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Universitat Autònoma de Barcelona

Faculty of Medicine

Department of Paediatrics, Obstetrics & Gynaecology and Preventative Medicine

PhD Program in Methodology of Biomedical Research and Public Health

DOCTORAL THESIS

**INITIATIVES TO IMPROVE THE
APPROPRIATENESS OF CLINICAL PRACTICE
IN THE HOSPITAL SETTING**

By DIMELZA OSORIO SÁNCHEZ

**Supervisors: Dr Xavier Bonfill Cosp,
Dr Gerard Urrútia Cuchí and Dr Sergi Bellmunt Montoya**

Barcelona, September 2020

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September 2020

Article-based PhD thesis submitted by Dimelza Osorio Sánchez in partial fulfilment of the requirements for the Degree of Doctor of Methodology of Biomedical Research and Public Health with International Doctoral Research Component by the Universitat Autònoma de Barcelona, supervised by doctors Xavier Bonfill Cosp, Gerard Urrútia Cuchí and Sergi Bellmunt Montoya.

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Conflicts of interest

The author declares that she has no conflicts of interest.

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Try.
Try again.
Try once more.
Try differently.
Try again tomorrow.
Try and ask for help.
Try finding someone who's done it.
Try to fix the problem.
Keep trying until you succeed.

Unknown.

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1. Abstract

1. Abstract

1.1 Abstract (English)

Introduction

Improving the appropriateness of clinical practice refers to the choice of tests, treatments and other interventions that, according to scientific evidence, possess more benefits than risks, a reasonable cost-benefit ratio, and are compatible with the preferences of people and the society. This process includes identifying and eliminating low-value practices and promoting those that are more appropriate.

Objectives

Our objectives are: 1. to describe the initiatives aimed at improving the appropriateness of clinical practice worldwide; 2. to develop methodological resources that assess and improve appropriateness in the hospital setting; and 3. to analyse the perceptions of health professionals about inappropriate or low-value practices and recommendations to reduce them.

Methods

We carried out five studies. To document initiatives to improve the appropriateness of clinical practice, we conducted a literature review. As methodological resources, we developed an open online database for consulting initiatives to improve the appropriateness of clinical practice and other information of interest. We also developed a set of indicators based on systematic reviews to assess appropriateness in two areas of the hospital setting. Finally, in order to achieve our third objective, we carried out two surveys and two focus groups with doctors and nurses.

Results

With the literature review we identified 22 initiatives from 10 countries, including Spain. As of July 2015, these initiatives produced 2,940 outputs in the form of

recommendations and appropriateness analyses mainly from clinical practice guidelines and most commonly from scientific societies. We found great variability in the methodological rigor employed to develop these resources and to guarantee that they draw on the best scientific evidence.

Based on our search results we created the website DianaHealth.com, which includes a database of the initiatives and their associated recommendations and appropriateness analyses.

We obtained 18 indicators applicable on delivery care from 303 systematic reviews (6%) and six indicators on peripheral arterial disease care from 149 reviews (4%).

In the surveys, we found a high agreement among doctors and nurses (83% and 96% respectively) with the recommendations for reducing low-value practices. In both groups, professionals believe that there is good adherence to these guidelines in the hospital (90% and 80%) and consider them useful (70% and 90%).

In the focus groups we identified defensive medicine, bad management of uncertainty and contradictory scientific evidence as the main barriers to reducing low-value practices. As facilitators, positive leadership and teamwork stand out.

Conclusions

The best-known initiatives for improving the appropriateness of clinical practice are those producing recommendations to reduce low-value practices, developed by scientific societies. Despite their important contributions, the lack of a rigorous and standardised methodology for identifying low-value practices or producing recommendations arouses concerns and jeopardises the implementation of their contributions.

Regarding the two methodological resources developed in this thesis work, DianaHealth.com is still active and it is frequently consulted. As for the indicators based on systematic reviews, we found that the number of indicators that could be produced is limited by the lack of solid evidence on low-value practices and their

implementation depends on the degree of detail, as well as the quality of clinical information.

In addition to employing scientific evidence, improving the appropriateness of clinical practice involves other aspects related to the beliefs and attitudes of healthcare professionals, the hospital environment and the dynamics of the healthcare system and society in general. These aspects should be worked on simultaneously and with the same intensity that should be devoted to ensuring that the initiatives are supported by the best scientific evidence available.

