Enhancing Cancer Care through Design: Understanding Multidisciplinary Teams

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Fig. 1. Narrative storyboard: Multidisciplinary Team Meetings where medical professionals gather to discuss multiple patient cases and achieve consensus over the best course of treatment. From left to right: participants arrive at the MDTM and engage in informal communication; a physician takes on the moderator role and introduces the first patient on the agenda for this meeting while displaying the summary on a shared screen; participants ask questions to gain insight into the case over the best course of treatment; the MDT reaches consensus and the moderator registers the decision next to summary, before moving on to the next case.

The surge of Multidisciplinary Teams (MDTs) has transformed healthcare, moving from siloed medical teams to collaborative units comprising professionals from diverse medical specialties. Despite their global adoption and recognized benefits, there is a research gap regarding the current context and dynamics of MDT Meetings (MDTMs), hindering the design of systems tailored to this context. This study delves into cancer MDTMs, highlighting emerging practices and challenges. We conducted an observational study across three hospitals, uncovering the intricate interplay of organizational, technological, and interpersonal factors. Our insights emphasize the complexities of MDTMs, including physical infrastructure, MDTM's discussion structure, and adaptability, revealing challenges in information management and turn-taking strategies. By addressing these dimensions, our aim is to inform the development of more efficient and effective MDTMs in healthcare.

CCS Concepts: • **Human-centered computing** → **User studies**; *Collaborative and social computing*.

Additional Key Words and Phrases: Multidisciplinary Team, Healthcare, Teamwork

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1 INTRODUCTION

Over the last decades, there has been a growing interest in research on medical teamwork, namely medical team practices and decision-making [5]. Teamwork stands as a cornerstone of healthcare approaches, traditionally characterized by medical teams focusing on a specific medical specialty and involving an internal role hierarchy [1, 7, 14–17, 21]. Multidisciplinary Teams (MDTs) represent a distinct paradigm, with individual members often operating independently or as part of other teams within their routine work [8]. In particular, MDTs have become an essential component of highly specialized decision-making in tailor-made cancer care [2, 10] by engaging multiple clinical specialties who

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gather weekly to collectively review complex cases or newly diagnosed patients [4]. MDT meetings (MDTMs) aim to serve as quality checkpoints, ensuring a thorough evaluation of each case [3, 20] while streamlining the wide range of individual decisions made by medical professionals [18].

Prior work has explored key aspects of the MDTMs workflow, such as achieving diagnosis as a collaborative effort [9], and the impact of information presentation modalities, such as record keeping affecting MDTM's efficiency, accountability and individual privacy preferences [11]. Others analyzed MDTs' work methods, protocols and the design of novel technology [12, 13], as well as building dedicated tools for MDTMs [6, 19]. Most recently, MDTs have become an underexplored topic, ultimately leading to a lack of understanding about the changes introduced by more recent technological changes and medical work.

This work aims to explore current cancer MDTs, namely new practices and breakdowns, to inform the design of systems and approaches fitting for this context. We describe the results from an observational study in three different hospitals and a total of 18 MDTMs. To this end, we leveraged Kane et al. framework [13] to explore hospital, technology and people perspectives in MDTMs. Our preliminary analysis revealed the intricate dynamics of MDTMs in healthcare, suggesting how the physical infrastructure, MDTM's structure, and adaptability intersect with physician availability and technology use, highlighting challenges in information management and turn-taking strategies.

2 METHODOLOGY

In this work, we aimed to answer two main research questions: *i)* What are the current practices of cancer MDTs during MDTMs?; *ii)* What are the current challenges of cancer MDTs during MDTMs?. Our goal was to inform the design of interactive systems tailored for this particular context's needs and constraints. To this end, we conducted an observational study in two institutions, *H1* and *H2*. First, we observed six co-located meetings at *H1* ranging from 10 to 23 participants ($M = 15.17; SD = 3.95$). Second, we observed four remote meetings at *H2A*, *H2's* flagship hospital, ranging from 13 to 20 participants ($M = 17.75; SD = 2.19$). Finally, we observed eight co-located meetings with groups ranging from five to seven participants from *H2B*, one of the hospital units from *H2*. Overall, we observed 18 MDTMs, for a total of 19 hours and 34 minutes. One researcher was present at all MDTM's and gathered observational notes, to comply with the MDT's privacy and ethical constraints. MDTs' consent was required before the researcher joined the MDTMs. The same researcher reviewed all observational notes, employing Kane et al.'s framework [13] to delve into current practices and breakdowns considering organisational, MDT, and technology dimensions. First, the Organisational dimension encompasses staff contracts, policies, procedures, the physical infrastructure and economic considerations. Then, the MDT dimension is set against a societal context, incorporating all the staff, their knowledge, needs, activities and constraints. Finally, the Technology dimension includes technological tools as well as their specifications.

