

Choosing Wisely for Health: a Context Analysis through a Systematic Search of the Published Literature

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The American Board of Internal Medicine Foundation and Consumer Reports initiated the Choosing Wisely campaign in 2012 to identify and develop lists of services that are overused, inappropriately used and potentially harmful. This study aims to identify all published literature on Choosing wisely for health, in order to answer to the following questions: 1) Which countries have published in this field? 2) According to the evidence, which scientific societies have defined recommendations? and 3) What are the main specialty areas affected?

Web of Knowledge and Google scholar databases were searched systematically from 2012 to 2015.

Analyse of the published literature allowed to identify 12 countries for which studies on this topic were published. United States and Canada were the countries major involved. Less published evidence was found for Germany, Australia, Japan, Netherlands, Denmark and New Zealand. Published literature returned 26 societies which have drawn up lists of recommendations for 20 specialty areas overall.

An important gap exist between the published literature and the practice diffusion of the Choosing Wisely principles: many countries are participating or in process of implementing the Choosing Wisely campaign. For most of these, there are few or no publications as of yet.

Field of Research: Health quality and safety

1. Introduction

The main goals of appropriateness policies are to contain health care spending and efficiently redistribute resources.

In this context, the American Board of Internal Medicine Foundation and Consumer Reports (CR) initiated the Choosing Wisely (CW) campaign in 2012 to identify services that unnecessarily increase health costs: tests, procedures, and therapies that are overused, inappropriately used and potentially harmful.

The campaign began in the United States and now many countries around the world are adapting the campaign and implementing it (Levinson et al. 2015) (Rosenberg et al. 2015).

The purpose of this study was to identify all relevant published literature on Choosing

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wisely in health, in order to answer to the following research questions: *Which countries to date have published in this field?* According to the evidence, *Which scientific societies have defined recommendations?* and *What are the main specialty areas affected?*

Previous studies mainly provide information about the review process of the recommendations published by each scientific society (Black et al. 1999) (Carroll et al. 2004) (Chow et al. 2015). None of these, provided knowledge according to our research questions. Accordingly, our focus was intentionally broad and the questions were more widely inclusive.

Our findings serves as a starting point for scholars with research interests in this field in addressing their future works. Also, we hope that our study can contribute to support efforts to engage physicians and consumers in these important conversations: all physicians should reflect on the Choosing Wisely lists and adjust their ordering patterns accordingly, and inform patients about potentially unnecessary care.

The paper is organized as follows: Section 1 has dealt with Introduction, Section 2 focuses on Literature Review and Section 3 contains Methodology. Results are provided in Section 4 and Conclusion is in Section 5.

2. Literature Review

In recent years, problems with health care quality, such as overuse and inappropriateness, have received much attention from quality improvement initiatives and patient safety efforts (Bathia et al. 2015).

Overuse of medical care has been defined as a “health care service that is provided under circumstances in which its potential for harm exceeds the possible benefit” (Morgan et al. 2015).

There is strong evidence for the widespread overuse of several specific medical services both in high-income countries and in low- and middle-income countries, and may be increasing.

Inaccurate perceptions about the benefits and harms of interventions are likely to result in inadequate clinical management choices. However, adequate and inadequate care concepts are crucial to the creation of an efficient healthcare system.

Discussions among physicians about appropriateness and identifying indications to reduce the use of inappropriate interventions is one of the most difficult challenges that health systems must tackle. The concept of appropriateness is complex, as it interfaces with patient safety, healthcare costs, clinical decision-making and effectiveness.

The CW campaign was launched in the United States (USA) as an attempt to change physician practice behaviour and increase patient/public awareness

regarding low-value tests, procedures and treatments (Bathia et al. 2015). The campaign's success lies in its unique focus on professional values and patient - physician conversations to reduce unnecessary care (Wolfson et al. 2014).

In developing the Choosing Wisely campaign, the specialty societies each developed lists of five tests and procedures that physicians and patients should question (Levinson et al. 2015) (Bathia et al. 2015). The main aim was to promote discussion between physicians and patients, helping patients to choose prudent care that is: 1) supported by evidence, 2) not a repetition of other tests or procedures already done, 3) without collateral effects and necessary.

3. Methodology

This systematic search was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) statement (Moher et al. 2009) (The complete PRISMA Checklist is provided in Appendix 1).

3.1 Data Sources, Search and Selection Strategy

Outlining the search strategy required the definition of two aspects concerning the findings process. First, the temporal extension of analysis: we considered studies starting from 2012, the year the campaign was initiated. According to this, databases were searched systematically from 2012 to 2015.

Second, the choice of the database from which to find papers. To obtain a collection of representative research papers, we retrieved our data from the ISI Web of Knowledge database for the following reasons: (1) it is the world's leading citation database and enjoys a great reputation; (2) its citation database is abundant in covering more than 10,000 high impact journals; (3) it is highly regarded and receives great popularity from researchers; (4) it provides a systematic and objective means to trace related information efficiently (Hsiao & Yang 2011).

We selected papers from the database using 3 separate keyword pairs (*choosing wisely, overuse, appropriateness*). We also used 2 keywords focusing on the healthcare setting (*Health, Healthcare*), using the Boolean operator AND to identify all relevant papers in the field and to classify articles according to the topic area. The search of the database using selected keywords was applied to title, keywords and abstracts (topics range). To overcome limits related to the choice and use of a single database, we gathered papers by using the search engine Google (The complete list of search terms and search strategy are provided in Appendix 2 - Table 1).

Prior to the searches, several authors reviewed all search terms, and a health science reference librarian verified the search strategy for each database. Search results were imported into bibliographic citation management software to aggregate relevant articles. Two authors independently reviewed all article titles and abstracts identified from the electronic searches. Their respective article lists were then combined. Relevant full-text articles were reviewed by two authors and assessed against the inclusion and exclusion criteria described below. Disagreements between authors were resolved through discussion with the third author.

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We have included only articles published in English language. The articles selected were intended to provide evidence on the CW campaign or about tests and inappropriate procedures. The collected articles were also intended to address behaviours and/or outcomes related to public health. Studies without reported findings on health behaviours or clinical outcomes, meeting abstracts, and proceedings papers were excluded. Letters to the editors and editorials without data were also excluded.

Each citation found in the electronic database search was reviewed by 3 authors, in rotating groups, and deemed probably relevant, irrelevant or unknown based on agreement of at least 2 of the 3 authors. A citation was rated as probably relevant if the information contained in the abstract indicated that it met the above inclusion/exclusion criteria. A citation was rated as unknown where the abstract was unavailable, where insufficient information was available in the abstract, or where the abstract was not sufficiently clear with respect to the inclusion/exclusion criteria. A citation was rated as irrelevant if it was clear from the abstract that the paper was not relevant to the aims of this review, or if it was an opinion paper with no data. Disagreements among the 3 authors were resolved at face-to-face discussions. No attempt was made to judge scientific merit at this stage.

