

# ACCP WHITE PAPER

## Critical Pathways: The Role of Pharmacy Today and Tomorrow

American College of Clinical Pharmacy

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Critical pathways represent comprehensive management plans that aim to optimize and streamline patient care.<sup>1</sup> Critical pathways have been referred to in the medical literature by a number of different terms, including care path, care map, clinical pathway, critical path of care, case management plan, multidisciplinary action plan, collaborative care track, plan of care, clinical care plans, and care guides.<sup>2</sup> These plans define key steps in disease management not only to improve the quality of health care, but also to reduce resource utilization. Some of the specific goals of critical pathways include providing continuous quality improvement, decreasing service fragmentation through managed care, optimizing cost-effectiveness of health care delivery, guiding the patient and family through expected treatment and progress, and increasing satisfaction of patients, families, staff, physicians, and third-party payers.<sup>3</sup> Critical pathways create targeted patient outcomes and quality end points, which form a foundation for common expectations, shared responsibility, regular communication, and early problem detection and inter-

vention among all members of the health care team.<sup>4</sup> Further, they identify specific time frames and desired outcomes associated with each care step, with the goals of minimizing delays and maximizing resource utilization.<sup>3</sup> The critical pathway can serve not only as a monitoring tool for identifying and addressing quality issues in a timely fashion, but also as a tool for educating health care providers to recognize the efficient and clinically appropriate use of resources. Although the importance of critical pathways remains somewhat controversial, since the first American College of Clinical Pharmacy (ACCP) White Paper was published in 1996<sup>1</sup> they have been shown to improve patient outcomes and to reduce health care expenses in various settings.<sup>5–23</sup>

Critical pathways should be distinguished from clinical treatment guidelines, as the latter may be intended to define appropriate care for a specific indication (e.g., community-acquired pneumonia). Development of critical pathways has been promoted in evidence-based clinical practice guidelines, as critical pathways include elements meant to track compliance, patient outcomes, or continuous quality improvement.<sup>24</sup> The main difference, therefore, between critical pathways and disease-specific guidelines is that critical pathways focus on targets of care for the clinical management of patient groups instead of addressing decisions regarding individual patient management.<sup>1</sup>

### Pharmacy and Critical Pathways

Historically, critical pathways were first

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implemented in health care during the 1980s when prospective payment and competitive bidding were introduced into hospital reimbursement systems.<sup>4, 25</sup> With the extensive implementation of managed care, critical pathways covered broader patient care–associated issues, such as pharmacologic and nonpharmacologic therapies, interventions, activities, and outcomes, throughout the entire course of care. As pointed out in the first ACCP White Paper,<sup>1</sup> critical pathways are often designed to control health care costs without sacrificing quality of care by targeting high-volume, high-cost, and/or high-risk diagnoses or procedures across a spectrum of health system settings.

Because pharmacotherapy is a central component of many critical pathways, pharmacists should take leadership roles in the development, implementation, and assessment of critical pathways.<sup>26</sup> Critical pathways have been used to establish and document the valuable, accountable roles of pharmacists as essential members of the health care team. Official statements regarding practice guidelines and pharmacists' involvement in patient management, particularly drug therapy and outcomes, have been published by the ACCP and the American Society of Health-System Pharmacists.<sup>1, 26</sup> Both of these articles not only describe the critical pathway process, from development through evaluation, but also promote and justify the pharmacist's role. With the advances of clinical pharmacy and medicine, particularly new knowledge and technology, into health care, pharmacists have been extensively involved in various aspects of the critical pathway. Therefore, a more comprehensive and updated document is warranted to incorporate these changes.

The purpose of this White Paper is to review the steps in critical pathway development, to discuss the pharmacist's role in critical pathways, and to describe the use of critical pathways to maximize delivery of health care while ensuring efficient and effective use of resources. This article also provides a summary of the key components of a critical pathway that have been suggested since the ACCP's initial publication.

