iPAAC
INNOVATIVE PARTNERSHIP
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Systematic review of the Quality Indicators (QIs) to evaluate the CCCN approach in the management of oncologic patients

WP10 task 3

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Contents

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Abbreviations

AHRQ	Agency for Healthcare Research and Quality
CCCN	Comprehensive Cancer Care Network
GL	Guideline
iPAAC	Innovative Partnership for Action Against Cancer
MTM	multidisciplinary team meeting
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
QCI	Quality of Care Indicator
QI	Quality indicator

Executive summary

The increase of life expectancy together with improvements in diagnostic accuracy and therapeutic efficacy have contributed to the increase of the prevalence of cancer patients within the population. Therefore, it is necessary to implement complete and economically sustainable clinical care pathways that integrate different professional competences. A model of cancer patient management is the Comprehensive Cancer Care Network (CCCN) that consists of multiple cooperating structures specialized in the diagnosis, treatment, follow-up, and rehabilitation for cancer patients. Quality Indicators (QIs) represent valid and reliable tools of evaluation that allow a standardized comparison among care networks that belong to different health systems. This aim of this project was to systematically review QIs described and implemented within CCCN, and to provide a systematic overview of available QIs. A secondary aim was to identify and analyze methodologies used for the development of QIs.

This systematic review was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement. Relevant studies that examined implemented QIs of cancer care in the context of CCCN were identified through systematic searches of two electronic databases: Medline (PubMed) and Scopus. Study selection focused on the last ten years of literature, and no language restriction was applied.

The initial literature search identified 7342 studies. After duplicate removal, title and abstract screening, and full text evaluation, 46 studies were included in the systematic review. Most QIs were implemented in USA Germany and Italy where the CCCN approach seems to be well defined. Eighty -two QIs concerned diagnosis, 260 concerned treatment, 7 concerned prevention, 29 about follow up, 71 about palliative care, 12 concerned rehabilitation and 7 research. The majority of the identified QIs belonged to the process domain, followed by the structure ones. Excluding QIs related to the management of cancer in general, the most represented organs resulted breast, colorectum and lung. Overall, it can be stated that the most represented categories of QIs concerned diagnosis and treatment. Furthermore, also the palliative care domain appeared very represented. The multidisciplinary and integrated approaches were here clearly described.

Regarding the methodology of the QIs development, a consensus approach among experts and the Delphi method were the most frequently used methodologies. Only a few studies included the participation of patients for the implementation of the QIs. This systematic review provides a synthesis of existing QIs related to the setting of integrated oncological care.

Category of QIs	Cancer type	Diagnosis	Prevention	Treatment	Follow-up	Palliative	Rehabilitation	Resea
Structure	General	0	0	3	0	24	0	0
	Ovarian	0	0	6	1	0	0	1
	Colorectal	5	0	9	2	1	0	2
	Lung	4	0	5	0	0	0	1
	Liver	0	0	0	0	0	0	0
	Prostate	2	0	1	1	0	0	1
	Uterus	0	0	0	0	0	0	0
	NHL	3	0	2	0	0	0	0
	Pancreas	0	0	1	0	0	0	0
	Melanoma	0	0	0	0	0	0	0
	Head & Neck	0	0	9	1	0	0	0
	Breast	1	0	9	0	0	1	2
	Esophageal	1	0	2	0	0	0	0
	Gastric	1	0	2	0	0	0	0
Process	General	0	1	11	3	29	0	0
	Ovarian	1	0	10	0	0	0	0
	Colorectal	13	1	37	2	0	3	0
	Lung	10	1	20	0	12	0	0
	Liver	4	0	16	4	0	0	0
	Prostate	3	0	10	4	0	2	0
	Uterus	2	0	13	0	0	0	0
	NHL	9	0	1	4	0	0	0
	Pancreas	0	0	3	0	0	0	0
	Melanoma	1	0	7	2	0	0	0
	Head & Neck	1	0	1	1	0	2	0
	Breast	19	2	35	0	0	4	0
	Esophageal	0	0	2	0	0	0	0
	Gastric	0	0	2	0	0	0	0
Outcome	General	0	0	3	0	5	0	0
	Ovarian	0	0	0	0	0	0	0
	Colorectal	0	1	12	0	0	0	0
	Lung	0	0	2	0	1	0	0
	Liver	0	0	0	0	0	0	0
	Prostate	0	0	7	2	0	0	0
	Uterus	0	0	0	0	0	0	0
	NHL	0	0	0	0	0	0	0
	Pancreas	0	0	0	0	0	0	0
	Melanoma	0	0	3	0	0	0	0
	Head & Neck	0	0	3	0	0	0	0
	Breast	2	1	6	1	0	0	0
	Esophageal	0	0	3	0	0	0	0
	Gastric	0	0	3	0	0	0	0

Table 1. Summary of the characteristics of the detected QIs

1 Introduction

1.1 Context

The progressive aging of the population, together with improvements in diagnostic and therapeutic efficacy, have contributed to the increase of the prevalence of cancer patients within the population.

Being responsible for an estimated death of 9.6 million people in 2018, cancer remains a major public health concern. As new therapies and diagnostics become available, cancer care becomes increasingly more complex. However, the progressive aging of the population, will lead to an increase in the demand for health care services, while many states at the same time face a shortage of health professional. Therefore, it is necessary to identify efficient management protocols that integrate skills of professional figures, coordinating them in the care activities and making clinical pathways valid, complete and economically sustainable.

The Innovative Partnership for Action Against Cancer (iPAAC), a project implemented under the aegis of the European Union and which involves the scientific collaboration of 24 partners across Europe, has recognized the pioneering role of the model of patient management identified as Comprehensive Cancer Care Network (CCCN). CCCN is an approach to the patient population based on the principle of networking many structures that cooperate with each other. Precisely, the architecture of a CCCN is imagined as constituted by numerous units specialized in research, diagnosis, care, follow-up, supportive and palliative care and rehabilitation related to the neoplastic pathology. These structures are coordinated to provide comprehensive patient care, with multidisciplinary teams adopting uniform care standards aligned to tumor-specific pathways. The objective of this model is to promote a uniform management scheme that requires the use of an informatics systems to guarantee an optimal exchange of information between the nodes that belong to the network.

Each unit interacts following a common governance with the aim of synergistically adjusting their skills to ensure an effective care service in a uniform and equitable manner throughout the territory.

In order to assess the quality of care within the CCCN´s the use of Quality Indicators (QIs) has been recognized by the iPAAC research group.

1.2 Quality Indicators: definition and properties

The Quality of Care Indicators (QCIs), hereinafter referred to as QIs, have been defined in several different ways:

- As measures that assess a particular health care process or outcome (Worning et al., 1992);
- As quantitative measures that can be used to monitor and evaluate the quality of important governance, management, clinical, and support functions that affect patient outcomes (JCAHO. Characteristics of clinical indicators);

- The Agency for Healthcare Research and Quality's (AHRQ) definition: QIs are standardized, evidence-based measures of health care quality that can be used with readily available hospital inpatient administrative data to measure and track clinical performance and outcomes (Agency for Healthcare Research and Quality's (AHRQ) https://www.qualityindicators.ahrq.gov/).

The QIs are multidimensional measures, preferably evidence-based assessment tools (Sackett et al., 2000) that can be used to measure the quality of performance, structure, and outcomes offered in care services.

1.3 Quality Indicators for Oncological diseases

Cancer care has made a significant progress in recent decades, with the development of effective therapies, the implementation of clinical practice guidelines, health care provision through multidisciplinary and inter-professional teams at all stages of the disease, and patient-centered care (Kowalski et al., 2015). However, not every cancer patient receives the same high-quality care. In order to identify failures and success it is necessary to ensure that the quality of care provided is transparent.

Many QIs are developed for oncological diseases, although often only for a single part of the healthcare process, for example, the multidisciplinary team meeting (MTM) or surgery (Kelly et al., 2013; Kessler et al., 2013; Lewis et al., 2015). Moreover, indicator sets in oncology do not incorporate the care delivered by allied health professionals who play an important role in the care delivered (van Overveld et al., 2016).

For these aspects, it is important to consider characteristics of a quality indicator such as: safety, effectiveness, equitable processes and efficiency (Committee on Quality of Health Care in America, Institute of Medicine. Crossing the Quality Chasm: A New Health System for the 21st Century. Washington, DC: National Academies Press; 2001)

In addition, as stated in the AHRQ's Evidence, key properties of a quality measure should take into consideration (AHRQ. Report no. 105 04-E030-2, 2004; Rosselli Del Turco et al., 2010):

- Reliability: the observation is highly consistent when measured by the same observer at different points or by different observers;
- Validity: the indicator is measuring what it is intended to do;
- Usability: the observations are easily interpretable and then applicable in healthcare actions;
- Feasibility: easy data collections during routine clinical activities with limited related costs.

1.4 Objectives

The objective of this project was twofold. First, this research aimed to carry out a systematic review of the scientific literature on QIs that have been already implemented in CCCN practice. Second, the project aimed to investigate the methodology, which was used to derive these QI´s.

Overall, this project should aid as the basis for discussing and consenting a methodology for QI-development in a standardized way. This may ultimately severe as a guidance to be used by EU Member States and the global audience.

1.5 References

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2 Material and Methods

2.1 Protocol and registration

The protocol of this systematic review was prospectively registered with PROSPERO. Code: CRD42018112852.

2.2 Strategy of identification of relevant studies

This systematic review was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Liberati et al., 2009). Relevant studies that examined implemented QIs of cancer care in the context of CCCN were identified through systematic searches of two electronic databases: MedLine (PubMed) and Scopus. The following search algorithm was used:

"(Cancer* OR carcin* OR tumo* OR neoplasm* OR malign* OR metasta* OR oncolog*) AND [(“quality indicators, health care” [MeSH Terms]) OR (“quality outcomes”) OR (“quality measures”)"

Only studies published during the last ten years were deemed eligible. No restriction of language was applied. The search ended in March 2019.

2.3 Study selection and eligibility criteria

Studies that did not focus on QIs of cancer care in the context of CCCN were not included. All types of study designs, but editorial and commentary, were included.

The review process consisted of a multi-step approach including title and abstract screening and full-text assessment. Duplicate articles were filtered using the JabRef 2.10 software. As a first step, two researchers independently selected articles identified through the search strategy by analyzing the title and the abstract. Any articles that were deemed relevant by the reviewers were included in the full-text assessment to determine if they met the inclusion criteria (Table 2). Any disagreement concerning full-text articles was resolved through discussion with a third investigator until full consensus was obtained.

2.4 Data extraction

A data collection sheet was developed by the research team to confirm the relevance of the studies and to extract their characteristics. Data extraction was conducted in duplicate with two reviewers independently extracting results from all included studies. Any discrepancies and disagreements were discussed and resolved through consensus session with a third researcher.

To perform a descriptive analysis of the studies, the following characteristics were collected:

- first author and year of publication;
- title;
- organization that led the study;
- country of the study;
- type of tumor;
- description of methodology to develop QIs (yes/no).

In order to describe the QIs for every single type of tumor the following data were extracted:

- QIs included in the studies;
- intervention area according to the proposed categories within CANCON guidelines for quality improvement in CCC (prevention, diagnosis, treatment, follow-up, palliative care, rehabilitation and research) (Tit, 2017);
- category of QIs according to the Donabedian model (Structure, Process, Outcome). (Donabedian, 1988).

Additionally, another data extraction sheet was created to highlight the methodologies used to derive QIs.

2.4.1 Data extraction of methodology to develop QIs

The identification and the definition of QIs in a Cancer Care Network involves a multiphase process. The investigation of the methods to derive performance measures was assessed according to the Reporting Standard of the Guidelines International Network (G-I-N) (Nothacker et al., 2016).

To perform an analysis of the studies, the following descriptive information and reporting standards were collected from each article:

- Reference: first author and year;
- Topic: cancer type;
- Guidelines selection/other sources: indication of all sources that were analyzed for the selection of Qis (literature review, systematic search of evidence, clinical guidelines….);
- Extraction/selection of recommendations: extraction and selection of QIs based on the strength of evidence and/or the grade of recommendation collected;
- Core attributes of QI/rating criteria: core attributes of performance measures that help to define QIs (relevance, feasibility, validity, usability….);
- Specification of QI (n/d): the quality indicator is expressed by the numerator and denominator unambiguously and in detail;
- Intended use of QI: clear description of the use of performance measures (evaluation of quality of care, certification process, pay for performance…);
- Measurement of QI: the article specifies the currency of the performance measures in use;

- Panel composition: composition of the panel involved in the selection process (multidisciplinary experts, stakeholders, patient representatives…);
- Selection process of QI: the clear and detailed description of the process that leads to develop the performance measures from the guidelines and recommendation selected (Delphi process, clinical audits, consensus process….);
- Panel Method: method used to reach consensus as level of agreement, vote through different scales.

2.5 References

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3 Results

3.1 Study Selection and study characteristics

The electronic search initially resulted in 7342 studies of which 6254 remained after removing duplicates. After screening the titles and abstracts 890 studies were analyzed on the basis of full-text. Forty-six studies were included in the systematic review. Figure 1 shows the flowchart of the study selection process.

Of the 46 articles, sixteen articles (ca.35%) came from the USA, eight articles developed QIs for use in Germany (17%) and six articles were conducted in Italy (ca. 13%). The remaining sixteen articles developed QIs in other countries such as the Netherlands, Japan, Canada and Belgium. Table 1 represents the main characteristics of the included studies.

