





ORIGINAL RESEARCH

Electronic tumor board presentations as the basis for the development of a head and neck cancer database

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Abstract

Background: Multidisciplinary team meetings or tumor boards (TBs) form a pivotal component of oncology practice. The crux of a TB revolves around making treatment decisions based on succinct head and neck cancer (HNC) patient data presentations, which can be challenging and complex. Apart from meticulous TB presentations, discussions and treatment plan documentation is equally important. The aim of this study was to structure an electronic synoptic TB data presentation to address all these areas. The overarching benefits of systematic TB data collection include facilitating audits and research.

Methods: We utilized a secure web-based tool that was used for common scientific research purposes but customized to store HNC patient data. The data points were tabulated across eight TB pages: (a) TB scheduling, (b) patient biodata, (c) diagnosis details, (d) index presentation, (e) images, (f) management and histopathology, (g) TB presentation, and (h) TB discussion and decisions. Each data point leads to additional fields by branching logic to permit further relevant data entry. This was integrated within the patient electronic medical records allowing for a direct internal trajectory to recall TB data.

Results: From October 2015 to October 2018, we recorded over 2000 presentations for 1279 individual patients. This is a quality improvement initiative, and hence, the results are more of a broad analysis of our TB presentation process. The most common cancers were squamous cell (523, 41%), thyroid (207, 16%), and nasopharyngeal

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(139, 11%) carcinomas. Importantly, this system has formed the basis for a number of clinical and translational research projects and audit outcomes.

Conclusion: Despite TBs being vital to oncologic practice, little attempt has been made to report TB data management. In this study, we present an efficient system that permits the integration of dual functions: TB data presentation and oncologic data collection for research, recall, and audit purposes.

KEYWORDS

audit, electronic medical records (EMRs), multidisciplinary team (MDT), research databases, synoptic

1 | INTRODUCTION

Multidisciplinary team (MDT) management is a pivotal component of oncology practice.¹⁻³ Tumor boards (TBs) or MDT meetings are the centerpiece of care delivery, tasked with distilling patient data for evidence-based decision-making. The merits of TBs include refinements in diagnosis and staging, alterations in initial treatment planning, increased implementation of multimodality treatment and coordinated care from MDT members.^{4,5} Given the necessity to review each case and arrive at therapeutic decisions, case presentations have to cover crucial oncologic data derived from electronic medical records (EMR) while being concise and driving to the crux of each case expeditiously due to time limitations. After a review of the objective data, specific questions and concerns regarding the complexity of the case are raised by the managing clinician for the MDT members to reach a unified decision. The electronic form of data documentation has been established as a more efficient system of maintaining medical information and has steadily replaced paper-based documentation.⁶ However, the downside to EMR is that it can be expansive and nonspecific, as it contains oncology information embedded within general medical notes. Hence, there is a fundamental need for developing focused oncologic data storage banks.

TB presentations require pertinent oncologic information to be delivered in a reader-friendly manner. Commonly used formats include Word, Excel, PowerPoint, and PDF, with a lack of the majority using specific formats.⁷ Further details regarding radiologic and pathologic findings are demonstrated by the respective experts during TB meetings, but these crucial details and TB discussion points are not consistently recorded in TB files; if recorded at all, it is done so in a brief manner with salient information missing.⁸ Furthermore, complexities of case management are not often detailed, and the rationale for specific decisions (especially when they are unconventional) is not recorded. Ironically, given the dependence on EMR for the recording and recall of patient data, most TB paper documents are not uploaded into the EMR system. Incomplete documentation of discussion points that lead to TB decisions is not safe for the patients and can possibly lead to deleterious consequences, especially if the TB verdict were in question by the patient or the patient's family or in the extreme event of any medico-legal consequence at a later time.^{9,10} Detailed documentation in the EMR is of paramount importance for reference and

recall and serves as a legal proof of the MDT discussions.¹⁰ Adopting a synoptic format to record and present the data ensures consistency and accuracy and prevents crucial details from being omitted.¹¹ Further, incorporation of detailed TB discussions and decisions renders the documentation complete and fulfills the criteria for "ideal TB patient documentation." Given the significance of TB data presentation, documentation of discussions and the medicolegal implications, it is surprising that there is a lack of reporting in the literature on this topic and unawareness of its importance among doctors.^{12,13}

