the reviewers prior to data extraction. Extracted data included background information (country of origin, aims, methods used, setting, clinical specialty/area, number of participants), perceptions about delegation (attributes, experiences, facilitators and barriers of delegation) from different perspectives (AHPs, AHAs and patients), as well as the conclusions and recommendations of each study. Finally, reviewers could capture any other comments and or data.

The methodological quality appraisal was conducted independently by pairs of reviewers using the Mixed Methods Appraisal Tool (MMAT), 2018 version [14]. Conflicts regarding appraisal were addressed via discussion and resolved by consensus. Overall grade of evidence of the qualitative studies included in this review was assessed using the Confidence in Evidence from Reviews of Qualitative research (GRADE-CERQual) criteria [15].

Data synthesis

Thematic synthesis of data of the qualitative studies was conducted without a priori codes [16]. Codes and descriptions were aggregated into emerging descriptive themes, before identifying analytical themes, using a thematic synthesis process [16]. Analytical themes identified from key descriptive themes reflected AHPs', AHAs' and patients' perspectives in relation to delegation, as supported by data from the studies. A meta-analysis was not possible due to the limited number of studies. Nevertheless, the findings from the

quantitative studies are discussed and presented in narrative form. Finally, quantitative and qualitative evidence was drawn together in a narrative synthesis.

RESULTS

Search results

Out of 2905 citations, 13 papers [17-29] met the eligibility criteria and were included in this review (Figure 1: PRISMA flow diagram) [30].

Figure 1: PRISMA flow diagram inserted here

No relevant studies were identified through additional searching of grey literature, references or citation tracking of included studies. The included studies that presented data across various care-settings and AHP disciplines. Six studies (7 papers) were conducted in a physiotherapy discipline [17, 21, 22, 24, 25, 26, 29], three in occupational therapy [18, 19, 23], two in speech and language therapy [20, 27] and one included multiple AHP professions [28]. In relation to methodology, two papers reported the same RCT [17, 21], six studies reported qualitative research [18, 19, 20, 22, 26, 29], four used mixed methods (quantitative descriptive and qualitative) [24, 25, 27, 28] and one was a non-randomised cohort study [23]. Eight studies were set in England [17, 18, 19, 21, 22, 24, 25, 26], three in Australia [20, 27, 28], one in USA [23] and one in South Africa [29]. Detailed characteristics of included studies are presented in Table 1.

Table 1: Characteristics of included articles and their conclusions inserted here

Quality appraisal

The MMAT quality evaluation highlighted that studies were of a mixed quality and that the majority of them had methodological shortcomings. Studies are presented based on their design/methods and the corresponding section of the MMAT tool i.e. qualitative studies (Table 2a), quantitative descriptive studies (Table 2b), RCTs (Table 2c) and mixed methods studies (Table 2d).

Table 2a: MMAT assessment of qualitative studies inserted here

Table 2b: MMAT assessment of quantitative descriptive studies inserted here

Table 2c: MMAT assessment of RCTs inserted here

Table 2d: MMAT assessment of mixed methods studies inserted here

Clinical and cost effectiveness of delegation

No study/paper was found addressing the cost-effectiveness of delegation. Two papers explored the clinical effectiveness of delegation [17, 21]. These referred to the same study: a single-blind, randomized, controlled trial, which recruited 282 stroke patients from those

admitted to a large, teaching NHS hospital with acute and rehabilitation facilities. Patients were between 1 and 5 weeks post stroke at entry to the study. These patients were randomly allocated to one of three groups; routine physiotherapy (n=95), routine physiotherapy with an additional treatment by a physiotherapist (n=94) or routine physiotherapy with additional treatment by a physiotherapy assistant (n=93). Routine physiotherapy was defined as the standard physiotherapy treatment given at the hospital where the study was conducted, it followed predominantly a Bobath approach and included daily treatment of approximately 30 to 45 minutes. Patients in the physiotherapist (PT) group received standard physiotherapy and in addition were treated for 2 hours per week over a five-week-period by a senior research physiotherapist. Patients in the physiotherapy assistant (PA) group received standard physiotherapy and in addition were treated for 2 hours per week over a five-week-period by a physiotherapy assistant. Patients in this group were initially assessed for 1 hour by the research physiotherapist who then supervised the assistant's treatment of each patient weekly to update and adjust the treatment program appropriately. Outcome was assessed after five weeks of treatment and at three and six months after stroke. The main outcome measures were the Rivermead Motor Assessment Arm (RMA arm) Scale [31] and the Action Research Arm Test (ARAT), [32] other measures included the Barthel Index [33] and the Extended ADL Index [34].

