Insular Decision Criteria in Clinical Practice: Analysis of Decision-Making in Oncology

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Keywords

Decision-making · Oncology · Insular criteria · Cancer

Abstract

Background: Medical decision-making is complex and involves a variety of decision criteria, many of which are universally recognised. However, decision-making analyses have demonstrated that certain decision criteria are not used uniformly among clinicians. **Aim:** We describe decision criteria, which for various contexts are only used by a minority of decision makers. For these, we introduce and define the term “insular criteria”. **Methods:** 19 studies analysing clinical decision-making based on decision trees were included in our study. All studies were screened for decision-making criteria that were mentioned by less than three local decision makers in studies involving 8–26 participants. **Results:** 14 out of the 19 included studies reported insular criteria. We identified 42 individual insular criteria. They could be intuitively allocated to seven major groups, these were: comorbidities, treatment, patients’ characteristics/preferences, caretaker, scores, laboratory and tumour properties/staging. **Conclusion:** Insular criteria are commonly used in

clinical decision-making, yet, the individual decision makers may not be aware of them. With this analysis, we demonstrate the existence of insular criteria and their variety. In daily practice and clinical studies, awareness of insular criteria is important.

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Introduction

Physicians need to make decisions with incomplete information and limited evidence [1]. Health care is associated with complex, ambiguous and uncertain decisions in diagnosis, treatment, management and prognosis [2]. The naturalistic decision-making model attempts to understand how domain experts (oncologists in our study) make decisions in a real-world context that is meaningful and familiar to them [3]. This view is dominated by the idea, that decision makers evaluate options by comparing them to previous situations and choose the one with the highest compatibility by applying intuition and pattern-matching mechanisms [4]. Medical decision-making is to choose among a multitude of treatment options, based on various explicit and implicit decision criteria [5, 6]. Among

Fig. 1. Sample decision tree for thoracic radiotherapy in small cell lung cancer based on fitness and thoracic and extrathoracic response to chemotherapy. CR, complete remission; PR, partial response; SD, stable disease; PD, progressive disease; TRT, thoracic radiotherapy.

other factors, decision-making is dependent on knowledge, which may be limited in a specific domain. As an example for such limited evidence, choice of the best treatment option in stage IIIA non-small cell lung cancer may be mentioned. Several studies compared surgery-based approaches to chemoradiotherapy but could not show a benefit for either of them [7]. The patient collective in this stage of disease shows substantial heterogeneity, leading to limitations in the transfer of the study results to the individual patient. Furthermore, patient-specific factors, such as age, comorbidity or personal preference, but also treatment availability have a great impact on this decision-finding process. Applying naturalistic decision-making to oncological treatment decisions opens the possibility that experts may choose differently based on their distinct experience and institutional prerequisites, leading to divergent pattern-matching mechanisms. We aim to introduce the term “insular criteria”, identify and describe these, based on a quantitative analysis of multiple cancer-related decision-making projects. Insular decision criteria are not universally implemented but are rather used individually by a minority of decision makers within a specific context. For the purpose of this article, decision-making strategies in multiple previous analyses among cancer experts were collected and compared (see Appendix A).

Methods

We arbitrarily define “insular criteria” as decision criteria, individually used by experts and/or institutions when asked about their individual decision strategies in specific clinical treatment situations for cancer patients. For the purpose of selection in this

investigation, we selected “insular criteria” as criteria, which were used by 25% or less of the participants, but not by more than 3 participants. Different wordings for the same concept were not considered individual insular criteria. Namely, ECOG performance score, Karnofsky index and performance score were grouped as one insular criterion “performance status” in this analysis as they all represented the same concept.