The aim of this study is to describe every aspect of a comprehensive synoptic electronic head and neck cancer (HNC) patient TB presentation, with an emphasis on the importance of documentation of TB discussion and decision making. This electronic synoptic format replaced the previous free-text Word document and was specifically structured with mandatory data prompts to increase the precision and quality of the data presented. This descriptive study dwells on all the microscopic details that are taken for granted as common knowledge but neither reported in detail nor stressed. Last, this study also highlights the merit of intertwining the function of TB presentation data with building a robust oncologic data source for research and audits.

2 | METHODS

To build an EMR-housed system for synoptic head and neck TB (HNTB) presentation, we utilized **REDCap**—Research Electronic Data Capture (<https://www.project-redcap.org/>) software, which was embedded within our existing EMR system on the Sunrise Clinical Manager (SCM) system (Allscripts, Chicago, Illinois). This is a browser-based, metadata-driven solution and workflow methodology for designing clinical and translational research databases that is not strictly open-source but is available at no charge to institutional partners. REDCap was created in 2004 at Vanderbilt University and is a secure tool that has met HIPAA compliance standards.¹⁴ Data management for TBs was implemented in stages at the National Cancer Centre Singapore and went live in October 2015. REDCap was approved by the SingHealth institutional review board (IRB) for prospective data collection (CIRB: 2011/678/B).

The electronic HNTB pages were specifically structured to address the deficiencies of the previous word document format (Table 1). The

TABLE 1 Summary of the comparison between the previous tumor board (TB) word document presentation and the current electronic head and neck synoptic format

Salient categories	Past tumor board (TB) presentation on word document	Current electronic head and neck tumor board presentation (EHNTB; on REDCap)
1. TB listing page	No comprehensive email notification bearing a summary of all listed patients.	Comprehensive opening page with salient details (patient data, Consultant in charge, diagnosis, pertinent case specific questions to the Board members)
2. Patient Biodata	Inconsistent data presentation since broad headings, with free text area on a word document.	Standardized mandatory data points that ensures uniform presentation for all TB patients.
3. TNM staging	Inconsistent usage of terminology (eg: SqCell Ca, SCC, squamous cancer, mod diff SCC) Grade is not always stated.	Synoptic format forces the user to consistently state in a uniform manner (eg.: SCC) with appropriate grade and permits additional details (eg.: P16 status).
4. Index presentation	Brief inconsistent history of presenting complaints.	Fixed data prompts that warrants compulsory entry of history and physical findings and scope findings.
5. Investigations	Salient investigations summary only, does not state all investigations completed.	All investigations summary and conclusions uploaded. (all radiological scan imaging summary and biopsy details)
6. Images	Not mandatorily uploaded	If relevant endoscopic images were captured then they are uploaded.
7. Histopathology	Basic TNM (tumor, node metastasis) status	Synoptic TNM stage and other salient details. (lymphovascular invasion, perineural invasion, extra-nodal extension, extra capsular extension, margin status, lymph nodes harvested, and how many were positive for metastatic focus)
8. AJCC	Not attached to the word doc. Template for the user to refer while entering TB details	AJCC 7 and 8 manuals attached to TB listing page for quick reference
9. Surgical History	In brief	Detailed (site of primary and secondary, type of neck dissection, levels, flaps,) with key surgical findings
10. Presentation Page	All details strewn on one page	Detailed five pages of patient related data summarized on a final presentation page.
11. TB Decision page	Final TB decision written without detailed TB discussion that led to the decision.	TB Discussion page with separate boxed comments tabled from radiologist, pathologist, medical, radiation and HN surgical oncologist inputs keyed with final TB decision
12. Summary of comparison	Single page word document	Synoptic eight electronic HNTB pages. <ul style="list-style-type: none"> • Page 1: TB listing page • Pages 2-6: comprehensive patient related data • Page 7: Final TB presentation page carrying summary of patient data (from pages 2-6). • Page 8: TB discussion and decision page

unique feature is that this new application is user-centric, with easy to customize data collection forms and the ability to modify and expand as required with branching logic that allows new data points to unfurl depending on the initial entries. (eg, if one were to enter that a patient underwent surgery [surgery = "yes"], then a series of subtabs would expand to prompt further data entry: primary surgical details, with or without reconstruction, neck dissection type and levels, etc.) Moreover, the collective data can be easily exported into a number of different formats, including text (tab-delimited/CSV), Excel, SPSS, R, or other commonly used statistical software for audit or research.