For each citation rated as probably relevant or of uncertain relevance in this initial screening, the entire paper was obtained from the library, and there was a second level of screening to ensure relevance. Papers were classified as probably relevant when the description in the abstract was not always consistent with the contents of the study.

As an adjunct to searching the electronic databases, and to reduce publication bias, we also examined the reference lists of all relevant studies in order to identify potentially relevant citations that might have been missed in the electronic database search.

All papers obtained in this manner were subjected to screening for relevance, utilizing the inclusion/exclusion criteria.

3.2 Data Extraction and Analysis

Article data were extracted manually into a database by three authors. Two separate matrices were created according to the aims of this study. The first summary matrix included information about authors, publication year, country, and type of study. We created a second summary matrix with the data extracted from all the relevant individual studies selected. This matrix included: source (authors and publication year), pathological area, scientific society, recommendations. Any discrepancies were discussed and resolved jointly among the three authors. The original study was reviewed if needed to resolve the discrepancy.

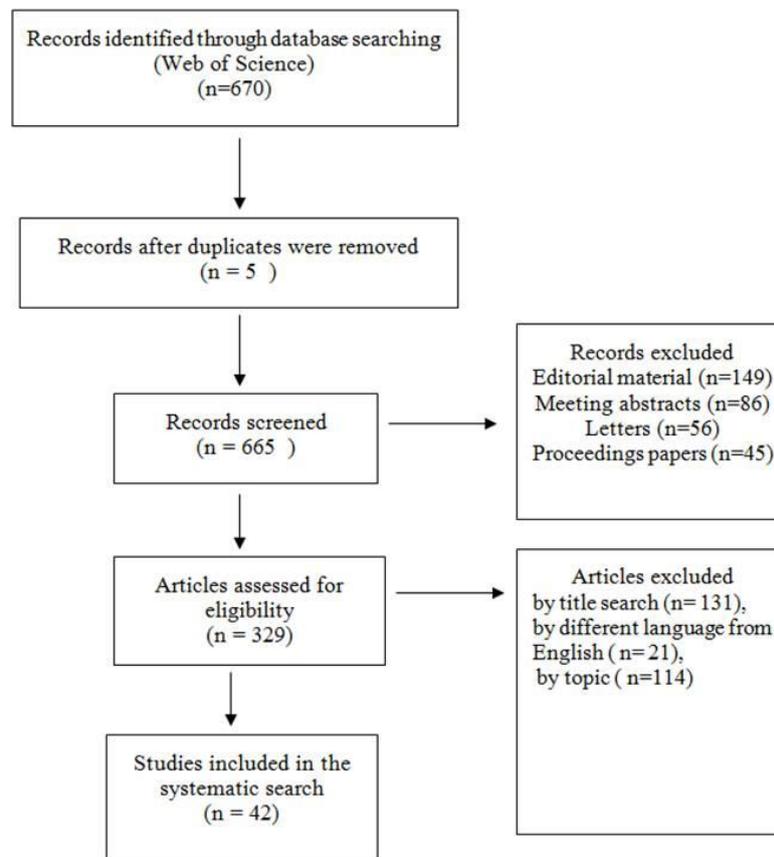
4. Findings

Initially, 670 records were found, of which 367 were articles; the rest were excluded because they were editorial materials, meeting abstracts, proceedings papers or letters.

We browsed publications, removed duplicates, determined their relevance and then downloaded those that were relevant. To reduce the selection bias, two members of the research team reviewed the titles, abstracts, and keywords of all records separately, to determine whether the studies met the inclusion criteria. Any disagreement was resolved by discussion. After duplicates were removed and the inclusion/exclusion criteria applied, 42 relevant articles were identified (Fig. 1).

Because of the heterogeneity between studies, and consistently with the aim of this study, meta-analysis was not performed and results are presented narratively (Eijkenaar et al. 2013).

Figure 1: Flow Diagram of the Selected Articles Included in the Systematic Search



4.1 Classification of Articles

Articles selected were sorted into three categories (Tab. 1):

- Theoretical articles: authors presented a theoretical explanation of the CW initiative and discussed the related questions. Analysis of these papers provided answers to the first question.
- Delphi studies and recommendations reviews: since the 1950s, the Delphi technique has become an increasingly important tool to address issues in health and medicine and an valuable method for developing consensual guidance on best practice. Selected papers allowed for identification of services in different specialty areas that physicians and patients should question. These were described in Top Five lists of recommendations. Analysis of these papers provided answers to the second and third questions.
- Descriptive/empirical articles aimed to further refine the scope of the recommendations.

Table 1: Classification of Articles (study type)

Study type	Number
<i>Theoretical articles</i>	3
<i>Delphi studies and recommendations reviews</i>	16
<i>Descriptive/empirical articles</i>	23
Total articles	42

4.2 Which Countries to Date Have Published in This Field?

Analysis of published literature returned 12 countries which have published in this field (Fig. 2).

Figure 2: Countries Which Have Published in the Field of CW in Health



Source: Our Elaboration

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From 2012 many medical societies in the USA have issued lists of tests, treatments and procedures that can safely be avoided in routine clinical practice (Malhotra et al. 2015).

From 2014, delegates from 12 countries (Australia, Canada, Denmark, the UK, Germany, Italy, Japan, the Netherlands, New Zealand, Sweden, Switzerland and the USA) met to exchange their experience with their own CW campaigns and to initiate collaborations. They created a model to reduce unnecessary care and waste. These countries were checked for Top Five lists released from their medical societies (Levinson et al. 2015), (Malhotra et al. 2015), (see Appendix 2 - Table 2).

Levinson et al. (2015) described CW Canada, which was modelled on the US initiative and launched in April 2014.

In Italy and Netherlands, the CW programme is part of a larger campaign directed at reducing low-value care. Italy adopted the principles of CW, incorporating them into a campaign called 'Doing more does not mean doing better', launched by 'Slow Medicine' (an independent organization linked to the Slow Food movement), and Netherlands recently launched the 'CW Netherlands Campaign'.

Other countries have well-established organizations that assess the quality of evidence and make recommendations to physicians, such as the National Institute for Clinical Evidence in England (Levinson et al. 2015).

Despite differences between the countries, all entities recognized that common factors have contributed to the clinical practice of ordering unnecessary services (patient expectations, fear of missing a possible diagnosis, malpractice concerns, reimbursement incentives, physician education and avoiding the challenging conversation of telling patients they do not need specific tests or treatments). While the relative weight of these factors differs in each country, they are remarkably similar overall (Korenstein et al. 2012).

The actual objectives are to influence the system at multiple levels: change physician attitudes, increase patient acceptance of the idea that more is not always better, change actual clinical practice and align the broader healthcare system with these goals (Berwick & Hackbarth 2012).

