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Dosage, Mode, and Timing of Acute Care Physical Therapy: A Scoping Review

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DOSAGE, MODE, AND TIMING OF ACUTE CARE PHYSICAL THERAPY: A SCOPING REVIEW

By

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ABSTRACT

Aims and Objectives: 1) To synthesize available evidence for mode, dosage, and timing of physical therapy in the acute care hospital setting. 2) To report the evidence about the effects of mode, dosage, and timing of physical therapy in the acute care hospital setting on LOS, associated costs, and PT-related outcomes.

Background: Hospital based physical therapy quality depends on providing evidence-based interventions, however, the research regarding dosage, mode, and timing of physical therapy in the acute care hospital setting has not been synthesized for patient populations except for total joint arthroplasties or patients in the ICU.

Design: A systematic search and scoping review were performed.

Methods: Search criteria were applied to 5 literature databases to capture articles that match our aims and objectives; non-ICU studies of physical therapy provided interventions in the acute care hospital setting not including patient populations with total joint replacement.

Results: Four studies of variable design met criteria for inclusion.

Conclusion: The research appears to suggest that early and increased mobilization with a physical therapist is more effective in that it can decrease length of stay, cost of care, and improve physical therapy-related outcomes.

Discussion: More research needs to be performed on mode, dose and timing of physical therapy in the acute hospital setting.

ACKNOWLEDGEMENTS:

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INTRODUCTION

Background

In the United States, approximately 36.5 million people were hospitalized in 2017. Hospital costs were $1.1 trillion in 2017 and had increased by 4.6 percent from the previous year (American Hospital Association, 2017). Patients usually stay in the hospital for a short time period, an average of 4.5 days. However, more complex patients, such as those in the intensive care unit (ICU), spend on average 3.3 days in the ICU and an additional 1.5 days in a non-ICU bed for every day spent in the ICU (Hunter, Johnson, & Coustasse, 2014).

In 1983, the federal government changed the Medicare reimbursement system for inpatient hospital services from a fee-for-service system where each service was paid individually, to a prospective payment system (PPS), wherein in a single payment is made for a patient's inpatient stay based primarily on admitting diagnosis (Holden & Daniele, 1987; Huckfeldt, Sood, Escarce, Grabowski, & Newhouse, 2014). After a 2-year phase in period, all states were under this payment model starting in 1985. Controlling length of stay (LOS) for patients in the acute care setting became crucial under this PPS as the same payment is made regardless of LOS (Holden & Daniele, 1987). When comparing the payment model between the U.S. and other European and Asian countries, they are very different. The U.S. utilizes a PPS model for payment that the patient is ultimately responsible for, while many countries outside of the U.S. use a system that places the financial burden on either the government or the patient's employer (Culyer, Ellis, Chen, & Luscombe, 2014). Because these systems are so

different, what is possible to perform with physical therapy in other countries may not be feasible in the U.S., and vice versa.

Physical therapists help to manage the recovery of hospitalized patients. As of May 2018, there were 228,600 physical therapists working in the United States, with 54,440 (24%) practicing in an acute care setting such as a medical or surgical hospital (Bureau of Labor Statistics, 2018). Physical therapists practicing in the hospital may treat patients admitted for trauma, surgery, or medical-related conditions. Physical therapy services are available both weekdays and weekends, with therapists spending on average 40.7 minutes per patient when some form of examination or intervention is performed (Jette, Brown, Collette, Friant, & Graves, 2009). Under the Medicare PPS, it is required that physical therapy treatment be available, but the value of that treatment needs to be better understood so it can be properly resourced.

The majority of current research for physical therapy in the acute care hospital has been conducted on to patients in the intensive care unit (ICU) or those that have undergone a total joint arthroplasty (TJA). The optimal amount of physical therapy during hospitalization has not been empirically determined, but the evidence indicates that patients could benefit from much more (Lenssen et al., 2006). Studies on ICU populations suggest that early mobilization improves patient function and reduces length of stay (Chiang, Wang, Wu, Wu, & Wu, 2006; Morris et al., 2008; Schweickert et al., 2009). Physical therapy research for people with TJA supports one session per day, electrical stimulation for pain relief, and early mobilization (Zhu, Feng, & Peng, 2017). For example, in a systematic review written by Henderson et al. they reported that

starting physical therapy earlier in the postoperative phase of total knee arthroplasty reduces LOS in the hospital by 3.5 days (Henderson, Wallis, & Snowdon, 2018).