3 FINDINGS

Overall, our preliminary analysis highlights the complex interplay between technological, organizational, and interpersonal factors shaping MDTMs in healthcare settings. We explored the intersections and individual characteristics of the dimensions of organisation, MDT, and technology.

3.1 Organisational: Physical infrastructure

MDTMs occurred in different types of physical spaces. At *H1*, MDTMs took place in a meeting room with several seats around the room, a rectangular table fitting a maximum of 14 participants, and also two wide screens, side-by-side. At the top of the table, facing the screens on the wall forward, radiologists and nuclear medicine physicians would sit next

to a desktop computer, accessing medical imagery, which was also displayed on the left screen. On the right side of the table, the moderator accessed a laptop computer, displaying the textual information with patient summaries and MDT's decisions, which was also displayed on the widescreen on the right. At *H2A*, MDTMs happened remotely, via a videoconference call, with some physicians sometimes joining in pairs or trios in the same space at the hospital. At *H2B*, MDTMs initially took place in a meeting room with a wide screen, mirroring the moderator's laptop screen, a rectangular table, fitting for 10 to 12 people, white boards on the wall, where physicians could write, and extra seats around the room. Then, the MDTM moved to a smaller room, at the Oncology department, with unstable wifi, also containing a wide screen mirroring the moderator's laptop screen, and a smaller table fitting for 8 people.

3.2 Organisational x MDT: MDTM's Structure

In all MDTMs, there was a physician serving as a moderator, typically an oncologist, responsible for managing the MDTM's agenda, making sure the MDT discusses and reaches consensus over all patient cases planned, as well as ensuring participation from key physicians in each case. Regardless of the specialty, the discussion follows a pattern, starting with a physician presenting the first patient's brief clinical history and findings, according to a list prepared in advance and circulated among the MDT before the MDTM. Then, physicians involved in this patient's management intervened and share images, reports or other contents they felt necessary for the evidence-based discussion. The MDT proceeds to ask more questions of the individual presenters, reviewing findings and asking for clarification until consensus on the patient management plan is reached. This is followed by a new discussion for a new patient, following the same pattern, until all patients on the initial list have been discussed.

3.2.1 Adapting to Physician Availability and Time Constraints. Often, MDT members were either not able to join or stay for the entirety of the MDTM, which was particularly important in case they were managing patients who were going to be discussed. This happened due to consults extending beyond schedule, unexpected clinical emergencies and even MDTMs continuing past its intended timeframe. To deal with this, physicians adopted different individual or team strategies. Absent physicians would share their key questions and concerns to a colleague who would attend, working as a proxy who was able to convey all important information on their behalf and ensured such points were considered in the discussion. Others joined via audio call, calling one of the attending physicians who would put them on speaker and enable them to participate in the discussion for a limited period of time. The MDTM's agenda and case order were flexible to accommodate physician availability and scheduling conflicts, not only for remote participation, but also for physicians who would need to leave early.

3.3 Technology x MDT: Information Management in MDTMs

In MDTMs, comprehensive patient summaries, managing physicians' recommendations, and follow-up results from previous meetings were crucial. Each patient discussed at the MDTM has a summary identified by their patient ID, and containing relevant medical information, including a brief clinical history, current medical conditions, treatments and diagnostic results. Such textual information is displayed during its presentation, enabling the MDT to follow and access all necessary data. Incomplete summaries or last-minute additions prolong discussions and create inefficiencies in managing information. Moreover, medical imagery is also key for the evidence-based discussion. Radiologists annotate images to describe specific features or findings, and resorting to different image layouts based on the type of analysis required. Side-by-side images are often used to compare the evolution of a certain aspect over time, such as tumour

growth, or examining different perspectives of the same anatomical structure. Besides these, data from external entities can be uploaded to the hospital's system for access during MDTMs.

While participants adapt to such tech-dependent practices, traditional methods, such as printing and taking notes on paper, are also employed by some participants for information management, including writing relevant aspects about a certain case while preparing to discuss it, as well as writing down subsequent clinical actions they should follow-up on after the MDTM.

3.4 Technology x MDT: Turn-taking Strategies and Challenges

Within the MDTM, participants adopted different turn-taking strategies and faced different challenges, depending on the MDTs' dynamics and setups.

3.4.1 Turn-taking Strategies. On the one hand, participants used explicit turn-taking signals, using the *"raise hand"* feature during remote MDTMs happening over videoconferencing calls, and requesting to speak, saying *"Can I say something?"* or emphasizing *"I have had my hand up for a while ..."*. Others opted for implicit turn-taking, sometimes interrupting each other or speaking simultaneously, and also by physically moving in the room or pointing to the screen to draw attention to specific information. Finally, the moderator also facilitated turn-taking by ensuring all relevant parties intervened, directly addressing any participant they felt necessary and prompting them to speak, as well as preventing anyone from speaking for too long.

