Facilitating Physician Adherence to Clinical Pathways Across a Multi-Site Oncology Practice Network

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ABSTRACT: With so many new developments in the field of oncology, physicians have a difficult time staying abreast of new guidelines and recommendations for different disease states. Clinical pathways are an efficient method of ensuring that the best, most evidence-based treatment is being used for patients. The authors provide an overview of the use of clinical pathways in health care and describe the development and implementation of two pathways introduced at UPMC Cancer Center: one for the treatment of bone metastases, and one for the treatment of early-stage breast cancer. Tactics for ensuring appropriate compliance with pathways among health care providers in large-scale health networks are discussed.

KEY WORDS: radiation therapy, oncology, clinical pathways


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In the field of oncology, physicians are often faced with treating a broad spectrum of cancers with different anatomical disease sites, each of which is associated with newly developed treatment techniques and continuously evolving evidence to guide the selection of treatment. One difficulty that many physicians face in their practices is staying current with the pace of newly published literature. Whereas academic physicians may have the ability to focus on more limited areas of oncology, community physicians must attempt to stay abreast of new evidence throughout the entire oncology field. During their residencies, physicians learn by reading the latest evidence and by modeling mentors within their training programs. Once they have completed their training and are managing busy practices without the benefit of direct mentorship, many physicians are likely to be more hesitant to adopt unfamiliar practices. Although practitioners certainly devote a significant amount of time and effort toward continuing medical education beyond residency, the continuous publication of new evidence covering a very broad subject imposes limitations on this approach. Medical oncologists in particular are challenged with staying abreast of the rapid introduction of molecularly targeted agents and a parallel increase in the number of treatment options available for a particular tumor type.

Clinical guidelines are consensus statements developed by experts in various fields of health care based upon the best available evidence to guide clinicians in making patient management decisions in specific circumstances. Clinical guidelines have been published by numerous national organizations throughout various fields of medicine with the goal of disseminating consensus statements based upon available scientific evidence. These efforts often fall short of...
The system is composed of 4 central academic sites and 18 community facilities throughout western Pennsylvania. Beginning in 2001, the UPMC CancerCenter implemented radiation and, later, medical oncology clinical pathways for the treatment of every disease site and nearly 95% of cancers throughout its health care network.

We have published our experience exploring the efficacy of two of these pathways: one for the treatment of symptomatic bone metastases and one for early-stage breast cancer.8,11 Here, we describe our processes for developing these clinical pathways and for ensuring physician involvement and adherence, and we highlight the improved outcomes that have been achieved through the implementation of these two pathways.

**Clinical Pathway Development and Implementation**

Framework for Clinical Pathway Development

Pearson et al described broad steps that should be taken when developing a clinical pathway: evaluating the current process of care at an institution; evaluating medical evidence and external practices; and documenting and analyzing variance data on provider actions and patient outcomes.7 They suggest that the first step in creating a clinical pathway may be to engage in chart review and to identify areas in which standardizing practices may improve patient outcomes. These may be areas in which there are significant variations in management decisions that impact patient outcomes. It is important to establish patient outcome-centric metrics such as success of a particular intervention, survival rates, treatment toxicity, as well as efficiency metrics such as readmission rates, hospital stays, and utilization of resources that may be impacted by treatment decisions. The introduction of a clinical pathway may also be motivated by the desire to bring the treatment decisions of all clinicians within an institution in line with the publication of new evidence.

After identifying an area in which clinical pathway intervention may reduce unnecessary variations in care, the next step is to perform a critical review of the available literature and published guidelines while incorporating local experience, a process best carried out by a committee including hospital administration and physicians. Administrators, who often include practicing physicians, seek to promote efficient care and improved patient outcomes on a system-wide level, while physicians are motivated to provide the best care possible to their individual patients. Furthermore, the committee should be inclusive of both academic physicians and community-based practitioners, who are likely to have a different perspective on patient management than hospital-based physicians. Forming a broad committee provides the benefit of incorporating a diverse range of expertise and practical experience with implementing changes throughout a hospital system while lending additional credibility to the process. In addition, physicians are more likely to accept and support the implementation of
a clinical pathway if they have been actively involved in its development. Grilli and Lomas speculated that changes in practice were most likely to occur when guidelines are based on good evidence, provide clear guidance, and do not require the practitioner to learn new skills and knowledge. While a pathway may present a provider with new knowledge or recently published evidence, it should do so in a way that is concise, relevant, and can be efficiently incorporated into one’s practice.