Aims

While systematic reviews of physical therapy for the TJA and ICU populations have been published, a synthesis of studies on physical therapy for other patient populations in the acute care hospital setting does not exist. A scoping review of the existing literature relating to mode, dosage, and timing of physical therapy in this acute care setting is needed. Thus, the aim of this scoping review was to identify evidence pertaining to the effects of mode, dosage, and timing of physical therapy on either LOS in the hospital, cost of care, or physical therapy-related outcome measures for this non-TJA or ICU patient population.

MATERIALS AND METHODS

Design

A systematic search and scoping review of the literature was performed while abiding by the principles outlined by the Joanna Briggs Institute in conjunction with five "Joanna Briggs Collaborating Centres" (Peters et al., 2015). The major principles written about in the methodological guidance for scoping reviews include the following: title, background, objective, inclusion criteria, participants, concept, data searching, data extraction, charting results, discussion, and conclusion. We have applied the principles written about by Peters et al. (2015) to our paper. The methodological guidance for scoping reviews gives insight on how to choose and determine key areas of focus within the scoping review. Using this methodological guidance, we focused the title and background to our specific patient population. We then asked ourselves questions about the patient population in order to narrow our objective. The guidance in the article also gave us insight on how to include and report on participants involved in the studies. The overall concept, data searching, data extraction, and charting results were performed in the same way. Finally, the discussion and conclusion of the paper were also written according to this guidance.

Search Strategy

We consulted a health research librarian and identified pertinent databases, and constructed a search strategy. The following five databases were searched: CINAHL, EMBASE, PubMed, Scopus, and Web of Science. Search terms included: 'hospital patient', 'acute care', 'hospitalization', 'physical therapist', 'physical therapist assistant',

‘hospitalist’, and ‘physical therapy. A review of related literature performed by Carrie Price from John Hopkins University yielded additional articles that matched our inclusion criteria. Due to Medicare changing from a retrospective to PPS in 1983 and some states being granted a waiver from this change up until 1985, we confined our search to the period between 1985 and 2019. During our search, we also reviewed reference lists from within articles that were found using our search criteria. Any references that met the inclusion and exclusion criteria using this method were included as “hand-selected.”

Inclusion/Exclusion Criteria

Articles were included if they met the following criteria: (a) written or translated into the English language; (b) conducted in the United States ; (c) conducted in an acute care hospital setting; (d) patients 18 years or older; (e) patient population in the acute care hospital; (f) an experimental or quasi-experimental study design; (g) examined mode, or dosage, or timing of physical therapy; (h) reported on cost of care, length of stay, and physical therapy-related outcome measures; (i) intervention performed by a physical therapist, or by a physical therapist assistant following an evaluation by a physical therapist; (j) study conducted after 1985. Articles were excluded if they (a) were conference abstracts or proceedings and/or (b) did not meet the criteria for inclusion.

Beginning on April 3, 2019, two independent reviewers screened the title and abstract of studies using the inclusion criteria, and the full-text article was obtained and reviewed if the article met the criteria. Data from full-text articles that met the criteria were extracted including author, year, study design, sample size, location of the study, purpose, mode, dosage, or timing of physical therapy, and associated outcomes and

results for each of the eligible studies. Outcomes were categorized as relating to changes in either length of stay, associated hospital costs, or physical therapy-related outcome measures.

RESULTS

Selection of Evidence

A total of 6,386 non-duplicate manuscripts were screened, with 37 full-text citations being reviewed and 3 of these meeting inclusion criteria (Figure 1). One hand-selected article was also included. Of the 37 full-texts, 34 were excluded from the review for reasons such as not containing physical therapy treatment, no physical therapy-related outcome measure was used, the citation was not a published article, the study was a case report, or physical therapy intervention was in the ICU or following a total joint arthroplasty (Figure 1). Four manuscripts were included in the final scoping review (Brown et al., 2016; Cook et al., 2008; KD et al., 2008; KJ, AL, GB, KA, & JD, 2004).