4.3 Which Scientific Societies have Defined the Recommendations? What are the Main Specialty Areas Affected?

In this section, we reported results from the analysis of published literature on the recommendation lists published by different scientific societies, with both surgical and non-surgical expertise, related to different specialty areas (See Appendix 2 - Table 3).

Our search strategy returned 20 specialty areas, in which 26 scientific societies had published different recommendations lists. For *emergency medicine, paediatrics, rheumatology, hospital medicine, anaesthesiology, general and internal medicine, and cardiology* specialty areas, we found different scientific societies that published

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top-five lists; for the specialties of *allergology* and *primary care*, we found more than 5 sets of recommendations.

The complete list of recommendations published for each specialty area is provided in Appendix 2 (Table 3).

Starting from 2012, nine medical societies developed and publicized an initial series of CW recommendations (Fischberg et al. 2013).

One of the first scientific societies identified was the American Society of Clinical Oncology (ASCO), related to the field of *oncology*. Cancer has been identified as one of the costliest chronic health conditions for the US healthcare system.

Many studies show the importance of adherence to the recommendations of CW (Ramsey et al. 2015).

Particularly for breast cancer, some authors identified inappropriate imaging test prescriptions (Hahn, et al. 2015) (Makarov et al. 2015) (Simos et al. 2014) (Simos et al. 2015).

The ASCO and the American *Urology* Association have jointly highlighted the need to reduce inappropriate imaging for patients at low risk of cancer of the prostate. In this regard, Makarov et al. (2013) noted Swedish efforts to provide data on prostate cancer imaging demonstrating that the adoption of imaging guidelines by clinicians was associated with a reduction in inappropriate imaging over a 10-year period and a slight reduction in appropriate imaging in high-risk patients.

Complexity of evidence and cost increase are also a source of concern for *haematology* (Hicks et al. 2013).

Critical Care Societies Collaborative was the only group to have involved a professional nursing society in development of its list of unnecessary procedures, reflecting the intrinsically interprofessional nature of *critical care*, particularly for patients in *intensive care* (Halpern et al. 2014).

For the American Society of *Nephrology* adhering to the campaign was important: the dissemination of routinely available information can be used by patients with chronic kidney disease and nephrologists to estimate risk of early mortality after initiation of dialysis therapy (Thamer et al. 2015).

One approach to improving value is reducing costs without affecting quality. Following this rationale, in the field of *emergency medicine*, a recent survey showed that 85% of emergency physicians agreed that too many diagnostic tests were ordered, and 97% agreed that at least some of the advanced imaging tests that they personally ordered were medically unnecessary (Maughan et al. 2015). As a result, professional bodies in *emergency medicine* have begun to advocate for reducing potentially costly and harmful medical imaging tests in emergency departments (computed tomography scans for patients with mild head trauma and simple

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headache, imaging of the lumbar spine for patients with low back pain, and radiography of the ankle without clinical evidence of fracture).

Yazdany et al.(2013) and Chow et al. (2015) described participation in the programme, both in the USA by the American College of *Rheumatology* and in Canada by the Canadian Rheumatology Association.

Some descriptive studies evaluated recommendations concerning anti-nuclear antibody testing (Ferrari 2015).

In February 2013, studies in the field of *paediatric care* were identified for various conditions. Paediatric rheumatology is a small subspecialty; by necessity, some adult rheumatologists manage paediatric rheumatic disease (Rouster-Stevens et al. 2014). The first recommendation of the American Academy of Pediatrics (AAP) discourages the use of antibiotics in cases of apparent viral respiratory infections.

Ho et al. (2015) described also the identification of 5 tests and treatments in *neonatal medicine*.

Focusing on *respiratory allergic diseases*, the American Academy of Allergy, Asthma and Immunology have issued many recommendations about improvement in asthma treatment (Rao & Levin 2012), (Cassel & Guest 2012).

Descriptive studies have been identified both in *paediatric* and *adult hospital medicine* (Herzig et al. 2015) (Schondelmeyer et al. 2015) (Quinonez et al. 2013) (Bulger et al. 2013). Swedish Hospital Medicine undertook a multifaceted quality improvement intervention to decrease unnecessary but common lab tests. There has been a modest decrease in the number of ordered inappropriate laboratory tests and hospital costs (Corson et al. 2015).

One of the five recommendations for improved value of hospitalized care is the reduction in inappropriate use of acid-suppressive medication to cure stress ulcers. Herzig et al. (2015) designed a study that used decision support to reduce overuse and suggested that attention should be focused on both inpatient and outpatient care.

In 2014, the American Geriatrics Society's CW list cautions against the use of any benzodiazepines or other sedative-hypnotics as initial treatments for agitation, insomnia, or delirium in older adults (Garrido et al. 2014) (Tannenbaum et al. 2014). Older adults were generally receptive to recommendations to stop cancer screening, especially in the context of a trusting physician relationship and when the discussions framed the recommendations around age, health status, and helping people live longer.

Many studies documented the commitment of the American Society of Radiation Oncology to improve the use of radiotherapy administered to patients with bone metastases or cerebral palsy (Ellsworth et al. 2014) (Gemici & Yaprac 2015).

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Using guidelines and performing a survey among a group of academic *anaesthesiologists*, the American Society of Anaesthesiologists selected 5 unnecessary practices: 2 preoperative and 3 intraoperative (Onhuoa et al. 2014). Focusing on a Canadian hospital, despite current recommendations to avoid preoperative laboratory testing before low-risk surgery without clear clinical indications, investigations and metabolic panel tests were frequently performed (Kirkham et al. 2015).

In *general internal medicine*, studies refers to Italy, Switzerland and Germany (Gaspoz 2015). The project "Doing more does not mean doing better" was launched in the cardiology department of the Santa Croce and Carle Hospital in Cuneo, Italy: the CW project can be implemented locally as well as nationally with the involvement of scientific societies (Bobbio et al. 2014).

Cardiac testing in low-risk patients appears on the CW lists of six specialty societies. Colla et al. (2015) estimated both the proportion of low-risk medicare beneficiaries receiving non-invasive cardiac screening tests without a clear, pertinent symptomatic indication and the regional variation in spending associated with these tests. They argue that the value of the action will be enhanced with stronger recommendations. Inappropriate use leads to increased costs, alert fatigue, and inefficient nursing care. Although there is no physiological indication for carotid ultrasound in "simple" syncope in the absence of focal neurological signs or symptoms suggestive of stroke, this practice remains common for routine syncope workups. This practice is still commonly ordered and may be an easy reduction target for institutions trying to curtail low-value care (Scott et al. 2014).

In *neurology*, different tests/procedures ordered by neurologists contribute most to mental health care (Burke et al. 2013) (Langer-Gould et al. 2013).

Hawasli et al. (2014) highlighted how to reduce spending on *neuroimaging* for migraines in the CW initiative; other organizations, particularly the American Headache Society, have offered guidelines to limit neuroimaging for headaches in the field of neurosurgery. Physicians must recognize their essential role in limiting the use of unnecessary tests and procedures.