Development Process and Implementation
The UPMC pathways were developed through open, active collaboration by administrators and academic and community physicians. Each disease site has one or two pathway directors who are community or academic physicians either from our institution or from any of the other institutions that utilize the clinical pathway platform. All oncologists throughout the network are invited to participate in the process through in-person meetings or via teleconference.

The recommendations within the pathway are written based upon national guidelines, published literature, institutional experience, and consensus. The priority of each decision point within a pathway is based upon the level of supporting evidence. Where Level I evidence is absent, other published literature and institutional experience are integrated into the treatment algorithms. Evidence is evaluated hierarchically on efficacy first, then toxicity, and then cost. When a decision is made between similar treatment options, the highest priority is given to efficacy. For example, anastrozole is recommended as adjuvant treatment over tamoxifen for post-menopausal women with hormone receptor–positive breast cancer, due to the higher efficacy of aromatase inhibitors in this population. However, because efficacy is similar between anastrozole and newer aromatase inhibitors such as fulvestrant, anastrozole is the recommended first option due to its lower cost. Other agents may remain as options for patients who are unable to tolerate the side effects of a particular drug.

Pathways were initially presented at the monthly staff meeting for further review and commentary prior to acceptance. Pathway development is an ongoing, iterative process, and pathways are modified at least semi-annually.
facilitating physician adherence to clinical pathways

based upon feedback from physicians, publications or presentations of new evidence, and measured success in meeting defined outcomes. When proposed changes are made to a particular pathway, the revised document is distributed to all radiation and medical oncologists. They are then presented at the monthly staff meeting prior to finalization and entry into the web-based platform.

Facilitating Physician Adherence

Starting in 2009, CancerCenter physicians have been required to enter their management decision into an online, menu-driven tool (Via Oncology, Pittsburgh, PA) integrated with electronic medical records to provide patient-specific decision support. Following each consultation, physicians record the patient encounter into the web-based platform and select the specific disease and stage from the menu (Figure 1). The system sequentially displays possible treatment options, as defined by the clinical pathway, and records the management decisions of the physician. Published pathways include both the justification for the recommendations and links to the primary evidence. Entries are subject to audits to confirm their accuracy.

The goal of a pathway is to cover common clinical scenarios while allowing the flexibility in treatment variation necessary for approaching unique clinical situations. Therefore, physicians also have the opportunity to make off-pathway selections (Figure 2). At the time that an off-pathway treatment decision is entered, the decision, along with the physician’s justification for the decision, is automatically submitted through the online platform to undergo peer review by designated physician experts serving as pathway directors. The pathway directors receive an electronic notification of the decision within 24 hours. Justification for the off-pathway treatment strategy must be approved by the pathway director before treatment delivery. The rate of selection of off-pathway treatment decisions is recorded for the entire network and for each individual physician, and the individual rate is considered in annual faculty evaluations. In radiation oncology, we have striven for a target of 90% or higher compliance, and the overall rate of off-pathway selections has consistently remained less than 10% for each disease site.

The examples of our clinical pathways for bone metastases and for early-stage breast cancer illustrate how these practices facilitate greater clinical pathway adherence to ensure that physicians across the network are providing evidence-based care to their patients.