Characteristics of Evidence

The designs of the included studies are included in Table 1. One study was a randomized controlled trial (Brown et al., 2016). Two were prospective cohort studies (KD et al., 2008; KJ et al., 2004). The remaining article was a retrospective observational study (Cook et al., 2008). The randomized controlled trial was single-blinded and used masked assessors to measure the outcome. It also used a block randomization strategy, in which all participants were grouped into blocks of 10, and from there were divided into groups of 5 in either the control or treatment groups.

Mode, Dosage, and Timing of Physical Therapy in the Acute Care Setting

Among the 4 included manuscripts (Table 1), all 4 detail of mode of physical therapy treatment (Cook et al., 2008; Brown et al., 2016; KD et al., 2008; KJ et al., 2004), 2 described the dosage of therapy and associated effects (Brown et al., 2016; KD et al., 2008), and 2 reported how timing of therapy affects patient outcomes (KD et al., 2008; KJ et al., 2004).

Mode of Physical Therapy Results

Within the 4 studies that describe mode of therapy, 75% utilized ambulation as a means of treatment (Brown et al., 2016; KD et al., 2008; KJ et al., 2004) with Cook et al., 2008 being the only one that did not implement ambulation as a mode of therapy. Brown, et al. (2016) reported the effects of an in-hospital mobility program (MP) versus those that only received usual care (UC) on functional mobility and outcome measures such as the Katz Activities of Daily Living (ADL) and the University of Alabama at Birmingham Life-Space Assessment (LSA) for community mobility. The mode of therapy, as displayed in Table 1, was ambulation that increased in frequency over time. The patient population included adults older than 65 years of age admitted to the Birmingham Veterans Affairs Medical Center (BVAMC) between January 12, 2010 and June 29, 2011 for general medical illness such as pneumonia, heart failure, and chronic obstructive pulmonary disease exacerbations. Patients with delirium and dementia were excluded from this study based on a screening for cognitive impairment. No significant difference in ADL scores were noted between the mobility program and usual care groups ($p=0.99$). However, at 1-month post hospitalization those enrolled in the mobility program group had scores that were on average 10 points higher than those in the usual care group ($p=0.02$) showing that physical therapy-related outcome scores did

improve for those in the mobility group long-term. This study also stated that those in the mobility program group did not experience any falls, but 3 falls were documented in the usual care group.

KD, et al. (2008) described how the implementation of the Amputee Mobility Protocol (AMP), which consists of bed exercises and ambulation as modes of therapy, affected LOS and modified-Functional Independence Measure (FIM) scores for those having either an above the knee amputation, below the knee amputation, or transmetatarsal amputation. The specific mode of therapy for each of the amputation types is described in Table 1. They showed that those admitted to the hospital for a lower extremity amputation had a significantly longer average LOS if they underwent the Amputee Mobility Protocol (AMP) (18.3 days) compared to those that were in the hospital before the AMP was implemented (15.3 days). They also showed that for all types of patients admitted to the hospital for a lower extremity amputation, they had an increase in their stand to pivot and sit to stand scores on the modified-FIM if they underwent the AMP compared to those that were in the hospital before the AMP was implemented. The transmetatarsal amputation group had a significant increase in their ambulation distances on the modified FIM compared to those prior to the implementation of the AMP. This study showed that LOS increased for those that underwent the AMP and physical therapy-related outcome measure scores improved for this group as well.

KJ, et al. (2004) reported that individuals older than 65 who were hospitalized for a hip fracture and underwent surgical intervention had a shorter LOS stay when following a clinical pathway guideline for acute rehabilitation compared to those in the

same setting without a clinical pathway (21.6 vs 13.7 day decrease, respectively $p < 0.001$). This clinical pathway outlined in Table 1 includes modes of therapy such as early mobilization, ambulation, endurance and strength training, balance training, and deep breathing exercises.

Lastly, Cook, et al. (2008) showed that those admitted into an acute care setting between 1988 - 2005 with a primary diagnosis of mechanical low back pain had a significantly longer hospital LOS ($P<.01$) if they received manual therapy compared to those that did not. The mode of therapy consisted of manual therapy with manipulation and mobilization of the low back. They also found that those who did receive manual therapy for low back pain had significantly lower hospital associated costs after adjusting for age, race/ethnicity, sex, household income, and a comorbidity index, ($P < .01$) compared to those that did not receive manual therapy despite the longer LOS.