5. Conclusions

The CW initiative seeks to encourage physicians and patients to follow evidence-based recommendations in managing health problems while avoiding medical tests and procedures that are unlikely to help (Hudzik et al. 2014). Physicians and patients must understand that more care is not always better care; in some instances, it can bring more harm than good.

In this context recommendation lists are a desirable tool for reducing the level of inappropriate of health care services and the waste of healthcare resources (Hudzik et al. 2014) (Cassel & Guest 2012).

The purpose of our review was to identify all published literature on CW in health from 2012 to 2015, with a focus on countries involved in the campaign which have

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published in this field, pathological areas included, medical societies and respective recommendations to reduce both the level of inappropriate of health care services and waste of healthcare resources.

To the best of our knowledge, any previous research has never investigated these aspects.

The search strategy returned only 12 countries for which studies on this topic were published (Australia, Canada, Denmark, the UK, Germany, Italy, Japan, the Netherlands, New Zealand, Sweden, Switzerland and the USA). Most of the studies found programmes originated in the USA and Canada. Less published evidence was found for Germany, Australia, Japan, Netherlands, Denmark and New Zealand.

Our search strategy returned also 20 specialty areas involved, and for each area, the respective specialty societies (26 overall) have drawn up lists of recommendation to avoid waste and unnecessary diagnostic tests.

3 specialty areas were major invested by recommendations. In particular, for Adult pulmonary medicine area, 10 recommendations were published by the American College of Chest Physicians and American Thoracic Society; for area of Allergology 10 recommendations were published by the American Academy of Allergy Asthma and Immunology. Finally, for the areas of Primary care, 15 recommendations were published by the American Academy of Family Physicians.

Limitations

First of all, only papers published in the English language were reviewed; data published in other languages were automatically excluded from this study. Our inability systematically to review literature in other languages may be considered a weakness. Although we had intended to review the non-English literature, professional language translation services proved prohibitively expensive. Moreover, we used a literature search approach to try to describe the state of the art about the Choosing Wisely campaigns which are active campaigns that are quickly evolving and producing materials, much of which is not in English or in the peer reviewed literature.

Second, analysis was necessarily limited to publicly available papers and thus potentially subject to publication bias. New papers relating to the implementation of CW for practice are being published quite regularly, and some may have been missed in this study.

Despite these limitations, our literature review allows to understand that an important gap exist between the published literature and the practice diffusion of the CW principles. Indeed, there are actually many countries participating or in process of implementing the Choosing Wisely campaign (Fig. 3). For most of these, there are few or no publications as of yet.

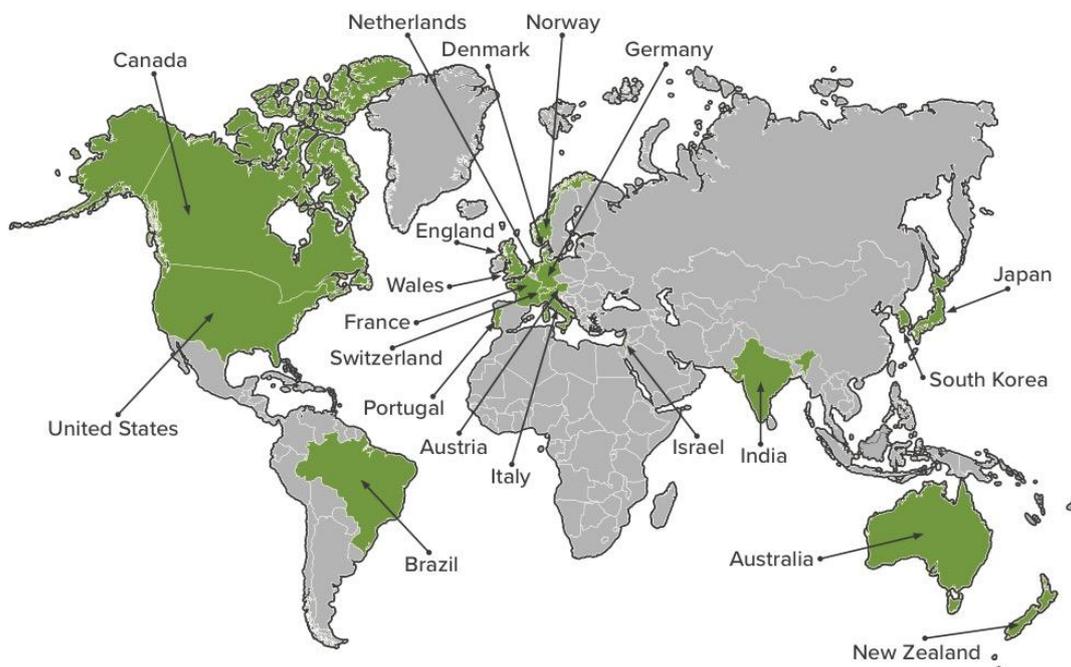
In this study we have provided a tool useful to know what results the published literature returns in terms of countries, medical societies, pathological areas involved

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and recommendations published, in order to identify literature gaps and elements that deserve special attention.

In addition, we can provide a number of suggestions for future studies: 1) CW is more of a grassroots campaign and not an academic program – hence why some work is not necessarily published. According to this, future studies which include a broader search of the literature, including grey literature and websites, is needed; 2) with regard to the recommendation lists, we suggest to the authors of future studies to remember that, in all cases, the recommendations are bounded by the current state of the science. As the evidence evolves it is possible that certain recommendations will need to be revisited.

Figure 3: Choosing Wisely Campaigns Worldwide



Source: www.choosingwisely.org

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Appendix 1:

Section/topic	#	Prisma Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	1-4
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	2-3
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	2
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	3-4
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	4
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	3-4
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	3-5
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	3-5
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	3-5
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	3-5
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	4
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	5
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	5

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Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	4
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	N.A.
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	6
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	7-11
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	4
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	7-11
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	N.A.
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	4
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	N.A.
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	11-12
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	12
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	11-12
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	13

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

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Appendix 2:

Table 1: Search Strategy for Systematic Search on Choosing Wisely

Search Strategy (Searched From 10/12/2017 to 13/12/2017)	
Database(s)	Search term(s)
Web of science	Search Terms: (choosing wisely, overuse, underuse, appropriateness) AND (Health, Healthcare) Filter English only. Included Science Citation Index Expanded and Social Sciences Citation Index Excluded Arts and Humanities Citation Index
Google Scholar	Search Terms: (choosing wisely, overuse, underuse, appropriateness, Health, Healthcare) Variety of key terms used from above searches.