Clinical Pathway for Bone Metastases

Bone metastases are a significant source of pain and morbidity for patients with advanced-stage cancers, and they also impose a significant economic burden on society. Multiple studies have confirmed that highly efficacious palliation can be achieved with radiation treatments consisting of either a single fraction or with longer courses, but shorter courses are associated with significant benefits in terms of patient convenience and reduced healthcare costs. Despite the published evidence and recommendations, it has been reported that fewer than 5% of patients received single-fraction treatment, and 29.5% of patients received extended courses consisting of more than 10 fractions.23

![Figure 2. Interface for submitting required justification for off-pathway treatments.](image)
We have previously published our experience with the implementation of a pathway for the treatment of symptomatic bone metastases with palliative radiation. The bone metastases pathway that we initially developed in 2001 listed 8 Gy in one fraction as the first option in patients with metastases in the extremity or other anatomic sites with low risk of toxicity, Eastern Cooperative Oncology Group (ECOG) performance status of 2 or higher, and in patients with a very short life expectancy. A dose of 20 Gy in five fractions was recommended as a secondary option, and a dose of 30 Gy in 10 fractions was recommended as a secondary option for cases of large radiation fields, spinal cord compression, or weight-bearing bones at risk of pathologic fracture.

Review of our experience from 2003 to 2010 demonstrated that the mean number of fractions gradually decreased over that period for both academic and community practice locations, though patients treated at community practices were more likely to be treated with longer courses throughout the time period. Utilizing Medicare data, we estimated the average cost per treatment course in 2010, and, based upon treatment patterns, we projected a difference of $638.11 per treatment course between academic and community facilities. Possible explanations for the utilization of longer fractionation courses at community practices include lack of awareness of the data, concerns about treatment toxicities, increased financial compensation with longer courses, and possible differences between the populations treated at academic versus community centers.

As part of the 2013 Choosing Wisely campaign, ASTRO recommended against the use of schemes with more than 10 fractions and promoted the use of single-fraction treatments. Based upon these new recommendations and our prior experience with the bone metastases pathway, we sought to further encourage the utilization of single-fraction regimens and discourage the use of extended fractionation (>10 fractions) schemes within our network. In 2014, the pathway was modified to encourage single-fraction treatment for all patients instead of only those with ECOG performance status of 2 or greater. The use of more than 10 fractions is now considered off-pathway and results in automatic peer review.

We found that, following implementation of online entry and peer review, the overall rate of single-fraction treatment increased from 7.6% to 10.9%. Adherence then grew even further to 15.8% in 2014 following further modifications to the pathway (Figure 3A). Factors significantly associated with single-fraction treatment were treatment of non-spinal anatomic sites, year of treatment, and treatment at an academic practice. Likewise, we found that the overall utilization rate of extended regimens decreased from 18.6% in 2003–2008, to 15.2% in 2009–2013, and 9.7% in 2014 (Figure 3B).

The data demonstrate that development of the clinical pathway for bone metastases was able to standardize practice patterns in accordance with national guidelines over a large network and led to increased patient convenience and more cost-effective treatment.

**Clinical Pathway for Early-Stage Breast Cancer**

For women with early stage breast cancer, adjuvant radiation decreases the risk of local recurrence after breast-conserving surgery (BCS), which translates to improved breast cancer-specific survival. In most clinical trials, radiation therapy was delivered using conventionally fractionated whole breast irradiation (CF-WBI). Hypofractionated whole breast irradiation (HF-WBI) schedules of 3–4 weeks in length have been compared to CF-WBI schedules lasting 5–6 weeks, and, despite a lower total dose being delivered over a shorter time period, outcomes have been shown to be equivalent. Even with the high level of evidence and
the publication of an ASTRO evidence-based guideline in April 2010, adoption of this treatment schedule remains limited in the US.26,27 Potential reasons for poor utilization of this technique include the reasons previously cited for over-utilization of palliative radiation for bone metastases.

The clinical pathway for early-stage breast cancer was modified to reflect the long-term results of a clinical trial by Whelan et al.,25 which demonstrated that HF-WBI is equivalent to CF-WBI in terms of local recurrence without increased toxicity. Following the incorporation of these results into national guidelines,28 our institution sought to increase the utilization rate of adjuvant treatment of early-stage breast cancer with a short-course regimen in order to improve patient convenience and reduce expenditures associated with more protracted courses. In January 2011, our network adopted HF-WBI as the preferred option for women aged ≥70 years with stages 0–IIA breast cancer. Although HF-WBI was the first option for women older than 70 years, other options, including CF-WBI and accelerated partial breast irradiation, remained pathway-compliant.