Dosage of Physical Therapy Results

Only 50% of the studies we reviewed detailed the dosage of therapy treatment. Brown, et al. (2016) reported that those in the mobility program group received 15-20 minutes of ambulation treatment twice daily, which resulted in this group improving in community mobility 1-month post hospital discharge. As mentioned previously, no significant difference in ADL scores were noted between the mobility program and the usual care groups.

Dosing of therapy for the amputee patient population is outlined in the AMP used by KD, et al. (2008). This protocol placed a two-hour limit on the amount of time an individual who sustained an amputation should be out of bed during the initial few days

of therapy. Furthermore, the AMP stipulated ambulation should be performed twice daily for those who underwent a below the knee or an above the knee amputation and three times daily for those with a transmetatarsal amputation in the later phases of therapy in the acute care setting. Those in the transmetatarsal amputation group were the only ones who demonstrated a significant increase in ambulation distance compared to those in the non-AMP group. As previously mentioned, LOS did increase for the AMP group compared to those in the hospital before the AMP was implemented.

Timing of Physical Therapy Results

We found only two studies that included timing of physical therapy treatment. Both KJ, et al. (2016) and KD, et al. (2008) identify therapy as beginning day 1 post-operatively for those who underwent either a surgical procedure for a hip fracture or those that had an amputation performed. The AMP also included a pre-operative physical therapy consult if necessary, whereas the hip fracture pathway did not mention this. LOS for patients in the clinical pathway guideline group in the KJ, et al. study did decrease, but on average increased for patients with amputations in KD, et al. (2008). Modified-FIM scores increased for those with amputations in the AMP group as detailed in the KD, et al. (2008) study.

DISCUSSION

Our scoping review found 4 manuscripts that detailed either the mode, dosage, timing, or a combination of these physical therapy treatment descriptors and how patient LOS, associated hospital costs, and/or functional outcomes were affected. All 4 of the peer-reviewed articles included mode of physical therapy treatment, but only 2 articles described dosage of physical therapy, and 2 detailed timing of therapy. The mode, dosage, and timing of physical treatment varied among each study along with the patient populations that were included. The level of evidence for this topic is also lacking because only 1 RCT was available. It detailed how the mode and dosage of a mobility program for acute care patients with general illnesses affected outcomes. The remaining articles were either retrospective observational, prospective cohort, or before-after comparative studies, which have additional limitations.

Mode of Physical Therapy

The lack of research that exists for the effectiveness of physical therapy for a non-TJA or ICU patient population in the acute care setting is apparent. There is no clear evidence for which mode of therapy is most beneficial for reducing LOS, associated hospital costs, and/or improving patient outcomes. Although ambulation was included as a primary mode of treatment in 75% of the studies in this review, and was associated with improved outcomes in two of them (Brown et al., 2016; KD et al., 2008), those two studies both included very specific patient populations (i.e., amputees or those older than 65 in a VA hospital), and KD, et al. (2008) included other modes of therapy such as various bed exercises.

A LOS of stay decrease for the clinical pathway guideline group was seen in one study (KJ et al., 2004) that included various modes of therapy such as early mobilization, ambulation, endurance and strength training, balance training, and deep breathing exercises, but it increased in two others (Cook et al., 2008; KD et al., 2008). Although Brown, et al. (2016) did not examine how LOS was affected, they did report fewer falls in the intervention group which may reduce LOS and would likely decrease cost of care. With regard to lower hospital associated costs despite longer length of stay for the intervention, Cook, et al. (2008) credited other factors for this decrease besides therapy such as age, race/ethnicity, sex, household income, and a comorbidity index. The longer length of stay in this study was attributed to either the attending physician's treatment patterns, hospital specific algorithms, or manual therapy not being effective.

Overall there were varied modes of therapy, patient populations, and outcome measures used among the 4 selected studies in our review. Because of this heterogeneity we have no recommendation for which type of physical therapy treatment would be most effective for a non-TJA or ICU patient population in the acute care setting. However, ambulation was discussed most frequently as a mode of treatment among included studies and may prove effective for most acute care populations. Future research should include studies that describe their mode of therapy in greater detail with a clearer difference in the mode when 2 or more groups are compared.