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Appendix 2:

Table 2: Countries which have Published on the Choosing Wisely for Health

COUNTRY	STUDY TYPE	SOURCE
CANADA	THEORETICAL	Bathia et al., 2015*; Levinson et al., 2015**
	EMPIRICAL/DESCRIPTIVE	Simos and Clemons 2015; Ferrari 2015;
		Kirkham et al., 2015
	DELPHI/REVIEW	Chow et al., 2015
USA	THEORETICAL	Levinson et al., 2015
	EMPIRICAL/DESCRIPTIVE	Ramsey et al., 2015; Hahn et al., 2015; Makarov et al. 2015; Thamer et al., 2015; Maughan et al., 2015; Herzig et al., 2015; Schoendelmeyer et al., 2015; Garrido et al., 2014; Tannenbaum et al., 2014; Ellsworth et al., 2014; Gemici and Yaprac 2015; Colla et al., 2015; Scott et al., 2014 ; Burke et al., 2013; Hawasli et al., 2015; Minen et al., 2015; Bathia et al., 2015*
	DELPHI/REVIEW	Hicks et al., 2013; Halpern et al., 2014; William et al., 2013 ; Fischberg et al., 2013; Wiener et al., 2015; Ho et al., 2015; Rouster-Stevens et al., 2014 ; Yazdany et al., 2013; Bulger et al., 2013; Quinonez et al., 2013; Chun et al., 2014; Samuel et al., 2014 ; Onhuoa et al., 2014; Langer- Gould et al., 2013; Loder et al., 2013
GERMANY	THEORETICAL	Levinson et al., 2015
ITALY	THEORETICAL	Levinson et al., 2015
	EMPIRICAL/DESCRIPTIVE	Bobbio et al., 2015
SWEDEN	EMPIRICAL/DESCRIPTIVE	Makarov et al., 2013; Corson et al., 2015
SWITZERLAND	THEORETICAL	Gaspoz et al., 2015; Levinson et al., 2015
AUSTRALIA	THEORETICAL	Levinson et al., 2015
JAPAN	THEORETICAL	Levinson et al., 2015
UK (England and Wales)	THEORETICAL	Levinson et al., 2015; Malhotra et al, 2015
NETHERLANDS	THEORETICAL	Levinson et al., 2015
DENMARK	THEORETICAL	Levinson et al., 2015
NEW ZEALAND	THEORETICAL	Levinson et al., 2015
Total number of studies included to answer at the first question: 42.		
*Bathia et al., 2015 reported evidence of CW in Canada and USA.		
**Levinson et al. 2015 reported evidence of CW in Australia, Canada, Denmark, England, Germany, Italy, Japan, the Netherlands, New Zealand, Switzerland,		

Appendix 2:

Table 2: Countries Which Have Published on the Choosing Wisely for Health

SOURCE	PATHOLOGICAL AREAS	SCIENTIFICS SOCIETIES	RECOMMENDATIONS
<p>Ramsey et al., 2015; Makarov et al., 2013; Hanh et al., 2015; Simos et al., 2015; Simos and Clemons, 2015; Makarov et al., 2015</p>	<p>CLINICAL ONCOLOGY</p>	<p>AMERICAN SOCIETY OF CLINICAL ONCOLOGY (ASCO)</p>	<p>1. Do not give patients starting on a chemotherapy regimen that has a low or moderate risk of causing nausea and vomiting anti-emetic drugs intended for use with a regimen that has a high risk of causing nausea and vomiting.</p>
			<p>2. Do not use combination chemotherapy (multiple drugs) instead of chemotherapy with one drug when treating an individual for metastatic breast cancer unless the patient needs a rapid response to relieve tumor-related symptoms.</p>
			<p>3. Avoid using PET or PET-CT scanning as part of routine follow-up care to monitor for a cancer recurrence in asymptomatic patients who have finished initial treatment to eliminate the cancer unless there is high-level evidence that such imaging will change the outcome.</p>
			<p>4. Do not perform PSA testing for prostate cancer screening in men with no symptoms of the disease when they are expected to live less than 10 years.</p>
			<p>5. Do not use a targeted therapy intended for use against a specific genetic aberration unless a patient's tumor cells have a specific biomarker that predicts an effective response to the targeted therapy.</p>
<p>Makarov et al., 2013</p>		<p>AMERICAN UROLOGICAL ASSOCIATION (AUA)</p>	<p>1. A routine bone scan is unnecessary in men with low-risk prostate cancer.</p>
			<p>2. Don't prescribe testosterone to men with erectile dysfunction who have normal testosterone levels.</p>
			<p>3. Don't order creatinine or upper-tract imaging for patients with benign prostatic hyperplasia (BPH).</p>
			<p>4. Don't treat an elevated PSA with antibiotics for patients not experiencing other symptoms.</p>
			<p>5. Don't routinely perform ultrasound on boys with cryptorchidism.</p>
<p>Hicks et al., 2013</p>	<p>HEMATOLOGY</p>	<p>AMERICAN SOCIETY OF HEMATOLOGY (ASH)</p>	<p>1. In situations where transfusion of RBCs is necessary, transfuse the minimum number of units required to relieve symptoms of anemia or to return the patient to a safe hemoglobin range (7-8 g/dL in stable, non cardiac in-patients).</p>
			<p>2. Do not test for thrombophilia in adult patients 15,16 with venous thromboembolism occurring in the setting of major transient risk factors (surgery, trauma, or prolonged immobility.)</p>
			<p>3. Do not use inferior vena cava filters routinely in patients with acute venous thromboembolism.</p>
			<p>4. Do not administer plasma or prothrombin 27,28 complex concentrates for nonemergent reversal of vitamin K antagonists (ie, outside of the setting of major bleeding, intracranial hemorrhage, or anticipated emergent surgery).</p>
			<p>5. Limit surveillance CT scans in asymptomatic patients after curative-intent treatment for aggressive lymphoma.</p>