In the intervention groups, 53 of the 94 patients in the PT group and 46 of the 93 patients in the PA group completed at least nine hours of additional treatment. Overall rates of noncompletion were not significantly different between the two treatment groups ($p = 0.17$) but there were differences in the distribution of reasons for noncompletion. These were: illness or low tolerance of treatment (PT 19, PA 13); death (PT 5, PA 4); recovery to minimal arm impairment (PT 9, PA 12); patient choosing to stop treatment (PT 3, PA 8); change in diagnosis after randomisation (PT 1, PA 5); transfer to another hospital (PT 0, PA 2); staff annual leave or sickness (PT 4, PA 5). The original paper reported that there were no significant differences between the groups and thus that additional physiotherapy of approximately two hours per week does not benefit a heterogeneous population of patients admitted for rehabilitation after their stroke [17]. When a post hoc per protocol analysis was conducted and patients were subdivided into groups according to the degree of severity of initial arm impairments, the results showed that less severe patients who received additional treatment by a physiotherapy assistant and completed their additional treatment or recovered had significantly better ARAT and RMA arm scores at post-intervention, three months and six months post stroke [21].

Thematic analysis of qualitative studies: Barriers and facilitators of delegation

Table 3 provides an overview of the main themes and sub-themes identified in studies exploring AHPs', AHAs' and patients' perspectives on delegation. Key descriptive themes were grouped under two broad analytical themes: facilitators of delegation and barriers to delegation. The overall grade of evidence of each qualitative study, as per GRADE-CERQual approach is also included. Facilitators of delegation included AHPs and AHAs receiving adequate training, AHPs' confidence regarding the competences of the AHAs in relation to the delegated task and having a clear framework for delegation i.e. appropriate systems and processes in place to facilitate delegation. Barriers included lack of clarity in relation to delegation, AHPs not being trained for the task of supervising and delegating work to assistants and unwillingness of qualified staff to delegate clinical tasks.

Table 3* Summary of findings on delegation themes and sub themes (with references) *inserted here

DISCUSSION

Clinical and cost-effectiveness

One of the primary aims of this review was to synthesise the best available evidence on the clinical and cost-effectiveness of interventions delegated by AHPs to AHAs. The data from the included publications was limited since no study assessed the cost-effectiveness and only two papers (referring to the same RCT) explored the clinical effectiveness of delegation [17, 21]. The results from the post hoc analysis showed that less severe stroke patients who received additional treatment by a physiotherapy assistant had better clinical outcomes than those who received additional treatment by a physiotherapist [21]. However, the content of the additional treatment was different for two groups: for patients in the physiotherapy assistant group, a greater proportion of time was spent practicing active movements and functional activities whereas for patients in the physiotherapist group, a considerable proportion of treatment time was spent teaching and encouraging patients to perform self-practice activities between sessions. Furthermore, only the patients who completed the additional treatment package in both the physiotherapist and the physiotherapy assistant group or those who recovered were included in the post hoc analysis whereas all patients in the routine group were included. This could have led to attrition bias and distorted the results. It should also be noted that 41 out of 94 patients in the physiotherapist group and 50 out of 93 patients in the physiotherapy assistant group did not complete the additional treatment. Although rates of non-completion were not significantly different in the additional treatment groups, there were differences in the distribution of reasons of non-completion. One difference was the proportion of patients who chose not to complete the additional treatment which was more than double in the physiotherapy assistant group. Although this was not explored by the authors, it raises questions about the acceptability of the additional treatment delivered by the physiotherapy assistants and patients' preferences. Previous research suggests that patients with rehabilitation needs prefer to be treated by qualified therapy staff rather than by assistants [35]. In a discrete choice experiment of patients' preferences for rehabilitation service configuration following hip fracture, patients indicated a statistically significant preference for the healthcare professional delivering the rehabilitation sessions to be a fully-qualified physiotherapist or occupational therapist [35]. It may be that some of the patients who participated in the RCT preferred to be treated by a physiotherapist and not by a physiotherapy assistant which could explain why more patients in the physiotherapy assistant group chose to stop treatment.

Perceptions about delegation

Data from the studies using qualitative methods included in this review highlighted that AHPs believe there are important factors which facilitate delegation. These include appropriate training for qualified staff, confidence regarding the competencies of the AHAs in relation to the delegated task and a clear implementation framework i.e. appropriate systems and processes in place. Only one study included patients' views about delegation, where patients expressed the view that close working between qualified and assistant staff also facilitates delegation [20].

Both AHPs and AHAs report that training for AHPs in delegation and supervisory skills is an important facilitator of delegation. Munn et al [3] also highlighted the need for appropriate supervision and mentoring of assistants to facilitate the use of delegation by AHPs and nurses. However, whilst there may be an expectation that AHPs are able to supervise and give direction to AHAs once they are qualified [36], training in supervision and delegation skills is often not included in the undergraduate training of AHPs, or when it is included it is insufficient [37, 38]. Changes in employment culture would suggest that the curriculum content of AHPs' undergraduate programmes needs to be updated in order to produce graduates who are equipped with the right skills demanded by changes in health care delivery [39].

