

Tools and Strategies to Integrate Multi-Domain Information for Personalized Decision-Making in Oncological Care Pathways: A Scoping Review

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Introduction: There is a growing interest in personalized decision-making in oncology. According to the Integrated Oncological Decision-Making Model (IODM), decisions should be based on information from three domains: (1) medical technical information, (2) patients' general health status and (3) patients' preferences and goals. Little is known about what kind of tool/strategy is used to collect the information, by whom this is collected (nurse, clinician) when this is collected (moment in the care pathway), and how this information should be collected and integrated within decision-making in oncological care pathways, and what its impact is.

Methods: We searched PUBMED, Embase and Web of Science in October 2023 for studies looking at tools to collect and integrate information from the three domains of the IODM. We extracted data on the content and implementation of these tools, and on decision and patient outcomes.

Results: The search yielded 2576 publications, of which only seven studies described collection of information from all three domains (inclusion criteria). In the seven included studies, information on the three domains was collected through dialogue, questionnaires, and assessments (what) by a nurse (2 out of 7 studies) or by other members of the Multi-Disciplinary Team (by whom) (5 out of 7 studies). Members of the Multi-Disciplinary Team subsequently integrated the information (5 out of 7 studies) during their meeting (when), with patients and family attending this meeting in 2 studies (how). In terms of decision outcomes, 5 out of 7 studies compared the treatment recommendations before and after implementation of the tools, showing a modification of the treatment plan in 3% to 53% of cases. The limited data on patient outcomes suggest positive effects on well-being and fewer complications (3 out of 7 studies).

Conclusion: The seven studies identified that integrated information from the three IODM domains into treatment decision-making lacked comprehensive information regarding the strategies, process, timing and individuals involved in implementing the tools. Nevertheless, the few studies that looked at patient outcomes showed promising findings.

Keywords: person centred care, patient centred care, patient preferences, treatment decision-making, multi-disciplinary team, oncology

Introduction

There is a growing interest in personalized decision-making in oncology due to the increased focus on shared decision-making and value-based healthcare.¹⁻³ The benefits of a personalized approach include improved communication between doctor and patient. This collaborative approach can strengthen patients' confidence and skills to manage their health resulting in better-tailored care.⁴ It also leads to improved satisfaction with the care experience, increased patient participation, reduced decisional conflict and increased cost-effectiveness of healthcare.⁵⁻⁷

To achieve personalized decision-making, a treatment plan should be based on information about medical technical aspects, patients' general health status, and patients' preferences and goals.⁸ However, little is known about what, by

whom, when and how this information should be collected. Moreover, although multiple tools exist to support decision-making processes, it is unclear how to integrate information obtained so that it best facilitates a personalized treatment in oncology.

In recent years, quality improvement of cancer treatment has been achieved by the introduction of Multi-Disciplinary Teams (MDTs).⁹ Benefits of MDTs include improved cancer staging, improved clinical decision-making and prolonged patient survival.¹⁰ Another quality improvement initiative has been the introduction of the oncological care pathway, which supports delivering quality cancer care for patients with a specific tumor type and/or stage.¹¹ However, MDTs and oncological pathways are not necessarily set up in a way that promotes personalized treatment. They tend to focus on the disease and its characteristics, rather than the unique patient. It is unclear how best to represent the patients' perspective in MDT meetings. MDTs often lack information about the *patient's preferences and goals*, and the *general health status* and have limited available time to discuss a patient case.^{12,13}

Furthermore, MDT leaders often present a definitive perspective on the optimal treatment recommendation, which allows for further discussion with other members, though perhaps based on fragmented and selected information.¹⁴ The outcome of an MDT meeting is often a clear-cut, single-option recommendation, based primarily on *medical technical information*. This single treatment recommendation is routinely discussed with the patient in the consultation room to arrive at a treatment decision. In this consultation room, clinicians find it challenging to deviate from the MDT recommendation and present an alternative option.¹⁵ To enable a more personalized treatment, shared decision-making (SDM) between patient and professional is a preferred model.^{2,16–18} However, what is the value of SDM when there is only one MDT recommendation to discuss, based primarily on medical technical information? This hinders SDM and personalization of the treatment decision.^{19,20}

Integrated Oncological Decision-making Model (IODM)

To move towards personalized treatment decisions, the Integrated Oncological Decision-Making Model (IODM) has been developed in the Netherlands. The IODM enriches the EBM model by specifying the domains of information that are required to make an evidence informed decision that meets the needs of the individual patients, including information about the medical technical information, patients' general health status, and patients' preferences and goals.²¹ Governmental organizations in the Netherlands, such as the Oncology Taskforce and the National Health Care Institute, have embraced the IODM as a way to support personalized treatment decision-making in oncology. The IODM entails collection of all relevant patient information and the subsequent use of that information in explicit deliberation. Within the Integrated Decision-making Model, information is collected from three domains: (1) *medical technical information*, such as tumor type and TNM stage reported in clinical practice guidelines, (2) *general health status* such as the physical-, psychological-, social- and daily functioning, and (3) *patient preferences and goals*, such as what is important for the patient (see [Figure 1](#)). Information regarding all three domains must be available to patients and health professionals to help them decide on the best treatment plan. The information can be stored and integrated in a patient/care team portal and used for deliberation within the MDT meeting and in conversations between the healthcare professionals and the patient. To access more comprehensive information pertaining to the three domains, see [Supplementary Material File S1](#).