3.4.2 Turn-taking Challenges. Participants often faced technological challenges, including internet connectivity disrupting their participation, such as when a managing physician's connection fails, leading to another case being presented in the meantime. In remote MDTMs, screen sharing coordination between the moderator, showing patient summaries, and radiologists, displaying and reporting on medical imagery, also affected the turn-taking flow. Occasionally, this created a conflict in the system, and participants resorted to alternative methods, such as taking pictures of screens using their smartphones and sharing them with the others. Similarly, two radiologists could not open the same case simultaneously, as the system displayed a message indicating that concurrent visualization was not allowed. Another issue were participants that lowered their hands and gave up on indicating their desiring to speak, feeling unseen or unable to contribute effectively. In such cases, other colleagues would sometimes intervene, mentioning there was someone waiting to contribute to the discussion. In other cases, multiple participants spoke simultaneously, leading to confusion and requiring the moderator to restore order, just as when there was silence or lack of engagement, the moderator would wrap up the discussion.

4 DISCUSSION

Our observations indicated that MDTM's maintained the same type of general structured format across time, being consistent with the patterns described in the past [9]. The role of the moderator seemed to be key for the success of the MDTMs, coordinating timely interventions, managing relevant data and ensuring the MDT reached consensus. However, this was also a demanding task, which could potentially benefit from technological solutions addressing a wide span of duties, such as streamlining clerical tasks, prompting the participation of physicians at convenient timings, or registering MDTMs' outputs. Another observation was the fact that discussions can occur in various physical and remote spaces, highlighting the adaptability of the MDT's infrastructure, facilitated by healthcare's move towards entirely digital systems with data that can be accessed by all managing physicians at all times. Information management tools and shared displays showed crucial to ensure collective understanding and supporting evidence-based discussion,

especially with the vast amounts of data generated throughout a patient's clinical journey. In addition, time management issues impact on participation and decision-making, allied to medical professionals being increasingly solicited, require MDTMs that are designed to be efficient and flexible to accommodate physicians' preferences and constraints. This includes leveraging MDTMs allowing hybrid and remote participation, which in turn need to explore strategies that foster enhanced turn-taking and coordination strategies. Another example would be to explore semi-synchronous or asynchronous approaches to potentially streamline MDTM discussions and decisions, while promoting more engaging and continuous collaboration outside these weekly forums. Finally, considering our methodological constraints in conducting an observational study based on textual annotations, we were also made aware that all designs would need to ensure and prioritize patients' privacy and needs, considering the MDT's patient-centric approach and ethical concerns.

5 CONCLUSION AND FUTURE WORK

Our work aimed to gain insight into current MDTM's practices and breakdowns, to enhance design considerations for such contexts. Next steps will look into new strategies to conduct research within MDT's scenarios, exploring enhanced approaches to capture and register data during MDTMs, that can be useful not only for researchers, but also for MDTs aiming to understand their rationale and creating structured textual data efficiently. In addition, we will look into the privacy preferences and expectations of MDTs concerning all information that is shared and available during the management of a patient's clinical case. Furthermore, we will look into recent generative Artificial Intelligence approaches not only to improve documentation tasks, but also as potential MDT's moderators.

REFERENCES

[1] Katherine Ann Zellner, Matt Coates, Alex Lee, Swathi Jagannath, Aleksandra Sarcevic, Emily C. Alberto, Allison Harvey, Randall S. Burd, and Ivan Marsic. 2021. Characterizing Speech in Life Saving Interventions to Inform Computerized Clinical Decision Support for Complex Medical Teamwork. In *Companion Publication of the 2021 Conference on Computer Supported Cooperative Work and Social Computing*. 199–202.

[2] Markus Brunner, Sinclair M Gore, Rebecca L Read, Ashlin Alexander, Ankur Mehta, Michael Elliot, Chris Milross, Michael Boyer, and Jonathan R Clark. 2015. Head and neck multidisciplinary team meetings: effect on patient management. *Head & Neck* 37, 7 (2015), 1046–1050.

[3] Harish Dharmarajan, Jennifer L Anderson, Seungwon Kim, Shaum Sridharan, Umamaheswar Duvvuri, Robert L Ferris, Mario G Solari, David A Clump, Heath D Skinner, James P Ohr, et al. 2020. Transition to a virtual multidisciplinary tumor board during the COVID-19 pandemic: University of Pittsburgh experience. *Head & neck* 42, 6 (2020), 1310–1316. https://doi.org/10.1002/hed.26195

[4] Mary L Fennell, Irene Prabhu Das, Steven Clauser, Nicholas Petrelli, and Andrew Salner. 2010. The organization of multidisciplinary care teams: modeling internal and external influences on cancer care quality. *Journal of the National Cancer Institute Monographs* 2010, 40 (2010), 72–80.