## Creating a Critical Pathway

### Pathway Setup

Critical pathways are typically created with the goal to efficiently improve care. The process of critical pathway development and implementation consists of the following steps:

- Identify target patient population, procedure, or disease category
- Educate staff about critical pathways
- Convene a multidisciplinary group of care providers
- Identify ideal key outcomes and corresponding timeline for accomplishment of key outcomes
- Gather information, which may include chart audits
- Develop critical pathway based on ideal, realistic, or current practice
- Educate the staff about the critical pathway and the implementation plan
- Implement the critical pathway
- Evaluate the critical pathway periodically
- Insert new alternatives, interventions, and plans into the critical pathway to improve performance
- Reevaluate the critical pathway after each adjustment

The process also includes evaluation of a health care facility's current process of care and review of medical evidence and external practices.<sup>27</sup> Health care teams place an emphasis on critical pathway development for medical or surgical conditions for which there are some evidence-based mechanisms for improvement of outcomes, efficiency, or cost reduction. The success of a critical pathway depends on several factors, including ease of use, integration and communication with all individuals involved, and incorporation of critical variables that could affect potential outcomes. Some patients or situations, however, may not fit within the confines of a critical pathway. Obtaining baseline measurements and identifying unforeseen situations during development may increase the success of a critical pathway. A pilot run before full implementation of the critical pathway can also be useful to reveal any unrecognized variables or barriers.

Once the critical pathway is implemented, a follow-up assessment of its impact, using predefined outcomes and baseline observations, should be considered. Periodic assessments may be needed to ensure that goals outlined by the critical pathway continue to be met. Deficiencies should be noted and corrected when possible. Objective observations that incorporate recent developments should be considered when modifying or updating a critical pathway. This process may have the additional benefit of providing useful continuous quality improvement measures as well.

### Patient Population Selection

The first step in critical pathway development is the selection of a patient population. Homogeneity of the population, predictability of hospital course, and standardization of care are key components in selecting patient groups for critical pathway management.<sup>28</sup> Patients may be classified by diagnosis, age range, procedure, or dependence on technology. The patient populations targeted may also be influenced by Joint Commission on Accreditation of Healthcare Organizations (JCAHO) indicator criteria, which are high-volume, high-cost, or high-risk patients or processes within a given institution.

### Team Members

Before undertaking the development and implementation of a critical pathway, the support of the medical staff and the health system's administration must be ensured. An interdisciplinary team must be formed to discuss and determine the goals of management of the selected disease state to be addressed by the critical pathway. The team must be cognizant of the current standard of care for whatever pathway is being pursued. Experts in the particular specialty, as well as those who will be using the pathway, should be consulted and included. Rational cost-effective therapy for the purpose of achieving definite outcomes that improve a patient's quality of life is the goal from the pharmacist's standpoint. In addition, mechanisms to ensure efficacy and patient safety must be incorporated into the pathway. The role of each discipline in achieving the team's goals must be documented. The critical pathway and rationale for specific components therein must be understood. Physicians; nursing staff; pharmacists; physical, occupational, and speech therapists; and the laboratory and other disciplines, as appropriate, should be included in the development, implementation, and continual evaluation of any pathway. They need to understand their roles in helping ensure that best practices and good patient care are incorporated into critical pathways.

Education about the disease state and the critical pathway is imperative at all levels, from the beginning of the development process through the piloting stage, organization- or hospitalwide implementation, and the continuous monitoring process. It is important to use and adapt the current systems in place in the development of the critical pathway. Information

needs to be easily obtained and followed on a daily, ongoing basis. Management information systems can help set up a database of objectives to be measured and, ideally, involve a system-wide automation process. Reimbursement issues may be of concern, particularly where the Centers for Medicare and Medicaid Services are involved. More stringent requirements for use of particular drugs may need to be adhered to in order to receive reimbursement. This should be taken into consideration when developing the pathway. The utilization review and risk management departments play key roles in assessing safety and compliance with state and national standards. In addition, incorporating goals, safety measures, and tools designed by other accreditation organizations, such as the Institutes for Safe Medication Practices and the JCAHO's National Patient Safety Goals, provides a mechanism for ensuring patient safety.