Fifty-three mandatory data points were customized across eight pages: (a) TB scheduling, (b) patient biodata, (c) diagnosis and staging details, (d) index presentation, (e) images (a field to upload clinical

photos, if available), (f) treatment details and histopathology reports, (g) presentation page, and last, (h) TB discussion and decision.

2.1 | TB scheduling

Patients are scheduled for TB if the inclusion criteria set by our MDT are met, and these are as follows:

1. All newly diagnosed patients with squamous cell carcinoma, salivary gland malignancies, sarcomas, rare tumors (eg, sinonasal cancers, esthesioneuroblastoma), metastatic nasopharyngeal carcinoma, thyroid or skin cancers. (At our institution, newly

Head & Neck Surgery Tumour Board

Data Exports, Reports, and Stats

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Tumor Board 25 Nov 2019

Indicates if relevant pages are completed

Patient Name patient_name	NRIC nric	Event Name redcap_event_name	Consultant in Charge tbl_consultant_in_charge	Diagnosis and Reason for Tumour Board listing reason_tbl	Histology Required? tbl_histology_required	Patient present at presentation? tbl_patient_present	Tumour Board Decision 1 tb	Complete? tumour_board_listing_complete	Complete? biodata_complete	Complete? diagnosis_details_complete	Complete? index_presentation_complete	Complete? images_complete
		Initial + Survival Status	Others (0)	Known NPC and ethmoid adenocarcinoma Now complaining of right face numbness and mri shows V2 thickening and enhancement For review of scans	No (0)	No (0)	EBV DNA. Explore biopsy options. If not amenable to biopsy now, repeat imaging in 2-3 mths and consider re-biopsy when feasible	Complete (2)	Complete (2)	Complete (2)	Complete (2)	Complete (2)
		Initial + Survival Status	Others (0)	IP SCC	Yes (1)	No (0)	SCC arising from inverted papilloma Post op. No malignancy seen. Margins clear. pT1 cN0 cM0. Completed resection. Watch. No indication for adjuvant RT.	Complete (2)	Complete (2)	Complete (2)	Complete (2)	Complete (2)

FIGURE 1 Tumor board summary document (each patient can be accessed individually for further details)

- diagnosed, nonmetastatic nasopharyngeal carcinoma [NPC], skin and thyroid cancers are not routinely discussed in TBs.)
- Post-surgery patients for final histopathology presentation to discuss whether adjuvant treatment is indicated.
- All recurrences (locoregional and distant metastasis), residual disease and unconventionally treated patients.
- All patients to be considered for clinical trials.

The weekly consolidated “Head and neck tumor board list” can be downloaded and mailed to MDT members the weekend prior to the meeting and on the morning of the meeting (Figure 1). This serves to remind all MDT members of the specific cases and alert them if there are any last-minute additions, especially for pathologists and radiologists, so they can prepare the relevant histology slides and scans, respectively.

2.2 | Data entry

There are four data entry components:

- Patient-related data: (name, age, gender, ECOG performance status, comorbidities, cancer presentation, and past, family, and social history).
- Investigations data: (clinical examination pictures when relevant, histopathology data, and radiological data including MRI, CT, and PET-scan findings).

- Treatment-related data: (surgical details, radiation therapy, and chemotherapy details).
- TB discussion: Real-time “live” case presentation, TB discussion, and final treatment plan.

The time needed to key in individual HNC patient data on the electronic TB files can range from 5 to 15 minutes depending on the complexity of patient data. Multiple events can be entered for a single patient to accommodate recurrences or second primary tumors. The electronic form also has a link to the current eighth and seventh AJCC staging manual (Figure 2). One important mandatory field is obtaining consent from patients to use the clinical data for audits and research, with a link for the attached consent forms.

