The Organization of Multidisciplinary Care Teams: Modeling Internal and External Influences on Cancer Care Quality

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Quality cancer treatment depends upon careful coordination between multiple treatments and treatment providers, the exchange of technical information, and regular communication between all providers and physician disciplines involved in treatment. This article will examine a particular type of organizational structure purported to regularize and streamline the communication between multiple specialists and support services involved in cancer treatment: the multidisciplinary treatment care (MDC) team. We present a targeted review of what is known about various types of MDC team structures and their impact on the quality of treatment care, and we outline a conceptual model of the connections between team context, structure, process, and performance and their subsequent effects on cancer treatment care processes and patient outcomes. Finally, we will discuss future research directions to understand how MDC teams improve patient outcomes and how characteristics of team structure, culture, leadership, and context (organizational setting and local environment) contribute to optimal multidisciplinary cancer care.


Quality cancer care is complex and depends upon careful coordination between multiple treatments and providers and upon technical information exchange and regular communication flow between all those involved in treatment (including patients, specialist physicians, other specialty disciplines, primary care physicians [PCPs], and support services) (1). Earlier in this supplement, Taplin and others have pointed out the challenges of transferring information and responsibility among providers and institutions; a problem at the interfaces of care. Advances in surgical procedures, chemotherapy, computer technology, and targeted molecular and radiation therapies have all led to an increase in multimodality therapy, which increases the number of interfaces among cancer specialists and other clinicians in the treatment of any single patient. Contemporary cancer care thus presents a paradox: The potential for unparalleled quality and sophisticated treatment is high, yet the number of potential “failure” events in the continuum of cancer treatment (2) has multiplied significantly. Each failure in communication between various physicians and care providers and every transition and interface miscue can result in delayed treatment planning and implementation, unnecessary duplication of tests, incomplete follow-up, increased patient anxiety, decreased patient satisfaction, and declines in quality of life.

This article will examine a particular type of organizational structure focused on the interfaces between multiple specialists involved in cancer treatment: the multidisciplinary treatment care (MDC) team. This structure has been identified as one method of ensuring the exchange of patient-related and technical information between all physicians and support services involved in a patient’s care. The setting and format of the MDC encourage active involvement of all actors (including the patient and his/her family) in the development of a care plan. Once formed, MDC team meetings can be convened at multiple times throughout the process of cancer care (Figure 1 in Taplin) (3) and can thus serve as an ongoing communication structure aimed at smoothing the transitions between multiple stages of care.

MDC teams are the successors to the tumor conference, and they have been an arrangement for coordinating cancer care for at least 30 years (4,5). The health-care management literature advocates for more frequent use of MDC teams (6,7), and the National Cancer Institute has historically supported their development and diffusion, dating back to the cancer network demonstrations of the late 1970s and early 1980s (5,8), and through the National Cancer Institute Community Cancer Center Programs of recent times (9). However, little, if any empirical evidence exists on the prevalence, efficacy, and diffusion of MDC teams in cancer treatment or on their effectiveness in smoothing transitions across stages of cancer care.

This article presents a targeted review of the literature (primarily since 2000) on what is known about various types of MDC team structures and their impact on the quality of cancer care; the use of multidisciplinary teams for health-care delivery in other diseases; external environmental factors; and the influence that structural characteristics at the level of the practice or hospital setting have on the ability of MDC teams to improve care quality. A conceptual model, informed by the literature, outlines the connections among team structure, process, and performance, and their subsequent effects on cancer treatment care processes and patient outcomes. We include studies of management team structure and performance from the organizational behavior and management literature where appropriate. Finally, we discuss future research directions for improving our understanding of how MDC teams improve patient outcomes, and how characteristics of team structure, culture, leadership, and the characteristics of the organizations and environment within which they operate contribute to optimal multidisciplinary cancer care.
Rationale and Definitions

Tumor Boards
Traditional cancer treatment strategies began with individual consultations initiated by the internist or family practitioner with the relevant cancer specialist and subsequent patient referral to other specialists for specific cancer care treatments. The tumor board (also called a cancer conference) evolved as a formal attempt to engage multiple specialties, such as radiology, surgery, pathology, radiation oncology, and medical oncology, in cancer care to collectively review complex cases or newly diagnosed patients (10).