A number of barriers to delegation from the AHPs' perspective were identified. These included lack of clarity around delegation such as what tasks should be delegated and who is accountable for the delegated tasks; as well as AHPs not being trained for the tasks of, firstly, delegating work to assistants, and secondly, supervising them to complete the delegated tasks. AHAs also highlighted the unwillingness of qualified staff to delegate clinical tasks. Inappropriate supervision and lack of training were also highlighted as barriers to delegation in the only other study in this review which was categorised as quantitative apart from the randomised controlled trial. This was a survey of occupational therapists and occupational therapy assistants [23].

Very similar themes in relation to barriers and facilitators of delegation to AHAs have been reported elsewhere [2, 3]. Munn et al [3] synthesised qualitative evidence regarding the appropriateness of strategies used to establish the health assistant role in both nursing and AHPs as a recognised delegated clinical role and to promote their inclusion in models of care. They reported that barriers to incorporating assistants in models of care and the recognition of their place in health service delivery as a delegated clinical role may include lack of clarity regarding their role and negative perceptions towards assistants by AHPs. In another systematic review, Lizarondo et al [2] summarised the evidence regarding the roles and responsibilities of AHAs and described the benefits and barriers to utilising AHAs. They reported that barriers to introducing AHAs in health care settings include uncertainty regarding the scope of AHA roles and responsibilities as well as protectionism of AHPs in relation to their own job roles. Their review focused on AHPs and AHAs but the aim was to synthesise evidence regarding the roles and responsibilities of AHAs rather than evidence of the effectiveness of using AHAs.

The methodological quality of the qualitative studies included in this review varied and a number of studies had either major or moderate methodological limitations, which reduced confidence in the review findings. However, the thematic analysis highlighted themes that were derived from a number of studies in different settings indicating that these findings are important. It must be highlighted that the majority of studies using qualitative methods were published approximately 15 years ago which poses questions about their relevance to current practice, especially bearing in mind some of the recent changes in healthcare delivery affecting workforce planning such as the use of virtual consultations, or the introduction of first contact practitioners. An example of findings that appeared dated in relation to current healthcare practice included in two studies that reported that the level of complexity of a procedure influenced delegation in physiotherapy [40, 41]. Physiotherapists were found to be more likely to delegate the application of passive modalities such as electrotherapy to assistants [40]. However, declining trends in the availability and usage of electrotherapy modalities have been reported elsewhere in the literature [42, 43]; therefore, these findings may have only limited relevance for delegation in contemporary physiotherapy

practice. This highlights the need for future studies to explore delegation issues related to current AHPs' practice as well as patients' perceptions, experiences and preferences.

Strengths and limitations

This is the first mixed methods systematic review to examine the clinical and cost-effectiveness of delegation by AHPs to AHAs and the perceptions of AHPs, AHAs, and patients about delegation. It has been reported that research on skill mix for AHPs is scarce and lags behind the fields of nursing and medicine, particularly in terms of understanding the health outcomes of delegation across both hospital and community settings [11]. It should be recognised that the AHP workforce has specific characteristics, which should be considered when investigating delegation. Our review highlighted the lack of evidence as well as the methodological shortcomings of available data.

Although no language restrictions were applied in the searches of the databases, all the studies included in this review were in English. Databases tend to have geographical and language biases [44, 45]. Unfortunately, we were unable to include any non-English language databases such as LILACS (Latin American and Caribbean Science Literature database) due to the limited time and resources.

CONCLUSION

Results from this review highlight the lack of evidence regarding the clinical and cost-effectiveness of delegation and provide evidence to support the argument that delegation is not standardised across the AHP professions, or within each profession. Additionally, there are clear knowledge gaps regarding delegation by AHPs in current practice in relation to patients' views, attitudes and preferences. Therefore, further research is needed to ensure that clinical and policy decisions around delegation are evidence-based, patients receive safe and effective treatment by the most appropriate clinician and cost-effective service provision. New research should incorporate the evidence regarding facilitators of and barriers to delegation to AHAs that this systematic review has highlighted, especially in relation to having adequate training for both AHPs and AHAs and clear processes in place to facilitate delegation.

Ethical Approval: Not applicable

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Conflict of Interest: This is to confirm that co-author Annette Bishop is an Editor for Physiotherapy but was not involved with the peer review of the paper or the final decision. The other authors declare that they have no conflicts of interest.

