CLINICAL PATHWAYS: EFFECT ON INTERPROFESSIONAL COLLABORATION IN A HOSPITAL SETTING

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In Partial Fulfillment of the Requirements For the Degree of Master of Science In the College of Pharmacy and Nutrition
Division of Pharmacy
University of Saskatchewan
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By

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ABSTRACT

Background

Effective collaboration between healthcare professionals helps to offer continuous and high-quality care to the patients. With interprofessional teamwork, healthcare professionals from multiple professions, specialties, knowledge and skillsets come together for a common goal.

There are many interventions available for the improvement of teamwork in healthcare. This review explores the role of clinical pathways (CPW) in teamwork within a hospital setting. Clinical Pathways are quality management tools, useful in translating recommendations from clinical practice guidelines into improved care processes. The subgroup analysis in this review is guided by the systematic review conducted by Rotter et al. (2010).

Objectives

To investigate the effect of clinical pathways (CPWs) on interprofessional collaboration in hospital settings compared to usual care.

Search methods

For this review, we utilized the studies identified in the 2010 review by Rotter et al. and 2017 update from the following databases from 2008 up to 2017: Cochrane Central Register of Controlled Trials (CENTRAL) and bibliographic databases including MEDLINE, Embase, CINAHL, Amed, PsycINFO, HMIC, Cochrane-HTA, ClinicalTrials.gov, WHO ICTRP, Cochrane-NHS EED and Global Health. We also searched the reference lists of relevant articles.

Selection criteria

We included randomized trials, non-randomized trials, interrupted time series studies, and controlled before-after. The subgroup analysis in this review will only include those studies that reported outcomes related to teamwork and interprofessional collaboration in a hospital setting.

Data collection and analysis

Two review authors independently screened all titles, abstracts and full-text manuscripts to assess eligibility and methodological quality. Studies were grouped and assessed based on
whether comparing clinical pathways with usual care or comparing clinical pathways as part of a multifaceted intervention with usual care.

Results

Out of the 39 studies utilized from the overarching systematic review by Rotter et al. (2010), six studies met the inclusion criteria. The search also yielded studies with low quality (high risk of bias), or where teamwork related outcomes were poorly reported. A meta-analytic comparison was not useful and limited our ability to identify mechanisms that could explain how CPW enhance teamwork.

Conclusion

The poor reporting of teamwork related outcomes in the studies was a challenge in this review. The reviewed studies also lacked critical information on the potential mechanism by which CPW affect teamwork. Despite this limitation, we were able to identify team relevant information. Studies revealed CPWs might be useful in improving documentation. Documentation and clear communication are facilitators in interprofessional conflict management, decision-making skills, adherence to the CPW, and teams support for innovation.
ACKNOWLEDGEMENTS

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<th>Description</th>
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<tbody>
<tr>
<td>ATHCT</td>
<td>Attitude towards healthcare teams</td>
</tr>
<tr>
<td>AMED</td>
<td>Allied and complementary medicine</td>
</tr>
<tr>
<td>CPWs</td>
<td>Clinical pathways</td>
</tr>
<tr>
<td>CPG</td>
<td>Clinical practice guidelines</td>
</tr>
<tr>
<td>CMA</td>
<td>Canadian medical association</td>
</tr>
<tr>
<td>CIHC</td>
<td>Canadian interprofessional health collaborative</td>
</tr>
<tr>
<td>CBA</td>
<td>Controlled before and after studies</td>
</tr>
<tr>
<td>CENTRAL</td>
<td>Cochrane central register of controlled trials</td>
</tr>
<tr>
<td>DARE</td>
<td>Database of abstracts of reviews of effectiveness</td>
</tr>
<tr>
<td>EBP</td>
<td>Evidence based practice</td>
</tr>
<tr>
<td>EPOC</td>
<td>Effective practice and organization of care</td>
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<tr>
<td>HMIC</td>
<td>Health management information consortium</td>
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<tr>
<td>IPC</td>
<td>Interprofessional collaboration</td>
</tr>
<tr>
<td>IGRT</td>
<td>Image guided radio therapy</td>
</tr>
<tr>
<td>ITS</td>
<td>Interrupted time series</td>
</tr>
<tr>
<td>ICRTP</td>
<td>International clinical trials registry platform</td>
</tr>
<tr>
<td>LOS</td>
<td>Length of stay</td>
</tr>
<tr>
<td>NHSEED</td>
<td>NHS economic evaluation database</td>
</tr>
<tr>
<td>RCT</td>
<td>Randomized control trials</td>
</tr>
<tr>
<td>NRCT</td>
<td>Nonrandomized controlled trials</td>
</tr>
<tr>
<td>WHO</td>
<td>World health organization</td>
</tr>
<tr>
<td>KS</td>
<td>Knowledge synthesis</td>
</tr>
<tr>
<td>TCI</td>
<td>Team climate inventory</td>
</tr>
<tr>
<td>CSCD</td>
<td>Collaboration and satisfaction about care decisions</td>
</tr>
<tr>
<td>MHPT</td>
<td>Mayo high performance teamwork scale</td>
</tr>
<tr>
<td>SAFAR</td>
<td>Strategic alliance formative assessment rubric</td>
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</table>
CHAPTER 1 - INTRODUCTION

1.1 Background and Rationale

“Teamwork and interdisciplinary collaboration is expected from health care providers either working in primary health care organizations or participating in networks of providers” (1). This recommendation by Romanow in 2002 highlighted the importance of moving away from the silo approach often seen in healthcare systems and working towards multidisciplinary and interdisciplinary approaches (2). Effective collaboration between healthcare professionals supports the delivery of continuous and high quality care to the patients (3). It is important to increase collaboration among health professionals to improve comprehensiveness, continuity and create an efficient healthcare system (4). However, effective teamwork in healthcare is complicated by the complexity of practice settings, diversity of skills, individuals, and management structures (5).

Clinical pathways (CPWs) are quality management tools, useful in translating recommendations from clinical practice guidelines into improved care processes. They support healthcare teams by suggesting evidence-based practices that can improve patient outcomes in a cost-effective manner (6, 7). CPWs can be effective tools to improve interprofessional collaboration (IPC), thereby maximizing the quality and efficiency of clinical services (4, 8).

Several studies have been conducted to determine if CPWs lead to better teamwork (7). A recent systematic review concluded that CPWs have the potential to support interprofessional teams; however, there are multiple behavioral and organizational components that influence the integration of care pathways into everyday practice. The authors indicated that any team-based approach has to be defined clearly to motivate better teamwork and team performance (7).
However, this systematic review was based on a number of studies of poor methologic quality (high risk of bias) and highly variable health care settings. To our knowledge, a systematic review examining the effect of clinical pathways on interprofessional collaboration specifically in hospital settings has never been conducted.

This Master’s thesis is part of a larger, rigorously conducted Cochrane systematic review on the effects of CPWs in hospitals carried out by the Health Quality Improvement research group at the University of Saskatchewan (8). The thesis aims to catalogue the available literature pertaining to the effectiveness of clinical pathways on teamwork and/or interprofessional collaboration.

1.2 Review objectives

The primary objectives of the thesis are to:

1. Describe the overall effects of CPWs on interprofessional collaboration
2. Summarize included studies narratively and according to methodological quality, country of origin, year of publication, and clinical context.
3. Apply statistical meta-analysis to included studies if supported by adequate quality and homogeneity.
CHAPTER 2 - LITERATURE REVIEW

2.1 The effects of clinical pathways on interprofessional collaboration; the need for an evolved healthcare system

2.1.1 Clinical pathways as important quality improvement tools in hospitals

Clinical Practice Guidelines (CPG) are recommendations based on scientific evidence, with a purpose to assist healthcare professionals in selecting the most suitable treatment option for a specific clinical condition (9). Unfortunately, the translation of research findings into hospital practice has been considerably slow and infrequent (10). As a result, some patients are deprived of proven effective treatments, as the time it takes for research to reach the patient bedside can be considerably long. One method of improving uptake of clinical practice guidelines is the use of clinical pathways (CPWs) (11).

Many terms have been in use to describe CPWs such as “care pathways”, “care maps”, “integrated care pathways”, and “critical pathways” (12). CPWs aim to link evidence-based recommendations to clinical practice and are implemented for specific health conditions in specific patient groups who meet the pre-specified criteria (13, 14). Further, they help in translating clinical guidelines into local practice by providing detailed structure, system and timeframes to address generic recommendations (8, 15). They are frequently used to maximize patient safety by specifying specific treatments and improving patient-provider and provider-provider communication (15-17).

CPWs have been used in the Unites States since their origin in the 1980(13, 18) and studies reporting on CPWs are now commonly reported in Australia, Europe, USA and Canada. Published CPWs are often aimed at improving patient outcomes and the efficiency of the
organization (7, 8, 13). When successful, this is most often achieved through a reduction in complications and/or reduced cost of healthcare (13). In addition, CPW often demand education for patients and their families about the course of treatment (13).

The development, implementation, and maintenance of CPWs require substantial resources. Despite this, almost 80% of the hospitals in the USA use CPWs for some interventions. (8, 19) Studies have reported the use of clinical pathways for a broad range of interventions such as management of stroke, laparoscopic surgeries, and management of patients with fractured neck or femur, and closure of arterial septal defects (20-24). CPWs have the potential to facilitate a proactive care management approach and ensure timely care. Further, CPWs are thought to improve the likelihood of IPC. For example, CPWs pertaining to Image Guided Radio Therapy (IGRT) [Figure 2.1] have been associated with reduced length of stay (LOS), hospital admissions, improved quality of care and, improved interprofessional cooperation and satisfaction (8).

**How pathways might improve IPC and coordination?**

CPWs provide support in decision making, allowing for improved communication between interdisciplinary health professionals, patients, and caregivers (7). CPWs have also been reported to change professional behavior (25). CPWs may mediate effective collaboration through improved communication, coordination, and relations between team members. Collaboration through shared clinical decision-making is one potential advantage of CPWs in patient care (4). Rotter et al. (2011) also stated that CPWs can affect teamwork, which can enhance patient safety (26).
2.1.2 Interprofessional collaboration in health care

Recently, there has been a shift in the way care is provided when dealing with chronic conditions. Most patient care, including chronic care, is provided by individual health care practitioners, however, best practices suggest chronic care should instead be provided by healthcare teams (1, 28). Halstead et al describes a team as a group of two or more healthcare professionals with different disciplines, sharing a common value system and working towards a common goal of providing efficient patient care (29). At a very basic level, team-based care requires multiple individuals with specific skill sets, performing independent tasks but working towards a common goal (30).
The move towards care teams emerged due to the necessity of integrating knowledge from various healthcare disciplines to manage complex conditions (31). In fact, it has been suggested that interprofessional collaboration (IPC) is an essential component of delivering high quality patient care (32). IPC is a means of allowing the team members to work at their full potential and scope of practice and creates a synergy amongst the professionals (33). In addition, collaboration has been found to act as a mechanism for creating workplaces that support healthy work culture (28).

The interprofessional practice model is generally characterized by cooperative efforts in which health care professionals assume complementary roles, share in the planning of patient care, solve problems together, and suggest solutions in the best interest of the patient (34). Calduvell et al (2003) have highlighted similar themes, suggesting interprofessional collaboration is characterized by concepts such as shared ideas, knowledge, skills and decision making (35). This is contrasted with multidisciplinary work in which each group maintains their individual contribution (35).

The cooperative efforts associated with interprofessional practice are often referred to as collaborative practice. Collaborative practice is described as practice focused on providing a “patient centered” approach which enables continuous interaction between multidisciplinary professionals to achieve a common goal, explore issues, and provide solutions with optimal patient participation throughout the process (36). According to the World health Organization (WHO), collaborative practice is a result of “multiple health workers from different professional backgrounds providing comprehensive services by working with patients, family and communities to deliver high quality patient care”(37). Physicians, nurses, and other allied healthcare professionals working together in collaboration has been found to lead to increased
awareness of each other’s skill and knowledge, resulting in efficient decision making and increased levels of continuous quality improvement (38).

The concept of collaborative practice shows substantial overlap with collaborative care, the Canadian Medical Association (CMA) defines collaborative care as follows:

“Collaborative care entails physicians and other providers using complementary skills, knowledge and competencies and working together to provide care to a common group of patients based on trust, respect and an understanding of each other’s’ skills and knowledge. This involves a mutually agreed upon division of roles and responsibilities that may vary according to the nature of the practice personalities and skill sets of the individuals. The relationship must be beneficial to the patient, the physician and other providers.”

In addition to the concepts of healthcare teams, multidisciplinary teams, interprofessional practice, collaborative practice and collaborative care, various other terms are often used in the literature. These include interprofessional, multiprofessional, interdisciplinary and multidisciplinary and depict various groups of professionals involved in a team and the processes associated with those teams (39).

*Multidisciplinary* is used in reference to professionals from different specialties working on a common project while maintaining independence or working in parallel with the project (40). *Transdisciplinary* teams are characterized by an exchange of skills, knowledge and expertise transcending the boundaries of traditional disciplines (40).

*Interprofessional Collaboration* involves the association of different professional groups to create a positive impact on healthcare(41). Interprofessional collaboration in healthcare, consist of clinicians and support staff who deliver healthcare services to a well-defined group of patients. In this way, clinicians and support staff act as consultant firms that emerge when a patient with specific care needs is admitted to the hospital (42). Expertise and contribution of
professionals is highly valued in IPC (41). Interprofessional collaboration represents the delivery of comprehensive health services to patients by multiple and interdepartmental care givers, who work in collaboration to deliver quality care (43). Interprofessional collaboration has been linked to many innovations in health care (34) and has been demonstrated to improve efficiency (41).