### Identification of Outcomes

Another component of critical pathway development is to define the desired clinical outcomes that can be achieved for most patients in the selected population. For example, a desired clinical outcome might be the cure of a disease, with no adverse effects, within a given time frame and for a given cost. Critical pathway development offers an ideal opportunity to examine current practice habits for the selected patient population. Before constructing the critical pathway, the best practice for the target population should be defined by using literature review and benchmarking. The reader is referred to the chapter entitled "Evidence-Based Pharmacotherapy" (in Book 5, pp 115–127, January 2005) in *Pharmacotherapy Self-Assessment Program, Fifth Edition* (ACCP, Kansas City, MO), for an excellent review on methods to access and use the literature for this purpose. Benchmarking involves a comparison of the institution's current practice with those of other similar institutions.<sup>27</sup> Particular attention should be paid to outcomes where the greatest variations occur, such as length of stay (LOS), average costs, departmental costs, timing of key interventions, and utilization of resources, such as laboratory and pharmacy services. This step in the critical pathway development process affords the pharmacist the opportunity to build rational and cost-effective drug therapy into the standard of practice for the selected patient population.<sup>28</sup> During the evaluation of best practices, team members

should meet frequently to discuss findings and determine how the information applies to their institution. Pharmacists should be prepared to support their recommendations for drug therapy with scientific data, if available, as well as with benchmarking information and cost analyses. Impediments to pathway development include lack of data on current practices and outcomes with specific disease states, difficulty in gaining consensus from multiple practice groups, and time-intensive personnel requirements. Teams should solicit support from critical users and experts who may help to ensure acceptance and assist with pathway implementation.

### Implementation and Assessment of a Critical Pathway

Successful implementation of a critical pathway depends on health care provider education and understanding of the purpose and need for the pathway. A 6-month pilot testing of the pathway is recommended to allow health care providers to become familiar with using the pathway and to allow the team to modify it as opportunities for improvement are identified.<sup>29</sup> Health care providers should be encouraged to offer suggestions and comments to improve the pathway and render it as “user friendly” as possible. Data collected during the pilot evaluation period should include measures of compliance with and variances from the pathway, as well as preliminary clinical and financial outcomes.

### Variances

When evaluating performance of a critical pathway, it is important to assess variances. A variance occurs when an intervention or outcome does not occur as predicted. For example, an intervention may not occur, or it may occur too early or too late. Variances can be positive or negative, avoidable or unavoidable. These variations can lead to unnecessary care or delays in care with resultant increased expenses. An analysis of the critical pathway begins with an evaluation of the complete process. Within most health care settings, critical pathways are recognized as essential components of quality improvement. They provide a basis for analysis of variances, outcomes, patient satisfaction, and caregiver experiences. The overall process should be conducive to implementation of revisions to improve the critical pathway.<sup>2</sup> As mentioned previously, the overall objective of the critical pathway is to improve the quality of

patient care by reducing variations in practice patterns for disease states or procedures.

Typically, data are collected and analyzed for LOS, complication rates, mortality rates, and financial charges for a specific diagnosis, diagnosis-related group, or procedure code. A focused review of negative variances is necessary to improve overall patient care. Positive variances, such as early discharges, may be evaluated for “best practices” for future addition to the pathway and as part of the continuous quality improvement process. Critical pathways, however, must also have sufficient flexibility to meet individual patient needs. Variances may be caused by the patient, family, clinician, system, or community. Timely identification of variances can speed initiation of corrective actions. For example, if an objective for a given day is not met, the rapid development of an action plan by the health care team can help the patient return to the established pathway.

### Measuring the Impact of a Pathway

Measuring the impact of a critical pathway can be a time-consuming process. Although there has been a general call to improve computerization and automation of health care services, because of the large expenditure in time and money required, relatively few organizations have the sophisticated systems that can be used to support a critical pathway. Nevertheless, now is the time to begin considering how technology can assist the pathway process. Automation will help to ensure that the policies and protocols already in place are followed. Electronic systems may provide solutions if the wealth of information stored in them can be retrieved easily. One key factor in the design of critical pathways is to determine variables that will be measured before implementation. With the outcome variables in mind, an institution may be able to create reports that would be beneficial to many areas of the health care system. Outcomes, both patient care and financial, must be taken into account when measuring the impact of a critical pathway. Outcome measures should consider approaches that allow easy retrieval of results or benchmarks from the electronic database. Developing software, especially during the implementation of new systems, that can automatically track a particular pathway may simplify the process and provide immediate feedback. The information generated can also serve as a means to benchmark with previous assessment periods or for

comparison with similar institutions. Acquiring protected patient information requires Health Insurance Portability and Accountability Act compliance and possibly institutional review board clearance.