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Halpern et al., 2014	CRITICAL CARE	CRITICAL CARE SOCIETIES COLLABORATIVES (CCSC) the American Association of Critical-Care Nurses, the American College of Chest Physicians, the American Thoracic Society, and the Society of Critical Care Medicine.	1. Don't order diagnostic tests at regular intervals (such as every day), but rather in response to specific clinical questions.
			2. Don't transfuse red blood cells in hemodynamically stable, non-bleeding ICU patients with a hemoglobin concentration greater than 7 mg/dL.
			3. Don't use parenteral nutrition in adequately nourished critically ill patients within the first seven days of an ICU stay.
			4. Don't deeply sedate mechanically ventilated patients without a specific indication and without daily attempts to lighten sedation.
			5. Don't continue life support for patients at high risk for death or severely impaired functional recovery without offering patients and their families the alternative of care focused entirely on comfort.
Thamer et al., 2015; William et al., 2013	NEPHROLOGY	AMERICAN SOCIETY OF NEPHROLOGY (ASN)	1. Don't perform routine cancer screening for dialysis patients with limited life expectancies without signs or symptoms.
			2. Don't administer erythropoiesis-stimulating agents (ESAs) to CKD patients with hemoglobin levels ≤ 10 .
			3. Avoid nonsteroidal anti-inflammatory drugs (NSAIDs) in individuals with hypertension, heart failure, or CKD of all causes, including diabetes.
			4. Don't place peripherally inserted central catheters (PICCs) in stage 3–5 CKD patients without consulting nephrology.
			5. Don't initiate chronic dialysis without ensuring a shared decision-making process between patients, their families, and their physicians.
Fischberg et al., 2013	PALLIATIVE MEDICINE	AMERICAN ACADEMY OF HOSPICE AND PALLIATIVE MEDICINE (AAHPM)	1. Don't recommend percutaneous feeding tubes in patients with advanced dementia; instead, offer oral assisted feeding.
			2. Don't delay palliative care for a patient with serious illness who has physical, psychological, social, or spiritual distress because they are pursuing disease-directed treatment.
			3. Don't leave an implantable cardioverter-defibrillator (ICD) activated when it is inconsistent with the patient/family goals of care.
			4. Don't recommend more than a single fraction of palliative radiation for an uncomplicated painful bone metastasis.
			5. Don't use topical lorazepam (Ativan), diphenhydramine (Benadryl), haloperidol (Haldol) ("ABH") gel for nausea.
Burke et al., 2013; Langergould et al., 2013	NEUROLOGY	AMERICAN ACADEMY OF NEUROLOGY (AAN)	1. Don't perform electroencephalography (EEG) for headaches.
			2. Don't perform imaging of the carotid arteries for simple syncope without other neurologic symptoms.
			3. Don't use opioid or butalbital treatment for migraine except as a last resort.
			4. Don't prescribe interferon-beta or glatiramer acetate to patients with disability from progressive, non-relapsing forms of multiple sclerosis.
			5. Don't recommend carotid endarterectomy for asymptomatic carotid stenosis unless the complication rate is low (<3%).

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<p>Wiener et al., 2015</p>	<p>ADULT PULMONARY MEDICINE</p>	<p>AMERICAN COLLEGE OF CHEST PHYSICIANS AND AMERICAN THORACIC SOCIETY (ATS)</p>	<ol style="list-style-type: none"> 1. Don't perform computed tomography (CT) surveillance for evaluation of indeterminate pulmonary nodules at more frequent intervals or for a longer period of time than recommended by established guidelines. 2. Don't routinely offer pharmacologic treatment with advanced vasoactive agents approved only for the management of pulmonary arterial hypertension to patients with pulmonary hypertension resulting from left heart disease or hypoxemic lung diseases (Groups II or III pulmonary hypertension). 3. For patients recently discharged on supplemental home oxygen following hospitalization for an acute illness, don't renew the prescription without assessing the patient for ongoing hypoxemia. 4. Don't perform chest computed tomography (CT angiography) to evaluate for possible pulmonary embolism in patients with a low clinical probability and negative results of a highly sensitive D-dimer assay. 5. Don't perform CT screening for lung cancer among patients at low risk for lung cancer. 6. Don't prescribe high-dose dexamethasone (0.5mg/kg per day) for the prevention or treatment of bronchopulmonary dysplasia in pre-term infants. 7. Don't perform screening panels for food allergies without previous consideration of medical history. 8. Avoid using acid blockers and motility agents such as metoclopramide (generic) for physiologic gastroesophageal reflux (GER) that is effortless, painless and not affecting growth. Do not use medication in the so-called "happy-spitter." 9. Avoid the use of surveillance cultures for the screening and treatment of asymptomatic bacteriuria. 10. Infant home apnea monitors should not be routinely used to prevent sudden infant death syndrome (SIDS).
<p>Maughan et al., 2015;</p>	<p>EMERGENCY MEDICINE</p>	<p>AMERICAN COLLEGE OF EMERGENCY PHYSICIANS (ACEP)</p>	<ol style="list-style-type: none"> 1. In situations where transfusion of RBCs is necessary, transfuse the minimum number of units required to relieve symptoms of anemia or to return the patient to a safe hemoglobin range (7-8 g/dL in stable, noncardiac in-patients) 2. Avoid placing indwelling urinary catheters in the emergency department for either urine output monitoring in stable patients who can void, or for patient or staff convenience. 3. Avoid placing indwelling urinary catheters in the emergency department for either urine output monitoring in stable patients who can void, or for patient or staff convenience. 4. Avoid antibiotics and wound cultures in emergency department patients with uncomplicated skin and soft tissue abscesses after successful incision and drainage and with adequate medical follow-up. 5. Avoid instituting intravenous (IV) fluids before doing a trial of oral rehydration therapy in uncomplicated emergency department cases of mild to moderate dehydration in children.

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Ho et al., 2015	PEDIATRICS	AMERICAN ACADEMY OF PEDIATRICS (AAP)	<p>1. Antibiotics should not be used for apparent viral respiratory illnesses (sinusitis, pharyngitis, bronchitis and bronchiolitis).</p> <p>2. Cough and cold medicines should not be prescribed or recommended for respiratory illnesses in children under four years of age.</p> <p>3. Computed tomography (CT) scans are not necessary in the immediate evaluation of minor head injuries; clinical observation/Pediatric Emergency Care Applied Research Network (PECARN) criteria should be used to determine whether imaging is indicated.</p> <p>4. Neuroimaging (CT, MRI) is not necessary in a child with simple febrile seizure.</p> <p>5. Computed tomography (CT) scans are not necessary in the routine evaluation of abdominal pain.</p>
Rouster - Stevens et al., 2014		AMERICAN COLLEGE RHEUMATOLOGY (ACR) PEDIATRICS	<p>1. Don't order autoantibody panels unless positive antinuclear antibodies (ANA) and evidence of rheumatic disease.</p> <p>2. Don't test for Lyme disease as a cause of musculoskeletal symptoms without an exposure history and appropriate exam findings.</p> <p>3. Don't routinely perform surveillance joint radiographs to monitor juvenile idiopathic arthritis (JIA) disease activity.</p> <p>4. Don't perform methotrexate toxicity labs more often than every 12 weeks on stable doses.</p> <p>5. Don't repeat a confirmed positive ANA in patients with established JIA or systemic lupus erythematosus (SLE).</p>
Yazdany et al., 2013;	RHEUMATOLOGY	AMERICAN COLLEGE RHEUMATOLOGY (ACR)	<p>1. Don't test ANA sub-serologies without a positive ANA and clinical suspicion of immune-mediated disease.</p> <p>2. Don't test for Lyme disease as a cause of musculoskeletal symptoms without an exposure history and appropriate exam findings.</p> <p>3. Don't perform MRI of the peripheral joints to routinely monitor in inflammatory arthritis.</p> <p>4. Don't prescribe biologics for rheumatoid arthritis before a trial of methotrexate (or other conventional non-biologic DMARDs).</p> <p>5. Don't routinely repeat DXA scans more often than once every two years.</p>
Ferrari, 2015; Chow et al., 2015;		CANADIAN RHEUMATOLOGY ASSOCIATION (CRA)	<p>1. Don't order ANA as a screening test in patients without specific signs or symptoms of systemic lupus erythematosus (SLE) or another connective tissue disease (CTD).</p> <p>2. Don't order an HLA-B27 unless spondyloarthritis is suspected based on specific signs or symptom.</p> <p>3. Don't repeat dual energy X-ray absorptiometry (DEXA) scans more often than every 2 years.</p> <p>4. Don't prescribe bisphosphonates for patients at low risk of fracture.</p> <p>5. Don't perform whole body bone scans (e.g., scintigraphy) for diagnostic screening for peripheral and axial arthritis in the adults.</p>

