Chapter 52. Critical Pathways

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Background

Burgeoning concerns regarding patient safety, variable health care quality and increasing health care costs have led to the introduction of clinical management tools that have their origins outside of the traditional health care sector. Primary among these innovations has been the implementation of critical pathways, administrative models that streamline work and production processes.[1] Critical pathways have been utilized extensively in several different business sectors including the construction and automotives industries.[2-4] It is theorized that the adaptation of pathways to health care, particularly inpatient care, may help ensure the delivery of quality care and decrease the occurrence of medical errors.

Practice Description

Although closely related to clinical practice guidelines (Chapter 51), pathways more directly target the specific process and sequence of care, frequently plotting out the expected course of an illness or procedure with associated prompts for appropriate interventions. Also known as clinical pathways and care maps, pathways are generally multidisciplinary by design and may incorporate the responsibilities of physicians and nurses with those of ancillary medical providers including pharmacists, physical therapists and social workers.[5] They are regularly intercalated into the point-of-care and may, in some cases, incorporate or even replace traditional chart documentation. In addition, pathways are often evidence-based and may even be integrated with locally or nationally developed clinical practice guidelines. Most pathways, however, are locally developed and are most frequently implemented at the level of the hospital or medical center as part of a cost-containment or quality assurance initiative.

Prevalence and Severity of the Problem/Opportunities for Impact

It is well established that the methods currently used to disseminate medical information are both cumbersome and inefficient. Even medical advances that are well entrenched in the literature and of unquestionable value are not routinely or universally implemented. A study of patients treated for myocardial infarction in Connecticut, for example, revealed only 50% of patients received the most basic beneficial treatments (aspirin and beta-blockers) at the time of admission.[6] A second report suggested that 3500 myocardial infarctions would be averted and 4300 lives would be saved annually if all eligible patients with coronary artery disease were prescribed beta-blockers.[7] Critical pathways, if able to beneficially alter health care provider performance and ensure that effective patient safety strategies were practiced on a widespread basis, could be powerful agents in the prevention of medical errors, in addition to any beneficial impact they might have on overall health care quality.

Study Design

There is a dearth of well-designed studies analyzing the extent to which critical pathways change physician behavior and patient outcomes. Even fewer relate specifically to the topic of patient safety. There are no systematic reviews of pathways and most of the published work describes the non-randomized implementation of pathways in which it is often difficult to differentiate effects of the pathway from secular trends. The vast majority of these studies describe the implementation of a pathway for a specific surgical procedure and use historical controls with a retrospective before-after study design.[8-19]

Four randomized controlled trials investigated the impact of the implementation of pathways.[20-23] There are also several studies with non-randomized concurrent controls with enrollment in the intervention arms being completed at the request of the attending physician.[24,25] The latter group of studies also included historical control groups. There is one prospective before-after trial in which the control group actually shifted to receive the intervention after a washout period.[26] Finally one study used historical controls and concurrent controls from other hospitals in the region.[27] Table 52.1 describes the salient features of these papers.

Study Outcomes

The great majority of the cited studies reported at least one clinical outcome (Level 1) with the most commonly reported variable being diagnosis-related complications. Very few of the studies reported more definitive endpoints, such as mortality. Most of the included studies reported surrogate clinical end-points (Level 2) as the major study outcome variables, usually length of stay and re-admission rates. The relative utilization of certain interventions including medications, laboratory tests and radiology studies was also commonly reported. In addition, most of the studies also included an analysis of the changes in costs associated with instituting the pathway. Some of the studied pathways did include other recommendations for interventions germane to the field of patient safety, including the use of indwelling urinary catheters (Chapter 15) and prophylactic preoperative antibiotics (Chapter 20.1), but these outcomes were rarely reported.