Dosage of Physical Therapy

Overall, the body of literature pertaining to dosage of therapy in the acute care setting for a non-TJA or ICU patient population is limited. Among the two studies we included that reported dosing (Brown et al., 2016; KD et al., 2008), the patient

populations may be too focused to generalize conclusions regarding optimal therapy dosage to other groups. The Brown, et al. (2016) study describes the dosage of therapy as being 15-20 minutes of ambulation twice daily, but there is no mention of how this therapy affected LOS or associated hospital costs, therefore it is difficult to determine the LOS and cost benefit from their dosage of daily ambulation. In the KD, et al. (2016) study, those in the transmetatarsal amputation group received ambulation three times daily, whereas those in the below the knee amputation and above the knee amputation groups ambulated twice daily. Likely due to this dosing difference, those in the transmetatarsal amputation group were the only ones who demonstrated a significant increase in ambulation distance. This may indicate that ambulation three times daily may be more beneficial than two times; however, there are other factors to consider such as comorbidities and the fact that a transmetatarsal amputation is less traumatic than a below the knee or above the knee amputation. Again, LOS for those in the AMP group increased for possible other factors besides therapy, so it is difficult to determine if dosage had any effect on stay.

These two studies show that twice daily ambulation is effective when implemented in a mobility program, and therefore may prove beneficial for a non-TJA or ICU patient population. However, more frequent ambulation may benefit some patients as was demonstrated by KD et al. Therapy dose may need to be more sensitive to individual patient condition than mode of therapy and so protocolized flexibility is recommended. Similar to mode of therapy treatment, future research should continue to investigate the optimal dosing of physical therapy in the acute hospital.

Timing of Physical Therapy

An insufficient amount of research also exists for timing of physical therapy treatment in the acute care setting for a non-TJA or ICU patient population as only two studies were discovered in our search (KJ et al., 2004; KD et al., 2008). While the patient populations in these two studies differ, both describe therapy beginning day 1 post-operatively. Although the two patient populations in these studies are very specific, earlier therapy treatment may also benefit other populations in the acute hospital. Schweickert, et al. (2009) showed that patients on mechanical ventilation in the intensive care unit (ICU) that underwent daily interruption of sedation to promote early mobilization demonstrated a quicker return to prior level of function than those that did not receive early mobilization. Juliano, et al. (2011) showed that implementing physical therapy on the same day of surgery for patients undergoing a total hip arthroplasty had an average LOS decrease of 0.21 days compared to those patients who began therapy one day post-operatively (Juliano et al., 2011). LOS did decrease for those who underwent a hip procedure in the KJ, et al. (2004) study, but it increased in the KD, et al. (2008) article. Patient function did improve in the KD, et al. study, but mode, dosage, and timing of therapy were all fixed variables. Whereas if they had kept mode and dosage of therapy constant and varied the timing of treatment, the effects of timing could be better understood. Future research should fill this void in evidence pertaining to the timing of physical therapy treatment in the acute care setting and more studies should be performed on a variety of patient population groups.

Limitations

Several limitations exist for this scoping review. We did not work closely enough with our librarians and cannot be confident that we were able to identify all available and

pertinent articles from 1985 to present. Only one librarian was consulted to assist in the construction of our search criteria, and it may have proven more beneficial to seek guidance from multiple librarians to obtain additional search strategies. Additionally, studies may have been accidently missed when reviewing the title and abstracts. However, the two researchers did cross-check each other's exclusion lists to ensure that articles that met the inclusion criteria were not mistakenly excluded. Lastly, the patient populations in each of the selected articles varied, making it difficult to compare to each other or generalize to other populations.

Conclusion

In this scoping review we identified four studies of mode, dosage, and/or timing of physical therapy treatment in the acute hospital setting and how LOS, associated hospital cost, and/or physical therapist-related outcome measures were affected. Mode of therapy predominantly consisted of ambulation with the majority of treatment being administered twice daily and beginning 1-day post-operatively. However, patient populations varied across each study and no general conclusions can be drawn regarding the effect of therapy on LOS, associated costs, and/or other outcomes. Physical therapists in the acute care setting and even hospital staff and management will hopefully benefit from utilizing this scoping review to become more informed about the value of acute care physical therapy treatment in order to improve patient outcomes, reduce patient LOS and reduce associated hospital costs. However, further research is necessary to determine the optimal mode, dosage, and timing of physical therapy treatment for this non-TJA or ICU patient population in order to improve the value of therapy, improve patient outcomes, and reduce associated hospital costs.