Integration of Information from the Three Domains

Acceptable and feasible tools for collecting information in the three domains have become increasingly available, but little is known about the strategies to integrate the information in the decision-making process. In the Netherlands, the IODM is being implemented in multiple hospitals, but it has not been described extensively in the scientific literature. In one study, led by one of the co-authors, information on the patient's preferences and general health status was gathered and integrated in the treatment decision-making process. This information was obtained through an additional consultation with an oncology nurse and is integrated in a supplementary onco-geriatric MDT meeting.¹⁹ Compared to the treatment recommendations from the original MDT meeting, integration of all information regarding the patient in an onco-geriatric MDT meeting led to a modified treatment recommendation (mostly less intensive treatments) in one in four cases.¹⁹ Another study provided a toolbox based on the domains of the IODM, to guide discussion with regard to

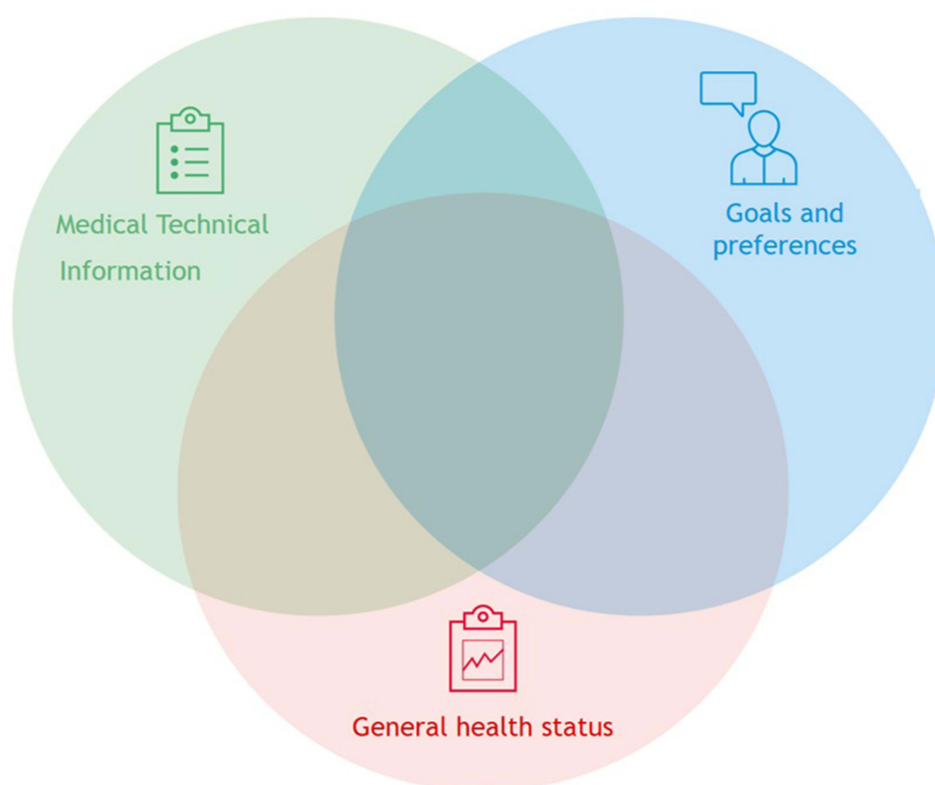


Figure 1 The Integrated Oncological Decision-Making Model (IODM) contains three domains: (1) medical technical information, (2) general health status, and (3) patients' preferences and goals.

general health status, patient preferences in life, and treatment options in preoperative MDT meetings.³⁸ Identifying both tools for retrieving information from the three domains and strategies for integrating this information in treatment decision-making is needed to support personalized treatments for all patients with cancer.

Aim

The aim of the review was to synthesize results from studies integrating information from all three domains (*medical technical information, general health status, and the patients' preferences and goals*). Our main goal was to identify how information from the three domains was integrated and used for personalized treatment decision-making. We reviewed both the content and practical details of tools for the collection of the information, and the strategies for the subsequent integration of the information into the decision-making process in oncological care pathways.

Objectives

1. To synthesize information on the content and practical details ("what", "by whom", "when", "how") of tools that aim to retrieve information regarding the three domains of the IODM.
2. To synthesize information on the strategies to integrate the information of the three domains.
3. To provide an overview of the (perceived or objective) effectiveness of the tools and strategies on relevant decision, patient outcomes and process evaluation.

Materials and Methods

We chose a scoping review approach as this has been shown to be optimal for researching areas that are in an early phase of development and to map the existing literature.³⁹ We followed the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) and the Joanna Briggs Institute's (JBI) framework for scoping reviews.⁴⁰

Eligibility Criteria

We placed no restrictions on the study design or publication year or status. We limited studies to those in the English or Dutch language and those available electronically. Studies were selected when describing tools for retrieving and integrating information for all three domains: (1) *medical technical information*, (2) *general health status*, and (3) *patients' preferences and goals*. The studies had to involve empirical research in an oncological care pathway in a hospital. We excluded studies that were not yet fully embedded in clinical practice, where, for example, study personnel were primarily responsible for implementation.

Information Sources

The search was conducted in October 2023. We searched the electronic databases PUBMED, Embase and Web of Science without limitations of years and checked the references of final included studies (snowballing).

Search

An experienced librarian helped the study team designing the Search strategy. Although we tried to design a sensitive search strategy, we also had to keep the data selection manageable and therefore made the search also as specific as possible. The search strategy was set up in PUBMED and then translated to EMBASE and Web of Science (see [Supplementary Material File S2](#)). Terms were created using Medical Subject Headings (MeSH), incorporating text word synonyms and including specific terms without a MeSH key search terms included: Oncology, MDT, Patient preferences and goals, SDM, General Health Status and Guidelines/Treatment options.

Selection of Sources of Evidence

Following the search, all studies were entered into EndNote and duplicates removed. First, two of the reviewers (T.U, S.Z) independently applied the inclusion criteria to all the citations using title and abstract. If a study's relevance was unclear, the reviewers assessed the full article. Any disagreements that arose between the reviewers at each stage of the selection process were resolved through discussion, and if needed, with an additional reviewer (T.W, J.J). When studies were excluded at the full text screening, the reason for exclusion was reported. [Figure 2](#) summarises the study selection process.

Data Charting Process

A data extraction form in Excel (see [Supplementary Material Table S1](#)) was developed by two researchers (T.U. and A.K) and approved by the supervisors (J.J. and T.W). For included articles, we first extracted descriptive data (including study year, country, type of oncological care pathway). Next, we extracted information pertaining to the domains of the IODM. This information encompassed a detailed description of the tools that were used to gather the information and the strategies to integrate this information. To guide the reporting of interventions, findings were described using what, by whom, where and how.^{41,42} We also extracted data, related to feasibility and acceptability of the tools as process evaluation. If the first reviewer had any doubts about whether the study's information aligned with the data that needed to be extracted, other project members were consulted (T.W. and J.J) to reach consensus. These project members supervised the final data extraction conducted by the first reviewer and discussed uncertainties when noticed with the first reviewer. In the case of missing important data, we contacted the author of the article by e-mail and received the missing data.