1.2 Resum (Català)

Introducció

La millora de l'adequació de la pràctica clínica fa referència a l'elecció de proves diagnòstiques, tractaments i altres prestacions que, segons l'evidència científica, tenen més beneficis que riscos, un balanç cost-benefici raonable i s'ajusten a les preferències de les persones i de la societat. Aquest procés inclou identificar i eliminar pràctiques de poc valor i promoure aquelles de valor.

Objectius

Els objectius d'aquesta tesi són: 1. Documentar les iniciatives destinades a millorar l'adequació de la pràctica clínica en l'àmbit mundial; 2. Desenvolupar recursos metodològics que permetin avaluar i millorar l'adequació en l'entorn hospitalari i 3. Analitzar la percepció dels professionals sobre les pràctiques de poc valor i sobre les recomanacions per a eliminar aquestes pràctiques.

Mètodes

Vam dur a terme cinc estudis. Per a documentar les iniciatives d'interès vam fer una revisió de la literatura. Com a nous recursos metodològics vam crear una base de dades d'accés lliure a internet que permet consultar criteris per a avaluar l'adequació de la pràctica clínica i altres eines per a millorar-la. A més, vam desenvolupar una sèrie d'indicadors basats en revisions sistemàtiques per a avaluar l'adequació en dues àrees de l'entorn hospitalari. Finalment, per a aconseguir el tercer objectiu vam realitzar dues enquestes i dos grups focals amb professionals de medicina i infermeria.

Resultats

Amb la cerca vam identificar 22 iniciatives originàries de 10 països, incloent-hi Espanya. Fins a juliol de 2015, aquestes iniciatives havien generat 2.940 recomanacions i anàlisis d'adequació procedents principalment de guies de pràctica

clínica i majoritàriament de societats científiques. Vam trobar una gran variabilitat en el rigor metodològic per a desenvolupar aquests recursos i garantir que estiguessin basats en la millor evidència científica disponible.

A partir d'aquests resultats vam crear el lloc web Dianasalud.com, que inclou una base de dades amb aquestes iniciatives i les seves recomanacions i anàlisis d'adequació.

Vam obtenir 18 indicadors aplicables en l'àmbit de l'atenció del part a partir de 303 revisions sistemàtiques (6%) i sis indicadors procedents de 149 revisions (4%) en l'atenció de la malaltia arterial perifèrica.

En les enquestes vam trobar un alt grau d'acord amb les recomanacions per a reduir pràctiques de poc valor entre professionals de medicina i infermeria (83% i 96%, respectivament). Aquests creuen que hi ha una bona adherència a aquestes recomanacions a l'hospital (90% i 80%) i les consideren útils (70% i 90%).

En els grups focals vam identificar com a principals barreres per a reduir pràctiques de poc valor la medicina defensiva, la mala gestió de la incertesa i l'evidència científica contradictòria. Com a facilitadors destaquen el lideratge positiu i el treball en equip.

Conclusions

Les iniciatives més conegudes són aquelles que han produït recomanacions per a eliminar pràctiques de poc valor, provinents de societats científiques. Malgrat les seves importants contribucions, la falta d'una metodologia rigorosa i estandarditzada per a identificar pràctiques de poc valor o generar recomanacions desperta inquietuds i limita la seva implementació.

Respecte als dos recursos metodològics desenvolupats, el lloc web continua actiu i és consultat sovint. Quant als indicadors, vam observar que la quantitat que se'n podrien formular està limitada per la falta d'evidència sòlida sobre pràctiques de poc valor i que la seva implementació depèn del grau de detall i la qualitat de la codificació de la informació clínica.

A més de l'evidència científica, la millora de l'adequació de la pràctica clínica implica altres aspectes relacionats amb les creences i actituds dels professionals sanitaris, l'entorn hospitalari i la dinàmica del sistema sanitari i de la societat en general. Aquests aspectes s'han de treballar simultàniament i amb la mateixa intensitat amb la qual es busca assegurar que les iniciatives es basen en la millor evidència científica disponible.

1.3 Resumen (Español)

Introducción

La mejora de la adecuación de la práctica clínica hace referencia a la elección de pruebas diagnósticas, tratamientos y demás prestaciones que, según la evidencia científica, tienen más beneficios que riesgos, un balance coste-beneficio razonable y se ajustan a las preferencias de las personas y la sociedad. Este proceso incluye identificar y eliminar prácticas de poco valor y promover aquellas de valor.