The WHO indicated in 2010 that health care professionals need to work in an interprofessional manner, suggesting that IPC is a means of allowing the team members to work at their full potential and scope of practice and create synergy between them (33). This sentiment is mirrored by the National Interprofessional competency framework (CIHC Feb, 2010) that states that healthcare practitioners must have an overall understanding of their role as well as those of the other practitioners in the team (44). The interprofessional team members are expected to collaborate effectively to formulate, implement and evaluate the care process by reflecting on the effectiveness of the processes used (44, 45).

More frequent use of IPC in healthcare settings is likely to improve outcomes. An analysis of malpractice claims on incidents in emergency department, for example, describes most of the incidents to be preventable if there was an existing culture of team work in place (46). Despite growing awareness about the benefits of IPC, the majority of healthcare organizations have not yet adopted this approach (46). In response, Grumbach and Bodenheimer have proposed five key characteristics of cohesive teams in healthcare. These include effective communication, clearly outlined goals, measurable outcomes, equal division of labor, and training of team members and support systems (47).
2.1.3 Barriers and facilitators of effective team work

Substantial research has been conducted on barriers and facilitators of successful interprofessional collaboration. Work from the United Kingdom (UK) published by Atwal et al suggest the following barriers to teamwork (17): communication gaps within and between professionals of different specialties and disciplines; confusion and uncertain ideas about the role and role overlap (role clarity); differences in the work ethics and ideologies amongst healthcare professionals in the team; and inequality in power dynamics across the team of healthcare professionals.

Interestingly, these findings mirror those of Grumbach and Bodenheimer (47), suggesting the absence of these facilitators can be seen as barriers. Poor communication alone is thought to be a major factor in seventy percent of medical error reported in healthcare (48). The Canadian interprofessional competency framework outlines four criteria that are required for successful IPC implementation (44)[Fig 2.2]. These include role clarification, team functioning, evaluation of the care process, and conflict resolution.

The first criterion requires that healthcare practitioners have an overall understanding of their role as well as those of the other practitioners in the team(44). This is generally referred to as role clarification. This allows practitioners to address individuals who have the requisite knowledge and skills required to meet patient needs and contributes to the equal distribution of workload and appropriate use of practitioners involved in the treatment (36, 44, 49). The ability to clearly identify ones’ own professional role whilst understanding roles and responsibility of others in the team relative to own work, is regarded as a core competency for effective collaboration (50, 51).
The second criterion necessitates an understanding of the dynamics of a team and can be referred to as team functioning. This requires facilitating decisions effectively, leading with respect, treating every member of the team equally. Further, members need to establish a healthy working atmosphere by fostering relationships within the team.

Third, interprofessional team members must formulate, implement and evaluate the care process. Teamwork itself does not predict success. Thus, team members must routinely examine the effectiveness of the processes used in order to maximize the impact of the care provided (44, 45).

Fourth, a process for conflict resolution is an essential factor in a high functioning team. Conflict resolution should be guided by the principles of ethics, confidentiality and equal allocation of resources. Also, all stakeholders should be effectively engaged in the patient care process (40).

Effective communication may be the cornerstone underlying each of the four criteria for building effective collaboration (31, 52). Effective communication is characterized by respect for other team members’ opinions as well as honesty in all communication (33, 53). Effective communication has been found to enhance interprofessional relations which leads to effective patient care and other activities related to work (50). Further, effective communication has been found to help in the development of sustainable relations between members of the team (33). Achieving all of these goals brings the team towards the true goal of IPC, “patient centered care”.
2.2 Overview of the methodology: Cochrane reviews and Systematic reviews.

Innovation in healthcare is often driven by the aim of optimizing patient safety and providing quality healthcare (36, 54, 55). The call for health quality improvement has stimulated researchers and managers to strive for innovation by developing new ideas for improving patient safety (54, 56). Many individual studies that have investigated the association of IPC and their effect on changes in patient outcomes; however, looking at studies in isolation can be both biased and misleading, especially if the methodology lacks rigor.

Systematic reviews are considered a means to develop evidence-based recommendations that can lead to evidence based practice (EBP). Evidence based practice represents the integration of the best available evidence within a clinical practice environment. Figure 2.3 shows that ‘systematic review and meta analyses’ are the ‘gold standard’ methodologies in evidence based research. Therefore systematic reviews are used extensively by healthcare professionals around the globe to answer questions related to healthcare (57, 58).
The Cochrane collaboration was established to provide healthcare professionals with up-to-date summaries of the available evidence on the effectiveness of tested healthcare interventions. Cochrane reviews report on all desired and undesired outcomes reported by the investigator and are published in the Cochrane library (60). There is currently an overwhelming amount of literature being published. Hence there is a need for healthcare professionals and policy makers to find reliable summaries of evidence about new therapies and interventions in the Cochrane library.

This gap in the availability of literature summarizing the effects of multiple studies was addressed by Archie Cochrane – a British epidemiologist in 1979 in his quote “It is surely a great criticism of our profession that we have not organized a critical summary, by specialty or subspecialty, adapted periodically, of all relevant randomized controlled trials” (60, 61).
The United Kingdom’s National Health services Research and Development Program directed funds towards the development of the Cochrane Center. This center was established with the vision of collaborating with researchers in the UK. The “Cochrane Collaboration” was founded in 1993 in collaboration with 11 countries as an international not for profit organization (60).

The Cochrane collaboration was created to help people make informed decisions regarding the effectiveness of health care interventions by preparing and maintaining a database of systematic reviews (Cochrane library). Since its inauguration, the Cochrane collaboration has expanded to 15 centers around the world, which support 49 review groups.

Knowledge translation (KT) activities are meant to promote continuous learning and this is only possible through a comprehensive synthesis of total available evidence. Systematic reviews are a means to achieve this, however the quality of reporting is problematic and it can be misleading to base clinical decisions on outdated reviews. The Cochrane collaboration by virtue of its clear guidelines and references for conducting a systematic review, have made it possible for researchers to access more than 2500 quality systematic reviews for KT (62).

The Cochrane Effective Practice and Organization of Care (EPOC) group was established to carry out systematic reviews of interventions aimed at improving health care delivery and systems (63). Cochrane reviews tend to focus on randomized control trials (RCT) as these studies generally have a reduced risk of bias. However, they may also consider evidence from other sources; the EPOC group recommends using interrupted time series (ITS) and quasi-experimental studies as described in table 2.1.
### Table 2.1. Characteristics of Cochrane EPOC study designs

<table>
<thead>
<tr>
<th>Study Type</th>
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<tr>
<td>Randomized Control Trials (RCT)</td>
<td>The individuals are randomly allocated to experimental and control group. This helps in equal distribution of patient characteristic and comparability of results. The exposure to the intervention is the only distinguishing factor between both the groups.</td>
</tr>
<tr>
<td>Non Randomized Controlled Trials (NRCT)</td>
<td>Experimental trials where patients or cluster are allocated to experimental and control groups using quasi random allocation techniques. (E.g. allocation by birthdate etc.)</td>
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<tr>
<td>Controlled Before and After Studies (CBA's)</td>
<td>In CBA studies two or more control groups are compared with experimental groups and the allocation to the intervention is not random. Data is collected before and after the implementation if the intervention in the both the group that receives the intervention and the group that does not. The reliability of the intervention differences is questionable owing to unidentified differences between the intervention and control group.</td>
</tr>
<tr>
<td>Interrupted time series (ITS) Study</td>
<td>The Interrupted time series study design is effective in observing the effect of an intervention as a trend over time. A minimum of three observational data points are collected before and after implementation of the intervention and the effect of the intervention is measured against the pre-intervention period.</td>
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2.3 Systematic Reviews and why are they needed?

It is highly improbable to expect healthcare professionals, researchers and policy makers to search for reliable evidence-based information from original research that is being published every month (64). More than two million articles are published in over 20 thousand journals of
biomedical importance. Thus, a health care provider would need to read in excess of 5000 articles even if they restrict their reading to relevant journals (65, 66). A systematic review is a “scientific tool which can be used to summarize, appraise, and communicate the results and implications of otherwise unmanageable quantities of research” (67).

There are two main practical reasons for the importance of systematic reviews; first, the limitations of the traditional review and, second, the added power brought by synthesizing the results of a number of smaller studies. A “traditional” or “narrative” review may be no more than a subjective assessment by an expert using a select group of materials to support their conclusion. In contrast, the systematic review attempts to follow a predefined and rigorous methodology in the identification and evaluation of materials, and to be objective in its interpretation and reproducible in its conclusions. Smaller studies, such as individual randomized controlled trials (RCTs), may have a rigorous study design but lack statistical power to demonstrate a statistically significant effect. Systematic reviews work to bring together a number of these separately conducted studies, sometimes with conflicting findings, and synthesize their results. In this way it can be used for the evaluation of both existing and new interventions. A systematic review is often called an “overview”.

In contrast to systematic reviews, narrative literature reviews are aimed at describing and discussing the theoretical context of a specific topic. They are important for continuing education, as they are generally meant to bring readers abreast with current research and developments about the given topic. Narrative reviews lack a rigorous approach or methodology used for generating data and typically do not answer questions using quantitative methodology (57).
2.3.1 Steps Involved in Conducting a Systematic Review

The Cochrane Handbook of Systematic Review of Interventions details a methodological approach to conduct systematic reviews (63). The steps recommended by Cochrane are:

1) **Well framed Research Question**: A Systematic review has to start with a well-defined research question that clearly describes the patient/illness and intervention to determine which articles will be included in the review. The focus of the question is very important, as a very narrow question leads to identification of very few studies and limits the generalizability to other populations (58, 63). The population; intervention; comparison; and outcome (PICO), criteria is normally used to determine a well framed research question.

2) **Building an Effective Search Strategy and Literature search**: Using several search databases such as CINHAL, Embase, MEDLINE, Cochrane Controlled Trial Database, PubMed and other sources of information (e.g. Conference proceedings, articles not indexed in major databases, and grey literature). The goal of an exhaustive literature search is to identify articles that are potentially relevant to be included in the review (63, 68).

3) **Data Extraction**: A standardized form is constructed (paper or electronic) to extract information and offers the advantage of doing a simultaneous data entry and retrieval. A pilot extraction is carried out on a few studies and then incorporated for the entire review. Data extraction is normally performed by two reviewers and any disagreement is reconciled by an arbitrator (63).

4) **Data Analysis and Results**: The data analysis includes quantitative evaluation of the information extracted from the included studies. Review of the information is crucial
to determine homogeneity between the studies to pool the information together for a meta-analysis. Often heterogeneity between the studies exists due to differing populations, interventions and assessment of outcomes. This makes it difficult to carry out a meta-analysis. The interpretation of the results is meant to understand and conclude based on the best available evidence to aid decision making. The intent is also to rigorously investigate and inform professionals about area which lack focus and need to be thoroughly investigated for future research purposes (58).

2.3.2 Meta-Analysis

Systematic reviews often include meta-analyses to estimate a pooled treatment effect from the studies under review. Meta-analyses generate precise estimates of the effect, increase generalizability in the findings and decrease the chances of false positive and false negative results. Meta-analyses can also help researchers detect heterogeneous results between studies of the same treatment, allowing subgroup analyses to be carried out to determine the cause of these differences (68, 69). Aggregating and analyzing information in a meta-analysis leads to higher statistical power and robust point estimate.

The analytic approach to meta-analysis can be modified depending on the studies under review(63, 69, 70) The fixed effect model relies on the assumption that there is a “true effect size” in all the included studies, and that any differences observed in the study are as a result of sampling error. The random effects model works under the assumption that “true effect” differs between the included studies, the purpose of this model is estimating the mean distribution of effects. The confidence interval is wider in a random effects model as compared to a fixed effect model and the estimate of effect size is different under the two models. Moreover under the
random effects model larger studies are seen to loose influence with the smaller studies being more influential as compared to a fixed effects model (71). The fixed effect model is generally implausible in the majority of systematic reviews, because when a decision is made to analyze a group of studies using meta-analysis, it is rarely assumed that the true effect size of all the studies included in the analysis is exactly the same (69, 71).

2.4 Published Systematic Review on Clinical Pathways: 2010 - Cochrane systematic review of Clinical pathways (CPWs) In Hospitals: Rotter et al.

Although there is ample evidence available on how to manage health conditions with improved patient outcomes at lower costs, a significant proportion of patients do not receive evidence-based care. This problem is known as evidence-practice gap (72). The development and implementation of CPWs in health care aims to narrow down this evidence practice gap. Understanding the reason behind the success or failure of CPWs is very important before additional resources are consumed in developing and implementing CPWs (8). Rotter and colleagues carried out a systematic review in 2010 “Clinical pathways: Effect on professional practice, patient outcomes, length of stay and hospital costs”, to analyze the effects on CPWs on professional practice, length of stay and hospital costs (8).

The systematic review followed the validated Cochrane Effective Practice and Organization of Care (EPOC) methodology for complex interventions (68) and included randomized controlled trials, nonrandomized controlled trials, controlled before and after, and interrupted time series study designs.
Development and refinement of an operational definition for CPWs

In 2010, Rotter and team of Cochrane review authors developed an operational definition for CPWs in hospitals. They followed the four-stage process methodology, (14) which required identification of articles exploring the scope and definition of CPWs (or similar terms) and synthesizing previously suggested components, drafting criteria for testing, applying the criteria to identified studies to review the agreement between the review authors, and modifying the criteria to maximize the agreement between the authors (14). The criteria were rigorously tested and after 100% agreement among the review members, a practical operational definition for CPWs was developed. As per the definition CPWs:

1) The intervention was a structured multidisciplinary plan of care;
2) The intervention was used to channel the translation of guidelines or evidence into local structures;
3) The intervention detailed the steps in a course of treatment or care in a plan, pathway, algorithm, guideline, protocol or other ‘inventory of actions’;
4) The intervention had timeframes or criteria-based progression (that is, steps were taken if designated criteria were met);
5) The intervention aimed to standardize care for a specific clinical problem, procedure or episode of healthcare in a specific population”(14)

An intervention was considered to be a CPW if it met the first criteria together with three out of four other criteria. The operational definition supported the identification of relevant full text studies that were eventually used in finalizing the first systematic review on CPWs in hospital care in 2010 (14).
Types of Outcome measures

Objectively measured patient outcomes, professional practice, length of stay, and hospital costs. Patient outcomes include in-patient mortality, hospital readmissions, in-hospital complications, and discharge destination. Professional practice outcomes included quality measures appropriate to the specific aim of the CPW, staff satisfaction and adherence to evidence based practice (for example, time to mobilization post-surgery or effects on quantity and quality of documentation) (8).