These discussions are typically held on a monthly basis, following diagnosis and primary treatment and without the patient or family present. They are essentially consultative, with the collective knowledge of the tumor board enabling the physician in charge to evaluate the effectiveness of treatment recommendations. The tumor board usually considers the patient’s situation at one point in time only, not along the treatment pathway. Given their collective “conference” structure with all major specialties in attendance, tumor boards can facilitate multidisciplinary treatment planning (11,12).

Over time, tumor boards have shifted focus somewhat toward prospective treatment planning as a way of building consensus about diagnostic and management decisions. In fact, the Commission on Cancer now requires that at least 75% of the cases presented to tumor boards be prospective (13). Patients also may be presented several times (in absentia) to the tumor board for further treatment decisions or as a follow-up to “close a loop” from a previous meeting.

Multidisciplinary Care Teams
With growing emphasis on multimodal therapy, the coordination of cancer care continues to evolve from the tumor board to a more proactive, interactive structure involving a broad range of specialists (14). Although the tumor board engages multiple medical disciplines to inform the patient treatment plan, the physician presenting the case ultimately weighs the recommendations and determines the course of treatment. MDC teams, however, allow for collaborative consultation continuously along the treatment pathway. This approach permits the consideration of the cancer patient’s psychosocial needs in the development of care pathways.
Typically, at one point in time, newly diagnosed, complex cases, plus “repeat” cases at end-of-life considerations and support services during focused treatment pathway. Multidisciplinary care is a team approach to managing patient care, with responsibilities for planning treatment and care management—encouraged to be present when possible and absent when necessary. Collaboration, consultation between all members of the team, includes the tumor board, physician in charge, newly diagnosed; complex cases, retrospective or prospective planning potential. Treatment only. Face-to-face only. Physician in charge. Absent.

Table 1. Comparing tumor boards and multidisciplinary care teams

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Tumor boards</th>
<th>Multidisciplinary treatment care teams</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage of cases</td>
<td>Newly diagnosed; complex cases</td>
<td>Newly diagnosed, complex cases, plus “repeat” cases at later stages</td>
</tr>
<tr>
<td>Approach Focus</td>
<td>Consultative; advice provided to lead MD</td>
<td>Collaborative, consultation between all members of team</td>
</tr>
<tr>
<td>Primary purpose</td>
<td>Education and training</td>
<td>Treatment and patient’s quality of life (rehabilitation;</td>
</tr>
<tr>
<td>Participants</td>
<td>Open to any practitioner</td>
<td>psychosocial needs; long-term care)</td>
</tr>
<tr>
<td>Timing</td>
<td>At one point in time</td>
<td>Planning treatment and care management</td>
</tr>
<tr>
<td>Case review</td>
<td>Retrospective; prospective planning potential</td>
<td>Focused on care team responsible for managing patient</td>
</tr>
<tr>
<td>Functioning</td>
<td>Face-to-face only</td>
<td>care for specific disease site</td>
</tr>
<tr>
<td>Treatment decision process</td>
<td>Physician in charge</td>
<td>Multiple points along treatment pathway</td>
</tr>
<tr>
<td>Patient</td>
<td>Absent</td>
<td>Prospective</td>
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</tbody>
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The “multidisciplinary care” label is used quite widely in contemporary cancer practice to describe diverse care structures, some of which look more like tumor boards than MDCs. So far, we have identified two important dimensions of team focus that can be used...
to differentiate MDC teams: a focus on specific disease or tumor sites and a focus on the care continuum, from active treatment through end of life. A third dimension deserves discussion: the distinction between “actual” vs “virtual” teams. Actual teams perform their work (consultation, care planning, changes in care plans) with all teams members present at the same time and place. This is similar to Thompson’s (22) notion of a “mediating” coordination structure as the best strategy to use when faced with complicated “reciprocal” technologies (tasks that require feedback and communication between all performers). Virtual teams are those in which team members do not meet face-to-face, or do so only infrequently. Using a virtual team strategy, the MDC would operate similarly to either a tumor conference (meeting only once) or the traditional pattern in which patients are seen in a sequence of separate appointments with multiple physicians over a short period of time. Virtual teams are similar to the concept of “teams without colocation” described by Hinds and Bailey (23).