Synthesis of Results

After the data was extracted, the characteristics and detailed information of the included studies and the findings on the research objectives were described in [Supplementary Material Table S2](#). Listing the tools and strategies used was done by means of copying the describing text from the papers. Any data available on the (perceived or objectified) effectiveness mentioned in studies of the tools and strategies on relevant decision and patient outcomes are reported along the methods used in the paper, being descriptive or comparative statistics or qualitative data.

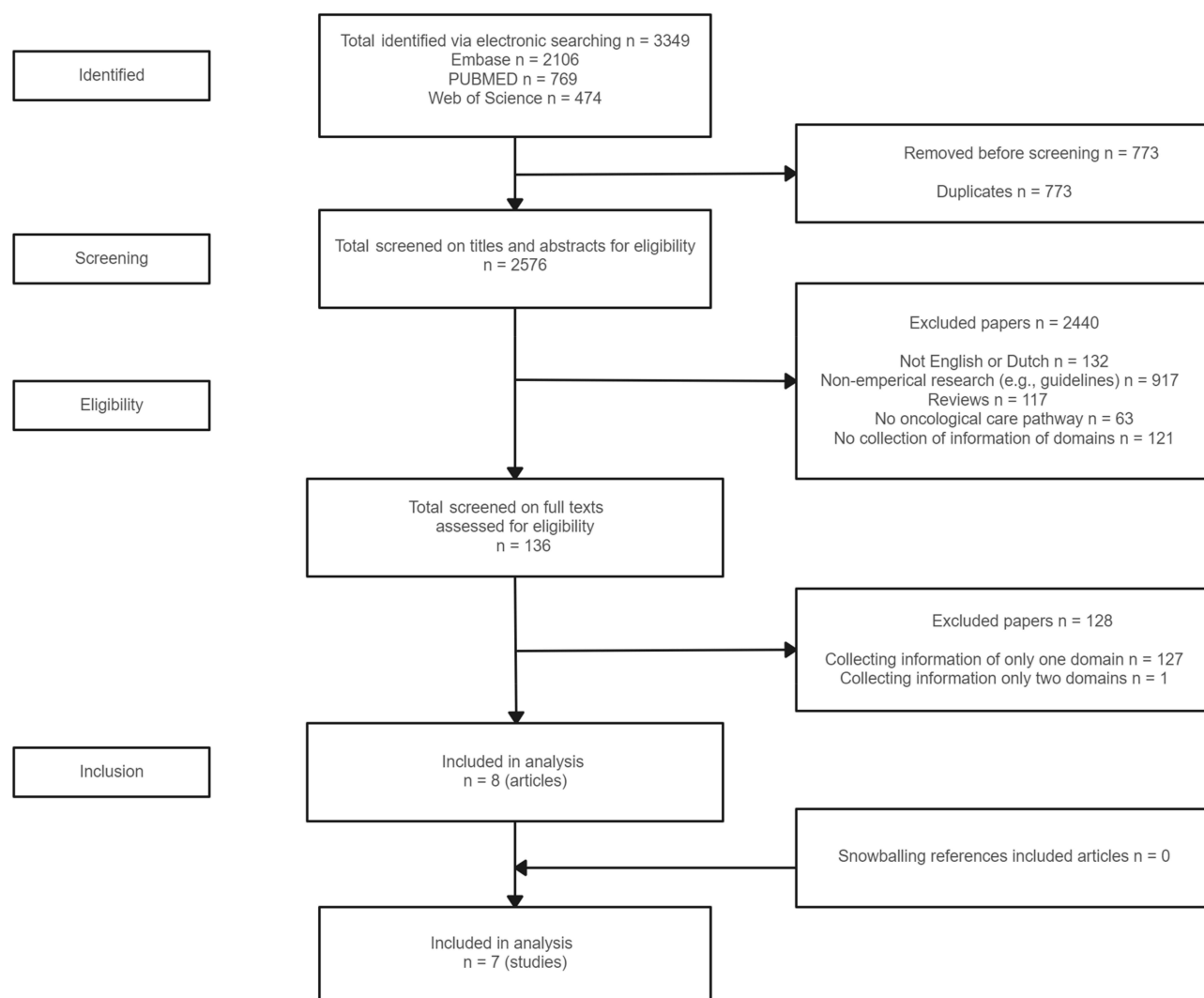


Figure 2 Study selection process.

Results

Sources of Evidence

Figure 2 depicts the study selection process. A total of 2576 studies were identified for screening after excluding duplicates. After title and abstract review, 136 full-text articles were assessed for inclusion. Of these, 128 studies were excluded for being studies only gathering information for only one ($n = 127$) or two ($n = 1$) domains. Of the eight articles included in this scoping review, two were based on the same study. Consequently, for the subsequent review, we combined the latter as one study. The raw data of the seven studies are presented in [Supplementary Material Table S2](#).

Description of Studies

The seven included studies stem from Europe ($n = 4$), the United States ($n = 2$) and Canada ($n = 1$). All studies were published within the last eight years (see [Table 1](#)). All seven studies were quasi-experimental studies. Six studies concerned solid malignancies, and one covered haemato-oncological cancer. See [Supplementary Material Table S2](#) for full details of the studies. In [Table 2](#), we present the tools for the collection of information per domain and the strategies used to integrate this information in the decision-making in oncological care pathways. Both the way in which these tools retrieve information about the three domains and the way in which the information is integrated to arrive at a decision are essential to the successful implementation of the IODM. The former is highlighted in the first three columns of [Table 2](#),