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Figure 1: PRIMA flow diagram

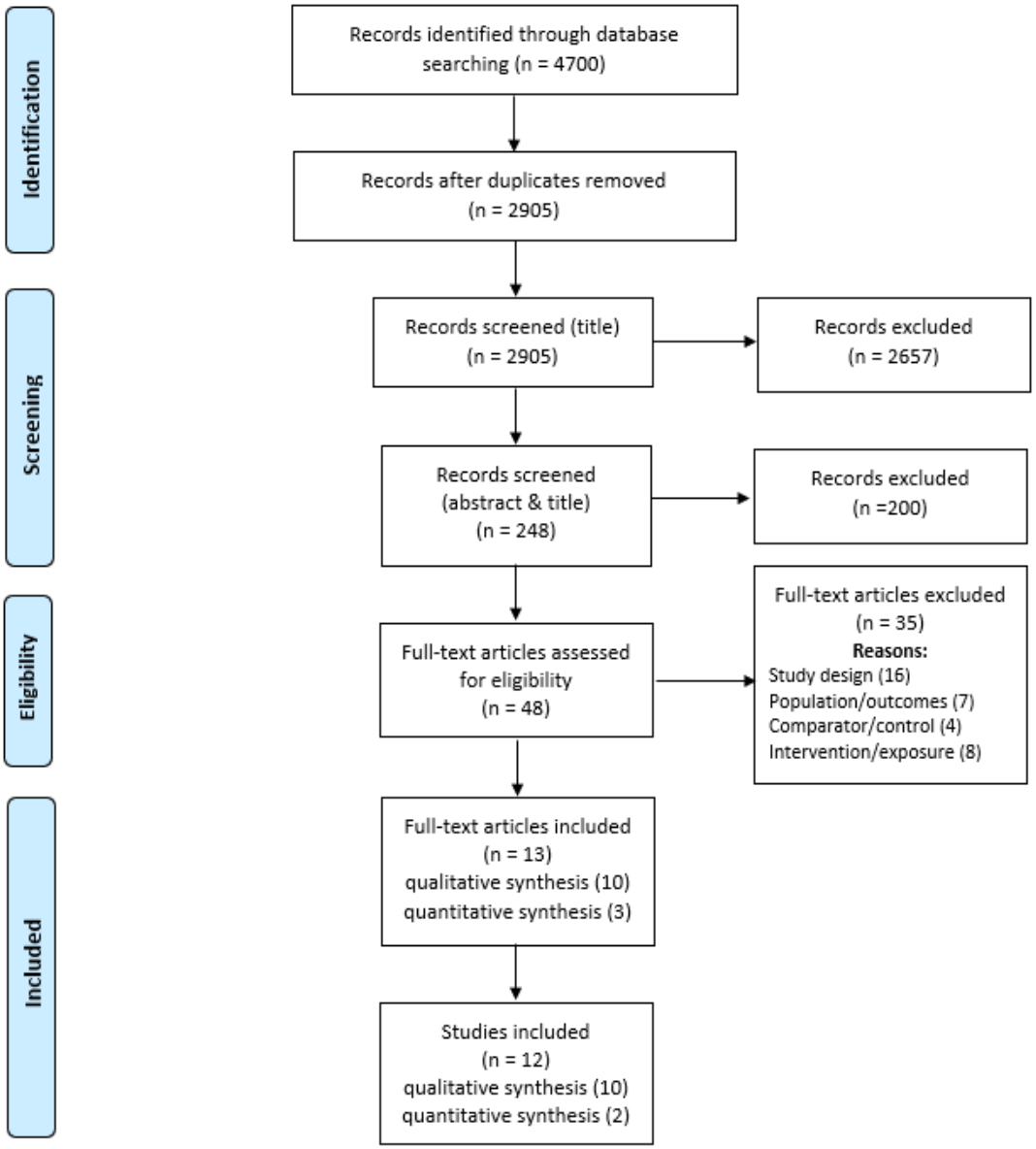

Table 1. Characteristics of included articles and their conclusions

Author/year/ country	Study design	Setting of care	AHP group/ specialty	Participants	Aim of the study	Conclusions
Lincoln et al, 1999[17] England	Single-blind, randomized, controlled trial	Large, teaching hospital with acute and rehabilitation facilities	Physiotherapy (PT) Neurology/stroke	Patients n = 282	To evaluate the effects of an increased intensity of treatment. Also to determine whether treatment of a type suitable for administration by a physiotherapy assistant was as effective as that provided by an experienced, senior physiotherapist.	The group comparisons showed no significant benefits of additional physiotherapy regardless of whether this was given by an assistant or a qualified physiotherapist. Patients in both control and intervention groups improved in terms of ADLs and arm function.
Mackey, 2004[18] England	Qualitative: focus group interviews	Primary Care, NHS Trust	Occupational Therapists (OT)	Qualified OTs OT assistants 36 participants in total, not clear how many of each group	To discover what Occupational Therapists perceive to be the major factors that need to be addressed before an extended role for support workers can be implemented.	Support workers have an important role in the development of OT services. A coherent approach needs to be implemented to change management, greater role clarity regarding individual practitioners, flexible training, and a pay structure that recognising diversity of roles and responsibilities.
Mackey & Nancarrow, 2005[19] England	Qualitative: focus group semi-structured interviews	Community-based Health Trust	Occupational Therapists (OT)	Qualified OTs: *n* = 5 OT assistants: *n* = 5 Managers: *n* = 4 Patients: *n* = 3	To evaluate the impact of a skill mix project introduced into a large community- based occupational therapy service.	The supervisory and accountability relationships of assistant practitioners (APs) must be clarified. Educational and management strategies are needed to ensure that public protection is optimized and professional vulnerability minimized. Supervising therapists need to be trained in how to prepare for and facilitate the role of AP and to be aware of the content of AP education and training to help with delegation and the verification of competence.