Objetivos

Los objetivos de esta tesis son: 1. Documentar las iniciativas destinadas a mejorar la adecuación de la práctica clínica a nivel mundial; 2. Desarrollar recursos metodológicos que permitan evaluar y mejorar la adecuación a nivel hospitalario y 3. Analizar la percepción de los profesionales sobre las prácticas de poco valor y sobre recomendaciones para eliminarlas.

Métodos

Llevamos a cabo cinco estudios. Para documentar las iniciativas de interés hicimos una revisión de la literatura. Como nuevos recursos metodológicos creamos una base de datos de acceso libre en internet que permite consultar iniciativas para la mejora de la adecuación de la práctica clínica e información de interés. Además, desarrollamos una serie de indicadores basados en revisiones sistemáticas para evaluar la adecuación en dos áreas del entorno hospitalario. Finalmente, para lograr nuestro tercer objetivo realizamos dos encuestas y dos grupos focales con profesionales de medicina y enfermería.

Resultados

Con la búsqueda identificamos 22 iniciativas originarias de 10 países, incluyendo España. Hasta julio de 2015, dichas iniciativas habían generado 2940 entre recomendaciones y análisis de adecuación procedentes principalmente de guías de práctica clínica y mayoritariamente de sociedades científicas. Encontramos una gran variabilidad en el rigor metodológico para desarrollar estos recursos y garantizar sus bases en la mejor evidencia científica disponible.

A partir de éstos resultados creamos la página web DianaSalud.com que incluye una base de datos con dichas iniciativas y sus recomendaciones y análisis de adecuación.

Obtuvimos 18 indicadores aplicables en la atención del parto a partir de 303 revisiones sistemáticas (6%) y seis indicadores a partir de 149 revisiones (4%) en la atención de la enfermedad arterial periférica.

En las encuestas encontramos un alto grado de acuerdo con las recomendaciones para reducir prácticas de poco valor entre profesionales de medicina y enfermería (83% y 96% respectivamente), quienes creen que hay una buena adherencia a dichas recomendaciones en el hospital (90% y 80%) y las consideran útiles (70% y 90%).

En los grupos focales identificamos como principales barreras para reducir prácticas de poco valor la medicina defensiva, la mala gestión de la incertidumbre y evidencia científica contradictoria. Como facilitadores destacan el liderazgo positivo y el trabajo en equipo.

Conclusiones

Las iniciativas más conocidas son aquellas que han producido recomendaciones para eliminar prácticas de poco valor, provenientes de sociedades científicas. Pese a sus importantes contribuciones, la falta de una metodología rigurosa y estandarizada para identificar prácticas de poco valor o generar recomendaciones despierta inquietudes y limita su implementación.

Con respecto a los dos recursos metodológicos desarrollados, la página web continúa activa y es frecuentemente consultada. En cuanto a los indicadores, observamos que la cantidad que podrían formularse está limitada por la falta de evidencia sólida sobre prácticas de poco valor y que su implementación depende del grado de detalle y la calidad de la información clínica.

Además de la evidencia científica, la mejora de la adecuación de la práctica clínica implica otros aspectos relacionados con las creencias y actitudes de los profesionales sanitarios, el entorno hospitalario y la dinámica del sistema sanitario y de la sociedad

en general. Estos aspectos deben trabajarse simultáneamente y con la misma intensidad con la que se busca asegurar que las iniciativas se basan en la mejor evidencia científica disponible.

2. Introduction

2. Introduction

In the following sections we will explain the following: 1. the definition of appropriateness and other related concepts; 2. the criteria and methods employed to determine the appropriateness of a certain practice; 3. some statistics on appropriateness; 4. possible causes of inappropriate clinical practice; 5. possible consequences of inappropriate clinical practice; 6. how we define initiatives to improve the appropriateness of clinical practice in the context of this project; and 7. the reasons for carrying out this thesis project.

2.1 Appropriateness definitions and related concepts

The World Health Organization (WHO) defines **appropriateness** of clinical practice as care that is “effective (based on valid evidence); efficient (cost-effectiveness); and consistent with the ethical principles and preferences of the relevant individual, community or society” (1).

Regarding effectiveness, the WHO stresses that to consider a certain practice as appropriate; it must always carry more benefits than risks. This risk-benefit analysis must be based on scientific evidence that: 1. analyses relevant outcomes, after comparing the intervention with other alternatives or with no intervention; 2. considers the magnitude of the effect and 3. describes the characteristics of the population or individuals to which it is applied.