Figure 1. Flow chart of included studies: PRISMA 2009 Flow Diagram.

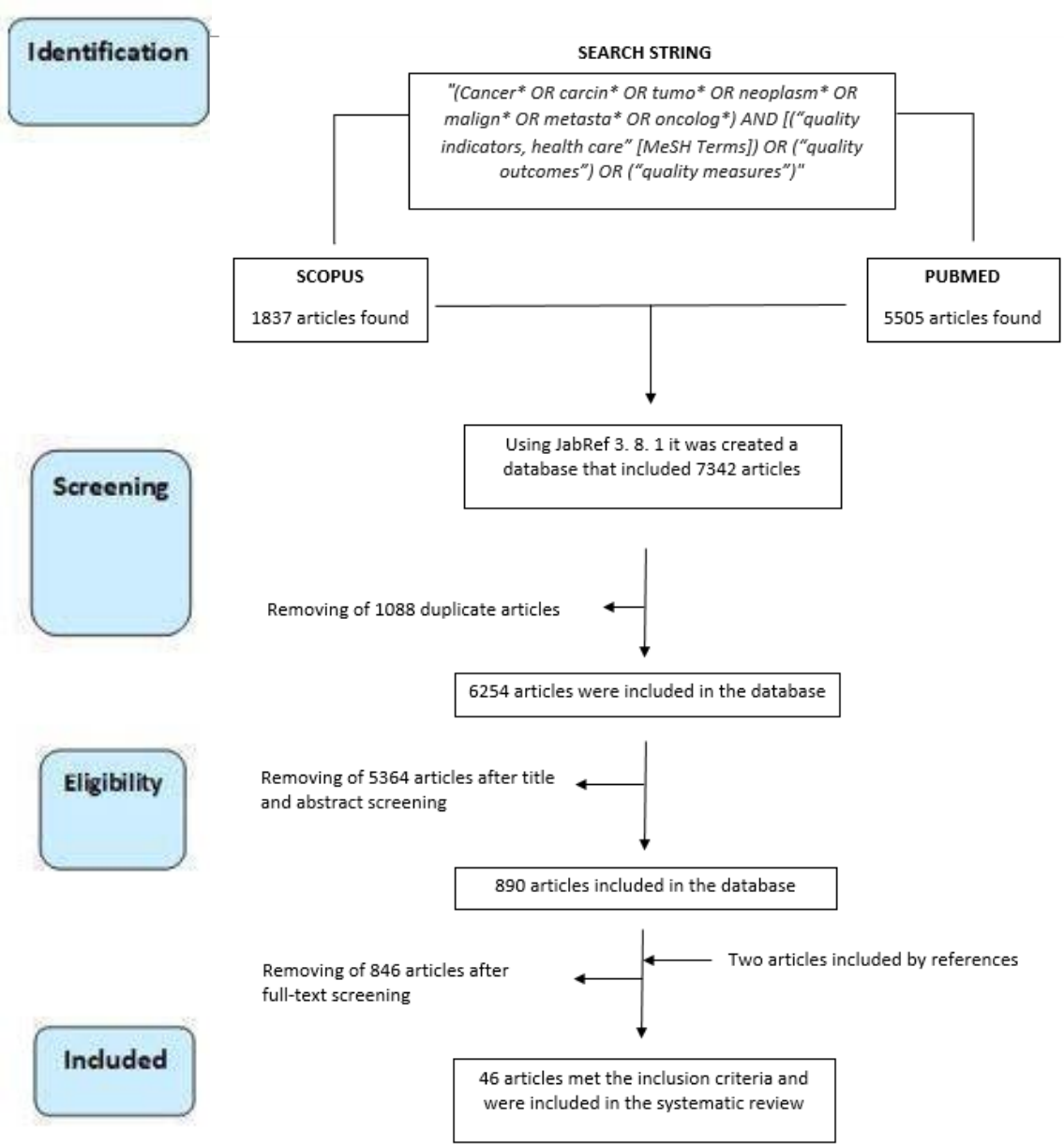

Table 3. Main characteristics of the included studies

First Author, Year	Title	Organization	Country of the study	Type of Tumor	Methodology to develop QIs
Albert US, 2009	Breast Centers in Germany	Certified Breast Centers (CBC) and German Society of Senology	Germany	Breast	No
Aletti GD, 2016	Quality control in ovarian cancer surgery	European Society of Gynaecologic Oncology (ESGO)	Italy	Ovarian	Yes
Brucker SY, 2011	Optimizing the Quality of Breast Cancer Care at Certified German Breast Centers	German Cancer Society and German Society of Senology	Germany	Breast	Yes
Busweiler LAD, 2016	Early outcomes from the Dutch Upper Gastrointestinal Cancer Audit	Dutch Institute for Clinical Auditing (DICA)	The Netherlands	Oesophageal and gastric cancer	Yes
Caldarella A, 2012	Feasibility of evaluating quality cancer care using registry data and electronic health records: a population-based study	Istituto Toscano Tumori (ITT)	Italy	Lung, Colorectal, Breast	Yes
Campion FX, 2011	Advancing Performance Measurement in Oncology: Quality Oncology Practice Initiative Participation and Quality Outcomes	American Society of Clinical Oncology (ASCO)	USA	General	No
Coyle YM, 2013	Model for the cost-efficient delivery of continuous quality cancer care: a hospital and private-practice collaboration	Baylor Charles A. Sammons Cancer Center, Oncology Evaluation and Treatment Center and Infusion Center	USA	General	No

van Dam , 2015	The effect of EUSOMA certification on quality of breast cancer care	European Society of Breast Cancer Specialists (EUSOMA)	Belgium	Breast	No
van Dam PA, 2017	Time trends (2006-2015) of quality indicators in EUSOMA-certified breast centres	European Society of Breast Cancer Specialists (EUSOMA)	Europe	Breast	Yes
Demetter P, 2011	Quality of care indicators in rectal cancer	Procare (PROject on CAncer of the Rectum)	Belgium	Colorectal	Yes
Desch CE, 2008	American Society of Clinical Oncology/National Comprehensive Cancer Network Quality Measures	American Society of Clinical Oncology (ASCO), National Comprehensive Cancer Care Network (NCCCN)	USA	Breast and colorectal	Yes
Dy SM, 2010	Cancer Quality-ASSIST Supportive Oncology Quality Indicator Set - Feasibility, Reliability, and Validity Testing	Johns Hopkins Hospital; Sidney Kimmel Comprehensive Cancer Center, Veterans Affairs Greater Los Angeles Health Care System	USA	General	Yes
Ferrua M, 2012	Development and feasibility of a set of quality indicators relative to the timeliness and organisation of care for new breast cancer patients undergoing surgery	COordination for Measuring Performance and Assuring Quality in Hospitals (COMPAQH)	France	Breast	Yes

Follmann M, 2013	Quality assurance for care of melanoma patients based on guideline-derived quality indicators and certification	German Cancer Society, Essen University Hospital, University of Duisburg Essen	Germany	Melanoma	Yes
Giuliani J, 2012	Oncological quality indicators and Colorectal Cancer Program: data from 2009-2010 of University Hospital in Ferrara, Italy	Colorectal Cancer Program, Sant'Anna Hospital Ferrara	Italy	Colorectal	Yes
Hasset MJ, 2014	High-Priority Topics for Cancer Quality Measure Development: Results of the 2012 American Society of Clinical Oncology High-Priority Topics for Cancer Quality Measure Development: Results of the 2012 American Society of Clinical Oncology Collaborative Cancer Measure Summit	The American Society of Clinical Oncology (ASCO)	Canada	General	Yes
Hayman AV, 2010	Assessing compliance with national quality measures to improve colorectal cancer care at the VA	Veteran's Health Administration (VHA)	USA	Colorectal	No
Higashi T, 2011	Demonstration of quality of care measurement using the Japanese liver cancer registry	Liver Cancer Study Group of Japan	Japan	Liver	Yes
Hui D, 2015	Indicators of integration of oncology and palliative care programs: an international consensus	Multinational Association of Supportive Care in Cancer (MASCC) Palliative Care study group and the ESMO Palliative Care Working Group	USA	General	Yes

Jackisch C, 2014	Disease management project breast cancer in Hesse - 5 Year survival data. Successful model of intersectoral communication for Quality Assurance	Disease Management Project Breast Cancer (DMP Breast Cancer)	Germany	Breast	No
Jackson GL, 2013	Utilizing NCCN Practice Guidelines to Measure the Quality of Colorectal Cancer Care in the Veterans Health Administration	Veterans Health Administration (VHA)	USA	Colorectal	No
Kaufman CS, 2009	National Quality Measures for Breast Centers (NQMBC): A Robust Quality Tool	National Consortium of Breast Centers (NCBC)	USA	Breast	Yes
Khare SR, 2016	Identification of performance indicators across a network of clinical cancer programs	The Rossy cancer network (Montreal)	Canada	Breast, colorectal, prostate, lung	Yes
Kiderlen M, 2015	Variations in compliance to quality indicators by age for 41,871 breast cancer patients across Europe: A European Society of Breast Cancer Specialists database analysis	European Society of Breast Cancer Specialists (EUSOMA)	The Netherlands, UK, Italy	Breast	No
Kowalski C, 2015	Quality assessment in prostate cancer centers certified by the German Cancer Society	German Cancer Society	Germany	Prostate	No
Kowalski C, 2017	Shifting cancer care towards multidisciplinarity: the cancer center certification program of the German cancer society	German Cancer Society	Germany	Breast, Colorectal, Melanoma, Uterus, Oral, Pancreas, Prostate, Lung, Ovarian	Yes

Kowalski C, 2015	Quality of care in breast cancer centers: Results of benchmarking by the German Cancer Society and German Society for Breast Diseases	German Cancer Society and German Society for Breast Diseases	Europe	Breast	No
Laronga C, 2014	Florida Initiative for Quality Cancer Care: Improvements in Breast Cancer Quality Indicators During a 3-Year Interval	Florida Initiative for Quality Cancer Care	USA	Breast	No
Liang MI, 2015	Setting the bar: compliance with ovarian cancer quality indicators at a	Society of Gynecologic Oncology (SGO)	USA	Ovarian	No
Manchon-Walsh P, 2016	Improving survival and local control in rectal cancer in Catalonia (Spain) in the context of centralisation: A full cycle audit assessment	Catalonian Cancer Strategy	Spain	Colorectal	No
Mandato VD, 2011	Province Wide Clinical Governance Network for Clinical Audit for Quality Improvement in Endometrial Cancer Management	Province Wide Clinical Governance Network	Italy	Uterus	Yes
Mano MP, 2010	Audit system on Quality of breast cancer diagnosis and Treatment (QT): results of quality indicators on screen-detected lesions in Italy, 2007	Italian Breast Screening Network	Italy	Breast	No
Mazzone PJ, 2014	Quality Indicators for the Evaluation of Patients With Lung Cancer	The Thoracic Oncology Network	USA	Lung	Yes
van Overveld LF, 2016	Quality indicators of integrated care for patients with head and neck cancer	Nederlandse Werkgroep Hoofd-Hals Tumoren, Paramedische Werkgroep Hoofd-Halstumoren and	The Netherlands	Head and neck	Yes

		Patiëntenvereniging Hoofd Hals			
van Rijssen LB, 2016	National compliance to an evidence-based multidisciplinary guideline on pancreatic and periampullary carcinoma	Dutch Pancreatic Cancer Group (DPCG)	The Netherlands	Pancreatic	
Rosselli Del Turco MR, 2010	Quality indicators in breast cancer care	European Society of Breast Cancer Specialists (EUSOMA)	Europe	Breast	Yes
Ryoo JJ, 2014	Facility Characteristics and Quality of Lung Cancer Care in an Integrated Health Care System	Veterans Health Administration (VHA)	USA	Lung	Yes
Shelton JB, 2014	Validating electronic cancer quality measures at Veterans Health Administration	Veterans Health Administration (VHA)	USA	Lung and prostate	Yes
Siegel EM, 2014	Florida Initiative for Quality Cancer Care: Improvements on Colorectal Cancer Quality of Care Indicators during a 3-Year Interval	Florida Initiative for Quality Cancer Care (FIQCC)	USA	Colorectal	Yes
Siegel RD, 2015	Quality Improvement in the National Cancer Institute Community Cancer Centers Program: The Quality Oncology Practice Initiative Experience	The National Cancer Institute (NCI) Community Cancer Centers Program (NCCCP)	USA	General	Yes
Skolarus TA, 2013	Quality of Prostate Cancer Care Among Rural Men in the Veterans Health Administration	Veteran's Health Administration (VHA)	USA	Prostate	No

Stienen JJC, 2015	Trends in quality of non-Hodgkin's lymphoma care: is it getting better?	Comprehensive Cancer Center	The Netherlands	Non Hodgkin Lymphoma	Yes
Tomatis M, 2009	Audit system on Quality of breast cancer diagnosis and Treatment (QT): results of quality indicators on screen-detected lesions in Italy for 2006 and preliminary results for 2007	Italian Breast Screening Network (GISMa)	Italy (Seven Regions)	Breast	Yes
Wallwiener M, 2012	Multidisciplinary breast centres in Germany: a review and update of quality assurance through benchmarking and certification	The German Cancer Society (DKG) and German Society of Senology (DGS)	Germany	Breast	Yes
Watanabe T, 2017	Quality indicators for cervical cancer care in Japan	Division of Health Services Research, Center for Cancer Control and Information Services, National Cancer Center	Japan	Uterus	Yes
Wesselmann S, 2014	Documented quality of care in certified colorectal cancer centers in Germany: German Cancer Society benchmarking report for 2013	German Cancer Society	Germany	Colorectal	No

3.5 QIs

QIs represent a fundamental tool to standardize the quality of care. In 1980 Donabedian presented a framework for categorizing and measuring quality of care. It has since then been universally recognized as a standard approach for the evaluation of the main dimensions of quality in healthcare. Therefore, QIs were classified according to Donabedian's classification. According to this classification, QIs can be divided in three different categories:

a) *Structure*, which refers to relatively static characteristics of the personnel who provides care and of the settings where the care is delivered. Simply put, it refers to physical and human resources needed to provide care.

b) *Process*, which refers to the way that care is delivered, it denotes all the activities taking place during the delivery of care to the patients (diagnosis, prescription, etc.). It measures the activities implemented by both the practitioners and patients during the process of care, and more precisely they refer to logistical and technical criticalities (Gort et al., 2013), as time for surgery since diagnosis or adherence to guideline protocols.

c) *Outcome*, which refers to the consequences and results of the care that has been provided. It refers to changes in patient's condition as well as patient's satisfaction. Thus, it refers to the increase of the patient's awareness about his health status and healthy lifestyles. (Ganz et al., 2016)

It is important to note that each component may have direct effect on the other. (Donabedian 1988; Bureau régional de l'Europe de l'organisation Mondiale de la santé (1998). Indicateurs de Résultats et qualité des soins. La démarche de l'OMS; Kelley and Hurst 2006; Mullan 2001; El Haj et al., 2013).