APPENDIX A: TABLE 1 – ARTICLES REPORTING MODE, DOSE, AND/OR TIMING OF PHYSICAL THERAPY PROVIDED IN THE ACUTE HOSPITAL

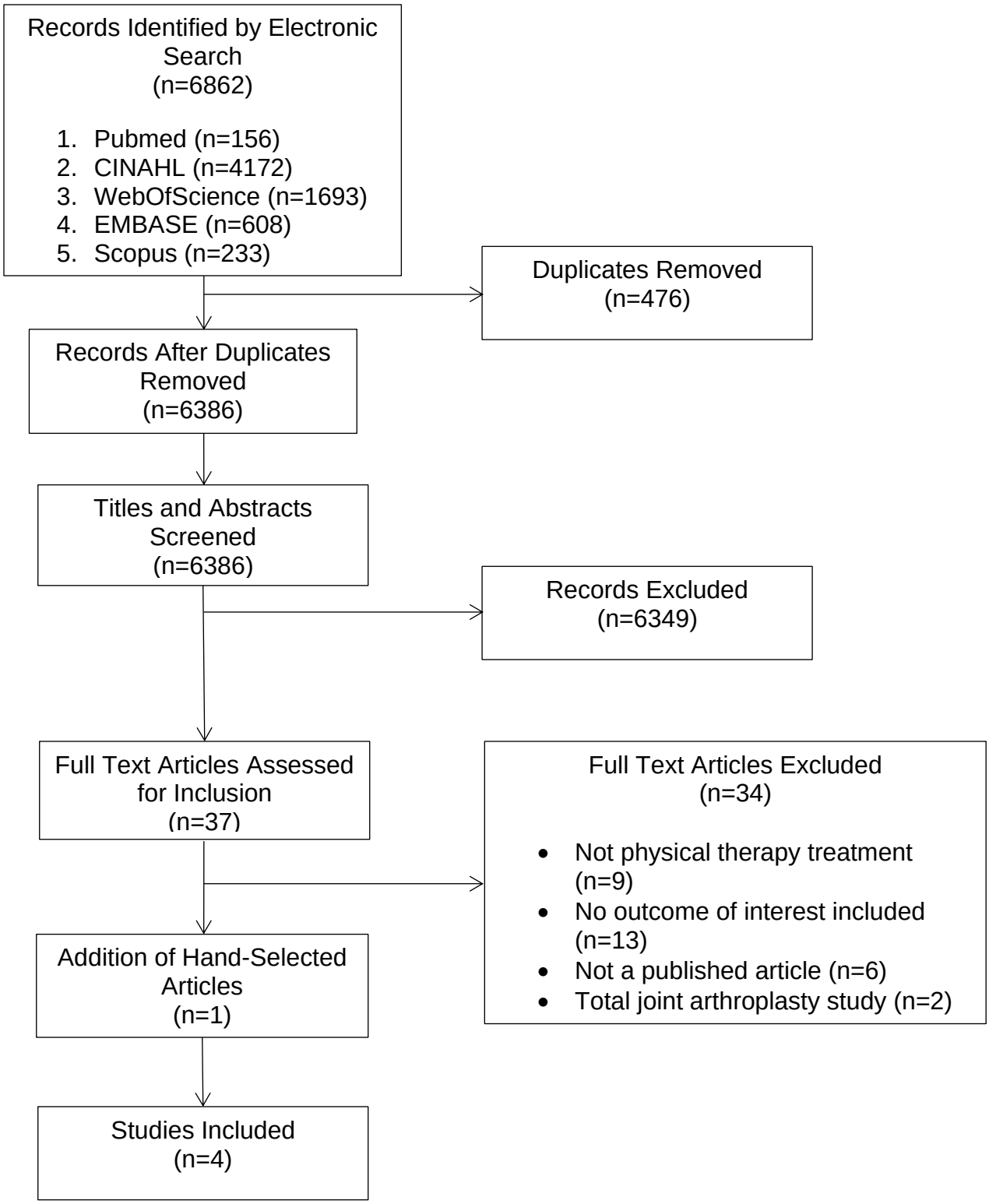
Author, year, study design; sample size; location	Purpose	Mode	Dosage	Timing	Physical Therapy-Related Outcome(s) & Results
1. Brown et al. (2016) - Randomized Controlled Trial n = 100 Birmingham, AL, USA	To determine whether or not an in-hospital mobility program (MP) would increase ADL function and community mobility when compared to a usual care (UC) group.	Ambulation	15-20 minutes of ambulation, twice daily.	Not specified in study.	No significant difference was found between the UC and MP groups ADLs (p=0.99). A statistically significant difference of 10.0 points was found between Life Space Assessment of UC and MP groups 1-month post-hospitalization (p=0.02).