In terms of efficiency, the WHO defines it as the effectiveness per unit of cost, and points out that this domain should be considered last compared to the others. Finally, regarding ethical principles and preferences, the WHO uses as an example those that Sweden has prioritised for decision-making at the policy level: human dignity (equity), need and solidarity and cost-efficiency (2).

The WHO recognises that the concept of appropriateness is complex, because it has several dimensions; the priority given to each dimension, (effectiveness, efficiency, principles and preferences), may vary between populations. Furthermore, the WHO explains that determining appropriateness entails an implicit judgment that can vary

according to the decision-making level: healthcare, healthcare policies or in the context of scientific research (1). This judgment draws together clinical, public health, economic, social, ethical and legal considerations. Therefore, it is important to consider who makes the judgment, on what evidence they do so, and how the decision-making process has been carried out.

On the other hand, the RAND Corporation, a recognised research and development institution from the United States, defines a medical intervention as appropriate when “the expected health benefit exceeds the expected negative consequences by a sufficiently wide margin that the procedure is worth doing” (3). This second definition, unlike the WHO definition, is based only on the risk-benefit analysis.

The Canadian Medical Association provides the following definition of appropriateness in health care: “the right care, provided by the right providers, to the right patient, in the right place, at the right time, resulting in optimal quality care”. The authors highlight five key components of this definition: 1. the right care is based on clinical evidence of effectiveness and efficacy, including use and failure to use; 2. the right provider refers to an appropriate scope where the provider does not exceed the skills and knowledge pertaining to their level; 3. the right patient means that care options should match the individual characteristics and preferences of the person, reconciling patient and health professional perceptions; 4. the right place refers to some setting being more appropriate than others in terms of safety and efficiency for the provision of a certain care; and 5. the right time indicates that proper care is provided in a timely manner (4).

Robertson-Preidler et al. conducted a literature review to describe how the concept of appropriate care is defined in the literature, and how it is used in scientific articles (5). They concluded that, although the concept of appropriate care varies between authors, there are five elements that are common: evidence-based care, clinical experience, patient-centred care, the use of resources, and equity.

Appropriateness is a fundamental element in the definition of **healthcare quality**. Since its early definitions, healthcare quality includes the risk-benefit analysis. For instance, in the 80’s, Avedis Donabedian’s definition was: “Quality of care is that kind

of care which is expected to maximise an inclusive measure of patient welfare after one has taken account of the balance of expected gains and losses that attend the process of care in all its parts” (6). Nowadays, the definition of healthcare quality includes several domains besides the effectiveness and safety already included in the definition of appropriateness, such as equity, access and satisfaction or acceptability (7).

The opposite of appropriateness is **inappropriateness** which refers to clinical practices that are either unnecessary, or that possess a negative risk-benefit or cost-benefit analysis.

A widely used concept, closely related to appropriateness, is **value in health care**. The definition of value in health care is controversial though, depending on whether the element “cost” is included or not (8). For those including it, value is defined as the outcome obtained (numerator) per monetary unit invested (denominator) (9–11). They argue that excluding the element “cost” from the definition of value turns it into the definition of *effectiveness*; therefore it is mandatory to include it (10).

Thus, **low-value practices** are those in which little benefit is obtained at a high cost, or those involving high spending without improving health outcomes (12). The lower the benefit, the lower the value is (13). Some authors even argue that ineffective or harmful practices should be considered worthless, rather than low-value (10,14). However, some authors use the term low-value practices in a purely clinical context, without considering the monetary value of the intervention, referring to ineffective or harmful clinical practices (15,16).

The UK National Institute for Health and Care Excellence (NICE) introduced the concept of “low-value activities” in 1999 in the context of the National Health Service, referring to practices that “are not clinically effective (and therefore not cost effective), have a poor risk-benefit profile, or are not supported by adequate evidence.” (17) However, some reports issued by institutions linked to the National Health Service expand the definition of low-value practices, including also costs; in this way they define as low-value care: 1. effective procedures where cost-effective alternatives should be tried first; 2. effective interventions with a close benefit or risk analysis in

mild cases; 3. potentially cosmetic interventions; 4. relatively ineffective procedures; and 5. cancelled scheduled procedures (18).