Main Results

The main results stated that clinical pathways were associated with reduction in-hospital complications and improvement documentation. Majority of the studies reported that implementation of clinical pathways may have the potential to decrease length of stay and inpatient hospital costs. Statistical pooling of results for length of stay and hospital costs was not conducted due to high contextual variation in the settings and study designs. Generally poor reporting limited the identification of characteristics common amongst successful clinical pathways. Despite limitations, the authors concluded that clinical pathways are associated with reduced in-hospital complications and improved documentation without a negative impact on the length of stay and hospital costs (8).

2.5 Summary

Various quality improvement strategies are used to organize and improve care processes. Clinical pathways (CPWs) are structured multidisciplinary care plans used to detail local structures and system to support the translation of clinical guidelines into local protocols (73).
CPWs bring together best evidence recommendations and clinical practice guidelines to the bedside, promote standardized treatment and enhance patient safety and efficacy in the healthcare system. Therefore, many healthcare systems globally implement CPWs as a quality improvement tool (74).

The complex and multifactorial nature of CPWs, facilitates tackling multiple dimensions of patient care. Due to their multidisciplinary nature, dynamics of teamwork and interprofessional collaboration are pivotal factors to be considered in the implementation of CPWs (74). There are individual studies and reviews analyzing the importance of IPC in a healthcare setting. The 2010 Cochrane systematic review by Rotter et al. reported a positive effect of CPWs on professional practice outcomes such as documentation (8) and the review by Deneceker et al states that CPWs do have the potential to foster IPC and enhance teamwork (75). Isolated references and previously reposted reviews lack high quality studies and rigor observing the effect of CPWs to support IPC especially in a hospital setting.

Despite the wealth of studies suggesting positive effects on various health and system-related outcomes, the evidence regarding the impact of CPW on teamwork and IPC in hospital settings has never been summarized using a systematic methodology. Therefore, the aim of this project is to assist in the update of the systematic review of CPW effectiveness in hospitals to specifically analyze a subgroup of studies examining the impact of CPW specifically on features of teamwork and inter-professional collaboration. We aim to gather an evidence base to fill the knowledge gap on reporting the effect of CPWs on IPC in hospital settings.
CHAPTER 3 - METHODS

3.1 Foundational work

An update of the Cochrane systematic review on CPWs in hospitals is currently being carried out as of 2017 by Rotter and colleagues. Following the Cochrane methodology (63), the update will include all studies identified from the 2010 Cochrane review as well as those identified in the search update, with the most recent searches conducted on March 1, 2017 (Please see results, results of the search, for more information on databases searched).

The research team working on the update created a revised operational definition comprised of a four criteria checklist. The revised operational definition requires that for an intervention to be considered a CPW it must meet each of the following four criteria (76) (13, 77):

- It is a structured multidisciplinary care plan;
- It is used to channel the translation of local guidelines or evidence in local structures;
- It details the steps in a course of treatment or care in a plan, pathway, algorithm, guideline, protocol or other ‘inventory of actions’ (i.e. the intervention had time frames or criteria based progression);
- It aims to standardize care for a specific clinical problem, procedure or episode of care in a specific population.

They followed the EPOC design and quality criteria for experimental studies as described in table 2.1. For the review update the team searched electronic databases using a search strategy developed by a Cochrane EPOC information specialist (MF). The search included the methodological inclusion criteria with select MeSH terms and text terms related to clinical
pathways or critical pathways. This search strategy was translated for a number of databases listed below using controlled vocabulary. The MEDLINE translation of the search strategy and databases searched is provided in Appendix 1. Details on the number of references identified; number of full text articles retrieved and number of both included and excluded articles is provided in Appendix 2. The methodological quality assessment and risk of bias analysis of all included studies of was conducted using the EPOC risk of bias tool and the studies were categorized as having low, moderate and high risk of bias provided in Appendix 4 (78).

The systematic review described in this thesis builds on the work carried out for the review update by conducting a comprehensive subgroup analysis to investigate changes in professional outcomes as a result of implementing CPW. This subgroup analysis will focus on understanding what are the potential effects of CPWs reported in the literature on teamwork and teamwork related indicators in a hospital setting?

3.2 Inclusion and exclusion criteria for the subgroup analysis

The subgroup analysis in this review will only include those studies that report on outcomes related to teamwork and interprofessional collaboration in hospital settings. Table 3 provides an overview of the inclusion and exclusion criteria.

Table 3.1 Summary of inclusion and exclusion criteria

<table>
<thead>
<tr>
<th>Study characteristic</th>
<th>Inclusion criteria</th>
<th>Exclusion criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of study</td>
<td>Randomized controlled trial (RCT), nonrandomized controlled trials, controlled before and after studies (CBAs), and interrupted time series (ITS)</td>
<td>Observational Studies (case-control, cohort, cross-sectional)</td>
</tr>
<tr>
<td>Participants</td>
<td>Studies comparing CPW interventions with usual care in the same setting</td>
<td>Studies which do not satisfy operational definition of CPWs</td>
</tr>
<tr>
<td>----------------------</td>
<td>------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Studies evaluating the effect of CPWs on teamwork</td>
<td>Studies which do not have evaluation of teamwork as one of their objectives</td>
</tr>
<tr>
<td>Health professionals</td>
<td>Non healthcare professionals and all other hospital staff who are not directly involved in the patient care process.</td>
<td></td>
</tr>
<tr>
<td>Hospitalized patients (inpatient and outpatient settings) with conditions managed on a CPW irrespective of diagnosis</td>
<td>Patients with conditions not managed on a CPW.</td>
<td></td>
</tr>
<tr>
<td>Interventions</td>
<td>Implementation of CPW guiding patient management for a specific condition</td>
<td>Interventions that do not satisfy operational definition of CPWs</td>
</tr>
<tr>
<td>Comparators</td>
<td>Treatment with usual care not involving CPWs</td>
<td>Treatment that does not require patients to be in admitted in the hospital.</td>
</tr>
<tr>
<td>Setting</td>
<td>Hospitals evaluating the impact of CPWs</td>
<td>Primary care</td>
</tr>
<tr>
<td>Outcome</td>
<td>Team work related outcomes</td>
<td>Studies which do not have teamwork as part of their objective and outcomes</td>
</tr>
</tbody>
</table>

3.3 Type of Participants for the subgroup analysis

This subgroup-analysis includes two types of participants:

1. Health professionals, including but not limited to physicians, nurses, physiotherapists, pharmacists, occupational therapists, social workers, dietitians, psychologists, psychiatrists, speech pathologists and dentists involved in CPW utilization in the hospital setting.

2. Hospitalized patients (inpatient settings) with conditions managed on CPW, irrespective of the diagnosis.
3.4 Outcome Measures: Indicators of Interprofessional Collaboration (IPC)

The Program Logic Model

The interim logic model aims to establish potential links between pathway implementation activities and subsequent teamwork related outcomes. The model is intended to depict the conceptual relationship and interplay between input, activities, and outcomes. The logic model describes which inputs might be needed to initiate and undertake implementation activities required to implement the pathway in a hospital setting. Also, it explains which outputs may be generated, subsequently resulting in a sequence of short- and long-term outcomes (i.e., teamwork outcomes).

Inputs

The key inputs for the model include funding, infrastructure – organizational resources, recruitment of healthcare professionals and key stakeholders, which entails collaboration with continuous quality improvement groups and human resources. The input section describes the required resources that are needed for the implementation and maintenance of CPWs.

Activities

The implementation activities essentially showcase how the process of developing and implementing CPWs in health care teams should work to generate desired team related outcomes. Activities include knowledge generation including but not limited to identifying the evidence practice gap, developing evidence-based content adapted for local use. Knowledge translation activities – conducting educational meetings and workshops to train and update the staff on the clinical pathway. The activities will also comprise of conducting conferences and meetings, distribution of audio and visual content regarding the clinical pathway, team meetings.
to understand and plan the activities of each personnel. The input and intervention section of the logic model describe and measure the effect of implementing clinical pathway in a hospital setting.

**Outputs**

Teamwork related outputs represent the link between implementation and impact by theorizing the potential behavioral changes that should occur during and after pathway implementation.

The output measures focus on explaining how the implementation of CPWs aim to create better teams. Improved teamwork manifest in increased efficiency and reduced medical errors. In addition, we understand the context in which CPWs will achieve its aim of improving teamwork and the factors that help facilitate this change.

**Outcomes**

The outcome section is focused on demonstrating the impact of clinical pathways on healthcare teams in the hospital and its contribution towards creating better health for the end users – the patients.

**Short-term outcomes**

The logic model intends to describe that effective policy, operational manuals and changes in practice due to the implementation activities, can help to improve the overall performance of the team. The short-term outcomes should reflect the direct impact of clinical pathways on team documentation, knowledge, collaboration, and increased efficiency of the team.
Long-term outcomes

Ultimately we aim to focus on interprofessional collaboration, by conducting workshops and sessions on effective teamwork to significantly improve the outcomes of the team. We envision that teams will be better equipped with the knowledge, skills and attitude required for effective collaboration. Clinical pathways will help to improve the decision-making ability of the team. The teams will be able to set goals by frequent team meetings and achieve them by virtue of teams support for innovation and attitude for change. Better work environment due to effective teamwork leads to higher levels of satisfaction and high work force retention. The overall effect of better teams leads to better health for the end users.

The arrows in the model represent the interplay that takes places between the sections. For example the outcomes of team work will impact on the context of hospitals and the quality of health delivered in a hospital setting. The arrows are intended to provide a fluidity of clinical pathway activities and the logic model.
Figure 3.1 depicts the logic model for effect of clinical pathways on teamwork in hospitals.

Source: A First Phase Evaluation of Saskatchewan’s Lean Health Care Transformation: Final report: Rotter and colleagues 2015(79); amended by the author.
In the literature, we identified a number of frequently reported indicators used to assess interprofessional collaboration. These measures were grouped into three major process indicators – team functioning, team performance and team development, which were further divided into teamwork measures as described in table 3.2. To increase objectivity, we initially focused on validated measurement scales such as the Team Climate Inventory (TCI) scale (3, 80), the Collaboration and Satisfaction about Care Decisions (CSCD) scale (81), the Mayo High Performance Teamwork (MHPT) scale (82), the Strategic Alliance Formative Assessment Rubric (SAFAR) (83) and McMaster Ottawa scale (84).

Table 3.2 Potential indicators of interprofessional collaboration

<table>
<thead>
<tr>
<th>Output / Process Indicators</th>
<th>Measures</th>
<th>Examples of Validated Scales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team Functioning</td>
<td>Staff Knowledge</td>
<td>Team Climate Inventory Scale(3, 80)</td>
</tr>
<tr>
<td></td>
<td>Team Support for innovation</td>
<td>Team Climate Inventory Scale(3, 80)</td>
</tr>
<tr>
<td></td>
<td>Decision making</td>
<td>Strategic Alliance Formative Assessment Rubric (SAFAR)(83)</td>
</tr>
<tr>
<td></td>
<td>Collaboration</td>
<td>McMaster Ottawa Scale(84) The Mayo High Performance Teamwork Scale(82)</td>
</tr>
<tr>
<td>Team Performance</td>
<td>Team Conflicts</td>
<td>McMaster-Ottawa Scale(84) The Mayo High Performance Teamwork Scale(82)</td>
</tr>
<tr>
<td></td>
<td>Documentation</td>
<td>The Team Climate Inventory Scale(3, 80)</td>
</tr>
<tr>
<td>Team Development</td>
<td>Role clarity</td>
<td>Team Climate Inventory Scale(3, 80) McMaster-Ottawa Scale(84)</td>
</tr>
<tr>
<td></td>
<td>Team Communication</td>
<td>Strategic Alliance Formative Assessment Rubric (SAFAR)(83)</td>
</tr>
<tr>
<td></td>
<td>Team goals</td>
<td>Attitudes towards Healthcare Teams (ATHCT)(85)</td>
</tr>
</tbody>
</table>
However, after full text assessment of the studies included in the review update, it became apparent that quantitative data and information on teamwork are poorly reported in the literature. We therefore decided to conduct a narrative synthesis and focused on extracting relevant information (e.g., quotes from the full text studies) which could explain how CPWs might generate desired effects on interprofessional collaboration.

Although the subgroup analysis aims to include only the potential impact of CPWs reported on teamwork and team relevant outcome indicators, we decided to include all relevant outcomes reported in the primary studies if those outcomes might help to explain potential relationships between effects of the intervention and effective teamwork, or team relevant outcomes (e.g., number of problematic symptoms identified and quality of documentation), or system-level outcomes (e.g., compliance with guidelines or patient satisfaction). These patient, professional, and system-level outcomes are described in detail in the overarching systematic review by Rotter et al (86). The idea behind the additional inclusion of patient, professional, and system level outcomes is to identify and establish any potential links between effective teamwork due to CPWs and improved patient outcomes.