After the implementation of this change, the overall rate of HF-WBI utilization increased among all physicians from 6.5% to 33.8%, though a gap remained in the utilization rates between academic and community practices. This amendment to the pathway was estimated to result in an annual savings of $154,000 throughout our network.10 Publication of the long-term results of the HF-WBI trial and modification of the pathway were both significantly associated with HF-WBI adoption among academic practices, but publication of the data had no significant impact on the utilization of HF-WBI in community practices. This lends support to the assumption that published data and guidelines may be slower to disseminate to community practices.10

In January 2013, HF-WBI became the preferred option for women 50 years of age and older with early stage breast cancer, though other fractionation schedules including CF-WBI and APBI were still listed as secondary options. Expanding pathway guidelines to include women aged 50–69 years in 2013 led to a significant increase in utilization. However, we were still not fully satisfied with the rate of HF-WBI utilization.

In January 2014, the pathway was modified again to mandate HF-WBI as the only acceptable external-beam treatment strategy for early-stage breast cancer in women older than 50 years of age.11 CF-WBI was permitted only with justification and peer-review based upon objective technical criteria. Following the final amendment, the rate of HF-WBI utilization in 2014 was 76.7% of all eligible patients in both community and academic practices in our network. Practice patterns equalized between academic and community facilities, and the clinical pathway increased the utilization rate to a level that compares favorably with those reported globally.

Following the implementation of the bone metastases pathway, there was a significant reduction in the mean number of radiation treatments delivered per course, an increase in the rate of single fraction utilization, and a decrease in the use of extended (>10) fraction regimens consistent with evidence-based and peer-reviewed guidelines9,9. The clinical pathway for the adjuvant treatment of early stage breast cancer was shown to dramatically increase the utilization of HF-WBI throughout the network.10,11

**DISCUSSION**

Clinical pathways are tools adapted to health care in order to reduce needless variability in practice patterns while promoting quality and cost-effective care. They are an effective means of disseminating clinical guidelines and promoting adoption of evidence-based practices in an era of rapid scientific and clinical advances alongside increased national attention to the need for efficacious, cost-effective care. While national guidelines are important consensus statements based upon the latest scientific evidence, they lack the direct impact and accountability necessary to create rapid changes in practice patterns. The development of clinical pathways is a method of actively implementing these guidelines and ensuring that evidence-based practices are used by health care providers. Clinical pathway development is an ongoing process of identifying areas in which practice patterns vary unnecessarily, evaluating the available evidence and external practices, and implementing a consensus clinical pathway through a collaborative process between physicians and administrators. This process incorporates scientific evidence and local knowledge to increase physician compliance and promote improved, cost-effective care.

The utility of clinical pathways has been demonstrated in many areas of medicine, including the treatment of community-acquired pneumonia (CAP). The treatment of CAP has been complicated by the lack of a common approach to diagnosis and treatment, leading to large variation in admission rates, length of hospital stays, and utilization of resources.2 A randomized controlled clinical trial of 19 hospitals was initiated to determine the impact of implementation of a clinical pathway versus continuing conventional management of CAP. This study found no difference in patient quality of life, occurrence of complications, readmission rates, or mortality between the two strategies. However, pathway use was associated with a significant reduction in hospital stays, admission of low-risk patients, intravenous therapy, and use of multiple classes of antibiotics. Introduction of the pathway was shown to reduce the use of institutional resources while maintaining quality outcomes.

The efficacy of clinical pathways in treatment of pneumonia has also been demonstrated in the outpatient setting. One Canadian study randomized 680 nursing home
patients to study the treatment of lower respiratory tract infections according to a clinical pathway compared with usual care. The researchers again found no difference in mortality rates, health-related quality of life, or functional status between the groups. Residents in the clinical pathway group were less than half as likely to be hospitalized and had shorter average hospital stays. While treatment on the pathway was associated with a small increase in upfront costs, the authors estimated this led to an overall savings of $1016 per resident based upon reduced professional billings, resident transport, and hospitalization costs with no associated decline in health care outcomes.