Table 1 Study Characteristics

Study	Year Published	Study Design	Country	Clinical Care Pathway	Number of Hospitals Involved	Numbers of Participants Involved	Age Participants (Mean/ Median)	Aim
Derman et al⁴³	2019	Quasi-experiment	United States	Haemato-oncology	1	247	67.9 yrs. (median) range 43–83	To establish a hematopoietic cell Transplant Optimization Program for older adults and report on the primary intervention: a Geriatric Assessment guided multidisciplinary team clinic to evaluate and enhance resilience of older adult hematopoietic cell transplantations and cellular therapy candidates.
Henry et al²³	2018	Quasi-experiment	Canada	Thyroid cancer	2	200	Intervention group 50.2 yrs. (mean) SD 17.1 Comparison group 51.8 yrs. (mean) SD 15.1	To implement and evaluate the need for and impact on distress, satisfaction of care and level of wellbeing of an Interdisciplinary Team-based Care Approach for Thyroid Cancer patients.
Festen et al¹⁹	2019	Quasi-experiment	Netherlands	Solid malignancy	1	197	78 yrs. (median) range (70–93yrs).	To set up a novel care pathway incorporating geriatric assessment and the Outcome Prioritization Tool into treatment decision-making for older cancer patients. Treatment decisions could be modified following discussion in an onco-geriatric Multi-Disciplinary Team.
Festen et al⁴⁴	2021	Quasi-experiment	Netherlands	Solid malignancy	1	184	77.5 yrs. (median) range (72–83 yrs).	To compare the effect of implementing an Geriatric Assessment and an assessment of patient preferences on treatment recommendations by an onco-geriatric Multi-Disciplinary Team, to the recommendation previously made by the tumor board (care as usual).
Huber et al²²	2015	Quasi-experiment	Germany	Renal malignancies	1	52	61 yrs. (mean) SD +-10 years	To evaluate the Interdisciplinary Counseling Service from the patients' and professionals' perspective and additionally performed an economic evaluation.

Wright et al⁴⁵	2017	Quasi-experiment	United States	Breast cancer	I	24	80 yrs. (mean) range 71–89	To develop a Multi-Disciplinary algorithmic approach to manage women aged 70 years with clinically staged T1N0 hormone receptor positive breast cancer, including geriatric assessments predicting life expectancy and the likelihood of functional decline in the near future, in the context of a program-wide quality improvement initiative, to better select patients for therapeutic interventions.
Massoubre et al⁴⁶	2018	Quasi-experiment	France	Head and Neck cancer	I	119	61.4 yrs. (mean) SD +/- 11.4 yrs.	To assess the influence of the presence of the patient during Multi-Disciplinary team meetings on the therapeutic treatment of Head and Neck cancer using a standardised computer model
English et al⁴⁷	2023	Quasi-experiment	United States	Breast cancer	I	127	73.0 yrs. (mean) SD +/- 5.2 yrs.	To evaluate the impact of a simplified multidisciplinary clinic in the population of adults aged >65 yrs with early-stage hormone receptor positive breast cancer by comparing treatment patterns and patient perceptions of adjuvant radiation therapy and hormone therapy between patients seen in the simplified multidisciplinary clinic versus standard consultation.

Abbreviations: SD, standard deviation; Yrs, years.

Table 2 Tools and Strategies per Domain per Study, and Strategies for Integration of the Information of Different Domains

Study	Domain Medical Technical Information	Domain General Health Status	Domain Patient Preferences and Goals	Strategies for Integrating the Information of All the Domains
Derman et al⁴³	<p><i>What</i> Accommodating 1 to 3 patients per session in the MDT clinic</p> <p><i>By whom</i> MDT Clinic team members</p> <p><i>When</i> The MDT Clinic is held weekly. Clinic occurs after the transplant professional recommends consideration of hematopoietic or cellular therapy, with the clinic being scheduled after pre-transplant testing and usually within a two- to six-week window before conditioning</p> <p><i>How</i> Members meet to review and discuss each patient. The patient and the primary referring transplant physician and team are notified of recommendation.</p>	<p><i>What</i> Modified cancer-specific Geriatric Assessment. Fills in versions of the questionnaires: Health Status Survey and Short Form-36</p> <p>2. Administers cognitive screen (ie Blessed Orientation-Memory-. Concentration test, Mental Health Index-17, Short Form-36 mental health) and functional tests: (ie grip strengths, 4-meter walk test, Timed Up and Go)</p> <p><i>By whom</i> 1. Patients 2. Clinical coordinator or similar staff</p> <p><i>When</i> 1. Before the MDT Clinic 2. On the day of and just before the MDT clinic</p> <p><i>How</i> 1. Electronically (or less common, paper) 2. Administrated</p>	<p><i>What</i> Transplant Optimization Program MDT Clinic</p> <p><i>By whom</i> Patients</p> <p><i>When</i> In the MDT clinic which is being scheduled after pre-transplant testing and usually within a two- to six-week window before conditioning</p> <p><i>How</i> MDT Clinic members engage the patient and caregivers in goal setting. How this is done is not mentioned.</p>	<p><i>What</i> An evaluation of ~five hours (accommodating one to three patients per session). In this evaluation the results from the Geriatric Assessment and steps to optimize the resilience of the patients are discussed. Next, recommendations to decrease the stressor of the proposed procedure are proposed. During this process the patient and caregivers are engaged in goals setting</p> <p><i>By whom</i> A Hematopoietic Cell Transplantation advanced practice practitioner and professional, a geriatric oncologist, an infectious disease professional, a physical and/or occupational therapist, a dietitian, and a social worker</p> <p><i>When</i> In the MDT Clinic held weekly</p> <p><i>How</i> Not mentioned</p>