Random and planned TB audits were carried out by the data managers who identified incomplete entries in 15% of cases. These results demonstrating incomplete data, as well as accurate data computed on the wrong page or in free text areas, indicate that constant review and periodic rectification are required. This reflects the need for a data manager to audit and retrospectively reenter data points.

2.3 | TB presentation

The data entered are automatically summarized and displayed in an easy-to-visualize presentation format for the TB meetings. The information is displayed in a succinct manner (Figure 3). These summaries are displayed on the monitor of the presenter and projected on

FIGURE 2 A, Basic data points on the index presentation page, with the AJCC eighth manual embedded for a quick staging reference. B, Management Page: Clicking each data point unfurls to more data points that prompt the collection of further relevant data

FIGURE 3 A & B, Final presentation page that appears during the patient data presentation. This is a synopsis of the data keyed on the individual pages. (single page, split as two images)

FIGURE 4 Tumor board (TB) dates, decisions and free text of salient discussion points, explaining the rationale for the TB recommendation

Actions: [Modify instrument](#) [Download PDF of instrument\(s\)](#) [VIDEO: Basic data entry](#)

Tumour Board Discussion

Editing existing NRIC 3M

Event Name: Initial + Survival Status

NRIC 3M

Number of Tumour Board Discussion 3

Date of Tumour Board Discussion 1 10-12-2018 Today D-M-Y

Tumour Board Decision 1

*State date, followed by TB conclusion Expand

Date of Tumour Board Discussion 2 Today D-M-Y

Tumour Board Decision 2

*State date, followed by TB conclusion Expand

Date of Tumour Board Discussion 3 Today D-M-Y

Tumour Board Decision 3

*State date, followed by TB conclusion Expand

Comments (Radiation Oncology) Expand

Comments (Medical Oncology) Expand

Comments (Head and Neck Surgery) Expand

Comments (Nuclear Medicine) Expand

Save & Exit F
Save & Stay
-- Cancel --

the screen during the TB meeting. The presentations are patient- and event-specific, and any overt mistakes can be identified in real time and corrected immediately.

2.4 | Entry of TB decision

During TB meetings, two computers are logged on to the system: one driven by the presenter is projected as the presentation and the second is used to record the final TB treatment verdict by senior oncologists. The discussion rationale for the final TB decision is recorded in

the free text space (Figure 4). This is especially important in complex clinical scenarios or when there are situations where the treatment plan deviates from the established guidelines. Successive TB discussions and decisions can be documented in a chronological manner.

3 | RESULTS

After reviewing our electronic HNTB data from October 2015 to October 2018, there were 1279 individual patient entries available for analyses, comprising over 2000 presentations. The most common

cancers discussed at our TBs were SCCs (523; 41%), thyroid cancers (207; 16%), and nasopharyngeal carcinoma (NPC; 139; 11%). Of the SCCs, the common subsites included the oral cavity (231; 44%), larynx (85; 16%), and oropharynx (77; 15%). These distributions reflect the selection bias of our TB presentations (refer to the TB patient scheduling criteria above), as NPCs and thyroid cancers are prevalent in Singapore (<https://www.nrdo.gov.sg/publications/cancer>). Therefore, separate efforts are now underway to build thyroid cancer and NPC databases retrospectively. The subcategory labeled as “others” composed of 276 (22%) patients, this included a variety of pathologies, including adenoid cystic carcinoma, mucoepidermoid carcinoma, desmoid tumors, esthesioneuroblastoma, neuroendocrine tumors, mucinous carcinoma, angiosarcoma, sebaceous cell carcinoma, myoepithelial carcinoma, lymphoepithelial carcinoma, and aggressive basal cell carcinomas.