The locus of coordination differs between actual and virtual teams. For actual teams, care coordination occurs within team meetings and care options are discussed “live,” as would follow-up coordination. Careful records of care plan decisions made during MDC team meetings (eg, use of a treatment summary document as recommended by the Commission on Cancer), and their communication to all team members, is essential. Virtual teams rely upon coordination through a staff or clinic coordinator and require formally structured communication.

In the rest of this section, we review what is known about important characteristics of team structure (the formal design, rules, arrangements, and divisions within teams) and team processes (the ways in which teamwork is performed, the activities involved in teamwork, and the interactions that take place between team members). We are particularly interested in examining how team structure and process affect team performance, and the relationship between team performance and patient care processes and outcomes.

**Team Structure**

Most studies of team structure within both the cancer-related and general health-care delivery literatures tend to conceptualize team structure as either team composition (24,25) or team size (26). Generally, the influence of both variables on team performance or patient outcomes is mixed. The composition of the team is contingent upon type of disease and whether the team pursues a limited focus or one that encompasses the entire care continuum. The influence of team size is nonlinear: Effective teams require a minimal size to cover needed disciplines; size increases as the complexity of the tumor treatment increases and management focus broadens. However, larger teams are generally more difficult to coordinate, and thus, larger size tends to correlate with poorer team performance and patient outcomes (27). It is also worth considering how the presence of nonspecialty care MDs might create more challenges than added value to the MDC team process, particularly when team size approaches 10 or more members, when not all members are relevant to a given discussion, and when team membership may not be constant across the treatment process.

Several articles have provided descriptive information on the process of organizing MDC teams, sometimes including team structural issues. Boon et al. (6) emphasize the level of structural complexity in describing team-oriented practice types and how hierarchy formally defines roles within the team. Wright et al. (10) describe province-wide (Canadian) standards for MDC models, which mention a number of team structure issues, such as whether statements of team mission, goals, and objectives exist; whether team protocols for meeting schedules, agenda, and minutes have been developed; whether the team has access to technical support for information technology, data needs, and coordinating staff; and whether the team has adopted statements of standards and/or medical guidelines. These descriptive pieces are helpful, but empirical data on team structure are lacking. Moreover, little work has been done on leadership structure within teams, including leadership rotation, selection protocols, or length of term.

**Team Process**

A much larger literature exists on multidisciplinary team processes. Team processes have been defined through a wide variety of variables, from the standard emphases on team coordination and communication factors, through team climate, culture, and identity issues. A number of these studies are summarized by Lemieux-Charles and McGuire (25) in their excellent review of health-care team effectiveness. Among the key findings are that 1) full participation of all team members is considered necessary for MDC teams to function effectively, although status differences among team members may depress team functioning (26,28); 2) teams with shared egalitarian values tend to work together effectively, leading to improved team performance, although value structures and the degree of meritocracy at team formation influence performance (18); and 3) team coordination improves team performance, but this effect can be diluted or mitigated by the emergence of conflict (29).