<p>Henry et al²³</p>	<p><i>What</i> The Inter-Disciplinary Team-based Care Approach in thyroid cancers. A collaborative care model including four components. A multi professional approach to patient care, a structured management plan, scheduled patient follow-ups, and enhanced inter-professional communication Before each meeting further evaluation with clinical practice guidelines. <i>By whom</i> Inter-Disciplinary Team members (including a dedicated nurse and dietetics, pharmacy, social work, psychology, and volunteer community supports). <i>When</i> During the care pathway of the patient <i>How</i> A structured management plan was made by the nurse by service coordination and continuity of care from diagnosis onwards. Scheduled patient follow-ups contained three supportive care meetings planned according to medical treatment and previously identified health care gaps and needs. The enhanced inter-professional communication was also done by the dedicated nurse</p>	<p><i>What</i> 1. Canadian Problem Checklist, Patient Health Questionnaire-9, General Anxiety Disorder-7. 2. Edmonton Symptom Assessment Distress-screening, further evaluation/ intervention on clinically significant symptoms using: a strengths-based nursing care model, a family assessment and intervention model, clinical practice guidelines <i>By whom</i> 1. Patient 2. Nurse navigator <i>When</i> 1. Not mentioned 2. Before each of the three supportive care meetings planned <i>How</i> 1. Not mentioned 2. Not mentioned</p>	<p><i>What</i> Distress-screening and a strengths-based nursing care model and family assessment; provision of emotional support; deliberation of patients' issues and concerns with the patients and the interdisciplinary team; referral to relevant hospital- and community-based resources as needed <i>By whom</i> Nurse navigator <i>When</i> Before each of the three supportive care meetings planned according to medical treatment <i>How</i> Being systematically present, and scheduling three information/support meetings with patients</p>	<p><i>What</i> Nurse with central, integrative role, integrated into the monthly, previously strictly medical, professional-based team meetings, with the goal of reviewing cases from a biopsychosocial perspective (ie, cases presenting challenging physical, psychological, or social issues) and developing, discussing, and implementing comprehensive integrated treatment plans in collaboration with larger interdisciplinary team members. The nurse met weekly with the psychologist and research team to discuss implementation challenges and clinical cases <i>By whom</i> Nurse navigator <i>When</i> During the care pathway of the patient <i>How</i> In hospital or via telephone or internet</p>
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Study	Domain Medical Technical Information	Domain General Health Status	Domain Patient Preferences and Goals	Strategies for Integrating the Information of All the Domains
Festen et al^{19,44}	<p><i>What</i> In addition to the regular tumor boards, all patients in the study were discussed in the onco-geriatric MDT</p> <p><i>By whom</i> Members of the Onco-Geriatric MDT attended by the nurse, a surgeon, radiation oncologist, medical oncologist, palliative care specialist and a geriatrician</p> <p><i>When</i> In a weekly regular tumor board and in an weekly onco-geriatric MDT</p> <p><i>How</i> In the stepwise discussion of patients where the benefits and risks of different treatment options are discussed in a systematic, stepwise fashion</p>	<p><i>What</i> A nurse-led Geriatric Assessment. This information is gathered by performing a semi-structured interview, combined with validated tests and questionnaires involving four domains: somatic, social, psychological, and functional: the Charlson Comorbidity Index, polypharmacy, weight loss, known dementia or delirium, the Groningen Frailty Score, the Letter Fluency Test, Timed up and Go test, Groningen Activity Restriction Scale</p> <p><i>By whom</i> Trained nurses</p> <p><i>When</i> At the patient's first visit to the outpatient clinic, following their appointment with the treating professional (surgeon or oncologist), a trained oncology nurse performs a Geriatric Assessment</p> <p><i>How</i> By filling in the Geriatric Assessment and questionnaires in consultation with the trained nurses. The nurses were trained, explaining the concept of frailty and the use of the instruments used in the Geriatric Assessment. This was followed by a practice session with a training actor to practice the Geriatric Assessment.</p>	<p><i>What</i> Nurses structurally assessed patient preferences regarding treatment outcomes, using the Outcome Prioritization Tool</p> <p><i>By whom</i> Trained nurses</p> <p><i>When</i> At the patient's first visit to the outpatient clinic, following their appointment with the treating professional (surgeon or oncologist)</p> <p><i>How</i> By using the Outcome Prioritization Tool in consultation with the trained nurses The nurses were trained in the assessment of preferences and in communication skills by a senior nurse and geriatrician prior to the study. This training lasted half a day and consisted of explaining the Outcome Prioritization Tool.</p>	<p><i>What</i> Multicomponent onco-geriatric care trajectory using a stepwise method, discussing the outcomes of the Outcome Prioritization Tool and the Geriatric Assessment</p> <p><i>By whom</i> Onco-geriatric MDT (nurse, geriatrician, members regular tumour board)</p> <p><i>When</i> In the weekly onco-geriatric MDT</p> <p><i>How</i> Benefits and risks of different treatment options are discussed in a systematic stepwise fashion</p>

<p>Huber et al²²</p>	<p><i>What</i> Interdisciplinary Counseling Service, where experts discussed the medical technical information and the different treatment options with the rest of the experts and the patient</p> <p><i>By whom</i> Members of the Interdisciplinary Counseling Service: The senior radiologist presented relevant imaging studies. The complete medical history was prepared based on case records beforehand and introduced by the resident.</p> <p><i>When</i> In the Interdisciplinary Counseling Service</p> <p><i>How</i> Referral was from other departments of the hospital, from external professionals and for a second opinion.</p>	<p><i>What</i> A standardized questionnaire. Patient Questionnaires: sociodemographic characteristics, use of pain medication, Patient Health Questionnaire-4 and demand for psychological support.</p> <p><i>By whom</i> Patient</p> <p><i>When</i> Directly before attending the Interdisciplinary Counseling Service</p> <p><i>How</i> Not mentioned</p>	<p><i>What</i> Patient involvement in the interdisciplinary counseling service</p> <p><i>By whom</i> Professionals from all four specialties, the resident and the patient (and loved ones)</p> <p><i>When</i> In the Interdisciplinary Counseling Service</p> <p><i>How</i> After discussing emerging questions from the professionals' and the patient's side, the counseling, there was a standardized phone call where they asked for their personal preferences when making medical decisions</p>	<p><i>What</i> Interdisciplinary counseling service with patient involvement where the group worked out a treatment plan. The medical history, the findings of the diagnostic imaging study, earlier filled in questionnaires by the patients and the different treatment options were discussed</p> <p><i>By whom</i> The patients (and loved ones) with the resident and experts from all four specialties</p> <p><i>When</i> In the Interdisciplinary Counseling Service. This combined the interdisciplinary tumor board with a conventional consultation</p> <p><i>How</i> After questions from both sides (professionals and patients) they worked out a treatment plan</p>
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Table 2 (Continued).