The growing HNC TB database has served as the basis for a range of new research projects, which can be classified as follows:

1. Filtered research data: Databases are built by extracting data points from the parent TB data list to answer a specific question. By defining precise filters (eg, all patients with larynx SCC or oral cavity P16+ cancers), database reports can be generated rapidly for patients confined to the mentioned filters and can be restricted to a specified time range or can be accrued over time to generate “real time dynamic research reports.” A number of ongoing projects are based on this premise, including audits of surgical quality (based on tumor margins, lymph node harvest, etc.), prognostic factors in young smokers, and the risk of metastasis in patients treated with prior radiotherapy.
2. Secondary research projects: This classification comprises projects where a master list is generated from our HNTB but subsequently layered with extensive additional data points beyond the scope of TB data. Studies include the assessment of posttreatment employment status of HNC patients, quality of life (QOL) and the impact of multimodal treatment on physical functions as well as translational research with the addition of genomics, transcriptomics, or biomarker data.
3. Satellite research projects: The simplicity of implementing specific data forms and adding to the basic information collected for HNTB allow the growth of independent subspecialties with interrelated projects. Plastics and reconstructive surgery have branched off to accrue detailed information in REDCap on flaps for HNC surgery, which has expanded to include all flap-related surgeries. Collection of specific speech and swallowing outcome data has also been initiated. The precedence set by our experience with HNTB data has motivated the development of other projects within the health care cluster.

4 | DISCUSSION

Although TBs are conducted worldwide, TB data presentation, documentation, and storage methods are subjective and unique to each

center, and the depth of attention one pays to details may vary; hence, standardization and literature reporting on a global level are indicated. Data-driven solutions for the process of conducting TB meetings should meet the following criteria: uncomplicated data entry, uncluttered presentation, TB discussion points, the ability to add layers of information across the treatment timeline, unlimited storage, and last, the ability to facilitate audits and research in a secure network.¹⁵ Additionally, direct access via an embedded icon within the individual patient EMR facilitates retrieval with an internal trajectory to the patient TB file. Here, we describe our experience with implementing the electronic, synoptic HNC patient data presentation for the past 6 years at our weekly TBs. Due to inherent user-centric features, the implementation of the TB pages was achieved with minimal effort.

What started as a basic TB e-form gradually expanded to include granular details but was specifically kept from being unwieldy by using branching logic for specific entries and limiting free-text sections. Synoptic reporting has replaced traditional free-text to ensure the repeated completeness of data documentation in a consistent scientific format and has gained acceptance in various fields, such as radiology, pathology, and operative surgery.^{11,16,17} It was hence a logical reporting choice to guide TB data entry due to the complexity of HNC patient data. Indeed, the evolution of the current iteration of the TB e-forms stemmed from a need to overcome previous deficiencies (Table 1), including incomplete and missing critical data points due to a variety of reasons; these include last minute preparations, residents unfamiliar with HNC complexity, investigations at external institutions, and results/reports being unavailable at the time of discussion. Specific and accurate data entry is mandatory for the MDT to arrive at the right decision; lack thereof results in unwanted deferments, which can result in a delay in treatment commencement, which is detrimental to oncology care delivery.

One of the major advantages of synoptic data entry is the ability to extract data for research and audits, both critical functions in a tertiary institution. Advanced users can generate specific reports from the data that can be exported to SPSS, R, or Excel under the umbrella of the appropriate ethical clearance. These data are further linked (indirectly) to the National Registry of Births and Deaths and can automatically include overall survival as an important outcome measure. Similarly, it is important to audit various aspects of TB decisions, including compliance with decisions, tracking outcomes, and comparing these to other national and international databases, to ensure that the standards of care delivery are met. Certainly, if a standardized system were adopted more widely, these audits can span across different institutions, similar to other widely used audit databases such as the “National Surgical Quality Improvement Program,” which audits and addresses surgical outcomes.¹⁸ Currently, the focus remains on accruing robust oncologic data for TB presentations, recording discussion points with final board approved treatment plans, and storing relevant data for research. However, the documentation of TB meeting minutes, charting the attendance of key board members, and specific points of discussion that steered a controversial decision would be future data points to add on for the phase II HNTB.