Nancarrow et al, 2015[20] Australia	Qualitative: interviews Semi-structured interviews, focus groups and documentary analysis of competency frameworks and policy documents	Rehabilitation setting	Speech and Language Therapists (SLT)	Qualified SLTs: n = 3 SLT assistants: n = 1 (trainee) Managers: n = 5 Patients: n = 4 Carers: n = 1	Examine the mechanisms to enable the successful implementation a trainee speech language pathology assistant (SLPA) role in a rehabilitation setting using a traineeship approach.	The AHA traineeship model is an innovative and effective way to implement a new role in a healthcare setting. There were added benefits of the new role to the service in terms of developing capacity. Implementation requires adherence to several enabling mechanisms, including strong leadership, good coordination and substantial resources to support training and supervision.
Parry et al, 1999[21] England	Single-blind, randomized, controlled trial (included post hoc analysis of groups according to severity of initial arm impairment)	A general hospital with acute and rehabilitation facilities for stroke patients.	Physiotherapy (PT) Neurology/stroke	Patients n = 282 (between one and five weeks after stroke)	To investigate effect of initial severity of arm impairment on response to additional physiotherapy for the arm after stroke.	Patients with severe arm impairment improved very little in arm function regardless of whether additional physiotherapy was given or not. Patients with less severe am impairment (early volitional arm movement) benefited from receiving additional physiotherapy planned by a qualified physiotherapist and administered by a trained, supervised assistant.
Parry & Vass, 1997[22] England	Case study including semi-structured interviews	Secondary care	Physiotherapists (PT) Neurology/stroke	Qualified PTs *n* = 7 PT assistants *n* = 1	To explore senior physiotherapists' views on task delegation, training and working with assistants. Also, role definition, assessment and training of one particular assistant in the context of a research study	Assessment and training packages are needed in both the research and clinical fields. The content and depth of any programmes should be carefully designed and clearly argued. Experimental evaluation is required in all areas where assistants contribute to physiotherapeutic management of patients.
Russel & Kanny, 1999[23] USA	Survey of systematically selected sample of 510 occupational therapists and occupational therapy assistants.	N/A	Occupational Therapists (OT), across many specialities)	Qualified OTs *n* = OT assistants n = 70	To examine the use of occupational therapy assistants in occupational therapy practice, the supervision and training of assistants and practitioners' attitudes toward the use of assistants.	Demonstrated widespread use of assistants. Most respondents followed guidelines for direct daily supervision of assistants. Major benefits of using assistants related to freeing the practitioner's time, increasing efficiency, and expanding service availability. Concerns about using assistants related to lack of adequate training and supervision, pressure for overuse, inappropriate billing, and a potential decrease in quality of services.