3.5 Data Collection and Data Analysis

3.5.1 Screening

In this sub-group analysis, we searched for relevant studies using the excel database conducted for the update Cochrane systematic review with the most recent update search conducted on March, 1, 2017. We used a two-level screening process to identify potentially relevant studies in the Cochrane database.
Level I Screening the title, aims and objectives of the studies

We extracted the aim of the studies to identify those studies that included process indicators of teamwork and interprofessional collaboration.

Level II Screen for teamwork related indicators or outcomes

We screened the methods and result sections of the studies identified in level I screening to find any teamwork related information reported as a result of the pathways implementation.

3.5.2 Data Management

Details on the number of references identified; number of full text articles retrieved and number of both included and excluded articles were recorded. This dataset was managed using Microsoft Excel.

3.5.3 Pilot Data Extraction

Initially, two review authors (AK and LA) conducted a pilot using 5 papers chosen randomly to assess the extraction process. We resolved any disagreements on data extraction to a third review author (TR). At this point there was 100% agreement between the authors on the extracted data. All data for both pilot extraction and complete extraction was taken directly from the articles using standardized extraction sheets. The data extraction sheets are provided in Appendix 3.

3.5.4 Data Extraction

After conducting pilot data extraction it was clear that there was insufficient data reported to allow for synthesis of team work outcomes through a statistical meta-analysis. We therefore extracted quotes from the primary publication on teamwork indicators from the studies that met
the inclusion criteria (see table 3.1). We decided to adopt a textual narrative approach using a number of tools to extract and synthesize the evidence that included evidence tables and narratives synthesis (75, 87). The following data were used for subgroup analysis:

- **Study characteristics**: Publication year, country, urban vs. rural location, inclusion criteria
- **Population characteristics (Professional)**: types of healthcare professionals involved, number of healthcare professionals involved in development, healthcare setting
- **Intervention characteristics**: Clinical pathways
- **Outcomes**: teamwork related information

### 3.5.5 Assessment of implementation strategies to develop and implement CPW

The impact of any CPW is highly dependent on how successfully it was implemented into the healthcare setting. Rotter and colleagues suggested a score of either “high, moderate or low” reflecting the quality of the implementation approach in a given clinical setting. Therefore, we assigned an implementation score to each study identified using the scale suggested by Rotter and colleagues in their overarching systematic review. Thus, an independent assessment of potentially relevant studies included in this review was conducted to identify potential links between desired outcomes, implementation strategies, and teamwork.
CHAPTER 4 - RESULTS

4.1 Results of the search

Application of the inclusion criteria for the original systematic review examining the impact of CPWs on patient outcomes (table 2.1) yielded 38 articles (24 from the 2010 Cochrane review (8) and 11 form the review update) presented in the PRISMA flow chart in figure 4.1. The Master’s student (AK) participated as a reviewer for the screening of title and abstracts for this original study. We then applied the inclusion criteria for the current study (i.e., impact of CPW on teamwork) to identify eligible papers for data extraction. After a full text review of all 38 articles, none of the validated scales assessing teamwork or interprofessional collaboration were found (table 3.2). Moreover, teamwork-related outcomes were poorly reported in the included studies.

4.1.1 Modification of the inclusion criteria

Given the potentially critical role of teamwork and interprofessional collaboration as mediators between CPW and improved patient outcomes, the inclusion criteria were broadened to identify articles from the 38 studies that contained any type of comment or observation about teamwork in the results or discussion sections (Table 4.1). The 38 studies represented the highest quality papers identified through a rigorous and systematic search strategy; thus, they still represented an important source of information pertaining to our research objectives. As a result of this modification, we decided to qualitatively describe the experiences and interpretations reported about the effects of CPWs on healthcare teams.
Figure 4.1 PRISMA Flow chart

Records identified through database searching (n = 38)

Records screened (n = 38)  
Records excluded (n = 30)

Full-text articles assessed for eligibility (n = 8)  
Full-text articles excluded, with reasons (n = 2)

Studies included in qualitative synthesis (n = 6)
Table 4.1 Modified inclusion criteria for studies examining the impact of clinical pathways on teamwork-related outcomes.

<table>
<thead>
<tr>
<th>Study characteristic</th>
<th>Inclusion criteria</th>
<th>Exclusion criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of study</strong></td>
<td>Randomized controlled trial (RCT), nonrandomized controlled trials, controlled before and after studies (CBAs), and interrupted time series (ITS)</td>
<td>Observational Studies (case-control, cohort, cross-sectional)</td>
</tr>
<tr>
<td></td>
<td>Studies comparing CPW interventions with usual care in the same setting</td>
<td>Studies which do not satisfy operational definition of CPWs</td>
</tr>
<tr>
<td></td>
<td>Studies evaluating the effect of CPWs on teamwork</td>
<td>Studies which do not have evaluation of teamwork as one of their objectives</td>
</tr>
<tr>
<td><strong>Participants</strong></td>
<td>Health professionals</td>
<td>Non healthcare professionals and all other hospital staff who are not directly involved in the patient care process.</td>
</tr>
<tr>
<td></td>
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<tr>
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<td>Implementation of CPW guiding patient management for a specific condition</td>
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</tr>
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<td><strong>Comparators</strong></td>
<td>Treatment with usual care not involving CPWs</td>
<td>Treatment that does not require patients to be in admitted in the hospital.</td>
</tr>
<tr>
<td><strong>Setting</strong></td>
<td>Hospitals evaluating the impact of CPWs</td>
<td>Primary care</td>
</tr>
<tr>
<td><strong>Outcome</strong></td>
<td>Validated teamwork measures, inferences, comments OR observations about teamwork in the results or discussion section.</td>
<td>Studies that do not have any observations or comments about teamwork.</td>
</tr>
</tbody>
</table>

4.1.2 Characteristics of the included Studies

Based on the modified inclusion criteria, six articles were considered eligible for the review [Figure 3.2]. Out of the six included studies, two were RCT(88-90), three were CBA(91, 92) and one was ITS(93). Two studies were carried out in United States of America (USA), (88,
91) one in Norway, (93) one in Australia, (92) and one in United Kingdom (UK) (90). The CPW were designed for five different conditions across the seven studies: asthma, (92) stroke rehabilitation, (88, 89), palliative care for advanced diseases (91) and bipolar disorder (93). Two studies were conducted in an acute care ward (e.g., gynecology, medical, surgical), (92) one study was conducted in an intensive care unit (ICU) (93), and four studies were conducted in an extended care facility (88-91) (see table 4.2). The studies tested the CPW in one of two ways: 1) patients were managed with the use of a CPW compared to usual care, or 2) patients were managed with the use of a CPW and a multifaceted intervention compared to usual care (Table 4.3).

Table 4.2 Characteristics of included studies

<table>
<thead>
<tr>
<th>Study ID</th>
<th>CPW condition</th>
<th>Type of ward</th>
<th>Type of hospital</th>
<th>Sample size</th>
<th>Study type*</th>
<th>Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doherty 2006(77)</td>
<td>Asthma care</td>
<td>Hospital medical unit</td>
<td>Acute</td>
<td>187</td>
<td>CBA</td>
<td>Single CPW vs usual care</td>
</tr>
<tr>
<td>Falconer 1993(88)</td>
<td>Stroke rehabilitation</td>
<td>Stroke rehabilitation</td>
<td>Extended care</td>
<td>121</td>
<td>RCT</td>
<td>Single CPW vs usual care</td>
</tr>
<tr>
<td>Sulch 2000(89)</td>
<td>Stroke rehabilitation</td>
<td>Stroke rehabilitation</td>
<td>Extended care</td>
<td>152</td>
<td>RCT</td>
<td>Single CPW vs usual care</td>
</tr>
<tr>
<td>Sulch 2002(90)</td>
<td>Stroke rehabilitation</td>
<td>Stroke rehabilitation</td>
<td>Extended care</td>
<td>152</td>
<td>RCT</td>
<td>Single CPW vs usual care</td>
</tr>
<tr>
<td>Bookbinder 2005(91)</td>
<td>Palliative care for advanced disease</td>
<td>Oncology, geriatrics and inpatient palliative care</td>
<td>Extended care</td>
<td>267</td>
<td>CBA</td>
<td>Multifaceted intervention including CPW versus usual care</td>
</tr>
<tr>
<td>Study ID</td>
<td>Intervention</td>
<td>Intervention characteristics</td>
<td>Multidisciplinary teams</td>
<td>Guideline based intervention</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brattebo 2002(93)</td>
<td>Bipolar disorder Surgical intensive care unit (ICU) University hospital 285 ITS Multifaceted intervention including CPW versus usual care</td>
<td><em>CPA</em> - Control before and after studies, <em>RCT</em> – Randomized control trials, <em>NRCT</em> – Non-randomized control trials and <em>ITS</em> - Interrupted time series. Source: Rotter and colleagues 2010(8) - Adapted by the author</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bookbinder 2005(91)</td>
<td>Palliative Care for Advanced disease (PCAD) pathway</td>
<td>CPW intervention: consisting of three components 1) interdisciplinary care path 2) documentation flow sheets 3) physician order sheets with medical management guidelines and feedback forms. Auto referrals to social workers and chaplaincy, staff debriefing sessions, Nurses daily flow sheet used to keep track of daily assessments and interventions.</td>
<td>QI Team - The PCAD QI Team consisted of nurses, physicians, an ethicist, researchers, educators, a pharmacist, social workers, a dieticians, and chaplains</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brattebo 2002(93)</td>
<td>Sedation scoring system and one page protocol for sedation</td>
<td>The CPW was combined with posters and continuous feedback. Mainly aimed at doctors and nurses</td>
<td>Doctors and nurses</td>
<td>Catered to meet the needs of the local intensive care unit.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doherty 2006(77)</td>
<td>Short term asthma management plan (STAMP)</td>
<td>Guideline based intervention for acute asthma, characterized by a proactive asthma severity assessment and short term asthma management plan (STAMP)</td>
<td>A specific implementation team at each hospital was not possible due to staffing levels.</td>
<td>Intervention developed utilizing guidelines to suite local needs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Falconer 1993(88)</td>
<td>Pathway for stroke rehabilitation reported as “multidisciplinary and standardized stroke rehabilitation”</td>
<td>Pathway for stroke rehabilitation reported as “multidisciplinary and standardized stroke rehabilitation with predefined daily written goals” Team conferences were conducted on a daily basis to set team goals to discuss potential team outcomes. Daily re-evaluation of discharge plans using continuous feedback from team meetings.</td>
<td>No implementation team was identified</td>
<td>The CPW was developed using an evidence based approach</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A senior nurse experienced was in charge of implementing the intervention with well laid out long term and short-term goals, including training sessions to establish the importance of the pathway. Weekly meetings conducted to discuss the various aspects of the project and determine the patient’s progress. In the control group, patients were treated with traditional methods.

Multidisciplinary team consisting of a physician, nurses, physiotherapists, occupational therapists, speech therapists, and a social worker, all with expertise in stroke management.

The intervention was customized to meet local requirements.

Source: Rotter and colleagues 2010(8); Adapted by the author

<table>
<thead>
<tr>
<th>Sulch 2000 (89) and Sulch 2002(90)</th>
<th>The Integrated Care Pathway (ICP) for Stroke Rehabilitation</th>
<th>The intervention was customized to meet local requirements</th>
</tr>
</thead>
</table>

4.1.3 Assessment of implementation strategies used to develop and implement CPW

As described in the methods, we used implementation scores for each study which were assigned in the Cochrane review by Rotter and colleagues (76). Studies were assigned a score of either “high, moderate or low” reflecting the quality of the implementation approach in a given clinical setting (26). A “high” score was assigned to studies utilizing at least seven out of eight listed strategies for the development and/or implementation of CPW [Table 4.3]. Studies utilizing between four and six strategies received a “moderate” score and studies utilizing less than four out of eight strategies received a “low” score.

Among the six studies identified in this SR, two were assigned a “high” implementation score (91, 93) and four studies scored “moderate” (77, 88, 90). Three strategies for implementation of CPW were identified in the six studies. All of the studies involved physicians to develop and implement the CPW, identified evidence-practice gaps before the development of the CPW, and used sessions to educate the team on CPW implementation (88-93). In addition, most of the studies (five of six) used a multidisciplinary team for pathway implementation. The multidisciplinary teams consisted of physician, nurses, physiotherapists, occupational therapists, speech therapists, researchers, educators, pharmacists, ethicist and/or social workers (88, 91-93).
Only one study reported the use of a local opinion leader for the CPW development and implementation (89). Three studies reported the use of audit and feedback system and incorporating reminder system to get information on the accountability and response of the staff towards the CPW, (See table 4.3) (91, 93).
Table 4.4 Strategies observed in studies to assess implementation and development of CPW’s

<table>
<thead>
<tr>
<th>Study ID</th>
<th>Involvement of clinician</th>
<th>Implementation team</th>
<th>Identification of evidence practice gap</th>
<th>Reminder of change</th>
<th>Audit and feedback</th>
<th>Potential barriers of change identified</th>
<th>Education sessions</th>
<th>Local Opinion leaders</th>
<th>Ratings*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bookbinder 2005(91)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>-</td>
<td>H</td>
</tr>
<tr>
<td>Brattebo 2002(93)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>-</td>
<td>H</td>
</tr>
<tr>
<td>Doherty 2006(77)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>-</td>
<td>Y</td>
<td>Y</td>
<td>-</td>
<td>M</td>
</tr>
<tr>
<td>Falconer 1993(88)</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>-</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>M</td>
<td></td>
</tr>
<tr>
<td>Sulch 2000(89)</td>
<td>Y</td>
<td>-</td>
<td>Y</td>
<td>-</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>M</td>
</tr>
</tbody>
</table>

*H = High, *M = Moderate, Y* = Yes, N* = No

Source: Rotter and colleagues 2010(8), adapted by the author

CPWs that have a high score as the result of maximum implementation strategies, do have the potential to improve teamwork, by improving team’s communication and treatment knowledge. Involving the entire team in implementing the CPW can ensure everyone gets to know their exact role and duties as mentioned in the guideline. Feedback forms may be helpful to understand the areas of improvement and provides the potential to decrease conflict amongst the team. We may be able to indicate that studies with high implementation scores can potentially improve teamwork using a CPW.