Given the widespread adoption of different EMR systems in hospitals across the world, it is surprising that MDT presentations are often not embedded within this system but exist as separate files, often in free-text form. Details of MDT discussions and decisions are recorded inconsistently, and salient discussion points may be missing.¹⁹ The lack of important details can be an issue during recall, or worse, if there were a medicolegal enquiry on the case. Apart from the primary clinician in charge, the concerned MDT members who participated in the discussion and treatment decisions can be potentially culpable.¹² Hence, meticulous documentation of the MDT discussion that navigated the treatment plan is of paramount importance from a legal perspective.¹²

Undoubtedly, the safest location for these data is embedded within each individual's EMR records for these purposes. Moreover, given the need to adhere to privacy laws and prevent the loss of data, the EMR system provides the necessary security against cyberattacks.^{20,21} REDCap is a parallel system embedded within the EMR data with stringent security measures including password protection, limited access, user-authentication, HIPAA compliance, and an auditing trail of usage, hence ensuring a regulated safe data storage environment.²² We also posit that if this system was widely adopted, it could be imported into other EMR systems, allowing for possible cross-institutional comparisons if required.

The major limitation of this system is the methodology of data entry; residents who are often busy and may not appreciate the need for precise data entry key in all the relevant data as one entry into the free text area, which is not in the appropriate field. The rate of incomplete entries validates this notion and supports the need for a dedicated data manager to oversee, audit and, where necessary, plan revisions for the e-form. One solution to deal with inappropriate data entry is to have codes specifically written to extract data points from the EMR for radiology and pathology and have them deposited directly into the HNTB pages. However, the cross talk between the systems has not been implemented for security reasons. Despite the versatility of this system, it remains a single-institution experience for the purpose of TB presentations and has not been exported to other centers, although the potential for doing so is substantial.

5 | CONCLUSION

Tumor boards contributes to improved patient outcomes and care delivered, provide exceptional educational value, and collected TB presentations serve as a growing bank of oncological data sources for monitoring trends. In this study, we present a simple yet efficient framework to compile and present standardized HNC patient TB data in line with current practice guidelines. The existence and widespread adoption of standardized TB presentation formats in future may foster seamless exchange of information and implementation of TBs to nascent centers via virtual TBs and tele-networking; thus decentralizing and not confining this practice to high volume tertiary care cancer centers. Constantly evolving knowledge in oncology will only lead to more TB data points; organization of these data can be

accomplished with greater ease in a web-based electronic synoptic format that can pave the pathway for precision medicine in cancer care.

CONFLICT OF INTEREST

The authors declare no potential conflict of interest.

AUTHOR CONTRIBUTIONS

M.R.: conceptualization, data curation, investigation, methodology, project administration, software, supervision, validation, visualization, writing—original draft, writing review, and editing. H.E.W.: conceptualization, data curation, formal analysis, project administration, resources, software, supervision, validation, and writing review. W.W.: conceptualization, data curation, project administration, resources, software, and writing review. S.M.: conceptualization, data curation, formal analysis, project administration, resources, software, supervision, validation, and writing review. K.A.B.A.K.: conceptualization, data curation, project administration, resources, software, supervision, validation, and writing review. T.S.: conceptualization, data curation, formal analysis, project administration, resources, software, visualization, and writing review. B.H.: data curation, formal analysis, methodology, project administration, resources, software, and writing review. K.S.: conceptualization, project administration, resources, software, validation, writing review, and editing. Y.-L. S.: conceptualization, project administration, resources, software, validation, writing review, and editing. M.L.K.C.: conceptualization, project administration, validation, writing review, and editing. G.T.: conceptualization, project administration, resources, software, validation, writing review, and editing. N.C.T.: conceptualization, project administration, validation, visualization, supervision, writing review, and editing. H.K.T.: conceptualization, project administration, resources, supervision, validation, writing review, and editing. N. G.I.: conceptualization, data curation, investigation, methodology, project administration, resources, software, supervision, validation, visualization, writing—original draft, writing review, and editing.

LEVEL OF EVIDENCE

2C.

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REFERENCES

- Shellenberger TD, Weber RS. Multidisciplinary team planning for patients with head and neck cancer. *Oral Maxillofac Surg Clin North Am.* 2018;30(4):435-444.
- Gibson MK, Forastiere AA. Multidisciplinary approaches in the management of advanced head and neck tumors: state of the art. *Curr Opin Oncol.* 2004;16(3):220-224.
- Varkey P, Liu YT, Tan NC. Multidisciplinary treatment of head and neck cancer. *Semin Plast Surg.* 2010;24(3):331-334.