Not only is software development a key component, but also maintenance of the hardware and infrastructure to facilitate the assessment of a critical pathway is essential. The rapid development of faster and more powerful computing devices may allow for greater access and compliance to the critical pathway. Institutions are now using wireless technology to bring patient care to the bedside, to the outpatient clinic, or into the patient's home. Handheld and portable devices may be used to sort, store, and retrieve patient data while using wireless network connections. These devices, coupled with a powerful network, can allow greater access and use of critical pathways within a particular health care system. The patient's care and progress through the critical pathway can be measured throughout the continuum of care.

Pharmacists play a key role in these processes. They should ensure that such programs are not prone to creation of errors. Pharmacists should also ensure that needed elements and links to other databases (such as allergy and reaction information, drug interaction information, dose range information, laboratory results, and problem lists or diagnoses) are built into the critical pathway to streamline the order entry process and to promote ease of use and compliance by practitioners. Automation of data collection by using computerized information can avoid the current necessity of chart review, interpretation of handwriting and intent of handwritten statements, and delay in data collection and feedback. Technologically inclined pharmacists can assist with designing programs that capture desired data elements and with writing programs to generate reports related to the data.

Electronic systems have additional benefits in ensuring compliance with a given pathway. In the setting of physician order entry, the standard order form used by the physician can be designed to follow established pathways. A specific step can be incorporated into the order entry process that requires a response before completing an order, allowing improved compliance with the pathway. Complex decision trees can be navigated by the responses at each step, easing the process while accomplishing the desired goals. For example, in a patient-controlled

analgesia pathway, the physician may not be able to complete an order until the allergies, anti-emetic regimen, and dosage rates are determined. Discharge orders may not be processed until a pharmacist has been notified to check and provide any necessary follow-up. Certain drugs may not be ordered if the necessary baseline laboratory values are not noted or ordered. Automatic stop times and necessary monitoring parameters can be determined and ordered at the time of initial order entry. The system can be tailored both to the current literature regarding the treatment of a disease state and to the formulary of the institution.

### Pharmacist's Role

As part of critical pathway development and implementation, pharmacists must review or revise current pharmacy policies and protocols and implement them to ensure consistency in practice. A pharmacist can play an important role on a team evaluating a critical pathway that requires appropriate drug utilization, including those in which drugs are ancillary, such as diagnostic or surgical procedures. Selection of a standard set of drugs to be used in the pathway should be based on the health system's formulary that includes a process in which new information on disease management, including available drug therapies, can be incorporated. Perhaps addition, deletion, or restriction of particular drugs will be necessary to accomplish this. By incorporating rational, cost-effective therapy into critical pathways, pharmacists can ensure that interventions are consistent with pharmacy department policies and procedures, pharmacy and therapeutics committee policies, and drug use evaluation indicators.<sup>28</sup> For diagnoses or procedures in which pharmacotherapy is necessary, a pharmacist can play a major role in the appropriate selection and monitoring of treatment.<sup>30</sup> Many health care organizations have created departments to manage pathway development, facilitate team composition, ensure consistent formats, and monitor the processes in an ongoing fashion for continuous quality improvement after implementation. These departments or committees should continue to be involved as the pathway is used and reevaluated.