3.5.1 QIs of Diagnosis

A total of 82 quality measures for breast, ovarian, colorectal, lung, liver, prostate, uterus, head and neck, esophageal and gastric cancer, non-Hodgkin's lymphoma and melanoma were found (Annex 1). Twenty-two QIs were found for breast cancer: 19 belonged to the process category, one to the structure and two to the outcome category. Process indicators mainly concerned histological analysis, lymph node evaluation, hormone receptor status and time from diagnosis to surgery (Albert et al., 2009; Caldarella et al., 2012; van Dam et al., 2017; Kowalski et al.,, 2015; Kiderlen et al., 2015; Laronga et al., 2014; Khare et al., 2016; Mano et al.,, 2010; Kaufman et al.,, 2009; Tomatis et al., 2009; Stienen et al.,, 2015; Wallwiener et al.,, 2012; Rosselli Del Turco et al., 2010). Outcome indicators were based on adequacy of cytology (Mano et al., 2010; Tomatis et al., 2009; Siegel et al., 2015) and mammography screening (Del Turco et al., 2010). Only one process indicator was found for ovarian cancer and melanoma. In the first case the indicator evaluated the diagnostic staging (Liang et al., 2015), while the other indicator referred to sentinel node biopsy and presence of metastasis (Kowalski et al., 2017). Two QIs were collected for uterus cancer (Mandato et al., 2011) related to histological examination and diagnostic accuracy (Stienen et al., 2015; Kowalski et al., 2017). Four studied were collected for liver and one for head and neck cancer: for these cancers only process indicators were retrieved. Eighteen indicators of colorectal cancer regarded mostly diagnostic imaging (X-Ray, CT, MRI) (Demetter et al., 2011; Khare et al., 2016), but also screening (Caldarella et al., 2012), staging (Demetter et al., 2011), and time between the first histopathologic diagnosis and the first treatment (Demetter et al., 2011; Khare et al., 2016).

Concerning prostate cancer five indicators were collected and focused on biopsy and staging techniques (Khare et al., 2016; Shelton et al., 2014) but mainly on case presentation conference in pre-treatment stage (Kowalski et al., 2015). Only one study included in the review treated non-Hodgkin's lymphoma (Stienen et al., 2015), reporting 12 indicators. As for the other types of tumors, procedures mainly concerned staging (by imaging or bone marrow aspirate/biopsy), but also patient's evaluation

by a multidisciplinary team. Fourteen lung cancer indicators were identified, four about structure and ten about process, assessed staging by mediastinoscopy (Caldarella et al., 2012; Mazzone et al., 2014; Ryoo et al., 2014; Shelton et al., 2014), biopsy rates (Mazzone et al., 2014) and waiting times from imaging diagnostic to diagnosis (Khare et al., 2016). Regarding esophageal and gastric cancer only one structure indicator was found about preoperative multidisciplinary meeting (Busweiler et al., 2016).

3.5.2 QIs of Prevention

The systematic review found seven QIs about prevention (Annex 2). The articles focused only on lung, colorectal and breast cancer and one article described all cancer in general. A process indicator was found about smoking cessation to prevent lung cancer (Mazzone et al., 2014), while colorectal and breast cancer involved process and outcome indicators. In the first case indicators were about genetic counselling and screening (Khare et al., 2016; Rosselli Del Turco et al., 2010); in the second one were about outcame screening (Siegel et al., 2014; Caldarella et al., 2012; Kaufman et al., 2009). Three general cancer indicators were identified, all about process (Siegel et al., 2014; Dy et al., 2010).

3.5.3 QIs of Treatment

From the selected articles a total of 260 QIs were retrieved (Annex 2). While for some studies a detailed description of the QIs is available, other studies only offer a general description. Most of the collected QIs were found for the domain ‘process’, and only a few articles focused on the domains ‘structure’ and ‘outcome’.

Seventeen studies (Hasset et al., 2014; Siegel et al., 2015; Kowalski et al., 2017; Dy et al., 2010; Coyle et al., 2013) focused on QIs of cancer in general**,** two of which underline the importance of interdisciplinarity (meant as interaction among different professionals) and multidisciplinarity (meant as interaction among different medical specialties) (Hasset et al., 2014). Among process indicators (n=11), importance was given at documentation of therapy, signed patient consent and assessment of patient’s functional status (Hasset et al., 2014; Siegel et al., 2015; Kowalski et al., 2017; Coyle et al., 2013). Three structure indicators (Hasset et al., 2014; Dy et al., 2010) and three outcome indicators (Coyle et al., 2013) were found.

Concerning breast cancer, most of the QIs referred to process of care (n=36) (Albert et al., 2009; Caldarella et al., 2012; Campion et al., 2011; Coyle et al., 2013; van Dam et al., 2017; Desch et al., 2008; Ferrua et al., 2012; Kiderlen et al., 2015; Kowalski et al., 2015; Laronga et al., 2014; Khare et al., 2016; Mano et al., 2010; Kaufman et al., 2009; Tomatis et al., 2009; Wallwiener et al., 2012; Del Turco et al., 2010; Jackisch et al., 2014; Brucker et al., 2011). Most of the process indicators concerned surgical procedures (Albert et al., 2009; Caldarella et al., 2012; Campion et al., 2011; Coyle et al., 2013; van Dam et al., 2017; Ferrua et al., 2012; Kiderlen et al., 2015; Kowalski et al., 2015; Laronga et al., 2014; Mano et al., 2010; Tomatis et al., 2009; Del Turco et al., 2010), chemo or radiotherapy (Albert et al., 2009; Caldarella et al., 2012; van Dam et al., 2017; Desch et al., 2008; Jackisch et al., 2014; Brucker et al., 2011 ; Kiderlen et al., 2015; Kowalski et al., 2015; Laronga et al., 2014; Khare et al., 2016; Kaufman et al., 2009; Del Turco et al., 2010) and documentation (Laronga et al., 2014). A considerably smaller number of indicators measured the structure (n=9) (Ferrua et al., 2012; Jackisch et al., 2014; Kaufman et al., 2009; Khare et al., 2016; Mano et al., 2010; Tomatis et al., 2009; Del

Turco et al., 2010). The QIs related to structure mainly referred to wait time for surgery from screening (Jackisch et al., 2014; Mano et al., 2010; Tomatis et al., 2009; Del Turco et al., 2010) or wait time for first-line chemotherapy from medical oncology visit (Khare et al., 2016; Del Turco et al., 2010). One process indicator referred to proportion of cancer patients discussed by a multidisciplinary team (Khare et al., 2016; Del Turco et al., 2010; Ferrua et al., 2012). Furthermore, six outcome indicators were found, especially concerning mortality and surgical or therapy complications (Demetter et al., 2011; Khare et al., 2016; Kaufman et al., 2009; Jackisch et al., 2014; Brucker et al., 2011; Mano et al., 2010; Kaufman et al., 2009; Tomatis et al., 2009; Wallwiener et al., 2012; Kowalski et al., 2015).

Eighteen prostate indicators were found, mostly (n=10) in the process category (Khare et al., 2016; Kowalski et al., 2015; Kowalski et al., 2017; Skolarus et al., 2013; Shelton et al., 2014). Among these, the majority concerned surgical procedures (Khare et al., 2016; Kowalski et al., 2015) and therapy, both radio- and chemotherapy (Khare et al., 2016; Kowalski et al., 2015; Kowalski et al., 2017; Skolarus et al., 2013; Shelton et al., 2014). Seven outcome QIs (Khare et al., 2016; Shelton et al., 2014) focused on treatment complications, relapse and survival. One indicator related to structure was found (Khare et al., 2016) concerning time between biopsy and beginning of treatment.

With regards to ovarian cancer, six QI for the domain structure were found (Aletti and Peiretti, 2016). These QIs focused on number of surgeries performed, multidisciplinary team meeting and care management. Ten indicators were concerning process of care (Kowalski et al., 2017; Aletti and Peiretti, 2016; Liang et al., 2015). These focused on complete surgical resection or chemotherapy (Aletti and Peiretti, 2016; Liang et al., 2015). No QIs related to outcome were detected.

Concerning colorectal cancer, the included publications described a total of 58 Qis. 37 QIs were found for the process domain (Caldarella et al., 2012; Demetter et al., 2011; Khare et al., 2016; Kowalski et al., 2017; Giuliani et al., 2012; Desch et al., 2008; Siegel et al., 2014; Wesselmann et al., 2014; Manchon-Walsh et al., 2016; Hayman et al., 2010; Jackson et al., 2014; Kowalski et al., 2017), and twelve QIs related to the outcome domain (Wesselmann et al., 2014; Demetter et al., 2011; Khare et al., 2016). Process indicators concerned surgery and radio or chemotherapy (Caldarella et al., 2012; Demetter et al., 2011; Khare et al., 2016). Outcome QIs involved overall survival, mortality, surgery complications and relapse (Khare et al., 2016; Demetter et al., 2011). Nine QIs for structure were found (Siegel et al., x; Wesselmann et al., 2014; Hayman et al., 2010; Jackson et al., 2013; Demetter et al., 2011; Khare et al., 2016), most related to time between diagnosis and treatment (Jackson et al., 2013; Hayman et al., 2010; Demetter et al., 2011; Khare et al., 2016) and neoadjuvant treatment (Jackson et al., 2013).

A total of 27 QIs were found for lung cancer (Caldarella et al., 2012; Khare et al., 2016; Ryoo et al., 2014; Kowalski et al., 2017). Five QIs were structure measures and examined wait time for surgery or for systemic therapy (Khare et al., 2016; Ryoo et al., 2014). Most were process QIs (n=20) regarding surgery and therapy (Caldarella et al., 2012; Ryoo et al., 2014; Khare et al., 2016; Kowalski et al., 2017; Mazzone et al., 2014; Shelton et al., 2014). Two outcome QIs (Caldarella et al., 2012; Khare et al., 2016) focused on overall survival at initial therapy and proportion of patients who died after surgery.

Concerning head and neck cancer a total of 13 QIs were found. Most focused on pertaining structure of care (n=9). In addition to treatment QIs, multidisciplinary team meeting and time to start treatment were described (van Overveld et al., 2016); three outcome QIs were related to tumour recurrence and

complication (van Overveld et al., 2016). Only one process indicator was found about lymphadenectomy (Kowalski et al., 2017).

For uterus cancer**,** 14 QIs were found (Watanabe et al., 2017; Mandato et al., 2011). These concerned the surgical approach and one outcome indicator about surgical complications.

Concerning melanoma, ten QIs were retrieved (Follmann et al., 2013), mostly for process category (n=7) about adjuvant therapy, biopsy and radiation treatment.

Concerning liver cancer only process QIs were found (Higashi et al., 2011). Specific attention was placed on surgical resection and documentation of medical records.

Four indicators were found for pancreas cancer: one in structure category (van Rijssen et al. 2016) regarding time between multidisciplinary team meeting and start of treatment, and three process indicators (Kowalski et al., 2017; van Rijssen et al. 2016) about surgical treatment, chemotherapy and discussion of patients by multidisciplinary team.

The study carried out by Stienen (Stienen et al., 201) included two structure indicators about multidisciplinary discussion and start of therapy after diagnosis, and only one process indicator about chemotherapy.

Only one study reported QIs for esophageal and gastric cancer (Busweiler et al., 2016). The indicators were the same for the both cancer: two in structure category (time between diagnosis and treatment, postoperative multidisciplinary team meeting), two in process category (preoperative treatment, lymph nodes resection), and three in outcome category (resection margin, postoperative complications and mortality).