Study	Domain Medical Technical Information	Domain General Health Status	Domain Patient Preferences and Goals	Strategies for Integrating the Information of All the Domains
Wright et al⁴⁵	<p><i>What</i> Results of the geriatric assessment and institutional algorithm. The algorithms incorporate patient preference as well as clinical characteristics, treatment decisions, and results of the geriatric assessments. The algorithms serve as a guide, the recommended treatment decision is not mandatory. The term “consider” is used in the algorithm, to allow shared decision-making between the patient and provider</p> <p><i>By whom</i> Patient and professional</p> <p><i>When</i> Brought in the discussion in each consultation with the patient and different professionals</p> <p><i>How</i> The result of the Geriatric Assessment and institutional algorithm is incorporated into the discussion, as well as the patient’s goals of care, and a decision is made regarding the use of Sentinel Node Biopsy. After surgery the patient is referred to both the radiation oncologist and the medical oncologist. Again, the results of the Geriatric Assessments and the institutional algorithm are brought into the discussion, and a decision is made regarding the use of adjuvant therapies</p>	<p><i>What</i> 1. Lee Schonberg index The majority of the questions for the Lee-Schonberg index can be completed by the professional according to the patient history and physical examination. Several questions need to be asked specifically because they may not be part of a routine history, such as ability to manage finances independently or pull or push a large object such as a living room chair. 2. The Vulnerable Elders Survey-31 is filled out by the patient at the time of consultation and is administered by the professional or nurse. Family members may assist in the filling out of this questionnaire, if needed. They have been combined and adapted into an online calculator available at http://eprognosis.ucsf.edu</p> <p><i>By whom</i> 1. Patient and professional</p> <p><i>When</i> At the first evaluation with the surgical oncologist</p> <p><i>How</i> Filled out online</p>	<p><i>What</i> Two algorithms incorporating patient preference for a “more aggressive” versus a “more conservative approach”</p> <p><i>By whom</i> Patient</p> <p><i>When</i> In different moments in the care pathway</p> <p><i>How</i> Patients are provided with packets about their care, including an introduction to the questionnaires, pamphlets on aging and cancer, navigating care, and treatment decisions. The patient’s role in decision-making is emphasized in these handouts. If the patient opts against a therapy, she may consider a more aggressive or a more conservative approach. If she chooses the more aggressive pathway, she may opt for RT regardless of estimated mortality.</p>	<p><i>What</i> The results of the questionnaires were discussed individually between the patient and each type of professional individually at the time of each consultation</p> <p><i>By whom</i> Patients and professionals</p> <p><i>When</i> In each discussion in each consultation with the patient and the professionals</p> <p><i>How</i> The result and institutional algorithm are incorporated into the discussion, as well as the patient’s goals of care, and a decision is made regarding the treatment option</p>

Massoubre et al⁴⁶	<p><i>What</i></p> <p>MDT meetings in a dedicated room with multimedia equipment. They made changes in presentation, using a standardised computer version of the files and a multimedia projector that allowed them to watch the diagrams, videos and radiologic imaging of each patient</p> <p><i>By whom</i></p> <p>The MDT team included at least one representative of the three primary specialties of otolaryngology surgery, medical oncology, and radiation oncology and a nurse. A radiologist, a nuclear doctor and a pathologist would regularly attend meetings</p> <p><i>When</i></p> <p>Once a week</p> <p><i>How</i></p> <p>The files were all presented in the same way by a professional in a standardised computer form prepared ahead of the MDT meeting.</p> <p>Next, the therapeutic decision was taken after examination of the patient during the multidisciplinary meeting.</p>	<p><i>What</i></p> <p>Demographic data, data related to diagnosis, Clinical data (medical history, comorbidity, risk factors, nutritional assessment according to the Nutritional Risk Index, assessment of social vulnerability by the EPICES (assessment of deprivation and health inequalities in health clinics) socio-economic score. The standardised form was filled in on a case-by case basis with specialist advice from a referring speech therapist, and from a geriatric oncologist for patients >70 years with an impaired G8 score</p> <p><i>By whom</i></p> <p>Professional and patients</p> <p><i>When</i></p> <p>Prepared ahead of the MDT meeting</p> <p><i>How</i></p> <p>Presented in a standardised computer form in the MDT</p>	<p><i>What</i></p> <p>There was a clinical examination at that moment and a presentation of information</p> <p><i>By whom</i></p> <p>Patients</p> <p><i>When</i></p> <p>Patients were seen at the end of the presentation of all files in the MDT meeting</p> <p><i>How</i></p> <p>In case recommendations were approved equally into two options the options were discussed with the patient before the MDT meeting and the preference was exposed to the team. Next, the therapeutic decision was taken after examination of the patient during the multidisciplinary meeting.</p>	<p><i>What</i></p> <p>During the MDT meeting the standardised form was shown, and the assessment with the patient at the end of the MDT meeting was done, informing patients about their disease, the therapeutic treatment recommended by the team, its modalities of application, its alternatives and its consequences to remain the ultimate arbiter in the choice of therapeutic treatment</p> <p><i>By whom</i></p> <p>The patients with the members of the MDT team</p> <p><i>When</i></p> <p>During the MDT</p> <p><i>How</i></p> <p>By attending of the patient in the MDT</p>
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(Continued)

Table 2 (Continued).

Study	Domain Medical Technical Information	Domain General Health Status	Domain Patient Preferences and Goals	Strategies for Integrating the Information of All the Domains
English et al ⁴⁷	<p><i>What</i> Same day consultations with medical and radiation oncology. Consultations were scheduled back-to-back, with the medical oncology appointment generally preceding the radiation oncology appointment, and the two professionals conferred prior to and between the consultations towards a treatment choice discussion</p> <p><i>By whom</i> The simple Multi-Disciplinary Clinic team included two referring surgeons, two radiation oncologists and three medical oncologists</p> <p><i>When</i> Patients were referred by participating referring breast surgeons at the time of the first post-operative visit</p> <p><i>How</i> First via telemedicine in the setting of the COVID pandemic, and later most were transitioned to in-person consultations</p>	<p><i>What</i> A short patient questionnaire including a validated assessment to assess life expectancy in a manner that incorporates comorbidities and functional status; the e-Prognosis questionnaire, which uses the Lee and Schonberg indices to predict 10-year mortality risk. The 15-item questionnaire includes questions on demographics, health conditions and functional status</p> <p><i>By whom</i> Professional and Patients</p> <p><i>When</i> Prior to the consultations</p> <p><i>How</i> Returned electronically or on paper to the nurse navigator and scanned to the Electronic Medical Records. Available for detailed review at the discretion of the consulting professionals, and a short summary of the data points was also sent to the professionals prior to the consultations</p>	<p><i>What</i> A combined questionnaire to assess patient preferences and attitudes toward health care and to assess a patient's inclination to receive more or less medical care for a given diagnosis; including two validated assessments; the Decision Autonomy Preference Scale and the Medical Maximizing-Minimizing Scale</p> <p><i>By whom</i> Patients</p> <p><i>When</i> Prior to the consultations</p> <p><i>How</i> Together with the other questionnaire</p>	<p><i>What</i> Professionals participating in the clinics were instructed to incorporate the results of the patient questionnaires into the treatment choice discussion</p> <p><i>By whom</i> Professionals</p> <p><i>When</i> Treatment choices made on the day of the visits up to one week of the consultations were recorded, including whether a specific recommendation for or against treatment was made</p> <p><i>How</i> No specific format was required</p>