The pathway, or its monitoring system, should allow for timely identification, resolution, and prevention of morbidity. Pharmacy services, including but not limited to pharmacotherapy consults and discharge drug counseling, should

be integrated into the critical pathway, and documentation of such services should be incorporated into the overall plan of care. Potential or actual drug-related issues, such as dosage adjustment guidelines, should be addressed proactively. Clinical interventions should be organized around patient needs and directed at outcomes. Reconciliation of drugs, generated cost-savings, and improvement in quality-of-care and quality-of-life objectives should be documented. In addition, pharmacists should develop a system for documentation and reporting of clinical interventions and services provided. These responsibilities and performance expectations for critical pathway development, implementation, and assessment should be incorporated into the pharmacist's job description. All of the above will ensure adherence to the critical pathway and uncover variations that may need to be addressed by the interdisciplinary team as they continue to assess the safety and effectiveness of the critical pathway.

After the initial pathway is developed, education of those who will be using the pathway is needed. Pharmacists can provide education to medical and nursing staffs regarding protocols and drug therapies to be used or incorporated into the pathway. These groups should also be informed of performance standards and goals being measured by pharmacy. The three "C's"—communication, continuity, and consistency—cannot be overemphasized. As pharmacists use a critical pathway, they can model and educate other clinicians about the pathway. Pharmacists should prospectively design drug use evaluations in such a way that areas of the critical pathway involving safety, adherence, variation, and efficacy, including specifically designated outcomes, can be assessed. Analysis of the results, with suggested alterations, should be shared with the groups who developed and use the pathway and appropriate clinical and/or administrative committees.

#### Use of Critical Pathways to Impact Patient Care: Theory and Experience

Many health care settings have developed critical pathways to become or remain competitive in the health care marketplace. Competition for managed care contracts is often a stimulus to implement critical pathways that improve predictability of the patient's clinical course and reduce cost. Evaluation of drug-related outcomes has become essential in this era of managed care

and health care reform. Although measurement of outcomes is one of the most important aspects of the critical pathway, it is one of the most difficult. Early work in the area of critical pathways focused primarily on processes. More recently, pathways have incorporated assessment of intermediate and long-term outcomes of care, including ambulatory management of the patient. Examples of out-comes measured directly by critical pathways include the level of patient activity at a defined time point and the patient's ability to demonstrate certain self-care skills or knowledge of drug therapies at the time of discharge.<sup>29</sup> This transformation follows the principles of continuous quality improvement and has been described as a transition from task-based practice to outcomes-based practice.<sup>31</sup> Two of the beneficial intermediate outcomes associated with a critical pathway are the reduction of variation and the prompt recognition and management of variation.

Among the potential positive outcomes described with critical pathway management are reduced length of hospital stay,<sup>32</sup> lower cost,<sup>32</sup> fewer complications<sup>32</sup> and readmissions,<sup>4, 33</sup> improved resource utilization, better communication among hospital staff,<sup>4, 34</sup> and greater patient satisfaction.<sup>35, 36</sup> Although these results of closely managed and monitored care are not unexpected, actually documenting such outcomes is important. Unfortunately, only a few studies have directly compared outcomes with those achieved with traditional patient care methods in randomized controlled studies.<sup>27</sup> The use of historical controls or pre- or postevaluation designs can result in bias.

A large number of studies have documented the effectiveness of critical pathways in achieving a wide variety of clinical and financial outcomes.<sup>5-14, 29, 37, 38</sup> Table 1 summarizes the results of representative clinical trials of critical pathways for a variety of surgical conditions, and Table 2 summarizes results of clinical trials for a number of medical conditions. Although critical pathways were initiated for medical conditions in the early 1990s, most evaluations of critical pathways during the past 5 years have been for surgical conditions. In a retrospective cohort review of surgical critical pathways implemented between 1990 and 1996, postsurgical LOS was already declining in the prepathway period in about 62% of conditions assessed.<sup>39</sup> Therefore, even though postsurgical LOS was shorter after implementation of the pathway in 85% of conditions assessed, only 27% of these differences were