Although clinical pathways have demonstrated effectiveness in many areas of medicine, adoption has been limited to the field of oncology. However, published outcomes following the introduction of oncology clinical pathways have been relatively limited. In the field of head and neck oncologic surgery, Chen et al. compared 94 patients who were treated following introduction of a clinical pathway for unilateral neck dissection with a historical control group of 96 patients treated prior to implementation of the pathway. Additional procedures that may have been performed included direct laryngoscopy, rigid esophagoscopy, and dental extractions. After the introduction of the pathway, the median length of hospital stay significantly decreased from 4.0 days to 2.0 days with an associated decrease in total median costs of care but no difference in complications or readmission rates. Similar findings were demonstrated following the implementation of a clinical pathway for radical retropubic prostatectomy.

Smith and Hillner systematically reviewed studies published on the impact of clinical practice guidelines and pathways for cancer care. The majority of the studies described the dissemination of practice guidelines as opposed to implementation of clinical pathways. Some attempts were successful at reducing costs and lengths of stay, minimizing practice variations, and maintaining patient quality of care and satisfaction. Characteristics of unsuccessful programs included national dissemination, lack of a patient-specific implementation plan, and lack of provider accountability.

UPMC CancerCenter has implemented radiation oncology clinical pathways guiding the treatment of every disease site and covering 95% of cancers. Since 2009, CancerCenter physicians have been required to enter their management decision into an online tool following each patient consultation, making off-pathway treatment selections subject to peer review before that treatment can be delivered. Review of the data from our bone metastases pathway reveals that we were able to significantly increase the rate of single-fraction utilization and decrease the rate of extended fraction utilization throughout the network. Iterative modifications to the early-stage breast cancer pathway resulted in increased adoption of HF-WBI among both academic and community practices. In both cases, these changes led to improved patient convenience and significant cost savings throughout the network.

Some concerns with applying the clinical pathway concept to medicine include eliminating variation in patient care without accounting for individual patient factors that may necessitate such variations in treatment decisions. Unlike industrial processes, patients are not standardized, and, thus, pathways must be created with the flexibility to account for differences between individual patients and for uncommon clinical scenarios.

It is important to note that, while national consensus guidelines are written broadly based upon the available evidence, they are rarely comprehensive enough to account for every situation or circumstance not uniform in different regions and health care systems. Pathways should be developed at the local level, so that there is a greater ability to integrate regional factors, variance in resources, and institutional experience. For example, a guideline could broadly describe the steps in diagnosing and treating community-acquired pneumonia, but a clinical pathway should incorporate critical local knowledge, such as antibiotic resistance patterns.

A further concern is that efficiency and cost-savings may become over-prioritized, causing necessary testing or procedures to be omitted and leading to poorer patient outcomes. Despite these apprehensions, a well-designed pathway will seek to promote efficient care in line with national guidelines. Clinical pathways have been a successful means of efficiently disseminating newly published evidence, reducing unnecessary variability in areas with clearly defined best practices, and improving patient outcomes in several fields of medicine.

CONCLUSION

Our experience shows that effective clinical pathways are based on current evidence, give clear guidance for providers, incorporate local experience, and provide accountability for management decisions, leading to improved patient outcomes and more cost-effective medical care. Our clinical pathways have been successful because they were developed through a process of open, active collaboration, which gives physicians a stake in their success, incentivizes on-pathway treatment selections, and provides instant accountability at the time a decision is made. In the cases of both the bone metastases pathway and the early-stage breast cancer pathway, high rates of physician adherence to the pathways led to substantial cost savings throughout the network. Our successes were a product of collaborative internal development of the clinical pathways, peer review, and iterative review and modifications based on prior outcomes.

We currently have clinical pathways for both radiation oncology and medical oncology disciplines, which were developed in parallel. Surgical oncology pathways are currently being developed as well. We are currently
in the process of integrating these pathways throughout the UPMC CancerCenter network. Ultimately, we expect there to be a single clinical pathway for each disease site that incorporates surgical, medical, and radiation oncology treatment through a streamlined process that better reflects the multidisciplinary approach to cancer care that we currently employ.

References