Taking up the Canadian Medical Association's definition of appropriateness, it points out that the "correct cost" is a consequence of providing appropriate care, being a result rather than an input. In other words, if the five components in their definition are met, high-quality care would have been provided, with an appropriate use of resources, and a correct cost. However, it should be noted that the correct cost is not necessarily the accessible cost (4).

In the same way, Lavis et al. point out that there are two types of appropriateness: appropriateness of a service and appropriateness of the setting in which care is provided (19). In this way, the former is defined by its effectiveness for a particular patient, with specific signs and symptoms. The second refers to the cost-effectiveness of a given intervention, in a given context, and with certain resources.

Some authors use the term "inappropriate practices" instead of "practices of low-value". J.R Repullo (20), based on a critique of inappropriateness in intensive care units made by B. Jennett in 1984 (21), and on Pablo Lázaro's work on appropriateness (22), defined inappropriate practices as those that are 1. ineffective, when they have little or no value, for example, the use of statins in the primary prevention of coronary heart disease; 2. unsafe, when the risks outweigh the benefits, such as long term hormone replacement therapy; 3. unnecessary, when there are simpler alternatives, such as caesarean delivery when there is no clear obstetric indication; 4. useless, when they do not add value to the patient, such as dysthanasia measures in terminally ill patients; 5. inclement, when they diminish the quality of life, such as teratogenic interventions; or 6. unwise, when they have a disproportionate cost such as some biologics treatments that demonstrate poor effectiveness.

Inappropriateness in clinical practice has led to other concepts commonly found in the literature and described below, such as overuse, underuse, and misuse.

The WHO defines **overuse** as the use of an intervention without a proven benefit or that is not cost-effective (1). The Institute of Medicine (IOM) of the United States

defines it as “when a health care service is provided under circumstances in which its potential for harm exceeds the possible benefit” (23). Perhaps a nuance that is missing in these two definitions is that overuse may also happen when an intervention is used in situations beyond those in which it has demonstrated efficacy or effectiveness.

Other related concepts commonly used in the literature are the overuse of diagnostic tests (overtesting and overdiagnosis) or treatments (overtreatment).

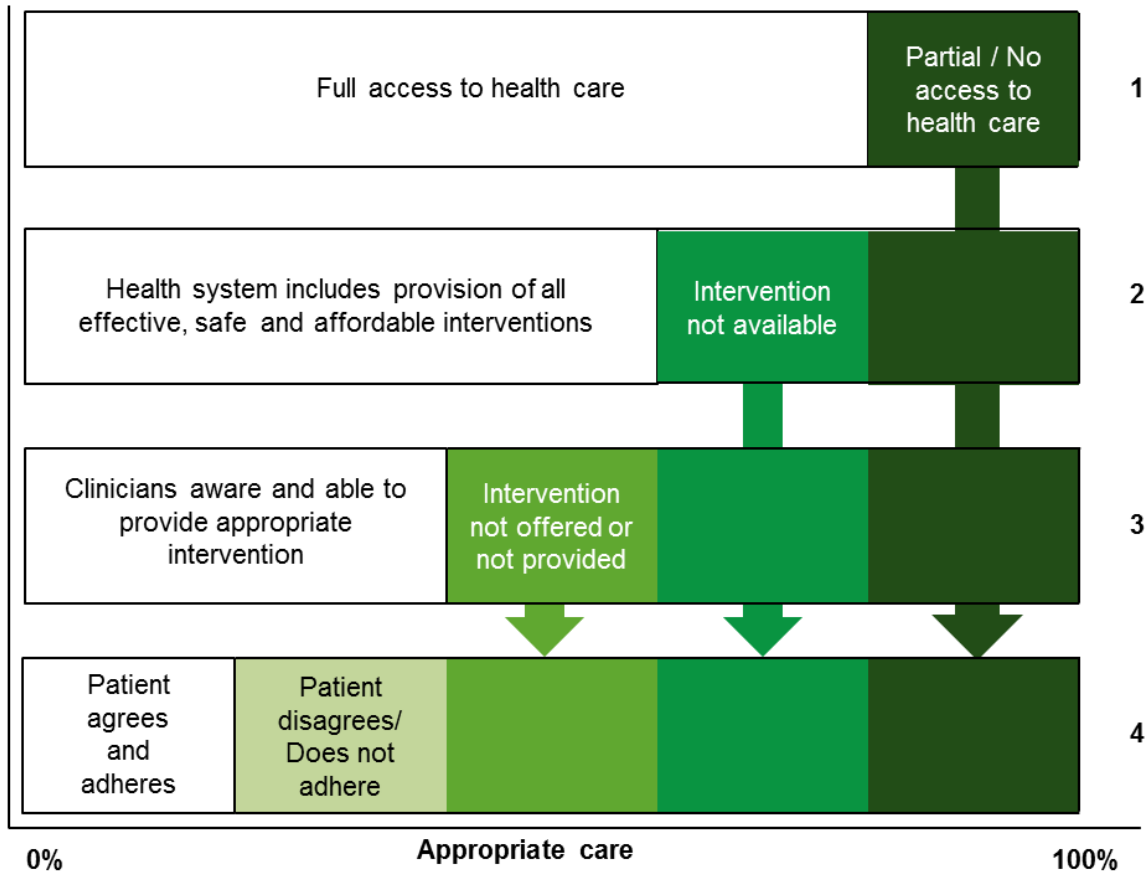
Overtesting refers more to the overutilisation of diagnostic tests, while the concept of **overdiagnosis** refers more to an unwanted effect of diagnostic tests in which abnormalities that do not generate symptoms or are indolent in the patient are detected, or that are related to non-progressive or regressive symptoms, and that in the absence of treatment will not reduce quality of life or survival (24). It is important to differentiate overdiagnosis from diagnostic test errors, i.e. false positives, false negatives or artefacts. In the case of overdiagnosis, the test correctly detects an abnormality, however, it does not affect the patient's health (25). Overtesting may end as overdiagnosis, but not always (24).