**Table 1. Summary of Results on Length of Stay, Clinical and Quality Outcomes, and Cost of Surgical Critical Pathways**

Study Design	Type of Surgery	No. of Patients by Group	Results
Randomized, controlled <sup>5</sup>	Laparotomy	31 pathway 33 traditional care	LOS 5.4 ± 2.5 vs 7.1 ± 4.8 days, pathway vs traditional (p=0.022); no difference in clinical care or QOL
Randomized, controlled <sup>6</sup>	Arthroplasty, hip and knee	92 pathway 71 standard care	Pathway group had shorter LOS (p=0.011) and earlier ambulation (p=0.001)
Retrospective cohort <sup>7</sup>	Arthroplasty, total knee	11 prepathway 24 postpathway	LOS 10.9 ± 5.4 vs 4.7 ± 1.4 days pre- vs postpathway (p<0.05), and cost trended lower in the postpathway group, \$13,328 vs \$11,862 (p=NS)
Retrospective cohort <sup>8</sup>	Retroperitoneal lymph node dissection	46 prepathway 72 postpathway	LOS decreased, 4.2 vs 6.4 days (p<0.005), fewer nasogastric tubes, 5% vs 94% (p<0.001), and fewer complications, 16% vs 26% (p=0.036) (post- vs prepathway for all comparisons)
Retrospective cohort <sup>9</sup>	Pancreatico-duodenectomy	68 prepathway 80 postpathway	LOS decreased 13.5 vs 16.4 days (p=0.001), and total cost decreased \$36,627 vs \$47,515 (p=0.003) (post- vs prepathway for both comparisons)
Case-control <sup>10</sup>	Mastectomy	83 pathway 69 control	LOS decreased 4.1 vs 4.91 days (p=0.018), and cost/case decreased \$4406 vs \$5050 (p=0.014) (pathway vs control for both comparisons)
Case-control <sup>11</sup>	Hysterectomy, myomectomy	28 pathway 28 control	LOS not different; shorter period of indwelling catheter (p=0.019), and more rapid return to normal diet (p=0.014) in the pathway group than in the control group
Retrospective cohort <sup>12</sup>	Appendicitis treatment	73 prepathway 112 postpathway	LOS (p<0.001) and hospital cost (p<0.01) were reduced in postpathway group
Retrospective cohort <sup>13</sup>	Laparoscopy, vaginal hysterectomy	40 prepathway 84 postpathway	Reduction in LOS, cost, and duration of surgery and anesthesia (p<0.01) in postpathway group
Retrospective cohort <sup>14</sup>	Cardiac bypass	382 prepathway 114 postpathway	LOS decreased 7.7 vs 11.1 days (p<0.0001), ICU stay decreased by 0.5 days (p<0.0001), and direct hospital cost was \$1181 lower (p<0.0001) in the postpathway group

LOS = length of stay; QOL = quality of life; ICU = intensive care unit.

statistically significant when adjusted for demographics, comorbidity, admission characteristics, and prepathway time trends. The median percentage change in LOS was a decrease of 12% or 1 day for aortic or mitral valve replacement, radical cystectomy, and radical prostatectomy, all of which achieved statistical significance.

Since 1995, only one randomized controlled trial of the value of critical pathways in community-acquired pneumonia was conducted.<sup>15</sup> Length of stay, bed days, and days of intravenous antibiotic therapy decreased in patients managed according to the pneumonia pathway. None of the other evaluations of critical pathways in medical conditions was prospective or randomized.<sup>16-23</sup> A Cochrane review of trials that evaluated critical pathways in patients with stroke revealed no difference in LOS, mortality, dependency after rehabilitation, or discharge destination.<sup>22</sup> However, these trials were conducted before the implementation of the recommendations for early intervention with fibrinolytics and may not be representative of

current practice.

Most of the individual analyses of surgical critical pathways did not adjust for independently occurring trends.<sup>7-14</sup> In the only two trials that were randomized and controlled, statistically significant reductions in LOS and time to ambulation were seen in patients after hip and knee arthroplasty and after laparotomy.<sup>5, 6</sup> The need for more rigorous scientific study of the impact of critical pathway management on patient outcomes seems apparent. In spite of this, the rate of implementation of critical pathways is exceeding the ability to prove their efficacy. Randomized controlled trials are needed to document the effectiveness of critical pathways on outcomes of care, both therapeutic and economic.