3.5.4 QIs of Follow-up

Twenty-nine QIs were found about follow-up (Annex 3) about head and neck, ovarian, breast, prostate, liver, colorectal, general cancer, non-Hodgkin's lymphoma and melanoma. QIs mainly concerned prostate cancer (n=7) with four process indicators concerning presentation at post-therapy visits and PSA monitoring after treatment (Kowalski et al., 2015; Shelton et al., 2014), two outcome indicators on symptoms after surgery at different follow up periods (Khare et al., 2016) and one structure indicator (Kowalski et al., 2015).

The QIs about liver, melanoma, all tumors and non-Hodgkin's lymphoma were only process indicators. Siegel et al. focused on general tumors and in particular the assessment of patient emotional well-being (Siegel et al., 2015). QIs about melanoma concerned biochemical assessment and lymph node evaluation at follow up (Follmann et al., 2013), Higashi et al. studied QIs about liver concerning diagnostic imaging and tumor marker tests after treatment (Higashi et al.; 2011).

Reporting of postoperative complication was the only one structure indicator found for ovarian cancer (Aletti et al.; 2016). Van Overveld et al. studied head and neck cancer and QIs of follow up concerned control of thyroid function and patient experience of care (Van Overveld et al.; 2016). Follow up for colorectal cancer concerned biochemical exams, diagnostic images and colonoscopy to evaluate treatment and recurrence rate (Jackson et al., 2013;, Giuliani et al., 2012). QIs of breast follow up regarded proportion of patients who undergo follow up protocol exams (Ferrua et a., 2012).

3.5.5 QIs of Palliative care

The importance of palliative care units within Comprehensive Cancer Center to ensure care for patients with incurable illness is internationally recognized. A substantial number of QIs were found (n=71), (Annex 4). Most of them targeted all kind of tumors (n=57) followed by thirteen about lung cancer and only one about colorectal cancer.

QIs related to generic oncologic patients were mainly of structure (n=23) and concerned: education about palliative care, presence in inpatient and outpatient care, clinical care pathways and guidelines, research and peer review publications (Hui et al., 2015; Dy et al., 2010; Campion et al., 2011; Hasset et al., 2014; Coyle et al.; 2013). The process QIs (n=29) mostly regarded symptom screening, documentation and treatment, response to therapy, hospice enrollment (Dy et. al, 2010; Hui et. al, 2015; Campion et. al, 2011) Only five studies emphasized outcome QIs about hospital or emergency room admission and mortality (Hui et al., 2015).

Process indicators about palliative care in lung cancer referred to prevention and treatment of symptoms (Shelton et. al, 2014; Ryoo et. al, 2014). The only structure indicator about colorectal cancer time from end of treatment to death (Jackson et al., 2013).

3.5.6 QIs of Rehabilitation

Twelve QIs were found about rehabilitation: eleven of them were process indicators, and one was a structure indicator. They concerned colorectal, breast, head and neck and prostate tumor. Five concerned breast cancer, which is the most represented category, with one structure indicator (Del Turco et al., 2010) about information and support for patients,and four process indicators (Caldarella et al., 2012; Kowalski et al., 2015; Mano et al., 2010; Tomatis et al., 2009) about mastectomy, psycho-oncologic care and social service counseling. Three QIs were about colorectal cancer (Caldarella et al., 2012; Wesselmann et al., 2014) and concern proportion of patients receiving various types of treatment, and they were all process indicators; two process QIs about head and neck cancer (Van Overveld et al., 2016) about involving of dental team and psychotherapists, and only two process indicators about prostate cancer (Kowalski et al., 2015), about social service counseling and psycho-oncologic care.

3.5.7 QIs of Research

About research, seven QIs were found: they were all structure indicators. The topics regarded ovarian, prostate, breast, colorectal and lung cancer. About breast cancer two QIs were about participation and percentage of patients in studies (Kowalski et al., 2017; Khare et al., 2016; Brucker et al., 2011), and two QIs about colorectal cancer, and concern percentage of patients and participation too (Siegel et al., 2014; Khare et al., 2016; Wesselmann et al., 2014). One indicator was for ovarian cancer (Aletti et al., 2017) about center participating in clinical trials; 1 for prostate cancer (Khare et al., 2016; Kowalski et al., 2017), about participation and one for lung cancer (Khare et al., 2016) and regards percentage of patients .

3.6 Methodology to develop QIs

The articles that include the methodology to develop QIs were twenty-nine (64% of the studies included in the review). In table 4 was shown a description of the results.

The most recurrent "topic" was breast cancer with nine articles (Brucker et al., 2011; Del Turco et al., 2010; Desch et al., 2008; Ferrua et al., 2012; Kaufman et al., 2009; Khare et al., 2016; Tomatis et al., 2009; Van Dam et al. 2017; Wallwiener et al., 2012). Six articles were about all cancer (Caldarella et al., 2012; Hasset et al., 2014; Kowalski et al., 2017; Siegel et al., 2015; Dy et al., 2010). Gastrointestinal, colon and rectal cancer were overall reported by six articles (Busweiler et al., 2016; Demetter et al., 2011; Desch et al., 2008; Giuliani et al., 2012; Khare et al., 2016; Siegel et al., 2014). About lung cancer four articles were founded (Khare et al., 2016; Mazzone et al., 2014; Ryoo et al., 2014; Shelton et al., 2014). Concerning ovarian cancer two studies were included (Aletti et al., 2016; mandato et al., 2011) and as many for prostate cancer (Khare et al., 2016; Shelton et al., 2014). One article was aimed at QIs in palliative care (Hui et al., 2015). The remaining studies were focused on melanoma (Follmann et al., 2013), liver cancer (Higashi et al., 2011), Non-Hodgkin's lymphoma (Stienen et al., 2015), head and neck cancer (Van Overveld et al., 2016) and cervical cancer (Watanabe et al., 2017).

Concerning the "sources", seventeen studies focused on reviewing guidelines (Busweiler et al., 2016; Caldarella et al., 2012; Del Turco et al., 2010; Desch et al., 2008; Ferrua et al., 2012; Follmann et al., 2013; Higashi et al., 2011; Hui et al., 2015; Kowalski et al., 2017; Mandato et al., 2011; Mazzone et al., 2014; Siegel et al., 2014; Stienen et al., 2015; Tomatis et al., 2009; van Overveld et al., 2016; Wallwiener et al., 2012; Watanabe et al., 2017) and sixteen used a systematic literature review approach (Aletti et al., 2016; Caldarella et al., 2012; Demetter et al., 2011; Desch et al., Higashi et al., 2011; Hui et al., 2015; Kaufman et al., 2009; Khare et al., 2016; Kowalski et al., 2017; Ryoo et al., 2014; Shelton et al., 2014; Dy et al., 2010; van Dam et al., 2017; van Overveld et al., 2016; Wallweine et al., 2012; Watanabe et al., 2017). In four studies (Demetter et al., 2011; Ferrua et al., 2012; Kaufman et al., 2009) sources came from expert opinions.

The most "selection process" used were the Delphi method (see methods paragraph) (n=10 studies) (Higashi et al., 2011; Hui et al., 2015; Khare et al., 2016; Ryoo et al., 2014; Shelton et al., 2014; Stienen et al., 2015; Dy et al., 2010; van Overveld et al., 2016; Watanabe et al., 2017) followed by the consensus of multidisciplinary experts (n=14 studies) (Caldarella et al., 2012; Del Turco et al., 2010; Demetter et al., 2011; Follmann et al., 2013; Hasset et al., 2014; Kaufman et al., 2009; Kowalski et al., 2017; Mandato et al., 2011; Mazzone et al., 2014; Siegel et al., 2014; ; Stienen et al., 2015; Tomatis et al., 2009; van Dam et al., 2017; Wallwiener et al., 2012).

Table 4. Methodology to develop QIs

Reference	Topic	GL /other sources	Extraction of all a selection of recommendations	Rating criteria	Specification of QI (n/d)	Intended use of QI	Measurement of QI	Panel composition	Selection process of QI	Panel Method
Aletti, 2016	Ovarian cancer	LR	Selection of best evidence and standard practice	NS	yes	Improve the quality of surgery	Results reported	Expert panel, patient representatives European Society Gynecological Organization (ESGO)	NS	NS
Brucker, 2011	Breast cancer	Clinically relevant parameters	"L3-GL/ED-BC (2003): level-3 GL for the early detection of breast cancer in Germany (2003); L3-GL/DT-BC (2004): interdisciplinary S3 GL for the	NS	No	Benchmarking programme	Results reported	Experts from German cancer societies	NS	DKG and DGS requirement

			diagnosis and treatment of breast cancer in women (2004). L3-GL/DT-BC (2008): interdisciplinary S3 GL							
Busweiler, 2016	Gastrointestinal Cancer	Evidence based GLs, Cancer registries	NS	NS	yes	Describe the initiation and implementation of the Dutch Upper Gastrointestinal Cancer Audit	Results reported	Multidisciplinary expert panel	NS	NS
Caldarella, 2012	All cancer	LR and CG	NS	NS	yes	Cancer Registry	Results reported	Multidisciplinary expert panel belonging to the regional network	Consensus process	NS

van Dam, 2017	Breast cancer	SR	NS	NS	NS	Certification process	Results reported	European Society of Breast Cancer Specialists (EUSOMA)	Consensus process	NS
Del Turco, 2010	Breast cancer	Evidence based raccomendations	NS	Reliability, feasibility, usability, validity	yes	Voluntary certification process	Results reported	Expert panel	Consensus process	Consensus on the basis of motivation, with attribution of level of evidence, motivation and minimum for target standar
Demetter, 2011	Rectum cancer	LR and expert opinions	NS	NS	yes	National and international benchmarking	Results reported	Multidisciplinary expert panel within PROCA	NS	NS

								RE (PROject on CAncer of the REctum)		
Desch, 2008	Breast, colon, and rectal cancer	Review the existing validated measures, relevant data, and GLs	Impact on disease free and overall survival, the degree to which opportunities for improvement exist, and the feasibility of data collection	Feasibility, impact of adherence on disease free or overall survival	yes	"Create metrics suitable				
Dy, 2010	All advanced cancer	LR	NS	feasibility, reliability, validity	yes	Evaluate supportive cancer care	Results reported	Multidisciplinary international expert	RMDM	NS
Ferrua, 2012	Breast cancer	GLs and experts	NS	Feasibility, reliability, relevance	not for all	Compare hospitals concerning quality of care and	Results reported	Experts and professional ssociations	QIs were identified then submitted to different cancer	Preliminary test about feasibility, second test about

						improvement			societies	metrological quality and final validation
Follmann, 2013	Melanoma	QI process linked to Guideline development	German Level-3 guidelines	Potential for improving patient outcomes	yes	Certification process	Results reported	Multidisciplinary expert panel and patient rappresentatives, quality managers, cancer registries	Process described (two step selection and assessment process)	Consensus (>75 %), written assessment
Giuliani, 2012	Colon cancer	NS	Best standard practice	NS	yes	Verification of compliance with the optimal standards in the diagnostic therapeutic care pathway	Results reported	NS	NS	NS

Hasset, 2014	All cancer	NS	NS	Applicability, feasibility, target gap in performance	NS	NS	Results reported	Professional societies and patient/consumer advocacy organizations organized by ASCO	Process described (three step selection: definition of high priority topics, harmonization process, in person meeting)	Voting for the categories that represent the highest-priority topics for quality measure development
Higashi, 2011	Liver cancer	Japanese HCC GL and LR	NS	NS	yes	Cancer registry	Results reported	Multidisciplinary expert panel	RMDM	Median rating of 7 or higher
Hui, 2015	Palliative care	LR and CG	NS	Level of agreement and level of meaning (1-10)	yes	Evaluate integration of palliative care	Results reported	International multidisciplinary experts	DM	Agreement of ≥ 70 %
Kaufman, 2009	Breast cancer	LR, expert opinion	NS	Safety, efficacy, efficient,	NS	Assess and compar	Results reported	Interdisciplinary workgro	NS	NS

				patient-centered/ equitable, timeliness of care		e the quality of care		up of breast care specialists		
Khare, 2016	Breast, prostate, colorectal, and lung cancer	LR	NS	Validity and importance, representative of an emerging practice, applicable across cancer networks	yes	performance improvement across the Rossy Cancer Network (rcn)	Results reported	Multidisciplinary groups of expert clinicians	RMDM	5-point Likert scale: indicators were eliminated if ≤ 2
Kowalski, 2017	All cancer	SR and CG	S3, highest quality	NS	yes	Certification program	Results reported	NS	Consensus process	NS
Mandato, 2011	Epithelial ovarian cancer	QI process linked to Guideline development	Principles of evidence-based medicine	NS	yes	Achieve the best clinical practice decreasing critical points	Results reported	Multidisciplinary oncology group	Clinical audits	Assessment of individual cases

Mazzone, 2014	Lung cancer	Evidence-based GLs	NS	Validity, feasibility, and relevance of the indicators	yes	Generate a list of process of care quality indicators	Results reported	Experts from Steering Committee of the Thoracic Oncology Network	Two surveys	70% of voters rate the indicator at >= 7, in each of the domains of validity, feasibility, and relevance.
van Overveld, 2016	Head and neck cancer	LR and CG	NS	Validity, reliability	NS	NS	Results reported	Members od national foundations of medical specialist, healthcare professionals and patients	RMDM	Agreement of ≥ 70 %
Ryoo, 2014	Lung cancer	SR	NS	Validity, feasibility	NS	Adherence to care of	Results reported	Multidisciplinary expert panel	RMDM	NS