4.1.4 Effect of CPWs on patient related outcomes observed in the included studies

The overall goal of a CPW is typically focused on improving patient outcomes among a given population of patients. For the purpose of this review patient outcomes were identified in
each paper if they represented either a clinical outcome (e.g., ventilation time, number of problematic symptoms identified and death), or a system-level outcome (length of stay, compliance with guidelines or cost reduction). These outcomes and results are described in detail in the overarching systematic review by Rotter et al (76). The following section highlights the patient related outcomes (other than teamwork outcomes) that were a part of the six studies used for this subgroup analysis.

Effects reported

All the six studies identified for this review reported the effect of CPWs on clinical outcomes affecting overall patient care. The sedation scoring system used by Brattebo 2002, resulted in a 28% decrease in the ventilation time and the rate of mortality decreased by 27% in the first 11 months and 22% in the second 11 month period of the study (93). Sulch et al. observed a numerically lower number of deaths (due to all causes) in the control group, reporting 10 events of death for 76 patients in the experimental group compared to six events of death in the 76 patients of the control group (90). Bookbinder reported a reduction in the number of problematic symptoms identified in the last two days of life (4.8 to 3.7; P = 0.014) and an increase in the inpatient consultations (4.0 to 5.1; p = 0.037). (91) CPWs showed a significant decrease in pre versus posttest results for number of problematic symptoms identified (1.1, P = 0.014) and an increase (1.1, P = 0.037) in consultation requests (76).

The majority of desired effects on patient care as a result of CPW allow exploration of the possibility of the influence of effective team work on patient care. Interprofessional teams working together using evidence-based guidelines have the potential to reduce the risk of errors, improve efficiency, decrease mortality rates, and create a positive environment for the patients seeking further consultation.
System level outcomes

All of the studies selected for this review measured system level outcomes as part of the objectives for their study. Hospital length of stay was the most common patient outcome, reported in 4 out of 6 studies (88, 89, 93). Sulch reported a decrease in LOS in stroke patients using a CPW based management system at a stroke rehabilitation center (90). Falconer 1993 and Bookbinder 2005 reported a decrease in LOS as a result of CPW implementation for stroke rehabilitation and palliative care for advanced diseases respectively (88, 91). Brattebo 2002 reported (93) an increase in compliance with the asthma intervention guidelines as reflected in statistically significant improvements in clinical indicators (assessment of severity, use of spirometry, over use of Ipratropium, underutilization of systemic corticosteroids, over use of antibiotics for asthma and utilization of the short term asthma management plan) in study hospitals (36% to 62%, P<0.001) with no change in control hospitals (77).

Positive system level outcomes observed in the studies can also be a result of interprofessional teams working together using an evidence-based guideline. Systematic approach towards work, being better informed about their tasks, and relative improvement in the knowledge do have the potential to decrease length of stay in hospitals as the result of following an efficient treatment plan provided in CPW’s.

4.2 Analysis of teamwork outcomes as a result of implementing CPW

Teamwork is a critical factor for the successful implementation and use of clinical pathways in a healthcare setting due to the inherent interdisciplinary nature of the work, requiring physicians, allied health professionals and collaborators from different specialties to
work together. The aim of this review was to examine the impact of CPW on indicators of successful teamwork.

Although none of the studies employed \textit{a priori} teamwork outcomes, we were able to extract relevant quantitative results and narratives pertaining to the effect on teamwork. These observations were categorized under recognized teamwork indicators. As indicated above (4.1.2), documentation, communication, staff knowledge, team support for innovation, team conflicts and decision-making, were the major teamwork indicators most commonly reported in the included studies.

\textit{4.2.1 Documentation}

We identified three studies reporting on quality and quantity of documentation as the result of the CPW intervention. Although measuring documentation was not a primary objective for these studies, we were able to extract information on the effects of documentation due to the intervention. In a guideline based intervention for acute asthma characterized by a proactive severity assessment and asthma management plan (77), lack of formal documentation on severity of asthma (mild, moderate, severe) in the clinical records was observed, and it was determined as a target for change while implementing the quality improvement project. In the pre-assessment period, insufficient clinical information and errors were attributed to the lack of detailed protocol for documenting severity of illness. Upon implementation of the CPW, the team reported an improvement by 54\% in documentation of severity in the study hospitals and there was no change observed in the control group. This improvement in documentation resulted in a significant improvement in the assessment of severity (8\% to 62\%, p < 0.001) in the post test observation (77).
Documentation was improved using a palliative care for advanced disease (PCAD) clinical pathway along with physician order sheets and nurses daily documentation flow sheets, used to improve palliative care of dying in-patients with a life expectancy of days or weeks (91). The nurses’ flow sheets were used to document the use of medications for symptom control and all the other components of patient care and nursing support that included notes on patient and family counselling and assessment of support provided for families during grieving and bereavement. The physician order sheets suggested the optimal use of drugs, therapies and consultation services along with a standard guideline for managing regular symptoms. The PCAD pathway also entailed regular meetings to discuss team goals for the day. It was observed that: “Notes taken during the weekly meetings accredit the hypothesis that care pathway may have impacted to improve the overall documentation” (91).

In contrast, the use of flow sheets did not improve documentation to initiate cardiopulmonary resuscitation (CPR), although positive trends were observed in care related documentation – such as documentation of mouth care, skin care, wound care and elements indicating efficient nursing support (91). Sulch 2002, reported documentation of death and follow up arrangements was significantly better (80% in group’s managed by CPW vs 70% control groups) for patients in a stroke rehabilitation center managed with Integrated Care Pathway (ICP) (90). Moreover, two out of the three primary studies reporting on documentation were comparable in terms of the study designs, study participants, and outcome measures employed, and we statistically pooled the individual study results reported on quality and
quantity of documentation (77, 90)

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Clinical pathway n/N</th>
<th>Usual care n/N</th>
<th>Odds Ratio M-H, Random, 95% CI</th>
<th>Weight</th>
<th>Odds Ratio M-H, Random, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doherty 2006</td>
<td>29/47</td>
<td>6/42</td>
<td>19.17%</td>
<td>[3.4, 27.5]</td>
<td></td>
</tr>
<tr>
<td>Sulch 2002</td>
<td>75/76</td>
<td>56/76</td>
<td>20.83%</td>
<td>[3.49, 205.58]</td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>113</td>
<td>118</td>
<td>100%</td>
<td>11.95 (4.72, 30.30)</td>
<td></td>
</tr>
</tbody>
</table>

Total events: 104 (Clinical pathway), 62 (Usual care)
Heterogeneity: Tau^2 = 0.14, df = 1; P = 0.38
Cochran's Q: 0.001

Figure 4.2: Forrest plot - CPW effects reported on quality of documentation Source: Rotter and colleagues 2010 (8) (94)

The pooled studies by Doherty 2006 and Sulch 2002 produced a significant result (OR 11.95; 95% CI 4.72 to 30.30) favoring improved documentation with CPWs. Thus, CPW may have the potential to improve documentation with the implementation and use of CPW.

4.2.2 Communication

In a controlled before and after study conducted in a palliative care ward by Bookbinder 2005, the CPW included communication and staff responses, the pre-study assessment revealed that in 10% of the cases allied health care professionals were not present with the physicians and family while discussing the patient goals of care. This lack of communication between the physicians, allied health care professionals and the patient’s family was reported to be an issue for the continuity of care (91). Assessments conducted before and after implementing the pathway to evaluate the difference in communication revealed no difference between the study and control units in communication with the ethics committee, social workers and pain specialists (91). It was also observed that queries asked to assess a patient’s eligibility for the study resulted in stimulated discussions between the team members to identify and determine patient goals of care; it was also
observed that the lead nurse had now begun to involve the patient’s primary physician while assessing the patient’s eligibility (91).

In a CPW designed to meet the needs of the local intensive care unit, the pathway was combined with posters and continuous feedback (93). Feedback was collected during weekly meetings to discuss any modifications after the sedation scoring guideline was implemented. These meetings were also important to discuss and establish the rationale behind monitoring sedation levels. Medical directors and nurses would discuss and plan tasks to be allocated for the teams working in the ICU. As stated in the observation “The medical and nursing directors’ open support for the project and short weekly meetings to allocate tasks also contributed to the success of the project” (88).

A stroke rehabilitation clinic implemented a CPW that included daily team conferences to set team goals, therefore clinicians experienced improvement in team communication as a result of Critical Path Method (CPM) (88). Physicians and allied health care professionals specifically reported to appreciate using CPM, as it helped to facilitate team communication whilst also giving them greater control over the quality of services that can be provided to the patients. They also reported that CPW included collaborative problem solving, continuous feedback, establishing project timelines by effectively scheduling activities were useful in setting goals for patients with an uncertain prognosis (88).

Sulch and colleagues 2000 conducted a study for stroke management using the integrated care pathway (ICP), the pathway was develop using a multidisciplinary team and extensive literature review. According to their observations, managing stroke patients brings people from multiple disciplines together and can lead to inefficient patient treatment (89). The ICP methodology gives a standard streamlined direction to everyone and helps to prevent this
miscommunication and lack of coordination by ensuring critical treatment steps are not overlooked, which also assists in preventing delays by timely intervention.

Table 4.5 Summary of the effects of CPW on communication

<table>
<thead>
<tr>
<th>Study</th>
<th>Method of communication</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bookbinder 2005(91)</td>
<td>Queries asked to determine patient eligibility and discussions to determine patient goals of care</td>
<td>Encouraged stimulated discussions between team members and increased consultation with the patients primary care physician</td>
</tr>
<tr>
<td>Brattebo 2004(93)</td>
<td>CPW combined with posters, continuous feedback and planned task allocation.</td>
<td>Allowed discussion between medical directors and nurses to discuss plans for task allocation. Feedbacks collected stimulated discussion on any modifications post implementation of the guideline.</td>
</tr>
<tr>
<td>Falconer 1993(88)</td>
<td>Daily team conferences, collaborative problem solving, continuous feedback</td>
<td>Facilitated team communication and better control of the services provided to the patient.</td>
</tr>
<tr>
<td>Sulch 2000(89)</td>
<td>Providing a standard direction to everyone</td>
<td>Avoids miscommunication, lack of coordination and prevents delay in treatment by timely intervention.</td>
</tr>
</tbody>
</table>

Source: own illustration

It is observed that CPW are stimulating discussions between healthcare professionals on patient care, implement feedback and prevent miscommunication, therefore we can consider CPW can potentially improve communication between teams in a healthcare setting.

4.2.3 Staff Knowledge

A very important objective of clinical pathways is to be able to bring the best and most reliable evidence to the healthcare practitioners and allied health professionals, to help them improve their knowledge on the latest treatment options. In this systematic review we identified four studies out of six making quantitative and qualitative observations on the effect of clinical pathways on staff knowledge. Bookbinder 2005, conducted a before and after study to evaluate the effect of using a care pathway for palliative end of life patients (91). The intervention was tested in three study units with a relatively high volume of dying patients – the Oncology unit,
Geriatric unit and the inpatient unit of the department of pain medicine and palliative care (DPMPC). Staff knowledge was assessed using the validated Palliative Care Knowledge Quiz consisting of 20 true or false questions assessing knowledge on the philosophy and principles of palliative care and symptom management; 15 questions out of the 20 were targeted towards continuous education on palliative care. Nurses from all the three units completed the quiz before pathway implementation and four months after the implementation. A numerically high score was achieved on the 15 questions pertaining to continuing education (91). In addition a statistically significant increase in the total test scores was observed between the sample at baseline and test results post implementation. Positive trends were observed in clinician knowledge and care related outcomes documented in the medical records (91).

In a similar multicenter CBA evaluating guideline based asthma management, Doherty 2006 implemented a guideline based intervention to improve medication use in patients with asthma (77). After seven months, the intervention was associated with a decrease in the use of Ipratropium in the study hospitals by 14% and a 9% reduction in control hospitals and neither group reached statistical significance. Compliance with six clinical indictors of asthma management increased from 36% to 62% at the study hospitals, with no change in the control units (77). The increase in compliance was highlighted to be a positive result of knowledge translation activities, which included training on evidence based medicine, education on asthma management and spirometry (77).

Brattebo 2002 noted that the healthcare staff did not encounter any problems in understanding and using the protocol because it was designed to meet the needs and conditions of the local intensive care unit. The visual posters and feedback was useful to understand and implement the protocol (93).
Table 4.6 Summary of the effects of CPW on staff knowledge

<table>
<thead>
<tr>
<th>Study ID</th>
<th>Knowledge improvement activities</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bookbinder 2005(91)</td>
<td>Palliative care knowledge quiz</td>
<td>Positive trends in clinician knowledge and care related outcomes documented in medical records.</td>
</tr>
<tr>
<td>Doherty 2006(77)</td>
<td>Guideline based intervention to improve medication</td>
<td>Decrease in use of Ipratropium for Asthma management, increase In compliance due to knowledge translation activities.</td>
</tr>
<tr>
<td>Brattebo 2004(93)</td>
<td>CPW combined with posters, continuous feedback and planned task allocation</td>
<td>Better understanding of the protocol which helped in effective implementation of the pathway.</td>
</tr>
</tbody>
</table>

Source: own illustration

As indicated in table 4.5, effective implementation of the protocol and use of knowledge tests quiz and use of posters point towards positive trends in the improving staff knowledge by the use of pathways.