### Next Steps for Success

#### Networking

Advancements in communication and emergence of health care systems have led to creation

Table 2. Summary of Results on Length of Stay, Clinical and Quality Outcomes, and Cost of Medical Critical Pathways

Study Design	Medical Condition	No. of Patients by Group	Results
Randomized, controlled <sup>15</sup>	Community-acquired pneumonia	1743 patients 53 pathway hospitals 63 nonpathway hospitals	LOS decreased 5 vs 6.7 days (p=0.01), 1.7-day decrease in bed days/patient (p=0.04), and decrease in days of i.v. antibiotics 4.6 vs 6.3 (p=0.01) (pathway vs nonpathway hospital for each comparison)
Retrospective cohort <sup>16</sup>	Pneumonia	63 prepathway 96 postpathway	Time to antibiotic administration decreased 175 vs 315 min (p<0.0001), and LOS decreased 8.9 vs 9.7 days (p<0.0001) (post- vs prepathway for both comparisons)
Retrospective cohort <sup>17</sup>	Pneumonia	284 prepathway 49 postpathway	LOS decreased 5.84 vs 7.29 days and total charge decreased \$9511 vs \$10,964 (no statistical analysis) (post- vs prepathway for both comparisons)
Retrospective cohort <sup>18</sup>	Asthma	1004 pathway 206 control	LOS decreased 2.7 vs 4.2 days (p<0.0001), and total annual charges decreased \$1.4 vs \$2 million (p<0.005) (pathway vs control for both comparisons)
Retrospective cohort <sup>19</sup>	Inpatient asthma	342 pathway 353 control	No difference in total charge; laboratory and radiology charges were lower in the pathway group than in the control group (p<0.05)
Retrospective longitudinal <sup>20</sup>	Acute myocardial infarction	Connecticut Medicare hospitals: 10 pathway hospitals 22 nonpathway hospitals	No differences in LOS or use of aspirin, $\beta$ -blockers, or ACE inhibitors between pathway and nonpathway hospitals
Retrospective cohort <sup>21</sup>	Acute myocardial infarction	86 pathway 89 nonpathway	Door-to-balloon time decreased 91.5 vs 108 min (p<0.01), ACE inhibitor use increased (p<0.01), use of lipid therapy increased (p=0.02), and no difference in use of aspirin or $\beta$ -blockers (pathway vs nonpathway for all comparisons)
Cochrane review <sup>22</sup>	Stroke	7 nonrandomized studies 3 randomized studies	No difference in LOS, mortality, dependency, or discharge destination
Retrospective cohort <sup>23</sup>	Depression	12 pathway 12 control	Trend for decreased LOS and cost (no statistical analysis) in the pathway group

LOS = length of stay; ACE = angiotensin-converting enzyme.

of global critical pathways that extend beyond a single institution. Networking and sharing of critical pathways can reduce the initial manpower often needed to develop new, institution-specific critical pathways. Health care systems may desire a single pathway to reduce duplication and errors and provide some objective standardization for benchmarking. Health care providers may also network with other institutions to streamline the process of creating a pathway, or for comparative benchmarking purposes with outside institutions. Institutions with similar information technology systems can then share experiences to provide better outcomes, thus more globally improving health care.

Caution should be used when applying a borrowed pathway. Subtle factors can influence outcomes, or make portions of the pathway completely obsolete. For example, assays, hemodialyzers, other drugs used, unique patient populations, or preferred procedures can differ considerably among institutions. A shared pathway can produce entirely different and potentially negative results. Critical pathways must also take into account the demographics of the institution. Example pathways have been published for numerous disease states such as stroke,<sup>40, 41</sup> unstable angina,<sup>42</sup> coronary artery bypass surgery,<sup>30, 43</sup> and cardiac surgery.<sup>29, 37, 38</sup> Most of these examples include limited information



on specific drug use, simply stating the drug or drug class and possibly the dosage.