4. Ruhstaller T, Roe H, Thurlimann B, Nicoll JJ. The multidisciplinary meeting: an indispensable aid to communication between different specialities. *Eur J Cancer (Oxf Engl)*. 2006;42(15):2459-2462.
5. Pillay B, Wootten AC, Crowe H, et al. The impact of multidisciplinary team meetings on patient assessment, management and outcomes in oncology settings: a systematic review of the literature. *Cancer Treat Rev*. 2016;42:56-72.
6. Evans RS. Electronic health records: then, now, and in the future. *Yearb Med Inf*. 2016;(Suppl 1):S48-S61. <https://doi.org/10.15265/IYS-2016-s006>
7. Ottevanger N, Hilbink M, Weenk M, et al. Oncologic multidisciplinary team meetings: evaluation of quality criteria. *J Eval Clin Pract*. 2013;19(6):1035-1043.
8. Knaup P, Harkener S, Ellsasser KH, Haux R, Wiedemann T. On the necessity of systematically planning clinical tumor documentation. *Methods Inf Med*. 2001;40(2):90-98.
9. Epstein JB, Kish RV, Hallajian L, Sciubba J. Head and neck, oral, and oropharyngeal cancer: a review of medicolegal cases. *Oral Surg Oral Med Oral Pathol Oral Radiol*. 2015;119(2):177-186.
10. Iyer NG, Chua MLK. Multidisciplinary team meetings—challenges of implementation science. *Nat Rev Clin Oncol*. 2019;16(4):205-206. <https://doi.org/10.1038/s41571-018-0148-2>.
11. Iyer NG, Nixon IJ, Palmer F, Ganly I, Patel SG, Shaha AR. Electronic synoptic operative reporting for thyroid surgery using an electronic data management system: potential for prospective multicenter data collection. *Ann Surg Oncol*. 2011;18(3):762-766.
12. Sidhom MA, Poulsen MG. Multidisciplinary care in oncology: medicolegal implications of group decisions. *Lancet Oncol*. 2006;7(11):951-954.
13. Deneuve S, Babin E, Lacau-St-Guily J, et al. Guidelines (short version) of the French otorhinolaryngology—head and neck surgery society (SFORL) on patient pathway organization in ENT: the therapeutic decision-making process. *Eur Ann Otorhinolaryngol Head Neck Dis*. 2015;132(4):213-215.
14. Harvey LA. REDCap: web-based software for all types of data storage and collection. *Spinal Cord*. 2018;56(7):625.
15. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform*. 2009;42(2):377-381.
16. Sluijter CE, van Lonkhuijzen LR, van Slooten HJ, Nagtegaal ID, Overbeek LI. The effects of implementing synoptic pathology reporting in cancer diagnosis: a systematic review. *Virchows Archiv Int J Pathol*. 2016;468(6):639-649.
17. Kennedy ED, Milot L, Fruitman M, et al. Development and implementation of a synoptic MRI report for preoperative staging of rectal cancer on a population-based level. *Dis Colon Rectum*. 2014;57(6):700-708.
18. Martin CT, Pugely AJ, Gao Y, et al. Reliability of a surgeon-reported morbidity and mortality database: a comparison of short-term morbidity between the Scoliosis Research Society and National Surgical Quality Improvement Program Databases. *Iowa Orthop J*. 2016;36:147-154.
19. Rankin NM, Lai M, Miller D, et al. Cancer multidisciplinary team meetings in practice: results from a multi-institutional quantitative survey and implications for policy change. *Asia Pac J Clin Oncol*. 2018;14(1):74-83.
20. Coventry L, Branley D. Cybersecurity in healthcare: a narrative review of trends, threats and ways forward. *Maturitas*. 2018;113:48-52.
21. Jalali MS, Kaiser JP. Cybersecurity in hospitals: a systematic, organizational perspective. *J Med Internet Res*. 2018;20(5):e10059.
22. Manion FJ, Robbins RJ, Weems WA, Crowley RS. Security and privacy requirements for a multi-institutional cancer research data grid: an interview-based study. *BMC Med Inform Decis Mak*. 2009;9:31.

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