[5] Geraldine Fitzpatrick and Gunnar Ellingsen. 2013. A review of 25 years of CSCW research in healthcare: contributions, challenges and future agendas. *Computer Supported Cooperative Work (CSCW)* 22 (2013), 609–665.

[6] Oscar Frykholm, Marcus Nilsson, Kristina Groth, and Alexander Yngling. 2012. Interaction design in a complex context: medical multi-disciplinary team meetings. In *Proceedings of the 7th Nordic Conference on Human-Computer Interaction: Making Sense Through Design*. 341–350.

[7] Swathi Jagannath, Neha Kamireddi, Katherine Ann Zellner, Randall S Burd, Ivan Marsic, and Aleksandra Sarcevic. 2022. A Speech-Based Model for Tracking the Progression of Activities in Extreme Action Teamwork. *Proceedings of the ACM on Human-Computer Interaction* 6, CSCW1 (2022), 1–26.

[8] Bridget Kane and Saturnino Luz. 2006. Multidisciplinary medical team meetings: An analysis of collaborative working with special attention to timing and teleconferencing. *Computer Supported Cooperative Work (CSCW)* 15 (2006), 501–535.

[9] Bridget Kane and Saturnino Luz. 2009. Achieving Diagnosis by Consensus. *Comput. Supported Coop. Work* 18, 4 (aug 2009), 357–392. https://doi.org/10.1007/s10606-009-9094-y

[10] Bridget Kane and Saturnino Luz. 2011. Information sharing at multidisciplinary medical team meetings. *Group Decision and Negotiation* 20, 4 (2011), 437–464.

[11] Bridget Kane and Saturnino Luz. 2013. "Do no harm": Fortifying MDT collaboration in changing technological times. *International Journal of Medical Informatics* 82, 7 (2013), 613–625.

[12] Bridget Kane and Saturnino Luz. 2017. Trust, Ethics and Access: Challenges in Studying the Work of Multi-disciplinary Medical Teams. In *2017 IEEE 30th International Symposium on Computer-Based Medical Systems (CBMS)*. IEEE, 527–528.

[13] Bridget Kane, Saturnino Luz, and Pieter Toussaint. 2013. Developing a framework for evaluation of technology use at multidisciplinary meetings in healthcare. In *Proceedings of the 26th IEEE International Symposium on Computer-Based Medical Systems*. IEEE, 355–360.

[14] Diana S Kusunoki and Aleksandra Sarcevic. 2015. Designing for temporal awareness: The role of temporality in time-critical medical teamwork. In *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing*. 1465–1476.

[15] Diana S Kusunoki, Aleksandra Sarcevic, Nadir Weibel, Ivan Marsic, Zhan Zhang, Genevieve Tuveson, and Randall S Burd. 2014. Balancing design tensions: iterative display design to support ad hoc and multidisciplinary medical teamwork. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. 3777–3786.

[16] Diana S Kusunoki, Aleksandra Sarcevic, Zhan Zhang, and Randall S Burd. 2013. Understanding visual attention of teams in dynamic medical settings through vital signs monitor use. In *Proceedings of the 2013 conference on Computer supported cooperative work*. 527–540.

[17] Hannah RM Pelikan, Amy Cheatle, Malte F Jung, and Steven J Jackson. 2018. Operating at a distance-how a teleoperated surgical robot reconfigures teamwork in the operating room. *Proceedings of the ACM on Human-Computer Interaction* 2, CSCW (2018), 1–28.

[18] Thomas Ruhstaller, Helen Roe, Beat Thürlimann, and Jonathan J. Nicoll. 2006. The multidisciplinary meeting: An indispensable aid to communication between different specialities. *European Journal of Cancer* 42, 15 (2006), 2459–2462. https://doi.org/10.1016/j.ejca.2006.03.034

[19] Eva-Lotta Sallnäs, Jonas Moll, Oscar Frykholm, Kristina Groth, and Jonas Forsslund. 2011. Pointing in multi-disciplinary medical meetings. In *2011 24th International Symposium on Computer-Based Medical Systems (CBMS)*. IEEE, 1–6.

[20] Thomas D Shellenberger and Randal S Weber. 2018. Multidisciplinary team planning for patients with head and neck cancer. *Oral and Maxillofacial Surgery Clinics* 30, 4 (2018), 435–444.

[21] Katherine A Zellner, Aleksandra Sarcevic, Megan A Krentsa, Travis M Sullivan, and Randall S Burd. 2023. Understanding Delay Awareness and Mitigation Mechanisms through an Iterative Design and Evaluation of a Prototype Alert System for Complex Teamwork. *Proceedings of the ACM on Human-Computer Interaction* 7, CSCW2 (2023), 1–30.

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