Abbreviation: MDT, Multi-Disciplinary Team.

which focuses on the description of the tools and how they are used in the oncological care pathway. The latter is highlighted in the last column of Table 2, which focuses on the strategies for integrating all three domains into care pathways. The findings are as follows:

The Tools to Collect Information for/on the Three Domains of the IODM

Medical Technical Information

The tools used to collect the *medical technical information* varied. Some studies created a new system such as the Interdisciplinary Counseling Service (what) of Huber et al²² in which the resident (by whom) filled in and presented the complete medical history (how). In another study, by Festen et al,^{19,44} after consultations where the information was collected, patients were discussed in a regular Multi-Disciplinary Team (care as usual) and in an onco-geriatric MDT (including a nurse and a geriatrician) in which benefits and risks of different treatment options were discussed in a systematic, stepwise fashion. These meetings were planned once a week (when).

General Health Status

All seven studies used patient questionnaires to assess *general health status*. Four studies used a Geriatric Assessment that contain questionnaires and/or assessments, seen in Huber et al,²² Festen et al^{19,44} and Derman et al.⁴³ The other studies used questionnaires only (what). In the study by Henry et al,²³ the patients used different questionnaires that were not focused on a geriatric population. In the study by Wright et al,⁴⁵ the *general health status* was assessed using two Geriatric Assessment tools. These results were combined in an algorithm, which included questions on demographics, health conditions, and functional status and assessed the patient's ability to perform (instrumental) Activities of Daily Living (i) ADL (how). A different approach was followed by Massoubre et al,⁴⁶ where patients were invited to attend the MDT meeting for clinical examination (how). Most studies assessed the following dimensions of health status: (a) Functional status, (b) Psychological health, (c) Somatic, and (d) Social functioning. In the studies using a Geriatric Assessment, the assessment was planned before the MDT meeting, and the results of the assessment were supposed to be integrated and discussed during the MDT meeting (when).

Patient Preferences and Goals

Different tools were used for assessing *patient preferences and goals*. Festen et al^{19,44} used the Outcome Prioritization Tool (what), an instrument that assesses the relative importance of four universal treatment outcomes (life extension, maintaining independence, reducing pain, and reducing other symptoms).⁴⁸ In the study by Huber et al,²² experts sat together with the patient (by whom) in an Interdisciplinary Counseling Service meeting and explained different treatment options, so the patient could discuss the treatment options and the patient preferences with the team (when). After discussing questions, the group worked out a treatment plan. A different approach was used in the study of English et al;⁴⁷ patients were seen in either a simplified multidisciplinary clinic or a standard clinic. In the simplified multidisciplinary clinic, patients completed (what), an instrument that assesses patients' preference for more active ("maximizers") or more passive ("minimizers") approaches to health care.⁴⁹

Strategies for the Integration of the Information for/on the Domains in the Treatment Decision-Making Process

The final column of Table 2 focuses on the strategies for integrating all three domains into decision-making. Within this column, findings (what, by whom, when, and how) about the integration of information within the domains of the studies are presented. While the data indicate variation in the level of integration, key similarities can be observed across different domain combinations.

Particularly, the integration of information mostly took place during oncological Multi-Disciplinary Team meetings (MDT meetings) (what), once a week (when). Festen et al implemented onco-geriatric MDT meetings, incorporating a nurse and a geriatrician into the team, to discuss the retrieved patient information (by whom).^{19,44} Derman et al invited additional experts to the MDT meeting, expanding the case discussions with a geriatric oncologist, a dietitian, and a social worker (by whom).⁴³ Huber et al combined interdisciplinary tumor board meetings with conventional consultations, thus

actively involving the patient in the decision-making process.²² This is similar to Massoubre et al, where patients were also invited in the MDT meeting.⁴⁶ Wright et al and English et al mention the incorporation of information assembled in the questionnaires and algorithm into the treatment choice discussion with the patient and professional.^{45,47} Both the patient and their loved ones actively participated in the MDT meeting, thereby directly involving the patient in the decision-making process. While professionals found this approach beneficial, they also recognized the challenges associated with time commitment and the effective coordination of medical experts. In the study conducted by Henry et al, a different approach was taken, assigning the nurse a central and integrative role within the monthly, previously strictly medical, professional-based team. She presented information distracted from questionnaires and meetings with the patient, whose information was integrated in the final decision-making.²³

Effect Evaluation: Impact on Decision and Patient Outcomes, and Process Evaluation

We present an overview of the evaluation methods of the implementation and mechanisms of impact and highlight the key outcomes. All seven studies included an effect evaluation. We provide an overview of the (perceived or objectified) effectiveness of these strategies. The key findings can be summarized as follows:

Decision and Patient Outcomes

Decision Outcomes

Five studies compared treatment recommendations after implementation of the tools with the recommendations previously formulated by the MDT or clinic. All studies showed a change in the initial cancer treatment plan after the (second) MDT meeting. Festen et al^{19,44} and Huber et al²² showed a modification of the treatment plan in, respectively, 27%, 25%, and 53% of the patient cases. In the study of English et al,⁴⁷ the simplified multidisciplinary clinic was associated with shorter radiotherapy courses in 31% of the cases. In the study of Massoubre et al,⁴⁶ a modification occurred only in 3% of the patient cases. Wright et al compared the decisions after their implementation of an algorithm with their own and national historical plans. They found that the omission of treatment options was significantly higher than in historical benchmarks, for omission of radiotherapy from 37% to 79% and for sentinel node biopsy from 18% to 46%.⁴⁵

Patient Outcomes

Three studies assessed patient outcomes. It is challenging to distinguish the individual and combined effects of the different components. Given our focus on integration, we were more interested in the multimodal intervention than disentangling the contribution of each of the three domains.