Nineteen analyses investigating decision-making using decision trees were selected as the basis of our analysis. These studies focused on different tumour entities and also specific clinical situations. This includes treatment modalities (such as radiotherapy or chemotherapy) in various diseases (such as prostate, lung or ovarian cancer). Studies were eligible for this analysis, if they collected input from different institutions or experts on decision-making criteria and performed a consensus analysis based on the comparison of decision trees representing decision-making strategies [8] (Fig. 1). Eligible publications were screened for potential insular criteria as described below. Additionally, for ongoing studies, the respective coordinators were asked to check their data for insular criteria arising from the input of the different institutions. All projects were based on open questions to the participants with no specific decision criteria suggested to the experts [9]. During data collection and analysis, the decision criteria were homogenised to enable comparability within the individual projects (e.g. fitness, ECOG and Karnofsky Performance Status Scale could be summarised as fit or unfit). Decision criteria considered universal were not included in these analyses – these would include for example informed patient consent. Criteria, which were used only by a minority of experts and did not fit into homogenised criteria, and were therefore excluded from the decision-making analyses, qualified as “insular criteria”.

Data acquisition was made for different tumour entities and different stages. Therefore, criteria that would qualify as insular in one project may be commonly used in another setting (therefore only qualifying as insular in the first setting). For example, positive resection margins may be an insular criterion in the context of glioblastoma, while it would not qualify as an insular criterion concerning decision-making in breast cancer where it is commonly

Table 1. List of included studies and their respective insular criteria

<i>Second-line treatment for metastatic clear cell renal cell cancer: experts' consensus algorithms</i> [A]	Uncontrolled hypertension/severe heart problem Uncontrolled diabetes mellitus with high insulin Response to first-line treatment Experience of early deaths Comorbidities Contraindications for certain drugs Performance status
<i>Salvage radiotherapy for macroscopic local recurrences after radical prostatectomy: A national survey on patterns of practice</i> [B]	PSA doubling time Size of macroscopic recurrence >1 cm Referring urologist
<i>Patterns of care in recurrent glioblastoma in Switzerland: a multicentre national approach based on diagnostic nodes</i> [C]	Patient preference Complete resection of enhancing tumour (CRET) Age
<i>Algorithms in the First-Line Treatment of Metastatic Clear Cell Renal Cell Carcinoma – Analysis Using Diagnostic Nodes</i> [D]	Laboratory parameters Comorbidities Avoidance skin/bone marrow toxicity Route of administration
<i>Diagnostic Nodes of Patient Selection for Cytoreductive Surgery and Hyperthermic Intraperitoneal Chemotherapy (HIPEC) among Colorectal Cancer Patients: a Swiss National Multicentre Survey</i> [E]	Peritoneal surface disease severity score Extraperitoneal metastases Ovarian metastases Incidental finding of peritoneal carcinomatosis Mucinous histology No open lung resection One lung metastasis No lung or liver metastases Positive resection margins Age No lung metastases
<i>Radiotherapy for pelvic nodal recurrences after radical prostatectomy: patient selection in clinical practice</i> [F]	Patient's preference Comorbidities affecting pelvic RT tolerance (e.g., severe diverticulosis, bowel adhesions)
<i>Pre- and Postoperative Chemotherapy in Localized Extremity Soft Tissue Sarcoma: A European Organization for Research and Treatment of Cancer Expert Survey</i> [G]	Angiosarcoma histology
<i>Choice of first line systemic treatment in metastatic pancreatic cancer among national experts</i> [J]	Need for fast response BRCA-mutation
<i>Patterns of care in metastatic pancreatic cancer: patient selection in clinical routine</i> [H]	Bilirubin Histology (squamous)
Patient selection for HIPEC in ovarian cancer (unpublished work)	Chemotherapy-/platin-sensitivity PS (ECOG/Karnofsky) Age FIGO stage Ascites Tumour board recommendation
<i>Variations in radioiodine ablation: decision-making after total thyroidectomy</i> [I]	BRAF-mutation (<i>included in decision tree</i>)
Selection for hyperthermic intraperitoneal chemotherapy (HIPEC) in colorectal cancer patients: An international multicenter survey (unpublished work)	Preoperative laparoscopy Radiological findings (not further specified)
<i>Treatment of brain metastases in small cell lung cancer: Results of a survey amongst a multidisciplinary panel of experts</i> [K]	Elderly
Stage III N2 non-small cell lung cancer treatment in Switzerland: Surgery or radiotherapy? (unpublished work)	Age ECOG performance status Response to neoadjuvant treatment Patients' preference Extent of resection (pneumonectomy) Karnofsky index

Fig. 2. Insular criteria grouped intuitively into clusters.

used. This will lead to insular criteria specific for each projects' research question and the identification of specific insular decision criteria is always a function of the selected decision-making settings.