Saunders 1995[24] England	Mixed methods including semi-structured interviews and a survey	10 physiotherapy departments, 5 in District general hospitals and 5 in community hospitals (in the Trent Region)	Physiotherapists (PT)	SURVEY: Qualified PTs: *n* = 60 PT Assistants *n* = 30 INTERVIEWS: Managers *n* = 10	To establish what tasks were being carried out by helpers and physiotherapists and to establish the attitudes of physiotherapists and managers to enlarging the assistants' role	There is wide variation in skill mix and in the delegation of tasks to physiotherapy assistants. When delegation is supported operationally, physiotherapy assistants carry out clinical tasks delegated to them by physiotherapists. Physiotherapists were more likely to express concern about assistants applying ultrasound, under supervision, in sites where the assistants performed mainly procedural and clerical tasks.
Saunders, 1998 (Nov)[25] England	Before and after control study including interviews with staff to elicit views and perceptions and a patient questionnaire.	Out-patient physiotherapy departments, 2 in District general hospitals and 1 in a community hospital.	Physiotherapists (PT) Musculoskeletal outpatients	Qualified PTs: *n* = 6 PT assistants *n* = 4 Patients *n* = not reported	To implement delegation according to the principles in the constructive delegation (CD) model. Also, to measure the extent to which delegation was achieved by analysing the effects on the service in terms of activity and quality.	Delegation was successfully set up in all sites using the CD model. No loss of quality due to the increased involvement of assistants in patient care. The CD model offers a scientific and structured approach to delegation.
Saunders, 1998 (Jan)[26] England	Structured interviews (manager, physiotherapists, assistants) and direct observation of assistants.	Outpatient physiotherapy departments in 5 sites: 4 in district and 1 in a large community hospital	Physiotherapists (PT) Musculoskeletal outpatients	Qualified PTs: *n* = 13 PT assistants *n* = 6 Managers *n* = 5	To test and implement delegation and to analyse current practice using the constructive delegation (CD) model. To identify factors involved in setting up delegation with the view to improving and altering the level of delegation.	Clear commitment to delegation by managers but full implementation did not occur. Professional decisions were preventing delegation from taking place. The CD model was able to measure delegation through its ability to generate a scoring system.
Schwartz et al, 2018[27] Australia	Comparison of structured patient observations carried out simultaneously by SLPs and AHAs (looking at level of agreement across the two groups) and semi-structured interviews	Secondary care	Speech and Language Therapists (SLT)	Qualified SLTs *n* = 5 (3 were interviewed) SLT assistants *n* = 7 (6 were interviewed) Patients *n* = 50 (they did not participate in the interviews)	To explore the feasibility and initial validity of using trained AHAs to complete structured mealtime observations of patients with dysphagia. Also, to determine perceptions of both AHAs and SLPs regarding this new role, as well as providing preliminary evidence regarding direct cost comparisons	Using assistants to complete mealtime observations was comparable to having a qualified therapist complete the observation. Consistent training and the availability of therapist support and guidance in the delegation process are important contributors to high levels of agreement.

Somerville et al, 2015[28] Australia	Mixed methods including qualitative data collected via focus groups and a quantitative survey	Multiple settings (primary and secondary care, mental health, aged care services, local government and private providers)	Multiple clinical specialties of AHPs e.g. audiology, music therapy, speech and language therapy, social work, psychology, orthotics, podiatry, physiotherapy, occupational therapy, nutrition/dietetics, and exercise physiology	<u>Qualified AHPs</u> n = 2703 <u>Allied Health Assistants</u> n = 350	To identify areas where allied health assistants (AHAs) are not working to their full scope of practice in order to improve the effectiveness of the allied health workforce.	The skills of AHAs are not being optimally utilised. Significant opportunity exists to reform the current AHPs workforce and increase its capacity to meet future demands.
Wazakili et al, 2000[29] South Africa	Semi-structured interviews	4 centres, 1 tertiary and 1 secondary hospital, 2 rehabilitation projects which provided a variety of health care services (including physiotherapy)	Physiotherapists (PT)	<u>Qualified PTs</u>: *n* = 3 <u>Assistants</u> *n* = 6 (4 PT & 2 rehabilitation assistants <u>Managers</u> *n* = 4 (2 PT & 2 from community projects)	To get the views of physiotherapy service providers (PSPs) in selected areas in the Western Cape Metropolitan area, over issues surrounding the need for physiotherapy assistants.	Changes are essential in assistant training and role. Shortages in physiotherapy services should be addressed by training more physiotherapy assistants.

Table 2a: MMAT assessment of qualitative studies

Paper	Are there clear research questions?	Do the collected data allow to address the research questions?	Is the qualitative approach appropriate to answer the research question?	Are the qualitative data collection methods adequate to address the research question?	Are the findings adequately derived from the data?	Is the interpretation of results sufficiently substantiated by data?	Is there coherence between qualitative data sources, collection, analysis and interpretation?
Mackey (2004)[18]	Yes	Yes	Yes	Yes	Cannot tell	Yes	Yes
Mackey & Nancarrow (2005)[19]	Yes	Yes	Yes	Yes	Yes	Cannot tell	Yes
Nancarrow et al (2015)[20]	Yes	Yes	Yes	Yes	No	Yes	No
Parry & Vass (1997)[22]	Yes	Yes	Yes	Cannot tell	Yes	Cannot tell	Yes
Saunders (1995)[24]	Yes	Yes	Yes	No	Cannot tell	No	Cannot tell
Saunders (1998 Nov)[25]	Yes	Yes	Yes	Cannot tell	Cannot tell	Cannot tell	Cannot tell
Saunders (1998 Jan)[26]	Yes	Yes	Yes	Yes	Cannot tell	Cannot tell	Cannot tell
Schwarz et al (2018)[27]	Yes	Yes	Yes	Yes	Yes	Yes	Cannot tell
Somerville et al (2015)[28]	Yes	Yes	Cannot tell	Cannot tell	Cannot tell	Cannot tell	Cannot tell
Wazakili & Mpofu (2000)[29]	Yes	Yes	Cannot tell	Cannot tell	Cannot tell	Yes	No