Another form of overdiagnosis is when the definition of a certain disease is broadened, making people who were previously considered healthy to be considered sick (26). The main problem of overdiagnosis comes when it is decided to give a treatment in consequence. This circumstance, in which an anomaly that does not affect the patient's survival or quality of life is treated, is considered a form of **overtreatment** (12,27,28). Another form of overtreatment is when a certain drug or therapy is used in futile situations, such as the use of antibiotics for the common cold (29,30) or when the risk exceeds the benefit, such as the use of antihypertensive drugs in frail older patients (31).

Underuse is defined as the disuse of an intervention that may improve the quality of life or survival, which is acceptable, and that the patient would have wanted. Glasziou et al. (32) propose that the cause of underuse be classified according to the point at which it occurs within patient care (Figure 1): 1. lack of access to health services, totally or partially, either because of a lack of coverage of the system or because of a lack of accessibility (inability to go or to afford it); 2. the health system cannot provide

the intervention, generally due to lack of resources; 3. health professionals do not provide the service when it is available (due to lack of evidence, competitive therapies promoted by commercial interests, lack of confidence or technical skills, insufficient time or provider convenience) and 4. lack of patient's adherence to interventions that are available and provided by the system.

Figure 1. Points in the healthcare process where underuse may appear.



Based on Glasziou P, Straus S, Brownlee S, Trevena L, Dans L, Guyatt G, et al. Evidence for underuse of effective medical services around the world. *Lancet*. 2017 Jul;390(10090):169–77(32).

Taking up the concept of value in health care explained before, and applying the equation including the cost of the intervention, any action to reduce overuse would have a great impact, increasing the value of clinical practice. However, those actions intended to reduce underuse would not change the result in terms of value. This is because the increasing use of the intervention would increase both the outcomes (numerator) and the costs (denominator); therefore, the result, in this case, the value, would remain unmodified (23).

A good example to explain the concept of inappropriateness, either due to overuse or underuse, is the cervical cancer screening, which is underused in some low-income countries and overused in high-income countries, such as in the United States (32).

Finally, the term **misuse** refers to circumstances where interventions with a negative net benefit are performed (1). Later, in sections 2.4 and 2.5 we will explain the causes and consequences of inappropriateness.

2.2 Appropriateness criteria

The categorisation of a certain practice as inappropriate requires a reliable definition of when it is appropriate (33). The definition is provided by the best evidence available, as indicated in the definitions of appropriateness set out above. The best available evidence comes from valid scientific studies that can demonstrate the efficacy and safety of a particular benefit. Systematic reviews of randomised clinical trials, and well-designed randomised clinical trials themselves are the most reliable source, because they assess the efficacy of the intervention against a control group, minimising the risk of bias (34).

However, clinical trials may have some limitations on their capacity to reflect the effectiveness of a given intervention in routine clinical practice, including highly selected groups of subjects, not measuring relevant outcomes for patients or society (35), and publication bias of negative results on the efficacy and safety of health interventions (36).