Results

We identified insular criteria in 14 out of the 19 included studies (Table 1). A total of 52 criteria were described as fulfilling the insular criteria in individual studies. Several criteria, such as comorbidities, age or performance status, were reported in multiple individual studies, leading to 42 unique insular criteria. Identified insular criteria were of various character and were intuitively grouped in a cluster-diagram (Fig. 2). This attribution has representative character, as their use is depen-

dent on the specific settings (e.g. histology may not be mentioned if the topic being analysed specifically deals with small cell lung cancer). Nevertheless, the visual attribution to these groups implies heterogeneity in the collective. 16 criteria were attributed to tumour properties/staging and only two to laboratory parameters.

Discussion

This paper demonstrates the existence of insular criteria as highly individual criteria, used only by a minority of decision makers (institutions and/or experts) when choosing treatment options. To summarise these relevant and potentially neglected items, the term "insular criteria" is proposed. To the best of our knowledge, this term has not yet been introduced – neither in medical nor in

managerial publications. While conceptual publications proposed the terms “local decision-making” or “decentralised decision-making” [10] for the process, we focus on the decision criteria involved. Therefore, a clear verbal discrimination by using “insular criteria” is justified in our view.

In daily practice, process models relying on decision trees enable visualisation and facilitate complex information. In clinical guidelines, these insular criteria are usually not implemented. The National Comprehensive Cancer Network (NCCN) and medStandards provide an example of how guidelines implement multiple decision criteria, defining a clear algorithm and course of action [11]. Guidelines represent a statement of evidence and consensus, defined by the authors, based on the available data and their views on currently accepted treatment approaches. Furthermore, guideline implementation may be limited to geographic regions (i.e., national, international or continental) due to the availability of specific diagnostic techniques or treatment options (i.e., developing countries, national restrictions, reimbursement issues). Commonly used criteria form the basis of inclusion and exclusion criteria, they are considered in databases and are reflected in guidelines. The consideration of insular criteria may vary considerably between experts or centres. Their omission in studies and guidelines complicates implementation into clinical practice among clinicians that would usually rely on these in decision-making. Cancer-related data is systematically collected in national and international registries. The European Network of Cancer Registries (ENCR), combining 39 European national registries [12], and the Surveillance, Epidemiology and End Results (SEER) programme of the National Cancer Institute (NCI) [13] collected millions of cancer cases over the past decades. These databases store information on tumour and patient characteristics, as well as treatments and their outcomes. Such data sets are the foundation for database analyses, which may identify new prognostic factors or associations with treatment response. Retrospective analyses of databases may be affected by a systematic decision-making bias. Attribution to specific treatments may already have been confounded by insular criteria, as they led to different treatments in the first place. The reason this bias may go undetected is that it is not detectable from the commonly collected parameters (which would not include insular criteria). However, this confounder is unknown, therefore their effect on results cannot be estimated, nor may algorithms analyse or compensate them. This underlines the importance of raising awareness to these factors on an institutional and per-

Table 2. Categories of managerial criteria and corresponding insular criteria groups

Managerial criteria	Insular criteria groups
Decision maker-related	Caretaker, patient, comorbidities
Decision-specific	Tumour properties/staging, scores, laboratory
Contextual	Treatment, scores

sonal level in order to improve cancer treatment decision-making.

Artificial intelligence and decision support systems are being increasingly used to facilitate medical decision-making [14–16]; these systems, however, are trained on data sets that omit insular criteria. These omissions may result in significant biases and discrepancies when the treatment recommendations are associated with existing data sources and collide with the real-world, that is institutional conditions like the unavailability of certain treatment modalities. This dissonance also occurs in the setting of transferring recommendations from one context to another when insular criteria are not equally implemented.