Table 2b: MMAT assessment of quantitative descriptive studies

Paper	Are there clear research questions?	Do the collected data allow to address the research questions?	Is the sampling strategy relevant to address the research question?	Is the sample representative of the target population?	Are the measurements appropriate?	Is the risk of nonresponse bias low?	Is the statistical analysis appropriate to answer the research question?
Russell & Kanny (1998)[23]	Yes	Yes	Yes	Yes	Yes	Cannot tell	Yes
Saunders (1995)[24]	Yes	Yes	Cannot tell	Yes	Yes	Cannot tell	Yes
Saunders (1998 Nov)[25]	Yes	Yes	Yes	Yes	Yes	Cannot tell	Cannot tell
Schwarz et al 2018[27]	Yes	Yes	Yes	Yes	Yes	Cannot tell	Yes
Somerville et al 2015[28]	Yes	Yes	Yes	Yes	Yes	No	Yes

Table 2c: MMAT assessment of RCTs

Paper	Are there clear research questions?	Do the collected data allow to address the research questions?	Is randomization appropriately performed?	Are the groups comparable at baseline?	Are there complete outcome data?	Are outcome assessors blinded to the intervention provided?	Did the participants adhere to the assigned intervention?
Lincoln et al (1999)[17]	Yes	Yes	Cannot tell	Yes	No	Yes	No
Parry et al (1999)[21]	Yes	Yes	Cannot tell	Yes	No	Yes	No

Table 2d: MMAT assessment of mixed methods studies

Paper	Is there an adequate rationale for using a mixed methods design to address the research question?	Are the different components of the study effectively integrated to answer the research question?	Are the outputs of the integration of qualitative and quantitative components adequately interpreted?	Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?	Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?
Saunders (1995)[24]	Yes	Yes	Cannot tell	Cannot tell	Yes
Saunders (1998 Nov)[25]	Cannot tell	Yes	Yes	Yes	Cannot tell
Schwarz et al (2018)[27]	Cannot tell	No	No	No	No
Somerville et al (2015)[28]	Yes	Cannot tell	Cannot tell	Cannot tell	Cannot tell

Table 3: Summary of findings on delegation themes and sub themes (with references)

Analytical themes	Perspective	Descriptive themes & studies contributing to the review finding	Assessment of Methodological Limitations	Assessment of Relevance	Assessment of Coherence	Assessment of Adequacy	Assessment of Confidence	Comments/ Explanation of Judgement
Facilitators of delegation in clinical practice	Qualified therapists	Appropriate training for qualified staff [19,20,24,29]	Minor concerns of one study[19], moderate concerns of one study[20] and major concerns of two studies[24,29]	Direct relevance	No or very minor concerns as patterns are consistent across studies	Minor concerns due to limited data	Moderate Confidence	Graded moderate confidence due to the concerns regarding methodological limitations
		Confidence regarding the competences of the allied health assistants in relation to the delegated task [19,20,22,26,28]	Minor concerns of one study[19], moderate concerns of two studies[20,22] and major concerns of two studies[26,28]	Direct relevance	No concerns as patterns are consistent across studies	Minor concerns due to limited data	Moderate confidence	Graded moderate confidence due to the concerns regarding methodological limitations
		Clear implementation framework i.e. appropriate systems and processes in place to facilitate delegation [18,20,22,24,25,26,27]	Minor concerns of two studies [18,27] moderate concerns of two studies[20,22] and major concerns of three studies[24,25,26]	Direct relevance	No concerns as patterns are consistent across studies	Minor concerns due to limited data	Moderate Confidence	Graded moderate confidence due to the concerns regarding methodological limitations and adequacy of data
	Assistants	Appropriate training for qualified staff [19]	Minor concerns regarding methodological limitations[19]	Direct relevance	Difficult to assess due to the finding being restricted to one study	Serious concerns about adequacy due to limited data	Low Confidence	Graded low confidence because of serious concerns with coherence and limited data
		Appropriate training for assistants to carry out the delegated clinical tasks[18,19,27]	Minor concerns regarding methodological limitations in all studies[18,19,27]	Direct relevance	No or very minor concerns as patterns are consistent across studies	Moderate concerns about adequacy due to limited data	Moderate Confidence	Graded moderate confidence because of concerns with methodology and adequacy of data
	Patients	Close working between qualified and assistant[19]	Moderate concerns about methodological limitations[20]	Direct relevance	Difficult to assess due to the finding being restricted to one study	Major concerns due to limited data	Low Confidence	Graded low confidence because of serious concerns with methodology and limited data