						Veterans Health Administration				
Shelton, 2014	Prostate and lung cancer	LR	Relevant by experts	NS	NS	Evaluate quality of care of Veteran Health Administration	NS	Veteran health administration expert panel	RMDM	NS
Siegel, 2014	colorectal cancer	evidence-, consensus-, and safety-based guidelines	GL	NS	not for all	Examine the overall difference in adherence between the 2 assessments period	Results reported	Oncology experts	Consensus process	NS
Siegel, 2015	All cancer	NS	NS	NS	yes	Quality of care in NCCCP network	Results reported	National Community Cancer Centers	NS	Discussing and analyzing best practices

Stienen, 2015	Non-Hodgkin's lymphoma	Evidence based GL	Particular relevance given to measurements PEARL study and the study of Wennekes et al.	NS	NS	Increase the transparency of care in Visible Care Program in Netherland	Results reported	Multidisciplinary expert panel	RMDM	NS
Tomatis, 2009	Breast cancer	CG	NS	NS	NS	Audit system in Quality Treatment	Results reported	Experts from European Breast Cancer Screening Network	NS	NS
Wallwiener, 2012	Breast cancer	LR and CG	German Level-3 guidelines	NS	yes	Voluntary benchmarking programme	Results reported	Multidisciplinary expert panel	NS	DKG DGS requirement
Watanabe, 2017	Cervical cancer	LR and CG	Relevant by experts	Validity, significance	yes	Cancer Registry	Results reported	Nationally expert panel from Japan society of Gynecologic	RMDM	Median ratings for both QI validity and the signifi

								Oncology		cance of 7 or higher 9

3.7 References

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4 Conclusions

The aim of the present study was to systematically review QIs developed and implemented within CCCN, and to provide a systematic overview of available QIs. The CCCN has been recognized as an ideal model for structuring the process of care that guarantees a complete and integrated approach for the management of oncological patients. All fields of care from prevention to diagnosis, from treatment to follow-up, from rehabilitation to palliative care and research are covered.

A substantial number of QIs for cancer care are available. Most QIs identified by this systematic review were implemented in USA, Germany and Italy, countries in which the CCCN approach seems to be well defined. The majority of the identified QIs belonged to the process domain, followed by the structure ones. Excluding QIs related to the management of cancer in general, the most represented organs resulted breast, colorectum and lung. Overall, it can be stated that the most represented categories of QIs concerned diagnosis and treatment. Furthermore, also the palliative care domain appeared very represented. The multidisciplinary and integrated approaches were here clearly described: this may be explained by the special needs of this phase of care.

A further objective of the present study was to analyze methodologies used to develop the QIs within CCCN. QIs were developed after the revision of guidelines and the systematic review of scientific literature on the basis of the best evidence. Considering the cancer care as a multidisciplinary process, the panel expert involved in the definition of the methodology was a multidisciplinary team of cancer professionals and numerous articles saw the participation of representatives of patients. The experience and evaluation of patients are parameters that must be taken into account to evaluate the quality of care and adding patients' opinions may lead to a more complete picture of patient centeredness. Moreover, it is important to realize that the process of care is rapidly moving towards a patient-centered approach that aims to guarantee the global taking over of patients, caring about clinical and psychosocial aspects.

The definition of qualitative parameters was usually held through a consensus process, structured in a Delphi method or in others consensus forms. Finally the use of QIs was various and heterogeneous as the certification processes, the assessment and comparison of quality of care and the analysis of cancer registry.

In conclusion despite the heterogeneity of definitions and organizations of the networks, this systematic review makes a synthesis of QIs developed in integrated oncological care and the methodology to derive them. Nowadays, a large development of QIs related to the process of care of specific neoplasms has been realized. It is necessary that future efforts are direct to research and implementation of quality measures applied to the CCCNs.

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5 Annexes

Annex 1. QIs for diagnosis

Site	Author	Structure, Process, Outcome	QI
BREAST:			
	Khare; Kaufman	Structure	Time from abnormal mammogram to diagnostic biopsy
	Jackisch; Albert; Caldarella; van Dam; Kowalski; Laronga; Mano; Kaufman; Tomatis; Wallwiener; Del Turco; Brucker	Process	Preoperative histological confirmation of diagnosis

	Brucker; Jackisch; Caldarella; Kiderlen; Kowalski; Laronga; Kaufman; Tomatis	Process	Proportion of patients with invasive carcinoma with sentinel lymph node evaluation
	van Dam; Jackisch; Caldarella; van Dam	Process	Proportion of patients with invasive carcinoma with histological analysis of 10 lymph nodes or more
	Jackisch; Albert; van Dam; Laronga; Mano; Stienen; Wallwiener; van Dam; Del Turco	Process	Invasive ca with hist. type, grading, ER/PR, stage & size recorded
	van Dam; Albert;van Dam; Laronga; Mano; Stienen; Del Turco	Process	Non-invasive ca with size, hist. pattern & grading recorded
	Laronga	Process	Documentation: family history and menopausal status
	Jackisch; Laronga; Mano; Wallwiener	Process	Documentation: hormone receptor status
	Brucker; Jackisch	Process	Intraoperative specimen X-ray
	Jackisch	Process	Ratio of malignant to benign cases
	Khare; Kaufman	Process	Complete synoptic pathology report according to the Canadian Association of Pathologists or Rossy Cancer Network guidelines
	Del Turco	Process	Proportion of women with breast cancer who preoperatively underwent: mammography, physical examination, ultrasound
	Del Turco	Process	Ratio of benign to malignant diagnoses is based on definitive pathology report (surgery only, non-operative biopsies excluded)

	Del Turco	Process	The proportion of cancer cases examined pre-operatively by MRI
	Del Turco	Process	The proportion of women with stage I breast cancer who do not undergo baseline staging tests (US of liver, chest X-ray and bone scan).
	Caldarella	Process	Proportion of patients with invasive carcinoma in whom c-erb analysis was performed
	Kowalski	Process	Patients with pretreatment histological diagnosis confirmation by means of a punch or vacuum biopsy/patients with initial procedure and histology showing invasive breast cancer or DCIS as primary disease
	Mano; Tomatis	Process	Frozen section examination not performed in cancers ≤ 10 mm
	Brucker; Jackisch; Ferrua	Process	Proportion of patients whose medical records provide all the diagnostic and prognostic information needed to initiate treatment
	Khare	Process	Percentage of biopsies performed at first site of metastasis (stage IV patients)
	Mano; Tomatis	Outcome	Non-inadequate cytology if final diagnosis is cancer
	Mano; Siegel	Outcome	Absolute sensitivity of cytology
OVARY:			
	Liang	Process	Complete staging for women with stages I-IIIB ovarian cancer
COLORECTUM:			
	Jackson	Structure	Time from colonoscopy to diagnosis.
	Jackson	Structure	Time from diagnosis to informing patient about diagnosis.
	Jackson	Structure	Complete Diagnostic Work-Up
	Wesselmann	Structure	Numbers of pretreatment primary cases presented at the multidisciplinary team conferences (interdisciplinarity)
	Khare	Structure	Wait time for computed tomography or MRI for staging
	Caldarella	Process	Microscopic preoperatory diagnoses
	Hayman; Caldarella; Jackson; Manchon-Walsh; Desch; Siegel	Process	Proportion of patients with invasive carcinoma with histological analysis of 12 lymph nodes or more
	Demetter	Process	Proportion of patients with a documented distance from the anal verge

	Hayman; Demetter	Process	Proportion of patients with abdominal CT and thoracal X-ray or CT before any treatment
	Hayman; Demetter; Jackson; Siegel	Process	Proportion of patients in whom a CEA was performed before any treatment
	Demetter	Process	Proportion of patients with complete large bowel-imaging before elective surgery
	Demetter	Process	Proportion of patients with TRUS and pelvic CT and/or pelvic MRI before any treatment
	Demetter	Process	Proportion of patients with cStage II-III rectal cancer that have a reported cCRM
	Manchon-Walsh; Demetter; Siegel	Process	Accuracy of cM0 staging
	Manchon-Walsh; Demetter; Siegel	Process	Accuracy of cT/cN staging in case of no or short radiotherapy
	Demetter	Process	Use of TRUS in cT1/cT2 stages
	Demetter	Process	Use of MRI in cStage II or III
	Siegel; Demetter; Khare	Process	Complete synoptic pathology report according to the Canadian Association of Pathologists or Rossy Cancer Network guidelines
LUNG:			
	Khare	Structure	Clinical stage at diagnosis in any of the network hospitals
	Khare	Structure	Time from first abnormal chest radiograph to pathology diagnosis
	Khare	Structure	Wait time for final pathology (histologic assignment and genotyping)
	Khare	Structure	Wait time for diagnostic imaging
	Khare	Process	Percentage of patients diagnosed with nonsquamous and non-small-cell disease with assigned EGFR and ALK status, by stage
	Khare	Process	Complete synoptic pathology report according to the Canadian Association of Pathologists or Rossy Cancer Network guidelines
	Caldarella	Process	Proportion of patients who receive mediastinoscopy
	Caldarella	Process	Proportion of patients who receive PET
	Mazzone	Process	Percentage of nonsurgical biopsies in patients with clinical stage IV nonsquamous lung cancer that

			obtained an adequate amount of tissue for molecular testing
	Mazzone	Process	Percentage of patients with lung cancer who have had a chest CT scan performed within 3 mo of initiating treatment
	Mazzone	Process	Percentage of patients with evidence of one to three distant metastases that have had an attempt at biopsy confirmation of a site of metastasis, or documentation of a reason that this was not possible or necessary
	Mazzone; Ryoo	Process	Stage (TNM or AJCC) recorded before treatment for lung cancer
	Shelton; Ryoo	Process	Pathologic staging of mediastinum in stage I, II, or III NSCLC
	Mazzone; Ryoo	Process	Lymph node sampling of at least three stations during mediastinoscopy for stage I, II, or III NSCLC
LIVER:			
	Higashi	Process	Dynamic CT/MRI study was performed before treatment
	Higashi	Process	The medical records documented the clinical stage (TNM or TNM factors) and liver function level (the Child–Pugh class or the liver damage class)
	Higashi	Process	15-min ICG retention rate was measured before treatment
	Higashi	Process	AFP and PIVKA-2 levels were measured before treatment
PROSTATE:			
	Kowalski	Structure	Case presentation in pretreatment conference—through urology (primary cases)
	Kowalski	Structure	Case presentation in pretreatment conference—through radiotherapy (primary cases)
	Skolarus; Khare	Process	Number of needle cores per biopsy
	Shelton; Khare; Skolarus	Process	Percentage of patients with high-risk disease (clinical stage T3-4, or Gleason score 8–10, or PSA > 20 ng/mL at diagnosis) who undergo general staging tests (pelvic computed tomography, magnetic resonance imaging, and bone scan)
	Khare	Process	Complete synoptic pathology report according to the Canadian Association of Pathologists or Rossy Cancer Network guidelines
UTERUS:			

	Stienen; Kowalski	Process	Diagnosis based on histological examination and on an excision or wide incision biopsy
	Mandato	Process	Diagnostic accuracy (hysteroscopy, dilatation and curettage, total abdomen and pelvis CT, lower abdomen and pelvis RMI)
NON HODGKIN'S LYMPHOMA:			
	Stienen	Structure	Diagnostic period of 4 weeks after the first visit to the hospital
	Stienen	Structure	Sending and receiving of unfixed biopsy material
	Stienen	Structure	Integrated reporting of pathology techniques
	Stienen	Process	Patients staged according to the Ann Arbor classification
	Stienen	Process	Diagnosis for NHL based on morphology and immune phenotype
	Stienen	Process	Staging techniques should include CT scans of the neck, thorax, and abdomen, bone marrow aspirate, and bone marrow biopsy
	Stienen	Process	Assessment of International Prognostic Index (IPI) for patients with aggressive NHL
	Stienen	Process	Assessment of lactate dehydrogenase value
	Stienen	Process	Examination of blood counts
	Stienen	Process	Results of pathology known before the start of treatment (incl. bone marrow)
	Stienen	Process	Pathology report should be complete
	Stienen	Process	All target lesions documented in radiology report before therapy
MELANOMA:			
	Kowalski	Process	Primary cases in which sentinel-node biopsy was carried out/Primary cases of primary cutaneous melanoma with a tumor thickness of ≥1 mm and no evidence of locoregional or distant metastasis
HEAD AND NECK:			
	van Overveld	Process	Pathological status of the tumour
OESOPHAGUS:			
	Busweiler	Structure	Preoperative MDT meeting
STOMACH:			
	Busweiler	**Structure**	**Preoperative MDT meeting**

Annex 2. QIs for Prevention.

Site	Author	Structure, Process, Outcome	QI
GENERAL:			
	Aletti; Campion	Process	Smoking/tobacco use–cessation counseling recommended to smokers/tobacco users in past year
LUNG:			
	Mazzone	Process	Percentage of active smokers with lung cancer who have had smoking cessation counseling documented
COLORECTUM:			
	Khare	Process	Percentage of patients with a family history of colorectal cancer offered referral to genetics
	Siegel; Caldarella	Outcome	Cancer screening detected
BREAST:			
	Khare; Del Turco	Process	The proportion of cancer cases referred for genetic counselling
	Del Turco	Process	The proportion of asymptomatic patients who undergo routine annual mammographic screening and clinical evaluation every 6 months in the first 5 years after the operation.
	Caldarella; Kaufman	**Outcome**	**Proportion of cancer screening detected**

Annex 3. QIs for treatment.