Evidence for Effectiveness of the Practice

Several of the randomized controlled trials provide at least some evidence that critical pathways can be effective in influencing health care provider behavior. One study evaluated the effectiveness of a pathway for the treatment of asthma in children admitted to a non-ICU hospital setting.[22] Those patients treated under the pathway, when compared to the control group undergoing "usual care," had a shorter length of stay as well as decreased hospital charges and medication usage, but no change in complication rates. Although the results are somewhat promising, the study was likely skewed by a significant Hawthorne effect, as patients treated under the pathway were placed on a separate clinical ward than those undergoing usual care (although the same physicians cared for both groups of patients). This study found no impact on the rate of complications, which provides little encouragement regarding the ability of pathways to reduce medical errors and enhance patient safety.

A second randomized trial investigated the utility of a pathway for the treatment of patients undergoing knee and hip replacement at an academic medical center in Australia.[21] Implementation of the pathway was followed by significant decreases in the length of stay and shorter times to patient mobilization and ambulation. More importantly, it showed a decrease in the incidence of medical complications, including readmission rates (although this change did

not reach statistical significance). The study, although fairly small at 163 total patients, represents some of the most convincing evidence that pathways may be effective in decreasing complications.

A third randomized trial, performed by the same Australian group, evaluated the effect of a pathway for the treatment of patients with hip fracture.[20] Implementation of this pathway, which provided recommendations regarding medications, laboratory and radiology testing and discharge planning, resulted in a significantly shorter lengths of stay without any concomitant change in complication rates. The study was rigorously conducted and complication rates were meticulously documented, but no information regarding the effort needed from clinicians to comply with the pathway was presented.

A final trial used cluster randomization to investigate the effectiveness of a critical pathway for the treatment of community-acquired pneumonia in 19 Canadian hospitals.[23] The pathway, which was initiated upon presentation of the patient to the emergency department, included recommendations for the use of a specific antibiotic and provided a clinical prediction tool to aid in decisions regarding hospital admission. Following admission, a study nurse also regularly placed guideline-based recommendations in the chart regarding changing to oral antibiotic therapy and discharge planning. The pathway showed impressive results in terms of cost containment, with a shorter length of stay and a smaller percentage of inappropriate admissions. However, there were no significant changes in the clinical parameters measured, including mortality and complication rates. In addition, it is difficult to dissect the effect of the pathway from that of the other elements of the multifaceted intervention.

The second strata of studies were less encouraging. A prospective before-after evaluation of the implementation of a pathway for the administration of supplemental oxygen for hospitalized patients showed the pathway was associated with markedly elevated costs without any significant clinical benefit.[26] This study, which used an intensive 3-tiered strategy including an oxygen order form, the posting of the pathway in patient rooms and a research nurse providing immediate audit and feedback, doubled the cost of providing supplemental oxygen. Although it did change some of the physician prescription practices, this alteration in practice resulted in no appreciable clinical effect.

At least 2 other studies compared an intervention group with a non-randomized concurrent control group (thus introducing the possibility of selection bias) as well as to historical controls. In a study evaluating the impact of a critical pathway on the treatment of patients undergoing neck dissection, the length of stay and total costs were significantly lower for the pathway group when compared with those of the historical controls. However, the differences disappeared when the concurrent control group was used.[25] In the other, a study of a pathway for the treatment of asthma exacerbations, the pathway resulted in improvements in resource utilization that were significant compared to both historical and concurrent controls.[24] However no changes were noted between the groups in readmission rates or medical outcomes.

Finally, there are a great number of observational before-after studies of pathways, the vast majority of which relate to specific surgical procedures.[8-19] Few of these studies account for secular trends and their capacity for judging the effectiveness of critical pathways is limited, at best. In addition, a recent evaluation of pathways for patients undergoing a variety of surgical procedures compared the intervention group to both historical controls and to patients from similar hospitals in the same region in an attempt to correct for such secular trends. Although implementation of the pathways resulted in significant decreases in length of stay when compared to the historical controls, these differences disappeared when the pathway groups were compared to the concurrent control groups from the other hospitals.[27] An additional study of the

effect of a pathway on the treatment of acute myocardial infarction demonstrated that the improvements seen in the intervention group were likely secondary to secular trends and not an independent effect of the pathway.[6] These powerful results cast a great deal of doubt over those studies that demonstrated effectiveness of the pathways in comparison to historical controls alone.