Because of the growing popularity of critical pathways, a national directory listing more than 2000 health care critical pathways was published in 1995.<sup>34</sup> Since that time, two large national databases have been developed and maintain a comprehensive listing of critical pathways: the National Electronic Library for Health: Protocols and Care Pathways (available from <http://www.libraries.nhl.nih.gov/pathways/>, accessed January 4, 2006), and the National Library of Medicine's Current Bibliographies in Medicine 95-8 critical pathway (available from <http://www.nlm.nih.gov/archive/20040829/pubs/cbm/critpath.html>, accessed January 4, 2006). These resources can serve as a guide to locate other institutions and contacts with experience in developing and implementing specific types of critical pathways and appropriate patient populations for pathway management. Sharing information avoids the need to "reinvent the wheel," allowing more time to tailor the pathway to an institution's individual needs.

### Education

Concerns and misunderstandings about critical pathways persist among clinicians. A major objection often expressed is that critical pathways result in "cookbook medicine," which can fail to accommodate real-world circumstances. Education about the need for critical pathways to reduce variation in care, to avoid overlooking or delaying implementation of important elements, and to promote best practices will continue to be needed until their acceptance and use become commonplace. An understanding that the need for individualization of treatment has not been abandoned is also needed. Inherent in this approach is the need to understand concepts such as best practices, benchmarking, and evidence-based medicine.

### Evaluation and Feedback

Currently, information about hospital performance related to outcomes is reported publicly. Aggregate results regarding how the hospital, clinic, system, or practice site is performing needs to be shared with administrators, hospital committees, and clinicians for self-assessment. Benchmarking, both internally and externally, should incorporate readily available sources, such as medical artificial intelligence (MEDai, Inc., Orlando, FL), the Atlas clinical information

management system (MediQual, Marlborough, MA) or other state-based programs, and Get with the Guidelines database (American Heart Association) or other national association databases. The following questions should be addressed in benchmarking: Are the intended goals being met? If not, how can the program be adjusted to accomplish them? Should the goals be altered in some format? It can be helpful to provide results of individual performance to practitioners, including pharmacists when appropriate, about how they perform compared with other practitioners in the same field or at the same site or system.

### Research

Critical pathways have become an important topic for clinical research. There are unanswered questions about whether critical pathways can improve patient outcomes in many areas of medical practice. Questions remain also about the cost-effectiveness of critical pathways, considering the enormous amount of effort that has gone into developing and administering them, as well as monitoring many of their results. Critical pathways have been developed for common procedures and conditions, but not for all clinical situations, such as recurrent cancer.<sup>44</sup> It is unknown if there should be a pathway for many diagnoses or procedures or for only the most frequent types. As members of teams charged with developing critical pathways and evaluating their results, pharmacists can contribute to answering these questions.

Clinical research addresses different aspects of critical pathways. Recent literature reveals that terminology and methods are not standardized, and descriptions of programs often are incomplete.<sup>45, 46</sup> Development of standards for reporting methods would aid in the interpretation and comparison of critical pathways and their results. Research on best methods is also needed. Although a definition of best practices is a moving target, information can still be gained about how to approach optimal medical care. Whether critical pathways reduce or increase medicolegal risk is also a concern.<sup>47, 48</sup> Throughout the process, it is imperative to share experiences regarding successful and unsuccessful critical pathways or specific pathway elements with peers and other health care professionals. This can be done in a variety of ways, including collaboration with coworkers and colleagues; exchange of information at local,

state, and national meetings; and through Internet sites.

## Conclusion

During the past decade, critical pathways have evolved and become common tools in providing health care. Even though the quality of the literature on critical pathways is limited, and further evaluation of their effectiveness is needed, current perceptions suggest that critical pathways have demonstrated improvement in clinical outcomes and reductions in health care expenses. The onus is on health care professionals to intensify the validation and justification for using critical pathways in clinical practice. Pharmacists, using new technology, new knowledge, and evidence-based medicine approaches, can and should play a critical role in answering the questions about the value of critical pathways. Minimal standards for research methodologies are needed to prevent the propagation of studies that do not adequately control biases and that, in turn, confound interpretation. As pharmacists continue to play a leading role in managed care, opportunities will be available for them in the critical pathway process that will be essential to ensure the future success of critical pathways.

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