Site	Author	Structure, Process, Outcome	QI
BREAST:			
	Khare	Structure	Wait time for adjuvant radiation therapy from the final pathology report
	Khare	Structure	Wait time for systemic adjuvant therapy from the final pathology report
	Khare	Structure	Wait time for first-line chemotherapy for metastatic disease, from medical oncology visit that decides on chemotherapy

	Jackisch; Mano; Tomatis; Del Turco	Structure	Waiting time for surgery from screening
	Ferrua; Khare; Del Turco	Structure	The proportion of cancer patients to be discussed by a multidisciplinary team
	Ferrua	Structure	Waiting time to first appointment with surgeon
	Del Turco	Structure	The proportion of patient referred for nurse counselling at the time of primary treatment
	Khare; Kaufman	Structure	Time from diagnostic biopsy to initial breast cancer surgery
	Ferrua	Structure	Proportion of patients whose records were discussed in a MDTM held within 14 days of surgery
	Ferrua	Process	Proportion of patients undergoing surgery within 21 days of the first appointment with surgeon
	Ferrua	Process	Proportion of patients whose first postoperative treatment was initiated within 30 days of surgery in the event of chemotherapy and within 56 days in the event of radiotherapy
	Desch	Process	Patient started breast radiation therapy within 1 year of diagnosis
	Albert; Caldarella; Campion; Kiderlen; Kowalski; Del Turco	Process	Invasive ca <=3 cm (including DCIS component) treated with BCT
	Jackisch; Albert; Caldarella; Coyle; Kiderlen; Kowalski; Tomatis	Process	Non-invasive ca <=2 cm treated with BCT
	van Dam; Albert; Caldarella; van Dam; Kiderlen; Kowalski; Laronga; Mano; Tomatis; Del	Process	Appropriate axillary surgery

	Turco; Jackisch; Brucker		
	Brucker; Jackisch; Caldarella;van Dam; van Dam; Kiderlen; Kowalski; Del Turco	Process	Proportion of patients with invasive carcinoma and metastatic lymph nodes who receive adjuvant chemotherapy
	van Dam; Brucker; Caldarella; van Dam; Kowalski; Del Turco	Process	Proportion of patients with invasive carcinoma and no metastatic lymph nodes who receive adjuvant chemotherapy
	Desch; Brucker; Caldarella; Laronga	Process	Proportion of patients with adjuvant chemo-therapy performed within one month after surgery
	Desch; Brucker; Jackisch; Albert; Caldarella; van Dam; van Dam; Kiderlen; Kowalski; Kaufman; Del Turco	Process	Proportion of patients who receive hormone-therapy among patients with metastatic lymph nodes
	Brucker; Jackisch; Albert; Caldarella; van Dam; van Dam; Kowalski; Kaufman; Del Turco	Process	Proportion of patients who receive hormone-therapy among patients with no metastatic lymph nodes
	van Dam; Jackisch; Caldarella; van Dam;	Process	M0 invasive ca receiving post-operative RT after BCT

	Kiderlen; Kowalski		
	van Dam; van Dam; Kiderlen; Mano; Tomatis; Del Turco	Process	Invasive ca receiving just one operation (excluding reconstruction)
	van Dam; van Dam; Kiderlen; Mano	Process	DCIS receiving just one operation (excluding reconstruction)
	Khare	Process	Percentage of patients with early-stage breast cancer (stage I or II) and clinically negative axillary nodes who receive sentinel node biopsy
	Khare	Process	Percentage of patients with involvement of axillary lymph nodes (1–3 nodes or more) who received adjuvant radiation
	Khare	Process	Percentage of patients with estrogen receptor–negative invasive carcinoma (tumour > 1 cm or node-positive) who received adjuvant chemotherapy within 8 weeks of surgical resection
	Brucker; Kiderlen; Khare	Process	Percentage of patients with inflammatory breast cancer or locally advanced nonresectable estrogen receptor–negative carcinoma who received neoadjuvant chemotherapy
	Khare	Process	Percentage of patients with stage III breast cancer who underwent baseline staging imaging, including bone scan, liver ultrasonography, and chest radiography
	Brucker; Jackisch	Process	Postoperative specimen X-ray
	Khare	Process	Percentage of patients receiving chemotherapy with grade 4 toxicity
	Mano; Tomatis	Process	Conservative surgery in invasive cancers ≤20 mm
	Kowalski	Process	Report to the cancer registry
	Kowalski	Process	Postoperative case presentation
	Kowalski	Process	Pretreatment case presentation
	Laronga	Process	Discussion/recommendation on adjuvant chemotherapy

	Ferrua; Laronga	Process	Documentation: informed consent
	Laronga	Process	Documentation: mammogram within 14 mo of definitive surgery
	Laronga	Process	Documentation: referral to radiation oncology within 1 y
	Laronga	Process	Documentation: surgery after neoadjuvant chemotherapy
	Laronga	Process	Documentation: chemotherapy flow sheet
	Wallwiener	Process	Guideline-concordant adjuvant and neoadjuvant chemotherapy (no age limit)
	Brucker; Wallwiener	Process	Radiotherapy after breast-conserving surgery
	Brucker; Wallwiener	Process	Radiotherapy after mastectomy
	Wallwiener	Process	Guideline-concordant endocrine therapy in hormone receptor-positive patients
	Khare	Outcome	Percentage of patients with primary operable breast cancer who developed first recurrence to ipsilateral breast or skin or chest wall (or both) within 5 years after mastectomy or breast-conserving surger
	Khare	Outcome	Percentage of patients who received systemic-relapse post-adjuvant therapy within 5 years of diagnosis
	Brucker; Jackisch; Kowalski; Mano; Tomatis; Wallwiener	Outcome	Surgery margins >1 mm after last surgery
	Kaufman	Outcome	5-Year survival rates
	Jackisch; Kowalski	Outcome	Revision operations primary cases
	Jackisch; Kowalski	Outcome	Postoperative wound infection primary cases
PROSTATE:			
	Khare	Structure	Time between positive biopsy showing high-risk disease (clinical stage T3-4, or Gleason score 8–10, or PSA > 20 ng/mL at diagnosis) and initiation of one or more of these treatments: radiation therapy, systemic therapy, surgery

	Kowalski	Process	Hormone ablative therapy in addition to percutaneous radio-therapy in high-risk patients (PSA > 20 ng/ml or Gleason score ≥8 or cT 2c)
	Khare	Process	Percentage of low-risk patients (clinical stage T1–2a, and Gleason score ≤ 6, and PSA < 10 ng/mL at diagnosis) with documentation of discussion about treatment options and adverse effects
	Khare	Process	Percentage of castration-resistant metastatic patients referred to a medical oncologist or multidisciplinary tumour board
	Skolarus	Process	Central axis doses of at least 75 Gy for radiotherapy
	Skolarus	Process	Docetaxel-based chemotherapy for castration-resistant, metastatic prostate cancer
	Khare	Process	Percentage of patients with bone metastases receiving bone-targeted therapy (for example, bisphosphonates or RANK ligand inhibitor)
	Khare	Process	Percentage of patients with metastatic disease treated with first-line systemic therapy
	Skolarus; Kowalski	Process	Primary cases with additional neoadjuvant and/or adjuvant hormone ablation therapy/primary cases with prostate carcinoma T1–2 N0 M0 with high risk (PSA > 20 ng/mL or Gleason score ≥ 8 or clinical stage T2c) and percutaneous radiotherapy
	Shelton	Process	3D-CRT or IMRT
	Shelton	Process	ADT with EBRT
	Khare	Outcome	Median length of stay after radical prostatectomy
	Khare	Outcome	Hospitalization rate within 30 days of treatment, and diagnosis code at time of admission
	Khare	Outcome	Blood transfusion rate from the surgical start time, to and including 72 hours postoperatively
	Khare	Outcome	Percentage of patients with acute surgical complication within 30 days (blood loss of 2.0 L or more; rectal injury; cardiovascular complications such as arrhythmias, myocardial infarction, heart failure, or pulmonary edema; proximal deep-vein thrombosis or pulmonary embolism; infection; or placed on long-term anticoagulant therapy)
	Khare	Outcome	Percentage of patients receiving radiotherapy who have Radiation Therapy Oncology Group grade 3 or higher rectal or bladder toxicity during the treatment period
	Khare	Outcome	Percentage of patients with positive margins and prostate-specific antigen (PSA) between 0.2 ng/mL and 0.5 ng/mL who receive radiation therapy

	Shelton; Khare	Outcome	Percentage of patients with positive surgical margins, by stage
OVARY:			
	Aletti	Structure	Number of Cytoreductive Surgeries Performed per Center and per Surgeon per Year
	Aletti	Structure	Number of Surgeries Performed by a Gynecologic Oncologist or a Trained Surgeon Specifically Dedicated to Gynecological Cancers Management
	Aletti	Structure	Minimum Required Elements in Operative Reports
	Aletti	Structure	Minimum Required Elements in Pathology Reports
	Aletti	Structure	Treatment Planned and Reviewed at a Multidisciplinary Team (MDT) Meeting
	Aletti	Structure	Preoperative, Intraoperative, and Postoperative Management
	Liang	Process	Operative report with documentation of residual disease within 48 h of cytoreduction
	Liang	Process	Intraperitoneal (IP) chemotherapy offered within 42 days of optimal cytoreduction to women with stage III disease
	Liang	Process	Intraperitoneal chemotherapy administered within 42 days of optimal cytoreduction to women with stage III disease
	Liang	Process	Platin or taxane administered within 42 days of cytoreduction to women with invasive stages I (grade 3), IC-IV ovarian cancer
	Liang	Process	Venous thromboembolismprophylaxis administerd within 24h of cytoreduction
	Liang	Process	Order for prophylactic parenteral antibiotic administration within 1-2h before cytoreduction
	Liang	Process	Order for prophylactic parenteral antibiotic discontinuation within 24h after cytoreduction
	Aletti	Process	Required Preoperative Workup
	Kowalski	Process	Primary surgical cases of FIGO IIB–IV ovarian carcinoma with postoperative chemotherapy
	Aletti	Process	Rates of Complete Surgical Resection
COLORECTUM:			
	Jackson; Hayman; Demetter; Khare	Structure	Time between first histopathologic diagnosis and first treatment

	Jackson; Hayman	Structure	Time from surgery to adjuvant chemotherapy
	Jackson; Hayman	Structure	Time from surgery to surveillance colonoscopy
	Jackson	Structure	Time from start date to end date of adjuvant chemotherapy.
	Jackson	Structure	Time from completion of neoadjuvant radiation treatment to surgery.
	Jackson	Structure	Time from completion of neoadjuvant chemotherapy to surgery.
	Wesselmann	Structure	Numbers of posttreatment primary cases presented at the multidisciplinary team conferences (interdisciplinarity)
	Siegel	Structure	For patients whom guidelines recommend use of chemotherapy,* did "the physician discuss, recommend, or refer for adjuvant chemotherapy?" Note: for stage III colon cancer patients, this must have occurred within 4 months of diagnosis
	Siegel	Structure	Treatment plan available
	Caldarella	Process	Proportion of patients with surgery performed within one month after diagnostic endoscopy
	Caldarella	Process	Proportion of patients with pathological stage II who receive adjuvant chemotherapy
	Giuliani; Caldarella; Khare	Process	Proportion of patients with pathological stage III who receive adjuvant chemotherapy
	Siegel	Process	For patients with stage II/III rectal cancer who received radiation, did "the patient receive a radiation regimen that included at least 45 Gray (Gy) over a period of 5 weeks?" or was "the patient in a clinical trial for radiation therapy?"
	Desch; Caldarella; Wesselmann	Process	Proportion of patients who receive adjuvant chemotherapy within two months after surgery among patients who receive adjuvant chemotherapy
	Caldarella	Process	Proportion of patients who undergo abdominoperineal resection among patients who undergo surgery
	Siegel; Demetter	Process	Proportion of cStage I patients that received neoadjuvant radio(chemo)therapy
	Demetter	Process	Proportion of cStage II-III patients that received a neoadjuvant pelvic radiotherapy

	Wesselmann ; Demetter	Process	Proportion of cStage II-III patients with neoadjuvant chemoradiation that received a continuous 5-FU infusion
	Giuliani; Demetter; Desch	Process	Proportion of patients completing long course neoadjuvant pelvic RT or chemoradiation within planned timing
	Siegel; Demetter	Process	Proportion of patients operated 4 to 12 weeks after completion of long course pelvic RT or chemoradiation
	Demetter	Process	Proportion of patients with cCRM < or = 2mm that received long course neoadjuvant radio(chemo)therapy
	Demetter	Process	Proportion of R0 resections
	Demetter	Process	Mesorectal (y)pCRM positivity after radical surgical resection
	Demetter	Process	Poportion of APR, Hartmann's procedure or proctocolectomy with definitive ileostomy
	Demetter	Process	Major leakage after partial mesorectal excision + SSO + reconstruction
	Demetter	Process	Major leakage after total mesorectal excision + SSO + reconstruction
	Wesselmann ; Caldarella; Demetter	Process	Proportion of (y)pStage III patients with R0 resection receiving adjuvant chemotherapy within 3 months
	Siegel; Manchon-Walsh; Caldarella; Demetter	Process	Proportion of pStage II-III patients with R0 resection receiving adjuvant (chemo)radiotherapy within 3 months
	Siegel	Process	For patients who had surgical resection, was "a barium enema or colonoscopy performed within 6 months before or 6 months after surgery?"
	Siegel; Caldarella; Demetter	Process	Proportion of (y)pStage II-III patients with R0 resection that started adjuvant chemotherapy within 12 weeks
	Jackson; Hayman; Caldarella; Demetter	Process	Proportion of (y)pStage II-III patients with R0 resection treated with adjuvant chemotherapy receiving 5-FU
	Demetter	Process	Proportion of cStage IV patients receiving chemotherapy