Potential for Harm

There are theoretical concerns that pathways may result in adverse patient outcomes as a result of shortened length of stay and a dependence on "cookbook medicine," although there is little support for this in the literature.

Costs and Implementation

Although many studies report cost savings associated with instituting pathways, very few detail the costs of developing and implementing them. One report attempted to put a dollar figure on the development of a pathway for the treatment of patients undergoing knee replacement surgery; however the reported estimate ($21,000) did not account for the time staff physicians spent on the project.[14] The expense of developing critical pathways in terms of physician time commitment and actual financial outlay is unknown. In addition, most pathways are developed on the local level and require a great deal of initiative and expertise on the part of the hospital or medical center. Whether most centers have access to these resources is unclear.

Physicians and other providers are also not universally welcoming of critical pathways. They are considered intrusive by some providers and evidence of "cookbook medicine" by others. The developers of pathways must be careful to allow for clinical judgment and flexibility in the pathways or they are likely to be ignored or applied too rigidly.

Comment

There is conflicting evidence regarding the efficacy of critical pathways as a method to modify health care provider behavior and a means of implementing patient safety initiatives. Although a few studies suggest they may impact physician practice and, to a lesser extent, complication rates and other clinical outcomes, the data are inconsistent and more studies are needed. Additionally it is unclear whether the costly development and implementation of pathways represents an appropriate use of limited health care resources. Finally, there is very little information on the application of pathways to patient safety.

Table 52.1. Key features of studies of critical pathways

Study Setting	Design, Outcomes	Clinical Outcomes (p value)	Non-Clinical Outcomes (p value)
Children with an asthma exacerbation admitted to an academic medical center: patients randomized to pathway group or usual care group[22]	Level 1, Level 1	Shorter duration of intensive nebulizer treatment (0.02), length of stay (0.01)	Lower room charges (0.001) and therapy charges (0.001)
Patients undergoing hip or knee replacement surgery at an academic medical center in Australia: patients randomized to pathway group or usual care group[21]	Level 1, Level 1	Shorter length of stay (0.011) and time to mobilization (0.001) and ambulation (0.02)	
Patients being treated for hip fracture at an academic medical center in Australia[20]	Level 1, Level 2	Shorter length of stay (0.03)	
Patients presenting to the emergency department with pneumonia at 19 medical centers across Canada: hospitals were randomized to pathway group or usual care group[23]	Level 1, Level 1	Lower rates of bed-days per patient (0.04), shorter length of stay (0.01) and shorter duration of IV therapy (0.01)	
Patients in need of supplemental oxygen therapy: prospective before-after analysis with washout period[26]	Level 2, Level 1	More frequent appropriate oxygen discontinuation orders (0.001)	Increased costs (0.02)
Patients undergoing unilateral neck dissection at an academic medical center: pathway group compared to historical controls and non-randomized concurrent controls[25]	Level 2, Level 1	Length of stay decreased compared to historical controls (0.001) but not concurrent controls	Total costs decreased compared to historical controls (0.001) but not concurrent controls
Patients admitted to a community teaching hospital for the treatment of an asthma exacerbation: pathway group compared to historical controls and non-randomized concurrent controls[24]	Level 2, Level 1	More appropriate antibiotic use and conversion to nebulizer treatment (0.002 for historical controls, 0.05 for concurrent controls)	
Patients undergoing one of several defined surgical procedures over a seven year period at an academic medical center: pathway group compared to historical controls as well as to patients from other similar hospitals in the same region[27]	Level 2, Level 2	Decreased lengths of stay for the pathway group compared to the historical controls, but not compared to the concurrent control group	

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