Author, year, study design; sample size; location	Purpose	Mode	Dosage	Timing	Physical Therapy-Related Outcome(s) & Results
2. Cook et al. (2008). Retrospective observational. Intervention *n*=75; Control *n*=75. Durham, NC, USA	To compare outcomes (complications, hospital disposition, length of stay, and inflation-adjusted costs) in those who received physical-therapist-administered manual therapy (mobilization and manipulation) for low back pain to those that did not receive manual therapy.	Manual therapy consisting of manipulation and/or mobilization.	Not specified in study.	Not specified in study.	Those who received manual therapy by a PT showed no statistically significant difference in CNS complications (p=0.21) or non-routine discharge (p=0.37) than those who did not receive manual therapy by a PT. (No record of nervous system complications, radiculitis, myelopathy, or cauda equina for either group. The only CNS complication found in both groups was sciatica.) Those that received manual therapy by a PT had significantly longer LOS (P < 0.01) and significantly lower costs of care after regression modeling and adjustments for covariates were made (P < 0.01).

Author, year, study design; sample size; location	Purpose	Mode	Dosage	Timing	Physical Therapy-Related Outcome(s) & Results
3. Koval et al. (2004). Prospective cohort study. Intervention *n*=747. Control *n*=318. New York, NY, USA.	To compare hospital length of stay, discharge disposition (home or skilled nursing facility), in hospital mortality, 6-month and 1-year mortality and ambulatory abilities prior to and following the implementation of a clinical pathway for patients with hip fractures who underwent a surgical procedure.	Ambulation training progression: distance; stair training; weaning from walker to forearm crutches Progressive strength training: supine, sitting, or standing; from active-assisted, to active, then resisted; reps increased Balance training if needed Deep breathing exercises with incentive spirometer	Not specified in study.	Postoperatively day 1. Postoperatively day 2. Post operatively day 3. To discharge	The intervention group demonstrated a significant decrease in acute LOS (21.6 vs 13.7 days, $p < 0.001$), decreased in hospital mortality (5.3% versus 1.5%), and 1-year mortality (14.1% versus 8.8%). There were no differences in the rate of revision hip surgery, discharge status, or recovery of ambulatory ability between the two groups of patients.

Author, year, study design; sample size; location	Purpose	Mode	Dosage	Timing	Physical Therapy-Related Outcome(s) & Results
4. Marzen-Groller et al. (2008). Before-after comparative study. Intervention, *n*=14. Control, *n*=30. Allentown, PA, USA	To compare length of stay and patients' functional independence after lower extremity amputation between patients who did and did not get the Amputee Mobility Protocol (AMP)	Amputee Mobility Protocol: PT instruct patient in general bed exercise (quad sets, glut sets, internal/external rotation of the hip). Pt is progressed with instruction on transfers and OOB activity. Pt then progresses to ambulation as tolerated QD, then progresses to BID, then TID over course of stay. Use of compression garment over amputated LE for edema management throughout.	Starting from no more than 2hrs BID OOB and progressing to ambulation TID.	Pre-operatively and post-operatively starting on day 0 and continuing through post-op day 3, up to discharge.	Those in the post-AMP group demonstrated a significantly longer LOS compared to the patients in the pre-AMP group. For the patients in the post-AMP group, the average LOS was 18.3 days, and for those in the pre-AMP group, 15.3 days was the average LOS. The modified FIM scores increased in both the stand to pivot and sit to stand categories for all those in the post-AMP group. The BKA and TMA groups both increased by 1 level in stand to pivot modified FIM category and 2 levels in the sit to stand modified FIM category compared to pre-AMP group. Those in the post-AMP TMA group demonstrated a significant increase in the modified FIM ambulation category (102 ft) compared to the patients in the pre-AMP TMA group (25 ft). (No p-value findings or other statistical analysis regarding significance for any outcome was discussed in this paper.)

APPENDIX B: FIGURE 1 – PROCESS OF REVIEWED ARTICLE SELECTION



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