Traditional views on human information processing and decision-making are dominated by the behavioural decision theory [3] which describes how individuals incorporate their personal values and beliefs in the decision-making process [17]. Unlike the classical concept of the *homo oeconomicus*, medical decision-making deals with far more non-rational modes of thinking (including “intuition” or “emotions”), diagnostic or therapeutic uncertainties and insufficient data for specific situations [18–20]. To get a better overview of the complexities and variability of decision-making criteria in oncology, Glatzer et al. [6] reflected on the adaptation of classical managerial decision-making into the field of oncology, adhering to the three categories “decision maker-related”, “decision-specific” and “contextual” factors. Our findings show similar characteristics and fit into these categories (see Table 2). Decision-specific factors have shown the most important influence in strategic decision-making [21].

Our results suggest a large number of insular criteria to match the surrogate, implicating their importance in medical decision-making. More recently, the naturalistic decision-making model has been used to explain decision-making in its naturally occurring environment. It takes into account that domain experts make complex,

high stakes, and potentially ill-structured decisions under time pressure [4]. This theoretical foundation might serve as an improved basis to explain how highly individual insular criteria could have developed in different institutions and among different groups of experts. Decentralization became more and more popular in the European health care systems, aiming for better performance in the health care sector by raising local agility and accountability of local institutions [22]. This means higher dependence on individual (experience of treating physician) and institutional knowledge for consistent choices with good health sector performance. In their respective “decision space”, local decision makers play a key role through their freedom of choice and resources [22]. Insular criteria are often not taken into account while defining the decision space from top down but might supplement and adapt them and increase the accountability of local decision makers. General characteristics like age are frequently considered, nevertheless, they might be insular criteria in specific situations. For patients in highly complex clinical situations, it is common to get a second opinion. This may lead to contradicting recommendations, as they may potentially use different sets of decision criteria, possibly including an insular criterion. The presence or absence of insular criteria among the available information may lead to discrepant recommendations. A limitation to this review is the potential for faulty or missing homogenization. Different institutions may use different criteria with the same goal. For example, risk stratification in cancer therapy can be based on TNM-staging or on histological classification (e.g., Gleason score in case of prostate cancer) or both. Additionally, the underlying decision-making studies were restricted to specific cancer entities and clinical scenarios and do not represent the whole spectrum of oncological decision-making. In the context of specific clinical problems, which require a decision-making process, insular criteria exist and were identified. Therefore, our list only demonstrated the existence of insular criteria for the investigated research questions. It is most likely that further decision criteria could be identified in other settings or among different experts. A limitation of all of the included studies is that psychological components such as emotions or personal experience of the treating physician and/or the patient, as well as institutional influences are not measured or accounted for systematically. Mostly, pre-structured medical criteria (such as staging and classifications) were used in the analysed studies. This may be explained by the desired reproducibility of certain decisions within an institution or multidisciplinary team.

Conclusion

The introduction of the term “insular criteria” is justified by the large number of identified infrequently used decision criteria and their relevance in the decision-making process. Treatment recommendations rely on guidelines and published data, typically omitting insular criteria. Taking these into account may improve the translation of recommendations into a real-world and local environment. Caretakers as well as patients should be aware that insular criteria exist and may be a cause of diverging clinical recommendations.

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Statement of Ethics

No clearance by the ethical commission was needed for this analysis. Included studies were already published and relied on experts’ opinion. Our research complies with the guidelines for human studies and the research was conducted ethically in accordance with the World Medical Association Declaration of Helsinki.

Disclosure Statement

The authors have no conflicts of interest to declare.

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Author Contributions

T. Iseli: Conceptualisation, Investigation, Writing – original draft; *G. Fischer:* Writing – Review and Editing; *C.M. Panje:* Writing – Review and Editing; *M. Glatzer:* Writing – Review and Editing; *T. Hundsberger:* Writing – Review and Editing; *C. Rothermundt:* Writing – Review and Editing; *B. Schmidt:* Writing – original draft; *C. Sirén:* Writing – Review and Editing; *L. Plasswilm:* Writing – Review and Editing; *P.M. Putora:* Conceptualisation, Review and Editing, Supervision.

Appendix A

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