Good quality systematic reviews are hierarchically superior to clinical trials as a source of evidence as they may indicate some of the limitations of individual studies (37). Systematic reviews achieve this by analysing and contrasting a set of individual studies, rating their methodological quality, and, in the case of those reviews that include a meta-analysis, surpassing the statistical power of individual studies through the combination of the numerical results from several studies (38). Cochrane systematic reviews are widely recognised for their methodological rigor and for

incorporating the analysis of the effects of health interventions through relevant outcomes for patients using the GRADE system (39).

A common source for the scientific evidence widely used by health professionals are clinical practice guidelines. These documents are useful for decision-making because they provide clinical recommendations on which interventions are the most appropriate according to the characteristics of the patient (40). In evidence based guidelines the clinical recommendations are built based on scientific studies, considering the benefits and risks of health interventions, either for the screening, diagnosis or treatment of a certain health problem (41).

In the 1980s, the RAND Corporation developed the Appropriateness Method®. This method defines a set of criteria establishing the circumstances in which a certain practice is more or less appropriate (3). They are based mostly on expert consensus, after a literature review.

In the Appropriateness Method®, first, an exhaustive review of the literature is carried out, synthesising the most recent evidence on the intervention in question (diagnostic test, treatment, etc.). Simultaneously, a list of specific clinical scenarios or indications is defined, indicating which patients could receive the intervention in terms of their symptoms, history and the results of preliminary relevant diagnostic tests. Both the synthesis of the evidence and the list of indications are sent to a panel of experts. For each indication, each expert assesses the benefits and risks of the intervention using a scale from 1 to 9, where 1 means that the expected damages outweigh the expected benefits, and 9 means that the expected benefits exceed the expected damages. This process is repeated in two rounds, one at the individual level and the other in a plenary of the panel of experts (3,42).

Table 1 shows an example of the appropriateness criteria proposed by the American College of Radiology for diagnostic imaging in hip dysplasia in children, applying the Appropriateness Method® (43). In this example, six different clinical variants are considered, depending on the age of the child and the findings of the initial physical examination. Following the method, it is defined that ultrasound or hip radiography are considered inappropriate in children younger than 4 weeks of age with suspected

dysplasia or risk factors. Between 4 weeks and 4 months of age, an ultrasound would be appropriate. Radiography, on the other hand, would be appropriate between 4 and 6 months of age.

Table 1. American College of Radiology ACR Appropriateness Criteria® for diagnostic images (ultrasound, radiography, tomography, and magnetic resonance imaging of the pelvis) on developmental dysplasia of the hip in child (six clinical variants).

	Variant	Procedure	Appropriateness Category	Relative Radiation Level
1	Child, younger than 4 weeks of age. Equivocal physical examination or risk factors for DDH. Initial imaging	US hips	Usually Not Appropriate	○
		Radiography pelvis	Usually Not Appropriate	☼☼
2	Child, between 4 weeks to 4 months of age. Equivocal physical examination or risk factors for DDH. Initial imaging	US hips	Usually Appropriate	○
		Radiography pelvis	Usually Not Appropriate	☼☼
3	Child, younger than 4 months of age. Physical findings of DDH. Initial imaging	US hips	Usually Appropriate	○
		Radiography pelvis	Usually Not Appropriate	☼☼
4	Child, between 4 to 6 months of age. Concern for DDH. Initial imaging	Radiography pelvis	Usually Appropriate	☼☼
		US hips	May Be Appropriate	○
5	Child, older than 6 months of age. Concern for DDH. Initial imaging	Radiography pelvis	Usually Appropriate	☼☼
		US hips	Usually Not Appropriate	○
6	Child, younger than 6 months of age. Known diagnosis of DDH, nonoperative surveillance imaging in harness.	US hips	Usually Appropriate	○
		Radiography pelvis	Usually Not Appropriate	☼☼
		CT pelvis with IV contrast	Usually Not Appropriate	☼☼☼☼
		CT pelvis without and with IV contrast	Usually Not Appropriate	☼☼☼☼
		CT pelvis without IV contrast	Usually Not Appropriate	☼☼☼☼
		MRI pelvis without and with IV contrast	Usually Not Appropriate	○
		MRI pelvis without IV contrast	Usually Not Appropriate	○

Based on ACR Appropriateness Criteria® Developmental Dysplasia of the Hip-Child (43). US: ultrasound; CT: computed tomography

As is shown in this example, the appropriateness of a certain intervention depends on the context and characteristics of the patient (19). A given diagnostic test or treatment may be effective in one patient, but ineffective in another. The need for detailed information may be a limitation for establishing and quantifying the appropriateness of clinical practice (18).