**The Impact of Team Process on Team Performance and on Quality of Care in Cancer Treatment.** The literature also describes how team processes may affect team performance or the process of patient care. Following the model of the cancer care continuum by Zapka et al. (2), if the interfaces between treatment stages are improved, then ultimately both patient care quality and patient care outcomes will improve. The literature on health-care teams has defined MDC teams as a crucial mechanism for improving “integrative health care” (6) and “collaborative health care” (30). However, the literature has scant quantitative evidence on the relationship between team performance and clinical effectiveness. Lemieux-Charles and McGuire (25) summarize the literature on health-care team performance as lacking specificity in conceptualization of team performance and having inconsistent empirical results. Our limited review found at least four different conceptual and measurement approaches used to assess team performance:

- team “functioning” (26), which can be thought of as team process variables, such as coordination mechanisms and conflict (31);
- clinical- or patient-reported outcomes, such as improved health (6,31), patient functional status (26), or other measures of patient, family, staff satisfaction (32);
- the “quality of the team’s work,” which uses indicators such as timeliness, productivity, accuracy (21), and goal achievement, which encompasses meeting standards, compliance with clinical
practice guidelines (33), and innovation in treatment (25); and
- indicators of organization-level efficiency, such as care cost and
cost-effectiveness (6).

Of these measures, the third set—in particular, indicators of
team performance and innovation—appear most promising for
defining and measuring team performance in terms of qualities
that describe how people work together as members of an MDC
team and the effectiveness of their work together.

**Organizational Layers Surrounding Multidisciplinary Teams**

**Setting**

MDC teams function within varied organizational cultures that can facilitate or impede the quality of care provided to patients. Both organizational culture and management support are contextual elements that operate in private practice as well as hospital settings. Organizational culture (as distinct from the team's culture) as well as teamwork have been associated with variation in care in quality improvement research (34,35). For example, MDC teams located within hospitals that value cross-disciplinary consultation are more likely to flourish compared with MDC teams embedded within hospitals where medical specialties are firmly placed in “silos.”

Recognizing that a variety of culture types exists within organizations, Bosch et al. (35) measured organizational culture as four distinct types: “group,” “developmental,” “rational,” “and hierarchical.” Three of these culture types are relevant to discerning the impact of organizational context on team performance: 1) the “group culture,” which highlights participation, teamwork, and cohesiveness; 2) the “hierarchical culture,” which highlights coordination, stability, rules, and regulations; and 3) the “developmental culture,” which highlights innovation, change, and flexibility.

Management support to implement MDC teams within the practice or hospital setting is another aspect of context that affects team performance. In a study within clinics of the Department of Veterans Affairs, Lukas et al. (34) identified the personal support of organizational leaders and their willingness to reward care delivery teams as strongly associated with greater implementation of a clinical innovation and team effectiveness. Of course, practical management support of team activities through the provision of necessary resources also has a positive effect on team performance.

**Professional Factors**

The organizations where multidisciplinary cancer professionals normally work can influence clinician behavior within MDC teams, particularly if team members are subject to different financial incentives, referral policies, or hospital and/or practice characteristics (location, composition, and management oversight) (36). Different medical specialists and affiliated health professionals are all subject to the specific norms and expectations of their own professional groups, and these do not always align (37). For example, the professional values of social workers are considerably different from those of clinical oncologists. Normative influences, such as expectations concerning the nature of professional interactions, also may inform styles and standards of practice (38). The practice policies of

“home” organizations may favor medical specialists and thus define whether clinicians participate on MDC teams and the nature of their participation. For example, if the specialist clinician works in a setting where MDC team participation is highly encouraged and colleagues are actively engaged in MDC teams, he/she would be motivated to network with neighboring hospitals and cancer programs. In contrast, if one of the specialists on an MDC team practices at a competing hospital, the likelihood of collaboration for patient-centered care would be low. Collaboration can also be linked to reimbursement and financial incentives.