4.2.4 Team Support for Innovation

Quality improvement projects are generally targeted to change the behavior of clinicians to deliver better patient care. (77) CPW uses an evidence-based approach and is targeted to aid clinicians believe in the evidence and understand the value of change. In a complex and dynamic environment, innovation is the key for improving quality and efficiency of the process. However, the success of the innovation lies in the acceptance and support of the team for change. In this review, we also looked into the support for innovation as a factor that can aid in building efficient and cohesive teams. We identified team support for innovation as the willingness of the staff to accept change, staff adherence to the pathway, change in the clinician’s behavior due to new policies and procedures, and the intention of the staff to change. There were four studies reporting on support for innovation either measured quantitatively or interpreted in qualitative manner. In the CBA study by Bookbinder 2005, a 35-item checklist called the Process Audit
Tool (PAT) was used to monitor the staff’s adherence to the pathway. It was observed that more than 90% of the staff adhered to all aspects of the clinical pathway. In 18% of the cases, physicians were resisting the use of the pathway; the reason cited was “too much paperwork” or they believed that their current method of practice and approach was already ‘in sync’ with the clinical pathway. One hundred percent adherence to the pathway was observed in the inpatient unit of the department of pain medicine and palliative care (IPU DPMC). Routine use of the question “Would you be surprised if the patient died during this administration?” triggered team discussions to determine the patients care plan (91).

In the study conducted by Brattebo 2002 on adult patients in a surgical ICU using a CPW combined with posters and feedback, the researchers suggested that a project that does not have any conflict of interest is responsible for higher staff involvement. The CPW in this study was an initiative of the Norwegian medical association who did not have any financial interest whatsoever. Researchers felt that staff involvement had increased because the CPW had more credibility and acceptance amongst the physicians (93). In the study using a guideline based intervention based on a Short Term Asthma Management Plan (STAMP), the post intervention analysis revealed an increase in the use of STAMP from 9% to 26% (p= 0.039) (77).

Table 4.7 Summary of the effects of CPW on team support for innovation

<table>
<thead>
<tr>
<th>Study ID</th>
<th>Intervention</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bookbinder 2005(91)</td>
<td>Use of process audit tool to monitor staff adherence</td>
<td>Mixed results in which 90% of the healthcare staff are adhering to the clinical guideline, 18% physicians resist the use of CPW</td>
</tr>
<tr>
<td>Brattebo 2002(92)</td>
<td>CPW along with posters and feedback</td>
<td>Staff involvement increased after the acceptance by physicians and when the project did not have any conflict of interest or the study sponsors do not have any financial interest in the outcome.</td>
</tr>
</tbody>
</table>
Team support for innovation is incumbent on staff’s acceptance of the guideline, the summary of results in Table 4.6, indicate a positive trend in the acceptance and implementation of the pathway. The results indicate a potentially positive effect on the teams support for innovation using CPWs.

**4.2.5 Team conflict and decision making ability**

Three articles in our review discussed the effect of team conflicts, role clarity and good decision making on teamwork and patient outcomes. In a single center randomized control trial examining a CPW for stroke rehabilitation, daily team conferences were required by the CPW to discuss team goals instead of discipline specific goals, potential team outcomes, and patient goals instead of patient status and discharge plans (90). Despite the inherent logic of this approach, observations reported on the effect of this activity were mixed. A team member at one of the sites mentioned “I think I was writing the same goals for different people”, which indicates that the team goals did not differ from patient to patient (90). It was suggested the CPW was helpful when they were presented with comorbid conditions such as AIDS or bulimia. Also, the CPW may have been beneficial to improve coordination and problem solving between interdisciplinary team members benefiting such patients with a poor prognosis. This method was also beneficial to expose conflicts between cross-disciplinary teams especially in the areas of scheduling and sequencing a treatment. The authors observed that team members identified appropriate professionals to delegate responsibilities, thereby avoiding any cross disciplinary conflicts (88).
Brattebo and colleagues 2004 concluded that an increase in the staff’s ownership for the project was a direct measure of displaying the results of the project graphically via wall posters. It was instrumental in providing the necessary encouragement and led to an increase in commitment and a willingness to change. Nurses were allowed to use the sedation scoring system to change the sedation times, this increased responsibility created a heightened sense of ownership and accountability and positive encouragement (93).

Table 4.8 Summary of the effects of CPW on team conflict and decision making

<table>
<thead>
<tr>
<th>Study ID</th>
<th>Methods used</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulch 2002(90)</td>
<td>CPW involved daily team conferences to discuss team goals</td>
<td>Mixed results. CPW may be beneficial to improve coordination and problem solving. Beneficial to expose interdisciplinary conflicts that lead to identification of personnel to mitigate conflict.</td>
</tr>
<tr>
<td>Brattebo 2004(93)</td>
<td>Displaying the results of the project graphically via wall posters</td>
<td>Increase in staff ownership, provide necessary encouragement to staff and heightened sense of ownership amongst the staff.</td>
</tr>
</tbody>
</table>

Source: own illustration

The results in table 4.7 showcased an improvement in coordination and problem solving and building a sense of ownership amongst the healthcare staff, all of which do point towards a potential use of CPW in conflict resolution, decision making and heightened sense of ownership amongst the healthcare staff.
CHAPTER 5 - DISCUSSION

5.1 Introduction

Healthcare has changed at a rapid pace in the past 20 years. Working in isolation is now considered undesirable and a patient safety issue. Moreover, the increasing complexity of healthcare makes it invariable for healthcare practitioners to work in teams towards a common goal (95). The need for patient-centered care approach is at the center of healthcare, and the demand for patient safety is the gold standard; therefore, it is essential to encourage the professional development of healthcare personnel with a focus on teamwork and interprofessional collaboration. CPW's involve using evidence-based guidelines, facilitating professionals from various health care disciplines to collaborate with a focus on quality patient care. Thus, this review intended to catalogue and assess literature showcasing the effects of CPW's on teamwork and interprofessional collaboration.

5.2 Summary of results

Following a rigorous screening process based on predetermined inclusion and exclusion guidelines, we were able to identify six studies with 891 patients from four countries containing relevant information related to the review's objectives for final data synthesis. All six studies were carried out in a hospital setting, and clinical pathways were implemented to address the medical condition. We were able to identify mixed results that were reported on the effects of CPW on interprofessional collaboration. The lack of quantitative information and considerable variation in the clinical setting and conditions examined, prevented meaningful meta-analysis of the outcomes. Despite the limitations of the review, we were able to identify contextual
information that can be valuable to research teams currently working or who may be required to work with clinical pathways in a hospital setting.

The overall findings indicate that CPWs implemented in a hospital setting may have the potential to have a positive effect on interprofessional collaboration between healthcare teams (low evidence). However, it is uncertain whether stand-alone CPW's may be adequate to improve teamwork outcomes like communication, staff adherence, team support for innovation, team conflict and decision-making abilities because of poor reporting or unavailability of evidence.

5.3 Documentation and Staff knowledge: Laying the groundwork for teamwork

CPWs are proposed based on the best available evidence from the research literature. They are instrumental in the reduction of evidence-practice gaps when healthcare professionals have a limited opportunity to review updates in healthcare practice regularly. Thus CPWs have the potential to improve staff knowledge by keeping them up to date on their skills based on evidence-based practice.

Documentation is essential to disseminate information, especially in a dynamic environment like healthcare. Proper documentation is vital for the seamless flow of information between healthcare professionals to reduce errors and maintain the continuity of care. Transparent and standardized documentation will assist in achieving the basis for effective communication between healthcare teams.

In the three studies identified for this review, documentation was vital for the success of the CPW. In the study by Doherty 2006, documentation of the severity of asthma in the clinical records was a driver for change. The implementation of CPW resulted in a 54% improvement in documenting the severity (77). This improvement was critical for assessing the severity as it was
a quality improvement marker after implementing CPW. Documenting severity is vital to assist the healthcare teams in diagnosis and providing the best care based on evidence, in turn, resulting in positive patient outcomes.

Patient records and care plans are required to be a part of the documentation in a multidisciplinary team set up. Not only does it give a clear idea of the patient's treatment protocol and status, but it also avoids the risk of errors in the patient's treatment plan. Therefore, physician order sheets and nurse's daily documentation flow sheets documenting the medications used, counselling services provided to the patient and family prove to be very beneficial to improve patient outcomes.

Proper documentation is also a result of competent staff knowledge. CPW's are based on evidence catalogued from research literature and is beneficial for the staff to stay updated on their skills. Four out of six studies of this review have observed a positive effect of CPW on staff knowledge. In the study by Bookbinder 2005, a Palliative Care Knowledge Quiz was conducted to assess their knowledge of palliative care. There was a statistically significant increase in the scores after the implementation of the pathway (91). The study by Doherty 2006, a guideline-based intervention, resulted in decreased use of Ipratropium for asthma and an increase in compliance with the indicators of asthma management (92). Although the evidence of teams benefiting from staff knowledge is weak, knowledge translation activities like CPWs help fill the evidence-practice gaps. Moreover, protocols designed to meet local needs assist the healthcare professionals to understand and use protocols without any problems.

Analysis of results on discussion and staff knowledge from the studies shows that documentation and staff knowledge can be classified as important factors required to enhance and support teamwork. Effective communication is a mainstay for successful interprofessional
collaboration, documentation and staff knowledge form the base for transparent and streamlined communication. CPWs assist in providing a sense of direction, filling the knowledge gaps, establish standardized documentation, thereby useful to improve communication and collaboration between multidisciplinary professionals.

5.4 Communication

Interprofessional communication between healthcare professionals and patients has to be open, transparent and efficient for the best patient outcomes. In a study by Bookbinder 2005, lack of communication between physicians, allied healthcare professionals while discussing the goals of patient care was a hindrance to the continuity of care. Although there was no difference observed in the communication between the ethics committee, social workers and pain specialists, however, queries asked to decide the eligibility of the patient for the study improved communication while deciding patient goals of care(91).

CPW's may have the potential to enable interprofessional communication by coordinating outcome-oriented care delivery(95). They can improve teamwork by building a standardized system to communicate and share knowledge(40). Care pathways allow communication with patients and also provide a documented summary of the patient's care plan and their progress(14). Team members get better at communicating with each other because every day they can get reminded of the patient care protocol on time. CPWs create an environment within the team to encourage professionals in the team to ask questions and give suggestions on the patients' treatment and also builds communication with the patients and their families at large.

In a study by Falconer 1993, the Critical Path Method (CPM) proved to be useful in facilitating team communication through problem-solving, timely feedbacks and establishing
project timelines to set patient goals of care(88). CPWS, in conjunction with posters and planned task allocation, assisted in ensuring the individual tasks in the team are communicated without any confusion and ensures every member of the team understands their role(93). Physicians and allied health professionals appreciated this approach because not only does it initiate communication, but it also helps to give them a streamlined direction for treatment and improved coordination amongst team members.

The studies identified in this review have been decisive in showing the beneficial effects that CPWs have on improving verbal and non-verbal communication between team members. Clear communication without any misunderstanding and reporting errors can be a good indicator of positive teamwork outcomes.

5.5 Conflict management and decision-making skills – Key to building positive relations within the team

A team's strength lies in its coordination and an organized approach used by the team members to achieve their goals. Used as an interprofessional quality improvement tool, CPWs also can enhance coordination and connection between the members. In the study by Sulch 2002, the CPW involved the use of daily conferences to discuss the team's goals. This method proved to be beneficial in improving coordination and problem solving amongst team members(90). Getting team members together every day in a conference may be the key to expose conflicts between team members primarily related to scheduling and sequencing the treatment. Every member of the team will bring specific skills, knowledge and service to the table; therefore, the cooperation between team members is vital to establish relationships to recognize the patient's needs for care. Hence, identifying appropriate professionals for delegating responsibilities is key to dissolving potential cross-disciplinary conflicts.
Health care professionals are accustomed to following set standards in protocols for care delivery, which lead to particular patient outcomes. Increasing staff ownership by displaying the results of the project was effective in encouraging the team members. It was useful to increase their commitment and willingness to change. Conflicts in a team arise when professionals in the team are not willing to accept the blurring of boundaries between professionals, which may hinder the progress of patient care. CPWs allow team members to share responsibilities, set common objectives and goals for care delivery and increase the efficiency of the process. CPWs promote a collaborative model, and every team member is allowed to participate in the decision-making process.

The study by Sulch 2002, the CPW involved daily team conferences in discussing the team's goals for the day. The meetings were beneficial to expose any interdisciplinary conflict in the treatment plan, and suitable personnel were identified to mitigate the conflict(90). The daily meetings are also beneficial to encourage team members to share new ideas; such events are useful to strengthen teamwork, build the staff morale and lead to job satisfaction. Nurses often are more involved with patients, and might not always be involved in the interprofessional team, therefore giving them more opportunities to be involved in the decision-making process helps to increase their sense of responsibility and ownership.

Care pathways by themselves are not effective in mitigating conflicts. CPWs, in conjunction with other process inputs, are required to improve relationships amongst team members. Daily conferences, team meetings, use of posters and feedback boards are proven to be useful in getting the team on the same page. Every member of the team is given an equal chance to present their ideas, providing positive encouragement and respect for each professional's contribution.
5.6 Team support for innovation – Reason for adherence and acceptance of the pathway

Hospitals have a complex and dynamic environment, and it is continuously evolving. Innovation in treatment modalities and delivery of care is the need for positive patient outcomes. Innovation involves a change, and every new idea needs acceptance from the stakeholders. The success of any team lies in its ability to accept change and innovate.