	Hayman; Demetter; Jackson; Manchon-Walsh	Process	Distal tumour-free margin mentioned in the pathology report
	Siegel; Demetter	Process	Number of lymph nodes examined
	Khare	Process	Percentage of patients with rectal cancer undergoing surgery with a positive distal or radial margin
	Khare	Process	Percentage of patients undergoing surgery or radiation therapy for rectal cancer who receive pre-treatment imaging of the pelvis with magnetic resonance imaging (MRI) within the preceding 1 month
	Khare	Process	Percentage of patients undergoing surgery for colon or rectal cancer who receive preoperative chest, abdominal, or pelvic computed tomography and MRI for rectal cancer only
	Khare	Process	Percentage of patients with rectal cancer undergoing sphincter-saving resection
	Wesselmann ; Khare	Process	Percentage of patients undergoing surgery for rectal cancer in whom continuity is re-established and who experience an anastomotic leak
	Hayman; Khare; Jackson	Process	Percentage of patients with stage II colon cancer whose case is reviewed by the tumour board or medical oncologist within 4 weeks
	Manchon-Walsh; Khare	Process	Percentage of patients with colon or rectal cancer, not treated with preoperative chemotherapy or radiotherapy, admitted for surgery within 8 weeks from the time of first surgical consultation
	Siegel; Khare	Process	Percentage of patients with known or suspected stage II or III rectal cancer who see a radiation oncologist or are presented to a multidisciplinary tumour board preoperatively or within 4 weeks postoperatively
	Demetter; Manchon-Walsh; Jackson; Wesselmann	Process	Documented TME
	Kowalski	Process	Patients with good to moderate quality TME (grade 1: mesorectal fascia or grade 2: intramesorectal excisions)/ patients with radically operated rectal cancer
	Siegel	Process	Documentation: Informed consent
	Siegel	Process	For patients who received chemotherapy, was “the patient’s body-surface area (BSA) documented?”

	Wesselmann ; Demetter; Khare	Outcome	Overall survival by stage
	Demetter	Outcome	Disease-specific survival by stage
	Demetter	Outcome	Disease-free survival
	Demetter	Outcome	Relative survival
	Demetter	Outcome	Proportion of patients with local recurrence
	Demetter; Khare	Outcome	Rate of acute grade 3 or 4 radio(chemo)therapy-related complications
	Demetter	Outcome	Proportion of patients with stoma 1 year after sphincter-sparing surgery
	Demetter; Khare	Outcome	30-day mortality
	Demetter	Outcome	Rate of intra-operative rectal perforation
	Wesselmann ; Demetter	Outcome	Postoperative major surgical morbidity requiring reintervention under narcosis after radical surgical resection
	Khare	Outcome	Percentage of patients having undergone colon or rectal cancer surgery who experience an unplanned return to the operating room within 28 days
	Khare	Outcome	Rate of local recurrence within 5 years for patients who have had rectal cancer surgery, by stage
LUNG:			
	Khare	Structure	Wait time from booking curative thoracic surgery to procedure
	Khare	Structure	Wait time from referral for curative radiation therapy to treatment
	Khare	Structure	Wait time to systemic therapy for metastatic disease
	Ryoo	Structure	Spine MRI or myelography within 24 hours of suspected spinal cord compression
	Khare	Structure	Percentage of lung cancer patients presented at a multidisciplinary tumour conference (tumour board)
	Shelton; Caldarella; Ryoo	Process	Proportion of patients who undergo surgical resections
	Caldarella	Process	Proportion of patients who receive surgery other than atypical resection in patients with stage I NSCLC
	Caldarella	Process	Proportion of patients with SCLC who not underwent surgical resection
	Caldarella	Process	Proportion of patients who receive neoadjuvant chemotherapy
	Caldarella	Process	Proportion of patients with N2 pathological stage who receive adjuvant radiotherapy

	Caldarella; Ryoo	Process	Proportion of patients with SCLC who receive chemo/radiochemotherapy
	Mazzone	Process	Percentage of patients with lung cancer in whom a performance status measure is documented in the pretreatment phase
	Khare	Process	Percentage of patients undergoing curative localized therapy (either surgery or chemoradiation) who receive positron-emission tomography before treatment
	Khare	Process	Percentage of patients with validated biomarker who receive appropriate targeted therapy
	Khare	Process	Percentage of lobectomies performed by video-assisted thoracoscopic surgery
	Ryoo	Process	No adjuvant chemotherapy for stage IA NSCLC
	Ryoo	Process	No radiation therapy for resected stage I or II NSCLC
	Ryoo	Process	Adjuvant chemotherapy for resected stage II or IIIA NSCLC
	Shelton	Process	Surgical node sampling (≥6 nodes)
	Ryoo; Kowalski	Process	Combined chemotherapy and radiation for stage III NSCLC
	Ryoo	Process	Platinum-based doublet chemotherapy for stage IV NSCLC
	Ryoo	Process	Radiation therapy for brain metastases
	Ryoo	Process	Steroids within 24 hours of suspected spinal cord compression
	Ryoo	Process	Radiation or surgery within 24 hours for radiographically confirmed spinal cord compression
	Khare	Process	Number of lymph nodes retrieved during lobectomy
	Khare	Outcome	Overall survival by stage at initial therapy
	Caldarella; Khare	Outcome	Proportion of patients who died within 30 days after surgery
LIVER:			
	Higashi	Process	Surgical resection or percutaneous local ablation therapy (PEI, MCT, or RFA) was performed
	Higashi	Process	Surgical resection was performed
	Higashi	Process	The advantages and disadvantages of each therapy were explained and documented in the medical records
	Higashi	Process	The pathological findings after surgery were explained to patients and were documented in the medical record
	Higashi	Process	The risks and benefits of the treatments received were explained and documented in the medical records

	Higashi	Process	Medical records documented the reasons why RFA was not performed
	Higashi	Process	TACE was performed
	Higashi	Process	Surgical resection was performed, or the medical record documented the reasons for not performing surgery
	Higashi	Process	Surgical resection or percutaneous local ablation therapy (PEI, MCT or RFA) is performed or the medical record documents the reasons for not performing these therapy
	Higashi	Process	Surgical resection, percutaneous local ablation therapy (PEI, MCT or RFA), or TACE was performed, or the medical record documented the reason for not performing these therapies.
	Higashi	Process	Lipiodol was used in the procedure
	Higashi	Process	The option of liver transplantation was explained and documented
	Higashi	Process	Medical record (including pathological report) documented the degrees of vascular invasion and tumor differentiation was postoperatively determined.
	Higashi	Process	The medical record documented the physician's judgment on the postoperative risk of recurrence
	Higashi	Process	Medical records documented the explanation to patients that surgical resection, percutaneous local ablation therapy or TACE could not be performed and that evidence for the efficacy of chemotherapy was lacking.
	Higashi	Process	Hormone therapy was avoided
UTERUS:			
	Watanabe	Process	Conization for CIN3 CIN3 patients who are under age 43 years
	Watanabe	Process	Total hysterectomy for adenocarcinoma in situ Patients who had adenocarcinoma in situ over age 44 years
	Watanabe	Process	Radical hysterectomy for stage II adenocarcinoma Stage II adenocarcinoma patients
	Watanabe	Process	CCRT as the first-line treatment for stage III or IVA Stage III or IVA patients
	Watanabe	Process	CCRT using cisplatin for stage III or IVA Stage III or IVA patients who had CCRT

	Watanabe	Process	Chemotherapy for stage III or IVA Stage III or IVA patients who had curative radiation therapy or CCRT as main treatment
	Watanabe	Process	Chemotherapy using platinum for stage IVB Stage IVB patients who had chemotherapy
	Watanabe	Process	Cystoscope or proctoscope for stage IVA Stage IVA patients
	Watanabe	Process	Curative radiation therapy using brachytherapy Patients who had curative radiation therapy without surgery
	Watanabe	Process	Post-treatment maintenance therapy using oral chemotherapy Stage I or II patients who had surgery, radiation or CCRT for the first time.
	Mandato	Process	Surgical approach
	Mandato	Process	Lymphadenectomy adequacy
	Mandato	Process	Radiotherapy adequacy
	Mandato	Outcome	Early surgical complications
GENERAL:			
	Dy; Hasset	Structure	Counseling regarding prognosis, intent of therapy, impact of treatment (eg, on fertility), and availability of clinical trials
	Hasset	Structure	Discussing, assessing, and communicating goals (eg, through creation of advance directives)
	Hasset	Structure	Interaction among providers, nurses, social workers, nutritionists, and so on (interdisciplinary) and among surgical, medical, and radiation oncology specialties (multidisciplinary)
	Hasset	Process	Evaluating panel of symptoms before, during, or after therapy
	Hasset	Process	Assessment and documentation of performance and functional status
	Siegel	Process	Chemotherapy intent (curative vs palliative) documented
	Siegel	Process	Chemotherapy intent discussion with patient documented
	Siegel	Process	Signed patient consent for chemotherapy

	Siegel	Process	Chemotherapy treatment summary completed within 3 months of chemotherapy end
	Kowalski	Process	Primary cases elective patients: (preinterventional, emergency patients: postinterventional) presented at the tumor conference/ primary cases, indicator not derived from clinical guidelines
	Coyle	Process	Treat with an additional antiemetic agent from a different drug class
	Coyle	Process	Within 1 hour treat with a broad-spectrum, antipseudomonal, bactericidal, antibiotic regimen as initial empiric therapy for Febrile Neutropenia
	Coyle	Process	Treat with ciprofloxacin + amoxicillin or ciprofloxacin + clindamycin for penicillin-allergic patients for Febrile Neutropenia
	Siegel	Process	Infertility risks discussed before chemotherapy with patients of reproductive age
	Coyle	Outcome	Chemotherapy-related breakthrough nausea and vomiting
	Coyle	Outcome	Hospital admissions for febrile neutropenia
	Coyle	Outcome	Hospital 30-day, all-cause, risk standardization mortality rate following febrile neutropenia hospitalization
NON-HODGKIN'S LYMPHOMA:			
	Stienen	Structure	Patients discussed in multidisciplinary consultations
	Stienen	Structure	Start of therapy within 2 weeks after diagnostic period
	Stienen	Process	Patients with DLBCL received chemotherapy with RCHOP
HEAD AND NECK:			
	van Overveld	Structure	Waiting time to referral to the hospital
	van Overveld	Structure	Presence of practitioner who is responsible for the patient in the MTM
	van Overveld	Structure	MTM takes place before treatment of the patient
	van Overveld	Structure	Presence of other disciplines in the MTM
	van Overveld	Structure	Waiting time to finish diagnostics
	van Overveld	Structure	Time to start first treatment
	van Overveld	Structure	Time to start second treatment (when applicable)
	van Overveld	Structure	Treatment plan available
	van Overveld	Structure	Conditions for treatment plan

	Kowalski	Process	Patients with CT or MRI examinations of the region from the cranial base to the superior thoracic aperture to determine the N category/ primary cases of patients with oral cavity carcinoma
	van Overveld	Outcome	Healthcare status of the patient
	van Overveld	Outcome	Tumour recurrence
	van Overveld	Outcome	Complications
MELANOMA:			
	Follmann	Process	Locoregional lymph node ultrasound
	Follmann	Process	Sentinel node biopsy (SLNB)
	Follmann	Process	Therapeutic lymphadenectomy
	Follmann	Process	Postoperative radiation treatment
	Follmann	Process	Adjuvant systemic therapy
	Follmann	Process	Adjuvant extremity perfusion
	Follmann	Process	BRAF inhibitor therapy
	Follmann	Outcome	Skin cancer board
	Follmann	Outcome	Margin of safety (1 cm) in radical excision
	Follmann	Outcome	Margin of safety (2 cm) in radical excision
PANCREAS:			
	van Rijssen	Structure	Time interval between final MDT meeting and start of treatment
	Kowalski	Process	Primary surgical cases of pancreas with ≥10 regional lymph nodes in the surgical specimen after completion of surgical treatment/ primary surgical cases in pancreas who have undergone lymphadenectomy
	van Rijssen	Process	Use of adjuvant chemotherapy following resection of a pancreatic carcinoma
	van Rijssen	Process	Discussion of a patient with pancreatic or periampullary carcinoma within a MDT meeting
OESOPHAGUS:			
	Busweiler	Structure	Time from diagnosis to treatment<5 weeks
	Busweiler	Structure	Postoperative MDT meeting
	Busweiler	Process	Preoperative treatment
	Busweiler	Process	≥15 lymph nodes in resection specimen
	Busweiler	Outcome	Tumour-negative resection margins
	Busweiler	Outcome	Complicated postoperative course
	Busweiler	Outcome	In-hospital/30-day mortality
STOMACH:			
	Busweiler	Structure	Time from diagnosis to treatment<5 weeks
	Busweiler	Structure	Postoperative MDT meeting
	Busweiler	Process	Preoperative treatment
	Busweiler	Process	≥15 lymph nodes in resection specimen
	Busweiler	Outcome	Tumour-negative resection margins