**External Factors Influencing Multidisciplinary Care Teams**

Several important environmental factors (or external layers of context) also are likely to influence team functioning. This influence can be examined using the conceptual framework provided by institutional theory as applied to health-care organizations (39,40), which emphasizes two categories of environmental constraints: technical and institutional. “Technical environments” not only relate primarily to market structures, economic health of the environments, and production concerns but also include demographic characteristics of local communities, geographic location (such as urban vs rural communities), and technological concerns (such as availability of state-of-the-art treatment facilities, health-care personnel). These sorts of factors provide direct and measurable feedback to the organization about how well it is performing. “Institutional environments” involve the social and political structures to which organizations must conform, including public opinion, legal structures (41), professional expectations and ideologies, and regulatory structures (42–45), which include state and federal reimbursement mechanisms and rates, and the expectations and reimbursement practices of major third-party payers within the community. Feedback from these environments may be explicit (such as receipt of accreditation) or normative (what the benchmark hospitals have adopted), but they are at best indirectly related to how well the organization is performing. Institutional theory also includes an emphasis on structures of connections or linkage between organizations as strategies to control access to resources, confront institutional constraints, and reduce environmental uncertainty (46,47).

We can apply this framework to consider a number of the major external factors facing multidisciplinary teams in cancer care. The structure of both cancer services and hospital markets are important aspects of the technical environment that can influence the scope of operation and success of MDC teams. This would include levels of competition for cancer services in the local market, market position of the focal cancer program and the host hospital, managed care penetration, market concentration, and presence of one or more academic medical centers. Location of the MDC team and its host cancer program in either an urban or rural community can significantly influence which type of team structure is even possible. Virtual teams, integrating telemedicine technologies, are more common within rural areas because cancer specialists may be significant distances away from the physical location of the cancer program. Using factors in the institutional environment, MDC teams may be embedded within regions where
major third-party payers do not provide an option for reimbursement of physician time devoted to MDC team conferences or to hospitals where MDC teams are sponsored. The development of collaborative linkages between hospitals and other health-care providers to diffuse innovative treatments in cancer care has been examined, and those linkages may enhance the survival and effectiveness of MDC teams (48,49).

**Modeling Team Context, Structure, and Process and Their Influence on Team Performance and Patient Outcomes**

Prior attempts to conceptually model the influence of MDC teams on quality of care have suffered from an exclusive focus on the effects of team process, or by defining team structure only as team composition (24). Most models have not considered the impact of context and environment on the development of team structures and processes (50), and they have not considered the direct and indirect effects of team structure and process on team performance or on subsequent changes in care process or quality-of-care differences. Further, extant models have not conceptualized the MDC team as a longitudinal structure, nor have they included change over time in team composition or structure as either a correlate or covariate of change in treatment stage or transitions across stages. As summarized by Lemieux-Charles and McGuire (25), Wright et al. (10), and Houssami and Sainsbury (50), the empirical results of the extant literature are at best inconclusive and not consistently embedded within a conceptual model.

We propose a conceptual model that builds upon two prior, well-known theories: Donabedian’s framework for linking structure–process–outcomes (51,52) and a contextualization of Donabedian’s framework based on institutional theory, in which MDC teams are embedded within hospitals or health-care organizations, and further embedded within technical and institutional layers of the larger organizational environment (24,25,53). Our model includes the contextual influences of hospital or health-care organization characteristics and the additional external influences of the technical and institutional environments of health-care organizations as well as the causal relationships between MDC team structure, team process, team performance, and both process and outcome measures of patient-level quality of care. In brief, both structure and process are primary determinants of health-care organizational performance. The model assumes that if high-quality structures and processes are put into place, good performances will result.

Figure 2 displays the core of our model for conceptualizing MDC team influences on the quality of patient care: Donabedian’s structure–process–performance trilogy, surrounded by multilevel characteristics of the hospital or health-care organization in which the team is located, and by characteristics of the larger environment within which the hospital is embedded (market, population demographics, urban–rural location, and institutional pressures). The focus on the Donabedian trilogy is extended to include the link between team performance to changes in patient care processes (such as efforts to improve the interfaces between stages of cancer care and communication and coordination between multiple care providers), to intermediate outcomes (such as increased accrual to clinical trials), and other care outcomes (such as survival rates, patient satisfaction, and improved functioning). Figure 2 also summarizes visually where our knowledge base on MDC teams is strongest (solid bold arrows) and where it is weak (dotted arrows). The figure itself only provides the skeleton of a conceptual framework; the exact specification of relationships expected between variables of context or environment and team structure, process, and outcomes is beyond the scope of this article. However, we have provided some preliminary indications of where relationships are expected in our review of organizational, professional, and environmental factors that might influence team functioning.