Physicians might resist using CPW citing reasons like "too much work" or if they feel their treatment methods are already in sync with the guideline(91). However, CPWs support the clinician's belief in evidence and understand the value in an evidence-based guideline. Change in the clinicians' behavior and the staff's intention to change is indicative of the team's support to innovate(96). Brattebo 2002, in their study, had a similar observation; credibility and acceptance of the pathway by physicians resulted in higher staff involvement. Acceptance of the pathway also resulted in an increase in the use of asthma guidelines from 9% to 26% (p=0.039)(93).

Innovative processes are associated with improvement in the quality of care and team satisfaction. Processes in which team members have a clear understanding of their tasks with shared goals, defined objectives, and supportive of the innovative process, are more likely to succeed as a team and more effective in the delivery of patient care. Staff members are more comfortable accepting and getting involved in change when there is no conflict of interest, or the study sponsors do not have any financial interest in the outcome.

CPWs are an innovative process to provide standardized guidelines based on evidence. They have an inherent purpose of bringing practitioners and staff from multidisciplinary areas together for a common goal - superior patient-centered care. A process that supports clarity of communication and roles ensures acceptance and adherence by the staff members. Effective
conflict management, a functional leadership style that promotes innovation and clear objectives, ensures that the teams support innovation and the clinical pathway's success.
CHAPTER 6 CONCLUSION

Effective teamwork amongst health care practitioners and allied health professionals is an important aspect of the patient care process. CPWs are designed to better manage specific diseases and symptoms, and to meet local needs to help improve patient outcomes. They might also serve to integrate multidisciplinary healthcare professionals to work collaboratively for a successful patient outcome. The low quality (high risk of bias) findings of this review reveal gaps in the literature on potential effects of CPWs on teamwork. These gaps create future research opportunities that can explain the mechanisms that impact CPWs on team-relevant outcome indicators.

Although poor reporting prevented us from understanding how CPWs affect teamwork, the studies show that clear communication and standardized documentation were facilitators to increase adherence to the CPW. They can also facilitate conflict mitigation within the team by assigning specific roles to each team member. The clarity in communication and documentation due to CPWs might facilitate a clear understanding of their tasks with shared goals, defined objectives, and support of the process and potential to improve decision-making skills. The development and implementation of CPW enable a team to be organized, improving collaboration between multidisciplinary healthcare professionals and a high performing team. Lack of teamwork can be a cause of increased adverse events in healthcare; therefore, improving teamwork by using CPWs will result in improved quality care and patient safety.
6.1 Implications for research

6.1.1 Quality of clinical pathway investigations reporting on team relevant outcomes

The quality of the six included studies in this thesis is low (high risk of bias, see Appendix 4), and poor reporting on team relevant outcomes was a challenge during screening and full text analysis. Future investigations into the effects of clinical pathways on team work should employ the validated and well tested outcome indicators and recommended measurement scales to evaluate interprofessional collaboration and team work in table 3.2 (Chapter 3, Methods). This strategy would enhance our knowledge on the potential impact of clinical pathways on team relevant outcome indicators.

6.1.2 CPW reporting.

Future investigations of CPW should use the consolidated framework for implementation research (CFRI) in order to specify the development and implementation process(97). This would allow the identification of potentially effective implementation efforts to improve team work. Authors should consider the CFRI framework to better report on their implementation effort, and to share this experience with a wide audience.

6.1.3 Grouping and comparing CPW studies.

We compared the effect sizes reported on LOS between the six included studies in this thesis which report on team relevant information, with the excluded CPW studies also reporting on LOS. Our hypothesis was that this comparison could help us to identify and explain potential mechanisms of team work and what role CPWs play in this process. The plan was to use this new information in order to revise and update the interim logic model (see methods, figure 3.1 logic model). Unfortunately, this comparison did not reveal new information and poor reporting
was a huge challenge during this exercise (see Appendix 5 for the comparison of effect sizes (LOS) reported in the six included studies vs. excluded studies which did not employ team relevant outcome indicators).

Considering the available evidence on the effects of CPWs on interprofessional collaboration, we are lacking critical information about potential mechanisms through which pathways work and can improve team work. Qualitative interviews and focus groups may yield more information which could help to explain how CPWs improve team relevant outcomes. Future investigations should use this information to revise our interim logic model(98).

6.2 Implications for practice

This thesis has established that a meta-analytic comparison was not helpful in identifying potential mechanisms that could explain how CPWs improve teamwork and interprofessional collaboration. Despite this limitation, we have been able to identify team relevant information that might be helpful for future improvement activities. For example, documentation (90-92), communication (88, 89, 91, 93), and staff knowledge (91-93) might be important facilitators to improve team work in hospitals. Unfortunately, we could not identify new information and more research is needed to answer this important question. In the meantime, complex intervention bundles, such as TeamSTEPPS® might be a better choice than the CPW concept to improve collaboration between different professions in hospitals(99). TeamSTEPPS® is a validated and well tested complex intervention that has the potential to improve team work and interprofessional collaboration. The Agency for Healthcare Research and Quality in Maryland has developed this intervention and it has been tested and evaluated globally, in different settings and contexts. Moreover, it comes with an evidence-based implementation manual to support effective implementation(100).
APPENDIX A


1. Critical Pathways/
2. ((clinical or critical) adj2 (pathway? or path)).ti,ab.
3. ((care adj2 algorithm?) or clinical algorithm?).ti,ab.
4. (care adj2 pathway?).ti,ab.
5. (treatment adj3 algorithm?).ti,ab.
6. (structured care or intensive management).ti,ab.
7. (standardi$ adj3 (treatment? or care or patient care or plan$)).ti,ab.
8. (care adj2 (plan? or map or maps or protocol? or algorithm?).ti,ab.
9. (protocol? adj4 (nursing or treatment or management or directed or guided)).ti,ab.
10. ((local or locally) adj2 adapt$ adj5 guideline?).ti,ab.
12. (standardi$ adj3 (template or templates)).ti,ab.
13. or/1-12 [Pathways]
14. Clinical protocols/
15. Algorithm/ and (di.f.s. or (treatment or care or patient?).ti. or diagnos$.ti,ab.)
16. Practice Guidelines as Topic/ or Guideline Adherence/ or Guidelines as topic/
17. ((guideline or guidelines) adj2 (adher$ or implement$)).ti,ab.
18. (guideline? adj4 (compliance or complying)).ti,ab.
19. or/16-18 [PGL or GL Adherence]
20. (adherence or care or compliance or comply$ or implement$ or impact or plan? or standardi?ed or pathway or (treatment adj3 (protocol? or algorithm?))).ti,ab.
21. 19 and 20 [GL ]
22. *Guidelines as topic/ or *Practice Guidelines as topic/
23. *Guideline Adherence/
24. or/22-23 [Focussed MeSH Guideline]
25. Primary health care/ or Primary Care Nursing/
26. Family practice/ or General Practice/
27. General Practitioners/ or Physicians, Family/ or Physicians, Primary Care/
28. ((general or family) adj2 (practice? or practitioner? or physician? or doctor?)).ti,ab.
29. (primary adj2 (care or health care or healthcare or medical care or patient care)).ti,ab.
30. (primary care or family medic$ or general practice or family practi$).jn.
31. GP.ti.
32. or/25-31 [Primary Care ]
33. Ambulatory Care/ or Community medicine/ or community health nursing/ or community health services/ or home care services/ or Community mental health services/ or Community Pharmacy Services/
34. Ambulatory Care Facilities/ or Community Health Centers/ (community or communities).ti,ab,hw.
35. (((ambulatory or walk-in or neighborhood or community) adj2 (clinic? or care centre or care centres or care center? or health$ centre or health$ centres or health$ center?)) or public clinic?).ti,ab.
36. ((urban or rural) adj3 health).ti,ab.
37. or/33-37 [Community Care]
38. 13 and 32 [Pathway terms & PC]
39. (and/13,38) not 39 [Pathways & Community-Ambulatory Care]
40. (and/24,32) not (or/39-40) [Focussed GL & PC]
41. (and/24,38) not (or/39-41) [Focussed GL & Community-Ambulatory Care]
42. ((or/14-15) and ((or/26-31,38) or *Primary health care/ or *Primary Care Nursing/) not (or/39-43) [Clinical Protocols/Algorithms Mesh & PC/Community Care-combine with RCT filter only]
43. (randomized controlled trial or controlled clinical trial).pt. or randomized.ab. or placebo.ab. or clinical trials as topic.sh. or randomly.ab. or trial.ti.
44. exp animals/ not humans.sh.
45. 45 not 46 [Cochrane RCT Filter 6.4.d Sens/Precision Maximizing]
46. intervention?.ti. or (intervention? adj6 (clinician? or collaborat$ or community or complex or DESIGN$ or doctor? or educational or family doctor? or family physician? or family practitioner? or financial or GP or general practice? or hospital? or impact? or improv$ or individuali?e? or individuali?ing or interdisciplin$ or multicomponent or multi-component or multidisciplin$ or multi-disciplin$ or multifacett$ or multi-face$t$ or multimodal$ or multi-modal$ or personali?e? or personali?ing or pharmacists or pharmacist? or pharmacy or physician? or practitioner? or prescrib$ or prescription? or primary care or professional$ or provider? or regulatory or regulatory or tailord$ or target$ or team$ or usual care)).ab.
47. (pre-intervention? or preintervention? or "pre intervention?" or post-intervention? or postintervention? or "post intervention?").ti,ab. [added 2.4]
48. (hospital$ or patient?).hw. and (study or studies or care or health$ or practitioner? or provider? or physician? or nurse? or nursing or doctor?).ti,hw.
49. demonstration project?.ti,ab.
50. (pre-post or "pre test$" or pretest$ or posttest$ or "post test$" or (pre adj5 post)).ti,ab.
51. (pre-workshop or post-workshop or (before adj3 workshop) or (after adj3 workshop)).ti,ab.
52. trial.ti. or ((study adj3 aim?) or "our study").ab.
53. (before adj10 (after or during)).ti,ab.
54. ("quasi-experiment$" or quasisexperiment$ or "quasi random$" or quasirandom$ or "quasi control$" or quasicontrol$ or ((quasi$ or experimental) adj3 (method$ or study or trial or design$))).ti,ab,hw.
55. ("time series" adj2 interrupt$).ti,ab,hw.
56. (time points adj3 (over or multiple or three or four or five or six or seven or eight or nine or ten or eleven or twelve or month$ or hour? or day? or "more than")).ab.
Part B: List of databases for search

The following databases were searched with no language restriction, with the most recent search on March 1, 2017.

- Cochrane Central Register of Controlled Trials (CENTRAL; 2017, Issue 3) in the Cochrane Library.
- MEDLINE Ovid (1946 to 1 March 2017)
• Embase Ovid (1974 to 1 March 2017)
• CINHAL EBSCO (Cumulative Index to Nursing and Allied Health Literature) 1982 to 1 March 2017
• HMIC (Health management Information Consortium) 2015 to 1 March 2017
• AMED Ovid 9 (Allied and Complementary Medicine) 1985 to 1 March 2017
• PsycINFO Ovid 1906-01 March 2017
• NHS Economic Evaluation Database (NHSEED; 2015, Issue 2), in the Cochrane Library
• Health Technology Assessment Database (NHSEED; 2015, Issue 2), in the Cochrane Library.
• Cochrane Database of Abstracts of Reviews of Effectiveness (DARE)

Other sources for searching

Grey Literature

A grey literature search was carried out to identify studies that were not indexed in the databases mentioned above. The sources for grey literature were Web of Science (www.webofknowledge.com) and OpenGrey (www.opengrey.eu).

The review authors also searched the following trial registries on 31 August 2016.
The World health Organizations (WHO), International Clinical Trials Registry Platform (ICRTP) search portal (www.apps.who.int/trialsearch) and Clinical trials.gov (www.clinicaltrials.gov).

Authors of relevant articles were contacted by the team working on the update of the Cochrane review to inquire about any published or unpublished work.
APPENDIX B

PRISMA Flow chart of the Cochrane review update, with the most recent search update conducted on March 1, 2017 (86).
## Inclusion and Exclusion (Level I and Level II screening)

<table>
<thead>
<tr>
<th>Study Name</th>
<th>Study ID</th>
<th>CPW indication</th>
<th>Measures of teamwork in aim</th>
<th>Measures of teamwork in objectives / results</th>
<th>Decision</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Whether there were any teamwork related measures included in the aims)</td>
<td>(Whether there were any teamwork related measures observed in the objective or results)</td>
<td>Include/Exclude</td>
<td></td>
</tr>
</tbody>
</table>

APPENDIX C
Pilot data extraction sheet

<table>
<thead>
<tr>
<th>Study ID</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome (teamwork)</td>
<td></td>
</tr>
<tr>
<td>N-EXP</td>
<td></td>
</tr>
<tr>
<td>mean</td>
<td></td>
</tr>
<tr>
<td>Percentage (%)</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>P value</td>
<td></td>
</tr>
<tr>
<td>CI</td>
<td></td>
</tr>
<tr>
<td>N-Cntrl</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td></td>
</tr>
<tr>
<td>Percentage (%)</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>P value</td>
<td></td>
</tr>
<tr>
<td>Percent (%) change</td>
<td></td>
</tr>
<tr>
<td>Mean difference</td>
<td></td>
</tr>
<tr>
<td>Did both reviewers agree on Inclusion / exclusion?</td>
<td>Yes / No</td>
</tr>
<tr>
<td>Notes , including source(s) of disagreement if any</td>
<td></td>
</tr>
</tbody>
</table>
# Data Extraction form

Clinical Pathways: Effect on Interprofessional collaboration in a hospital setting