	Busweiler	Outcome	Complicated postoperative course
	Busweiler	**Outcome**	**In-hospital/30-day mortality**

Annex 4. QIs for Follow-up

Site	Author	Structure, Process, Outcome	QI
BREAST:			
	Ferrua	Structure	Proportion of patients given appointment relative to MDTM proposals within 14 days of MDTM
	Del Turco	Outcome	The proportion of asymptomatic patients who do not undergo a follow-up protocol more intensive than local examination (mammography, US and clinical evaluation every 6/12 months in the first 5 years after the operation)
OVARY:			
	Aletti	Structure	Existence of a Structured Prospective Reporting of Postoperative Complications
COLORECTUM:			
	Jackson; Giuliani	Structure	Proportion of patients enrolled in a follow-up plan within 1 year after surgery
	Siegel; Jackson; Giuliani	Structure	Proportion of patients treated for colorectal cancer that are evaluated with CEA screening after the treatment
	Giuliani	Process	Propotions of patients treated for colorectal cancer by surgery that undergo liver TC or US evaluation within 12 months
	Giuliani; Demetter; Hayman; Jackson	Process	Rate of curatively treated patients that received a colonoscopy within 1 year after resection
PROSTATE:			
	Kowalski	Structure	Participation of core disciplines in post-therapy conferences— radiotherapy, urologist or medical oncologist pathology
	Kowalski	Process	Presentation at post-therapy conference— all patients with initial manifestation of a recurrence and/or distant metastasis

	Shelton	Process	PSA monitoring after treatment
	Kowalski	Process	Presentation at post-therapy conference— primary cases >pT3a and/or R1 and/or pN
	Khare	Process	Percentage of patients having undergone definitive therapy for prostate cancer who are followed at least twice in the first year and at least annually thereafter
	Khare	Outcome	Biochemical disease-free and overall survival at 5, 10, and 15 years after primary treatment by radical prostatectomy or radiation therapy, by stage of disease
	Khare	Outcome	Percentage of patients with significant urinary incontinence (>2–3 pads daily) at 1 year after surgery
LIVER:			
	Higashi	Process	CT/MRI and tumor marker tests were performed within 2 months after TACE
	Higashi	Process	Image studies (contrast-enhanced CT/MRI, if not contraindicated) were performed at least every 3 months
	Higashi	Process	Tumor marker tests (AFP, PIVKA-2) were monitored at least every 3 months
	Higashi	Process	TACE was repeated, or the medical record indicates the TACE was considered
MELANOMA:			
	Follmann	Process	Locoregional lymph node ultrasound during follow-up
	Follmann	Process	Serum LDH measurements
NON HODGKIN'S LYMPHOMA:			
	Stienen	Process	Reporting of response to therapy using complete remission, partial remission, stable disease, progression, recurrence
	Stienen	Process	All target lesions documented in radiology report after therapy
	Stienen	Process	Evaluation after chemotherapy with CT scans (or PET), and for stage IV patients also with a bone marrow aspirate and biopsy
	Stienen	Process	Dose of RCHOP was not reduced or reason for reduction was reported
HEAD AND NECK:			
	van Overveld	Structure	Patient experience (experience with healthcare providers, information andcommunication, shared decision-making, coordination of care,guidance and support, completion of treatment and follow-up)
	van Overveld	Process	Control of thyroid function
GENERAL:			

	Siegel	Process	Patient emotional well being assessed by second office visit
	Siegel	Process	Action taken to address problems with emotional well being by second office visit
	Dy	**Process**	**If a patient with cancer who is being treated with agents that block epidermal growth factor receptors, then the presence and severity of skin rash should be evaluated within 1 month after starting the treatment and at each visit**

Annex 5. QIs for Palliative Care

Site	Author	Structure, Process, Outcome	QI
GENERAL:			
	Dy; Hui	Structure	Place of death consistent with patient's preference
	Campion; Hui	Structure	Hospice within 3 days of death
	Hui	Structure	Presence of palliative care inpatient consultation team
	Hui	Structure	Presence of palliative care outpatient clinic
	Hui	Structure	Presence of interdisciplinary palliative care team
	Hui	Structure	Didactic palliative care curriculum for oncology fellows provided by palliative care teams
	Hui	Structure	Continuing medical education in palliative care for attending oncologists
	Hui	Structure	Combined palliative care and oncology educational activities for fellows/trainees
	Hui	Structure	Oncology fellows have routine rotation in palliative care
	Hui	Structure	Palliative care team routinely involved in multidisciplinary tumor conference for patient case discussions
	Hui	Structure	Presence of palliative care specialists among cancer center senior leadership (e.g. head of oncology department/division and chief executives)
	Hui	Structure	Availability of same day inpatient palliative care consultation upon request

	Hui	Structure	Availability of same day outpatient palliative care consultation upon request
	Hui	Structure	Palliative care fellows have routine rotation in oncology
	Hui	Structure	Continuing medical education in oncology for palliative care specialists
	Hui	Structure	Tenured faculty in palliative care
	Hasset	Structure	Number of existing measures addressing duration in hospice, palliative care consultation, spiritual counseling etc
	Hui	Structure	Institutionally accepted palliative care symptom management guidelines in written format
	Hui	Structure	Institutionally accepted palliative care referral criteria available in written format
	Hui	Structure	Institutionally accepted clinical care pathways (automatic triggers) for palliative care referral available
	Hui	Structure	Institutional funding for palliative oncology research
	Hui	Structure	Peer-reviewed publications in palliative oncology
	Hui	Structure	Collaborative research between oncology and palliative care
	Hui	Process	Routine symptom screening in the outpatient oncology clinic
	Hui	Process	Routine documentation of advance care plans in patients with advanced cancer
	Dy; Coyle	Process	Hospital admissions for intractable nausea and vomiting
	Dy; Coyle	Process	Hospital admissions for intractable pain
	Dy; Campion; Hui; Siegel	Process	Pain assessed/addressed before death
	Dy; Campion; Hui	Process	Dyspnea assessed before death
	Dy	Process	Fatigue assessed/addressed appropriately
	Dy	Process	Anemia assessed/addressed appropriately
	Dy	Process	Dysphagia or other gastrointestinal issues (diarrhea) assessed/addressed appropriately
	Dy	Process	Anorexia assessed/addressed appropriately
	Dy	Process	If a patient with advanced cancer is admitted to the ICU and survives 48 hours, then within 48 hours of ICU admission, the medical record should document the patient's preferences for care or attempt to identify them
	Dy	Process	If a hospitalized patient with cancer aged >65 years or with advanced cancer has delirium then there should be an assessment for the presence or absence of at

			least 1 of the following potential causes and their association with delirium: medication effects, central nervous system disease, infection, and metabolic processes.
	Dy	Process	If a cancer patient is treated with enteral or parenteral nutrition, then there should be an assessment before starting nutrition that there was difficulty maintaining nutrition due to significant gastrointestinal issues and that life expectancy was at least 1 month
	Dy; Campion; Hui; Siegel	Process	Hospice/palliative care addressed appropriately
	Hui	Process	Administration of systemic cancer therapy (e.g. chemotherapy and targeted agents) in palliative care patients possible
	Hui	Process	Proportion of patients with advanced cancer who had documentation of prognostic discussion
	Hui; Siegel	Process	For patients not referred, the proportion who had hospice or palliative care discussed within the last 2 months of life
	Campion; Hui	Process	Proportion of patients with chemotherapy administered within the last 2 weeks of life
	Coyle; Hasset	Process	Obtain palliative care consult if pain is resistant to conventional interventions or if there is a high risk for poor pain control related to one or more of the following: neuropathic pain; incident or breakthrough pain; psychological and family distress; rapid escalation of opioid dosage; history of drug or alcohol abuse; impaired cognitive function
	Campion; Siegel	Process	Hospice enrollment and enrolled >7 days before death
	Dy	Process	If a patient has advanced cancer and receives radiation treatment for painful bone metastases then s/he should be offered single-fraction radiation or there should be documentation of a contraindication to single-fraction treatment
	Dy	Process	If a cancer patient has new neurologic symptoms or findings on physical examination consistent with spinal cord compression then s/he should be treated with steroids as soon as possible, but within 24 hours or a contraindication to steroids should be documented
	Dy	Process	If a cancer patient has new neurologic symptoms or findings on physical examination consistent with spinal cord compression then a whole-spine MRI scan or myelography should be performed as soon as possible,

			but within 24 hours or there should be documentation of why an MRI scan was not appropriate
		Dy	Process	If a cancer patient is treated for spinal cord compression then there should be follow-up of neurologic symptoms and signs within 1 week after treatment is completed
		Dy	Process	If depression is diagnosed in a cancer patient, then a treatment plan for depression should be documented
		Dy	Process	If a patient with cancer is treated for depression, then response to therapy should be documented within 6 weeks
		Dy	Process	If a patient with cancer is undergoing chemotherapy treatment with a high acute emetic risk, then a 3-drug regimen including single doses of a 5-HT3 receptor antagonist, dexamethasone, and selective neurokinin-1 receptor blocker should be given immediately before chemotherapy
		Dy	Process	If a patient with cancer is undergoing chemotherapy treatment with a moderate acute emetic risk, then a 2-drug regimen including a 5-HT3 receptor antagonist and dexamethasone should be given immediately before chemotherapy
		Dy	Process	If a patient with advanced cancer dies an expected death, then there should be documentation of an advance directive or a surrogate decision maker in the medical record
		Hui	Outcome	Proportion of outpatients with plan of care for pain documented on either of the last two visits before death
		Hui	Outcome	Proportion of patients with 2 or more emergency room visits in last 30 days of life (negative indicator)
		Hui	Outcome	Proportion of patients with intensive care unit admission in last 30 days of life
		Hui	Outcome	Proportion of patients with two or more hospital admission in last 30 days of life
		Hui	Outcome	Proportion of patients who died in an intensive care unit
LUNG:				
		Khare	Process	Percentage of patients with metastatic lung cancer referred to outpatient palliative care services
		Ryoo	Process	Referral for palliative care or hospice before death
		Shelton; Ryoo	Process	Outpatient screening for pain before death or hospice using quantitative scale

	Ryoo	Process	Reassessment after change in opioid treatment before death or hospice
	Shelton; Ryoo	Process	Short-acting opioids for breakthrough pain in advanced cancer
	Shelton; Ryoo	Process	Short-acting opioids for breakthrough pain before death or hospice
	Caldarella	Process	Proportion of patients who receive chemotherapy within one month prior death
	Ryoo	Process	Prevention of chemotherapy-related nausea/vomiting with two-drug regimen
	Shelton; Ryoo	Process	Outpatient screening for pain in advanced cancer using quantitative scale
	Ryoo	Process	Reassessment after change in opioid treatment in advanced cancer
	Khare	Process	Percentage of patients with metastatic lung cancer treated with cytotoxic chemotherapy during the last 2 weeks of life
	Shelton	Process	Prevention of nausea with chemotherapy
	Khare	Outcome	Percentage of patients receiving systemic therapy experiencing grade 3 or 4 toxicity
COLORECTUM:			
	Jackson	**Structure**	**Time from end of treatment to death (stage IV only)**

Annex 6. QIs for Rehabilitation

Site	Author	Structure, Process, Outcome	QI
BREAST:			
	Del Turco	Structure	All women with a diagnosis of breast cancer should have direct access to a breast care nurse specialist for information and support with treatment-related

			symptoms and toxicity during the treatment and follow-up and rehabilitation after initial treatment.
	Caldarella; Kowalski; Mano	Process	Proportion of patients with reconstructive surgery among patients who underwent mastectomy
	Tomatis	Process	Immediate reconstruction after mastectomy
	Kowalski	Process	Psycho-oncologic care (>30 min)
	Kowalski	Process	Social-service counseling
COLORECTUM:			
	Caldarella	Process	Proportion of patients who receive rehabilitative treatment after anterior rectal resection and colostomy
	Wesselmann	Process	Proportion of patients receiving psychooncological and social services (discussion period >25 min)
	Wesselmann	Process	Proportion of patients receiving social service counseling
HEAD AND NECK:			
	van Overveld	Process	Involvement of dental team when treated with radiotherapy
	van Overveld	Process	Involvement of physiotherapist when treatment consists of neck dissection
PROSTATE:			
	Kowalski	Process	Social service counseling (primary cases)
	Kowalski	**Process**	**Psycho-oncologic care (>30 min) (primary cases)**

Annex 7. QIs for Research

Site	Author	Structure, Process, Outcome	QI
BREAST:			

	Kowalski; Khare	Structure	Participation in research study
	Brucker	Structure	Percentage of patients in clinical trials
COLORECTUM:			
	Siegel; Khare	Structure	Percentage of colorectal cancer patients treated on a clinical trial
	Wesselmann	Structure	Participation in research study (clinical trials)
LUNG:			
	Khare	Structure	Percentage of lung cancer patients treated on a clinical trial
PROSTATE:			
	Khare; Kowalski	Structure	Participation in research study
OVARY:			
	Aletti	**Structure**	**Center Participating in Clinical Trials in Gynecologic Oncology**