Festen et al assessed the effect of the onco-geriatric MDT on one-year mortality, days spent in the hospital and complications. The results showed no significant difference in one-year mortality between the two groups. However, the modified group (onco-geriatric MDT) had significantly fewer complications and spent fewer days in the hospital compared to the unchanged group.¹⁹ Henry et al evaluated the effectiveness of the Interdisciplinary Team-based Care Approach compared to the usual care. Compared to the usual care control group, the patients who participated in the Interdisciplinary Team-based Care Approach showed significantly higher levels of overall well-being, reduced tiredness, and fewer problems with physical, spiritual, practical, and social dimensions.²³ In the study conducted by Derman et al, the resilience of older adult hematopoietic cell transplantation and cellular therapy candidates was enhanced through the implementation of a Geriatric Assessment guided Multidisciplinary Team Clinic. The evaluation utilized patient-reported tools such as the Health Status Survey and quality of life measured by the Short Form 36 (SF-36). To better understand the improvements achieved over time, the Multidisciplinary Team Clinic was divided into two phases: the initial phase and the more recent phase. The study revealed significant reductions in hospital length of stay and early death after implementation, compared to the period before the implementation of the Multidisciplinary Team Clinic.⁴³

Process Evaluation

There are even less data available regarding the process evaluation. Only two of the seven included studies reported data on the feasibility and acceptability. These data have therefore only been described in [Supplementary Material File S3](#).

Discussion

Summary of Main Results

The aim of the review was to synthesize information on studies integrating information from all three domains (medical technical information, general health status, and the patients' preferences and goals). We found only seven studies that describe tools related to all three domains of the IODM. The main finding is that these studies often lack a detailed description of the specific tools used to extract the information and of the strategies used to integrate this information in the decision-making in oncological care pathways. This is problematic as the limited data available suggest positive impact on decision and patient outcomes.

The collection of medical technical information was least explicitly reported, as it is probably taken for granted that the clinicians used evidence and guidelines during their MDT meetings. All identified studies integrated the domain of *general health status*, mostly utilizing a geriatric assessment.^{50,51} It highlights the potential need for tools that evaluate general health status in possibly frail younger populations. The collection of patient preferences and goals occurred using various tools, such as value eliciting instruments that facilitate preference talk. In some studies, patients were actively involved in MDT meetings with the purpose of hearing their views.

Notably, different approaches for integrating information in MDTs are being used. In most studies, a nurse gathers information across the domains prior to the MDT meeting (when). However, Huber et al²² and Massoubre et al⁴⁶ took a different approach by merging an MDT meeting with a patient consultation. Notably, in the study of Massoubre et al⁴⁶ in the light of the high concordance rate (>97%) between each decision, the presence of the patient while the decision is being taken seemed to be optional and not making the difference in the treatment decision-making. In the literature, Alfieri et al⁵² refer to this approach and mention that when the patient is present in the MDT meeting, the treatment decision process is more based on the consensus between the professionals and the patient. This means that the consensus achieved is not only "disease-centered" but also "patient-centered". Disadvantages can be that the professionals need to modify their language and that it is time-consuming having patients being part of the discussion in the MDT meeting.^{53,54} In a study by Geerts et al, almost all professionals rejected the strategy to invite the patient to the MDT meeting. The professionals believed that the patient would be distressed, and the professionals would not be able to discuss the patient as openly as they otherwise would.²⁴

From the perspective of lessons learnt on implementation of personalized decision-making, it can be concluded that the level of detail of the tools and strategies was inadequate. We cannot determine what the effective components were or hypothesize on the mechanisms of impact.⁵⁵ Recognizing this issue, Hoffman et al⁴² developed the Template for Intervention Description and Replication (TIDieR) checklist to guide researchers in providing more comprehensive and structured accounts of their interventions. We recommend researchers to use this checklist, which will improve the quality of describing complex interventions. Unfortunately, in the included studies in our review, this checklist has not been used.

Strengths and Limitations

This scoping review has limitations. Because of the heterogeneity of terms used in this field, we attempted to make the search as sensitive as possible while keeping data selection manageable. Despite our efforts, we may have missed relevant papers. Another limitation was that only the first author handled the data extraction. However, even though the first author handled the data extraction, other project members (J.J. and T.W) were available to address and discuss uncertainties when they arose. In addition, the earlier mentioned project members reviewed the original studies in case of any uncertainties. Our study focused on tools to gather information on the three domains and strategies to integrate the gathered information in the decision-making process in an oncological care pathway, which was only possible if at least two domains were included. Therefore, a major strength of this scoping review lies in its focused examination of how the integration of the domains of the IODM manifests in real-world practice settings.

Implications

Limited knowledge exists regarding the content and format of tools to gather information on the three domains and strategies to integrate the gathered information. There is a need for more detailed descriptions of IODM-type

interventions, such as the tools and strategies for collecting and integrating the information of all the domains (“what”, “by whom”, “when” and “how”). Future studies need to ensure better description of the tools and strategies to gather and integrate the information of the IODM within the oncological care pathway. Furthermore, studies with a thorough process evaluation of the implementation of the IODM are needed to inform large-scale implementation of this model in clinical practice. These studies are crucial to ensure the fidelity of such interventions and to determine what the efficient components of the interventions are. Next, these studies are crucial for measuring the effectiveness of clinical and patient outcomes over time. A longer prospective study with a follow-up study would be necessary for measuring patient outcomes such as quality of life.

Conclusion

Given the small number of studies, it is not possible to draw strong conclusions. The limited available data shows promising effects of the integration of the IODM on decision and patient outcomes. However, further research is needed to investigate and describe the content and format of tools and strategies used for the implementation of the Integrated Oncological Decision-making Model (IODM) including a comprehensive process and effect evaluation.

Data Sharing Statement

All data relevant to the study are included in the article or uploaded as [Supplementary Materials](#).

Collaborators

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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