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<p>Rao et al., 2012; Cassel et al., 2012;</p>	<p>ALLERGOLOGY</p>	<p>AMERICAN ACADEMY OF ALLERGY, ASTHMA & IMMUNOLOGY (AAAAI)</p>	<ol style="list-style-type: none"> 1. Don't perform unproven diagnostic tests, such as immunoglobulin G (IgG) testing or an indiscriminate battery of immunoglobulin E (IgE) tests, in the evaluation of allergy. 2. Don't order sinus computed tomography (CT) or indiscriminately prescribe antibiotics for uncomplicated acute rhinosinusitis. 3. Don't routinely do diagnostic testing in patients with chronic urticaria. 4. Don't recommend replacement immunoglobulin therapy for recurrent infections unless impaired antibody responses to vaccines are demonstrated. 5. Don't diagnose or manage asthma without spirometry 6. Don't rely on antihistamines as first-line treatment in severe allergic reactions. 7. Don't perform food IgE testing without a history consistent with potential IgE-mediated food allergy. 8. Don't routinely order low- or iso-osmolar radiocontrast media or pretreat with corticosteroids and antihistamines for patients with a history of seafood allergy, who require radiocontrast media. 9. Don't routinely avoid influenza vaccination in egg-allergic patients. 10. Don't overuse non-beta lactam antibiotics in patients with a history of penicillin allergy, without an appropriate evaluation.
<p>Bulger et al., 2013; Corson et al., 2015; Herzig et al., 2015; Schondelmeyer et al., 2015</p>	<p>HOSPITAL MEDICINE (ADULT AND PEDIATRIC)</p>	<p>SOCIETY OF HOSPITAL MEDICINE (SHM)</p>	<ol style="list-style-type: none"> 1. Do not place, or leave in place, urinary catheters for incontinence or convenience or monitoring of output for non-critically ill patients (acceptable indications: critical illness, obstruction, hospice, perioperatively for <2 days for urologic procedures; use weights instead to monitor diuresis). 2. Do not prescribe medications for stress ulcer prophylaxis to medical inpatients unless at high risk for gastrointestinal complications. 3. Avoid transfusions of red blood cells for arbitrary hemoglobin or hematocrit thresholds and in the absence of symptoms or active coronary disease, heart failure, or stroke. 4. Do not order continuous telemetry monitoring outside of the intensive care unit without using a protocol that governs continuation. 5. Do not perform repetitive complete blood count and chemistry testing in the face of clinical and lab stability.
<p>Quinonez et al., 2013</p>		<p>SOCIETY OF HOSPITAL MEDICINE (SHM) for pediatric</p>	<ol style="list-style-type: none"> 1. Do not order chest radiographs in children with uncomplicated asthma or bronchiolitis. 2. Do not routinely use bronchodilators in children with bronchiolitis. 3. Do not use systemic corticosteroids in children under 2 years of age with an uncomplicated lower respiratory tract infection. 4. Do not treat gastroesophageal reflux in infants routinely with acid suppression therapy. 5. Do not use continuous pulse oximetry routinely in children with acute respiratory illness unless they are on supplemental oxygen.

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<p>Chun et al., 2014; Samuel et al., 2014; Garrido et al., 2014; Tannenbaum et al., 2014;</p>	<p style="text-align: center;">GERIATRIC S</p>	<p style="text-align: center;">AMERICAN GERIATRICS SOCIETY(AG S)</p>	<p>1. Don't Prescribe Cholinesterase Inhibitors for Dementia without Periodic Assessment for Perceived Cognitive Benefits and Adverse Gastrointestinal Effects.</p> <p>2. Don't Recommend Screening for Breast or Colorectal Cancer, nor Prostate Cancer (with the Prostate-Specific Antigen Test) without Considering Life Expectancy and the Risks of Testing, Overdiagnosis, and Overtreatment.</p> <p>3. Avoid Using Prescription Appetite Stimulates or High-Calorie Supplements for Treatment of Anorexia or Cachexia in Older Adults; Instead, Optimize Social Supports, Provide Feeding Assistance, and Clarify Patient Goals and Expectations.</p> <p>4. Don't Prescribe a Medication without Conducting a Drug Regimen Review.</p> <p>5. Avoid Using Physical Restraints to Manage Behavioral Symptoms of Hospitalized Older Adults with Delirium.</p>
<p>Ellsworth et al., 2014; Gemici and Yaprac, 2015;</p>	<p style="text-align: center;">RADIATION ONCOLOG Y</p>	<p style="text-align: center;">AMERICANSOCIET Y FOR RADIATION ONCOLOGY(ASTR O)</p>	<p>1. Don't initiate whole breast radiotherapy as a part of breast conservation therapy in women age ≥ 50 with early stage invasive breast cancer without considering shorter treatment schedules.</p> <p>2. Don't initiate management of low-risk prostate cancer without discussing active surveillance.</p> <p>3. Don't routinely use extended fractionation schemes (>10 fractions) for palliation of bone metastases.</p> <p>4. Don't routinely recommend proton beam therapy for prostate cancer outside of a prospective clinical trial or registry.</p> <p>5. Don't routinely use intensity modulated radiotherapy (IMRT) to deliver whole breast radiotherapy as part of breast conservation therapy.</p>
<p>Onhuoa et al., 2014</p>	<p style="text-align: center;">ANHESTESIOLOG Y</p>	<p style="text-align: center;">AMERICAN SOCIETY OF ANESTHESIOLOGIS TS (ASA)</p>	<p>1. Don't obtain baseline laboratory studies in patients without significant systemic disease undergoing low-risk surgery – specifically complete blood count, basic or comprehensive metabolic panel, coagulation studies when blood loss (or fluid shifts) is/are expected to be minimal.</p> <p>2. Don't obtain baseline diagnostic cardiac testing (trans-thoracic/esophageal echocardiography – TTE/TEE) or cardiac stress testing in asymptomatic stable patients with known cardiac disease (e.g., CAD, valvular disease) undergoing low or moderate risk non-cardiac surgery.</p> <p>3. Don't use pulmonary artery catheters (PACs) routinely for cardiac surgery in patients with a low risk of hemodynamic complications (especially with the concomitant use of alternative diagnostic tools (e.g., TEE).</p> <p>4. Don't administer packed red blood cells (PRBCs) in a young healthy patient without ongoing blood loss and hemoglobin of ≥ 6 g/dL unless symptomatic or hemodynamically unstable</p> <p>5. Don't routinely administer colloid (dextrans, hydroxylethyl starches, albumin) for volume resuscitation without appropriate indications.</p>
<p>Kirkham et al., 2015</p>		<p style="text-align: center;">CANADIAN ANESTHESIOLOGI ST'S SOCIETY (CAS)</p>	<p>1. Don't order baseline laboratory studies (complete blood count, coagulation testing or serum biochemistry) for asymptomatic patients undergoing low-risk non-cardiac surgery.</p> <p>2. Don't order a baseline electrocardiogram for asymptomatic patients undergoing low-risk non-cardiac surgery.</p> <p>3. Don't order a baseline chest x-ray in asymptomatic patients, except as part of surgical or oncological evaluation.</p> <p>4. Don't perform resting echocardiography as part of pre-operative assessment for asymptomatic patients undergoing low to intermediate-risk non-cardiac surgery.</p> <p>5. Don't perform cardiac stress testing for asymptomatic patients undergoing low to intermediate risk non-cardiac surgery.</p>