Taken by itself, Figure 2 also does not provide an explicit framework for incorporating our concerns about change over time in team composition and structure. However, considering Figures 1 and 2 together may provide a method for considering timing of both MDC team interventions and stages of the MDC team “lifecycle” where team composition may change. Figure 1 identifies three possible transition stages in the cancer care continuum where MDC team intervention may be needed; those three transition points are suggested as a minimum, as there may be additional points to consider. Those transition points may also correspond to stages where team composition may or could change, as different care issues become more or less dominant. For example, the initial MDC team meeting would require full attendance by all practitioners, both primary and specialty care, and including nonmedical specialists related to survivorship issues for a particular patient. The second intervention point corresponds to the transition between preoperative treatment (if needed) and primary treatment; at this stage, cancer specialists and the PCP would be most needed. And finally, the third intervention point occurs between the completion of primary and adjuvant treatment and the transition to survivorship, palliative treatment, or end-of-life care. At this transition point, the team membership might emphasize primary care and nonmedical specialists, with less input needed from the cancer specialists. Thus, at each transition point, there may be changes in active team composition, and in team processes, to best align with contingencies faced at each stage.

**Directions for Future Research**

Despite the research advances on the organization, functioning, and performance of health-care teams, our understanding of the prevalence of various forms of MDC teams in cancer care and our knowledge of what affects the performance of MDC teams still has many gaps. Major unanswered questions include the following: In what circumstances do which types and structural configurations of MDC teams function best? What characteristics of physicians and other clinical specialists lead to optimal team performance and for which disease sites? What external regulatory influences (especially reimbursement incentives) prohibit or enhance the sustainability of MDC teams in private practice and community cancer centers? Perhaps the most important question of all is: Which MDC team models and configurations lead to optimal patient outcomes, in terms of improved cancer and overall survival, patient experience, and health-related quality of life?

These gaps in knowledge reflect in part a lack of attention to research applications in cancer care delivery. Our review found
scant research relating to how cancer specialists work together as clinical teams in either virtual or actual MDC team settings. With the exception of some research in breast cancer, very little attention has been given to the patient experience in different multidisciplinary care models and how patient experience, care support, and health-related quality of life is affected by “dose–response” or the amount, duration, and scope of MDC team involvement. Almost no research exists comparing the different models and how performance attributes (eg, team cohesion, coordination of care, adherence to guideline-based care, reduced costs, and improved outcomes) vary by characteristics of the breadth of specialties and subspecialties, the organizational setting (eg, academic based vs community based), and the environmental context within which these programs function. In particular, the relationship between MDC team involvement and physician and patient engagement in clinical research, including clinical trials, is a high-priority research topic. Finally, we need to further develop our conceptual models of MDC team settings or context and team structure and functioning to actively consider change over time in team composition. MDC teams are not single-dose interventions; they are longitudinal care structures that require theoretical approaches that go beyond the more typical cross-sectional snapshots of team structure, process, and performance.

Even if more research applications in cancer specialty care were pursued, a problem would still exist. Although much can be learned from existing studies of team-based care in other diseases, much of that literature is descriptive. Intervention studies are needed to create the foundation of empirical evidence to understand how MDC team structure influences MDC team processes and ultimately influences MDC team performance. In particular, studies of how team composition, culture, organizational characteristics and environmental factors either directly affect MDC team performance or serve as key mediators or moderators to its success are needed. These studies are rarely done in any disease context but are especially needed in cancer care if the organization of cancer treatment services will keep pace with the future trajectory of personalized medicine.

Understanding these complex interrelationships is challenging and we hope that the conceptual framework described in this article will assist in thinking through these issues. In particular, we

Figure 2. The organization of multilevel effects on multidisciplinary treatment care teams and their impact on cancer care processes and outcomes.
References


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