Barriers to delegation in clinical practice	Qualified therapists	Lack of clarity in relation to delegation including what tasks should be delegated and accountability of delegated tasks[18,19,25,26,27]	Minor concerns regarding methodological limitations of three studies[18,19,27] and major concerns related to methodology of two studies[25,26]	Direct relevance	No concerns as patterns are consistent across studies	Moderate concerns about adequacy due to limited data	Moderate Confidence	Graded moderate confidence because of concerns with methodology
		Not being prepared for the task of delegating work to and supervising assistants[19,29]	Minor concerns of one study[19] and major concerns related to methodology of the other study[29]	Direct relevance	Some concerns due to the findings restricted to two studies	Moderate concerns about adequacy due to limited data	Low confidence	Graded low confidence because of major concerns with methodology and limited data
	Assistants	Unwillingness of qualified staff to delegate clinical tasks [18,19,24,29]	Minor concerns related to methodology of two studies[18,19] and major concerns for the other two studies[24,29]	Direct relevance	No concerns as patterns are consistent across studies	Moderate concerns about adequacy	Moderate Confidence	Graded moderate confidence because of concerns with methodology and limited data
	Patients	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Others	Patients	Trust in the employing organisation to ensure that the assistant had the necessary skills to deliver the care they required[19]	Minor concerns regarding methodological limitations of the study[19]	Direct relevance	Difficult to assess due to the finding being restricted to one study	Serious concerns about adequacy due to limited data	Low Confidence	Graded low confidence because of the limited data
		Acceptance of assistant role if it increased the volume of treatment received[20]	Moderate concerns regarding methodological limitations[20]	Direct relevance	Difficult to assess due to the finding being restricted to one study	Serious concerns about adequacy due to limited data	Low Confidence	Graded low confidence because of the limited data

Supplementary Table1: Search Strategy OVID MEDLINE search strategy

The following table is an explanation of the symbols used in the search strategy below.

/	indicates an index term (MeSH heading)
.ti,ab.	indicates a search for a term in title/abstract
*	at the end of a term indicates that this term has been truncated
#	within or at the end of a search term indicates that a character has been substituted
adj*n*	indicates a search for two terms where they appear adjacent within *n* words of each other

1. ("allied health").ti,ab
2. "ALLIED HEALTH OCCUPATIONS"/ OR "OCCUPATIONAL THERAPY"/ OR "PHYSICAL THERAPY SPECIALTY"/
3. "ALLIED HEALTH PERSONNEL"/ OR "PHYSICAL THERAPIST ASSISTANTS"/
4. ("art therap*").ti,ab
5. "ART THERAPY"/ OR "SENSORY ART THERAPIES"/
6. ("drama therap*").ti,ab
7. PSYCHODRAMA/
8. ("music therap*").ti,ab
9. "MUSIC THERAPY"/
10. (chiropod* OR podiatr*).ti,ab
11. PODIATRY/
12. (dieti#ian* OR nutritionist*).ti,ab
13. NUTRITIONISTS/
14. ("occupational therap*").ti,ab
15. REHABILITATION/
16. (operating ADJ2 practitioner*).ti,ab
17. "OPERATING ROOM TECHNICIANS"/
18. (orthoptist*).ti,ab
19. (orthoptics*).ti,ab
20. ORTHOPTICS/
21. (osteopath*).ti,ab
22. "OSTEOPATHIC MEDICINE"/ OR "OSTEOPATHIC PHYSICIANS"/
23. (physiotherap*).ti,ab
24. ("physical therap*").ti,ab
25. (prosthetist* OR orthotist*).ti,ab
26. (prosthetics).ti,ab
27. (orthotics).ti,ab
28. (radiograph*).ti,ab
29. RADIOGRAPHY/
30. ((speech OR language) ADJ3 therap*).ti,ab
31. "REHABILITATION OF SPEECH AND LANGUAGE DISORDERS"/ OR "VOICE TRAINING"/
32. (non registered OR nonregistered OR unregistered).ti,ab
33. (assistant*).ti,ab
34. ("auxiliary personnel").ti,ab
35. (unlicensed).ti,ab
36. (aide OR aides).ti,ab
37. (technician*).ti,ab
38. (1 OR 2 OR 3 OR 4 OR 5 OR 6 OR 7 OR 8 OR 9 OR 10 OR 11 OR 12 OR 13 OR 14 OR 15 OR 16 OR 17 OR 18 OR 19 OR 20 OR 21 OR 22 OR 23 OR 24 OR 25 OR 26 OR 27 OR 28 OR 29 OR 30 OR 31 OR 32 OR 33 OR 34 OR 35 OR 36 OR 37)
39. (delegat*).ti,ab
40. "PERSONNEL DELEGATION"/
41. "DELEGATION, PROFESSIONAL"/
42. (skill* ADJ3 mix*).ti,ab
43. ((profession* OR personnel* OR role*) ADJ3 substit*).ti,ab
44. (39 OR 40 OR 41 OR 42 OR 43)
45. (38 AND 44)