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Gaspoz et al., 2015	GENERAL AND INTERNAL MEDICINE	SWISS SOCIETY OF GENERAL INTERNAL MEDICINE (SGAIM)	<ol style="list-style-type: none"> 1.Obtaining imaging studies during the first six weeks in patients with non-specific low back pain. 2.Performing the Prostate Specific Antigen (PSA) test to screen for prostate cancer without a discussion of the risks and benefits 3.Prescribing antibiotics for uncomplicated upper respiratory tract infections. 4.Obtaining preoperative chest radiography in the absence of a clinical suspicion for intra- thoracic pathology. 5.Continuing long-term treatment of gastro- intestinal symptoms with proton pump inhibitors without titrating to the lowest effective dose needed.
Bobbio et al., 2015; Colla et al., 2015	CARDIOLOGY	AMERICAN GASTROENTEROLOGICAL ASSOCIATION (AGA)	<ol style="list-style-type: none"> 1.Don't perform stress cardiac imaging or advanced non-invasive imaging in the initial evaluation of patients without cardiac symptoms unless high-risk markers are present. 2.Don't perform annual stress cardiac imaging or advanced non-invasive imaging as part of routine follow-up in asymptomatic patients. 3.Don't perform stress cardiac imaging or advanced non-invasive imaging as a pre-operative assessment in patients scheduled to undergo low-risk non cardiac surgery. 4.Don't perform echocardiography as routine follow-up for mild, asymptomatic native valve disease in adult patients with no change in signs or symptoms. Don't perform routine electrocardiography (ECG) screening as part of pre-operative or pre-procedural evaluations for asymptomatic patients with low perioperative risk of death or myocardial infarction.
Scott et al. 2014		AMERICAN SOCIETY OF NUCLEAR CARDIOLOGY (ASNC)	<ol style="list-style-type: none"> 1.Don't perform stress cardiac imaging or coronary angiography in patients without cardiac symptoms unless high-risk markers are present. 2.Don't perform cardiac imaging for patients who are at low risk. 3.Don't perform radionuclide imaging as part of routine follow-up in asymptomatic patients. 4.Don't perform cardiac imaging as a pre-operative assessment in patients scheduled to undergo low- or intermediate-risk non-cardiac surgery. 5.Use methods to reduce radiation exposure in cardiac imaging, whenever possible, including not performing such tests when limited benefits are likely.
Loder et al., 2013 ; Hawasli et al. 2015 ; Minen et al., 2015	NEUROSURGERY	AMERICAN HEADACHE SOCIETY (AHS)	<ol style="list-style-type: none"> 1.Don't perform neuroimaging studies in patients with stable headaches that meet criteria for migraine. 2.Don't perform computed tomography (CT) imaging for headache when magnetic resonance imaging (MRI) is available, except in emergency settings. 3.Don't recommend surgical deactivation of migraine trigger points outside of a clinical trial 4.Don't prescribe opioid or butalbital-containing medications as first-line treatment for recurrent headache disorders. 5.Don't recommend prolonged or frequent use of over-the-counter (OTC) pain medications for headache

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Rao et al., 2012; Cassel et al., 2012	PRIMARY CARE	AMERICAN ACADEMY OF FAMILY PHYSICIANS (AAFP)	1. Don't do imaging for low back pain within the first six weeks, unless red flags are present.
			2. Don't routinely prescribe antibiotics for acute mild-to-moderate sinusitis unless symptoms last for seven or more days, or symptoms worsen after initial clinical improvement.
			3. Don't use dual-energy x-ray absorptiometry (DEXA) screening for osteoporosis in women younger than 65 or men younger than 70 with no risk factors.
			4. Don't order annual electrocardiograms (EKGs) or any other cardiac screening for low-risk patients without symptoms.
			5. Don't perform Pap smears on women younger than 21 or who have had a hysterectomy for non-cancer disease.
			6. Don't schedule elective, non-medically indicated inductions of labor or Cesarean deliveries before 39 weeks, 0 days gestational age.
			7. Avoid elective, non-medically indicated inductions of labor between 39 weeks, 0 days and 41 weeks, 0 days unless the cervix is deemed favorable.
			8. Don't screen for carotid artery stenosis (CAS) in asymptomatic adult patients.
			9. Don't screen women older than 65 years of age for cervical cancer who have had adequate prior screening and are not otherwise at high risk for cervical cancer.
			10. Don't screen women younger than 30 years of age for cervical cancer with HPV testing, alone or in combination with cytology.
			11. Don't prescribe antibiotics for otitis media in children aged 2–12 years with non-severe symptoms where the observation option is reasonable.
			12. Don't perform voiding cystourethrogram (VCUG) routinely in first febrile urinary tract infection (UTI) in children aged 2–24 months.
			13. Don't routinely screen for prostate cancer using a prostate-specific antigen (PSA) test or digital rectal exam.
			14. Don't screen adolescents for scoliosis.
			15. Don't require a pelvic exam or other physical exam to prescribe oral contraceptive medications.
Rao et al., 2012; Cassel et al., 2012		AMERICAN COLLEGE OF PHYSICIANS (ACP)	1. Don't obtain screening exercise electrocardiogram testing in individuals who are asymptomatic and at low risk for coronary heart disease.
			2. Don't obtain imaging studies in patients with non-specific low back pain.
			3. In the evaluation of simple syncope and a normal neurological examination, don't obtain brain imaging studies (CT or MRI).
			4. In patients with low pretest probability of venous thromboembolism (VTE), obtain a high-sensitive D-dimer measurement as the initial diagnostic test; don't obtain imaging studies as the initial diagnostic test.
			5. Don't obtain preoperative chest radiography in the absence of a clinical suspicion for intrathoracic pathology.