<table>
<thead>
<tr>
<th>Name of reviewer</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Study Design</strong></td>
<td></td>
</tr>
</tbody>
</table>
| Type of study (using EPOC criteria) | RCT  
RCT: Random allocation of participants, contains a control group  
CCT: Quasi random allocation of participants, contains control group  
CBA: nonrandom allocation of participants  
ITS: no control group. Must contain three data sets before and after the intervention |  
CCT  
CBA  
ITS |
| Years of data collection | |
| Country | |
| Where was the study conducted? | Not clear if information is not available |
| Type of Hospital | |
| Where was the hospital situated? | Rural  
Regional  
Urban  
Remote  
Not clear |
| Description of health professionals | |
| Specialists  
Multidisciplinary  
Nurses  
Others (specify) | |
| Number of health professionals involved at the intervention and control sites | |
| Years of data collection (n=?) | |
| Type of Intervention | CPW vs Usual care |
| Was the CPW combined with any intervention or was it a standalone intervention | |
| Description of the intervention | |
| Outcome measures | Primary outcomes that include teamwork corresponding to the primary questions as defined by the authors |
| Outcome measures other than the primary outcome of interest | |
| Quotes on teamwork corresponding to the primary outcomes. | Quotes which describe the effect of CPWs on teamwork |
## APPENDIX D

### Risk of Bias (8)

**Bookbinder 2005 (CBA study design)**

<table>
<thead>
<tr>
<th>Item</th>
<th>Authors Judgement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Was the allocation sequence adequately generated?</td>
<td>High risk</td>
<td>CBA design</td>
</tr>
<tr>
<td>Was the allocation adequately concealed?</td>
<td>High risk</td>
<td>CBA design</td>
</tr>
<tr>
<td>Were baseline outcome measurements similar?</td>
<td>Unclear</td>
<td>No mention of baseline characteristic</td>
</tr>
<tr>
<td>Were baseline characteristic similar?</td>
<td>Low risk</td>
<td></td>
</tr>
<tr>
<td>Were incomplete data adequately addressed</td>
<td>Unclear</td>
<td>Insufficient information to say “yes or no”</td>
</tr>
<tr>
<td>Was knowledge of the allocated intervention adequately prevented during study</td>
<td>High risk</td>
<td>Subjective measures used (CAT, PAT, PCQN), no mention of blinding</td>
</tr>
<tr>
<td>Was the study adequately protected against contamination?</td>
<td>High risk</td>
<td>The pilot was quasi-experimental and involved the acquisition of relevant pre-post data from patient records and nursing staff on the three study units and on two general medical units (the “comparison units”)</td>
</tr>
<tr>
<td>Was the study free from selective outcome reporting</td>
<td>Unclear</td>
<td>Insufficient information to say “yes or no”</td>
</tr>
<tr>
<td>Was the study free from other risk of bias</td>
<td>High risk</td>
<td>Many factors may have limited our ability to quantify a positive effect related to the PCAD pathway and PCAD intervention. We could not exercise control over multiple extraneous variables within the system (e.g., referral to the consultation team of the DPMPC), cultural and leadership styles within each unit, exposure of staff to other educational offerings in pain or symptom management, and varied patient diagnoses.</td>
</tr>
</tbody>
</table>

Overall risk of bias: High risk

**Brattebo 2002 (ITS study design)**

<table>
<thead>
<tr>
<th>Item</th>
<th>Authors Judgement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Was the interpretation independent of other changes</td>
<td>Unclear</td>
<td>No mention of other changes</td>
</tr>
<tr>
<td>Was the shape of intervention effect pre specified</td>
<td>High risk</td>
<td>ITS design – not specified only based on figures</td>
</tr>
<tr>
<td>Was the intervention unlikely to affect data collection</td>
<td>Low risk</td>
<td>Baseline data were taken from the intensive care unit’s clinical database (Regina), which has been in use for several years. Severity of illness was measured by the SAPS II scoring system. Ventilator time (measured in 24 hour days - for example, 6 hours = 0.25 days), length of stay in the</td>
</tr>
</tbody>
</table>
intensive care unit (in days), and mortality were also recorded.

<table>
<thead>
<tr>
<th>Item</th>
<th>Authors Judgement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Was knowledge of the allocated intervention adequately prevented during study</td>
<td>Low risk</td>
<td>No mention of who performed data collection, ventilator time, length of stay and mortality all objective measures.</td>
</tr>
<tr>
<td>Were incomplete data adequately addressed</td>
<td>Low risk</td>
<td>No missing outcome data.</td>
</tr>
<tr>
<td>Was the study free from selective outcome reporting</td>
<td>Low risk</td>
<td>All the study pre-specified outcomes have been reported.</td>
</tr>
<tr>
<td>Free of other bias</td>
<td>Unclear</td>
<td>Difficult to interpret the observed results and to know whether they are due to the intervention effect or other factors.</td>
</tr>
<tr>
<td>Overall risk of bias</td>
<td>Low risk</td>
<td>Overall risk of bias is low.</td>
</tr>
</tbody>
</table>

Doherty 2006 (CBA study design)

<table>
<thead>
<tr>
<th>Item</th>
<th>Authors Judgement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Was the allocation sequence adequately generated?</td>
<td>High risk</td>
<td>CBA design.</td>
</tr>
<tr>
<td>Was the allocation adequately concealed?</td>
<td>High risk</td>
<td>CBA design.</td>
</tr>
<tr>
<td>Were baseline outcome measurements similar?</td>
<td>High risk</td>
<td></td>
</tr>
<tr>
<td>Were baseline characteristic similar?</td>
<td>Low risk</td>
<td></td>
</tr>
<tr>
<td>Were incomplete data adequately addressed</td>
<td>Unclear</td>
<td>Number of patients differs between pre and post intervention. No reasons for missing data provided.</td>
</tr>
<tr>
<td>Was knowledge of the allocated intervention adequately prevented during study</td>
<td>Unclear</td>
<td>Based on estimates of attendances with asthma for these hospitals, 7 months of pre-intervention data were collected from 1 January to 31 July 2004 and 7 months of post-intervention data were collected from 1 October 2004 to 30 April 2005.</td>
</tr>
<tr>
<td>Was the study adequately protected against contamination?</td>
<td>Low risk</td>
<td>The study hospitals were subjected to an EBI outlined below. The control hospitals had no additional intervention to help implement.</td>
</tr>
<tr>
<td>Was the study free from selective outcome reporting</td>
<td>Unclear</td>
<td>Main outcome of the study not clearly defined in the methods section outcomes appears only in the results section.</td>
</tr>
<tr>
<td>Was the study free from other risk of bias</td>
<td>Unclear</td>
<td>Insufficient information to assess whether an important risk of bias exists.</td>
</tr>
<tr>
<td>Overall risk of bias</td>
<td>High risk</td>
<td>Overall high risk of bias.</td>
</tr>
</tbody>
</table>

Falconer 1993 (RCT)

<table>
<thead>
<tr>
<th>Item</th>
<th>Authors Judgement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Was the allocation sequence adequately generated?</td>
<td>Unclear</td>
<td>Insufficient information about the sequence generation process to permit judgment yes or no.</td>
</tr>
<tr>
<td>Was the allocation adequately concealed?</td>
<td>Unclear</td>
<td>Method of concealment not described.</td>
</tr>
<tr>
<td>Were baseline outcome measurements similar?</td>
<td>Low risk</td>
<td>ANCOVA controlling for baseline functional status revealed no significant differences between groups.</td>
</tr>
</tbody>
</table>
Were baseline characteristic similar? | Low risk | The groups were statistically equivalent on all descriptive variables.

Were incomplete data adequately addressed | Low risk | Seven randomly assigned patients did not complete the rehabilitation program because of sickness (CPM group n = 3, control group n = 4) and were dropped from the study.

Was knowledge of the allocated intervention adequately prevented during study | High risk | The main outcome measures were length of stay, hospital charges, and functional status. Functional status was measured by the Functional Independence Measure (FIM) is a standardized, performance based, observer-rated assessment of self-care. The professional most relevant to the item scored the item.

Was the study adequately protected against contamination? | Unclear | No description of potential contamination.

Was the study free from selective outcome reporting | Low risk | All of the pre-specified outcomes have been reported in the pre-specified way

Was the study free from other risk of bias | Low risk | The study appears to be free of other sources of contamination

Overall risk of bias | Unclear | Overall high risk is unclear

**Sulch 2000**

<table>
<thead>
<tr>
<th>Item</th>
<th>Authors Judgement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Was the allocation sequence adequately generated?</td>
<td>Low risk</td>
<td>Patient allocation made on the basis of a computer-generated list of random numbers.</td>
</tr>
<tr>
<td>Was the allocation adequately concealed?</td>
<td>Unclear</td>
<td>Insufficient information about the sequence generation process to permit judgment of yes or no.</td>
</tr>
<tr>
<td>Were baseline outcome measurements similar?</td>
<td>Unclear</td>
<td>No mention of baseline outcome measures</td>
</tr>
<tr>
<td>Were baseline characteristic similar?</td>
<td>Low risk</td>
<td>There were no significant differences in age and stroke characteristics between the 2 groups. Although there were more men in the ICP-managed group, this difference was not statistically significant. The 2 groups were also comparable for premorbid function, neurological impairment, and level of disability at randomization.</td>
</tr>
<tr>
<td>Were incomplete outcome data adequately addressed</td>
<td>Low risk</td>
<td>No missing outcome data</td>
</tr>
<tr>
<td>Was knowledge of the allocated intervention adequately prevented during study</td>
<td>High risk</td>
<td>Research assessments were undertaken by 2 observers who were not directly involved in patient care. Both observers undertook independent assessments on each patient, and scores on which there was agreement were used</td>
</tr>
<tr>
<td>Was the study adequately protected against contamination?</td>
<td>Low risk</td>
<td>The study was carried out on a stroke rehabilitation unit, which consisted of 2 separate bed areas managed by separate teams of nurses</td>
</tr>
<tr>
<td>Was the study free from selective outcome reporting</td>
<td>Low risk</td>
<td>All of the pre-specified outcomes have been reported in the pre-specified way</td>
</tr>
<tr>
<td>Was the study free from other risk of bias</td>
<td>Low risk</td>
<td>The study appears to be free of other sources of bias</td>
</tr>
<tr>
<td>Overall risk of bias</td>
<td>Unclear</td>
<td>Overall high risk is unclear</td>
</tr>
</tbody>
</table>
### Sulch 2002

<table>
<thead>
<tr>
<th>Item</th>
<th>Authors Judgement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Was the allocation sequence adequately generated?</td>
<td>Low risk</td>
<td>Patient allocation made on the basis of a computer-generated list of random numbers.</td>
</tr>
<tr>
<td>Was the allocation adequately concealed?</td>
<td>Unclear</td>
<td>Insufficient information about the sequence generation process to permit judgment of yes or no.</td>
</tr>
<tr>
<td>Were baseline outcome measurements similar?</td>
<td>Unclear</td>
<td>No mention of baseline outcome measures.</td>
</tr>
<tr>
<td>Were baseline characteristic similar?</td>
<td>Low risk</td>
<td>The ICP and MDT groups were comparable for age (75±11 versus 74±10 years), sex (46% versus 56% male; P=NS), domicile, and premorbid function. There were no differences in the baseline mean Orgogozo score (57±24 versus 53±22) and median Barthel Index score (5 versus 5) between the 2 groups.</td>
</tr>
<tr>
<td>Were incomplete outcome data adequately addressed</td>
<td>Low risk</td>
<td>No missing outcome data.</td>
</tr>
<tr>
<td>Was knowledge of the allocated intervention adequately prevented during study</td>
<td>High risk</td>
<td>Demographic and other data, such as cognition and premorbid functional ability, were collected at entry to the study.</td>
</tr>
<tr>
<td>Was the study adequately protected against contamination?</td>
<td>Low risk</td>
<td>The study was carried out on a stroke rehabilitation unit, which consisted of 2 separate bed areas managed by separate teams of nurses.</td>
</tr>
<tr>
<td>Was the study free from selective outcome reporting</td>
<td>Low risk</td>
<td>All of the pre-specified outcomes have been reported in the pre-specified way.</td>
</tr>
<tr>
<td>Was the study free from other risk of bias</td>
<td>Low risk</td>
<td>The study appears to be free of other sources of bias.</td>
</tr>
<tr>
<td>Overall risk of bias</td>
<td>Unclear</td>
<td>Overall high risk is unclear.</td>
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</table>
APPENDIX E

Analysis to determine potential relationships or theories on the effect of CPW on teamwork.

Review: Clinical pathways: Effect on interprofessional collaboration in a hospital setting
Comparison: Stand-alone clinical pathway vs usual care
Outcome: Length of Stay (LOS) Excluded studies

![Forest plot of comparison: Clinical Pathway vs Usual care, outcome: Length of Stay (LOS) Excluded studies. Source: Review Manager 5(94)]
Review: Clinical pathways: Effect on interprofessional collaboration in a hospital setting

Comparison: Stand-alone clinical pathway vs usual care

Outcome: Length of Stay (LOS) Excluded studies

Figure 5.2: Forest plot of comparison: Clinical Pathway vs Usual care, outcome: Length of Stay (LOS) Excluded studies. Source: Review Manager 5(94)

Review: Clinical pathways: Effect on interprofessional collaboration in a hospital setting

Comparison: Stand-alone clinical pathway vs usual care

Outcome: Length of Stay (LOS) Included studies

Figure 5.3: Forest plot of comparison: CPW intervention vs Usual care, outcome: Length of Stay (LOS) Included studies. Review Manager 5(94)
Review: Clinical pathways: Effect on interprofessional collaboration in a hospital setting
Comparison: Stand-alone clinical pathway vs usual care
Outcome: Length of Stay (LOS) CPW indication

Figure 5.4 Forest plot of comparison: Clinical Pathway vs Usual care, outcome: Length of Stay (LOS) CPW indication. Source: Review Manager 5(94)
REFERENCES

50. Twigg N. Core Competencies for Interprofessional Collaborative Practice.