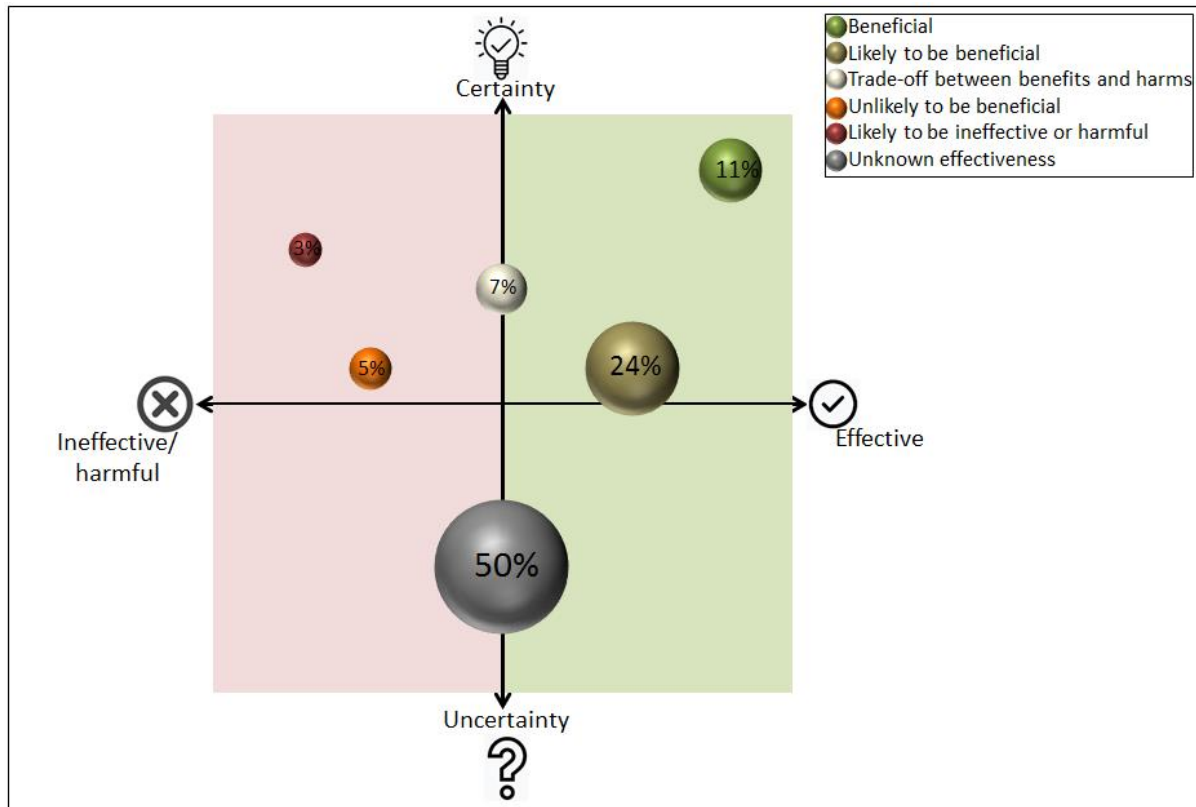
Unlike clinical practice guidelines, the appropriateness criteria based on the RAND method are documents with a much narrower scope, since they focus on the indications of a certain intervention. Furthermore, they do not start from clinical questions as clinical guidelines, the evaluation rounds are not intended to reach an expert consensus, they do not always consider cost-effectiveness, and they do not involve patients in the process or prioritise their values and preferences.

2.3 Prevalence of inappropriateness

Direct measurement of the prevalence of inappropriateness is not easy given the high detail of information required about the circumstances in which a given intervention is used. Such a high degree of detail is usually not available, and even if it is available, its collection is not automated (44), making the process complex and time-consuming (4).

In spite of these difficulties, some literature reviews and the measurement of variability of clinical practice are indirect ways of exploring the inappropriateness that have revealed the dimension of the problem. For example, the Clinical Evidence team of the United Kingdom National Health Service used to systematically and periodically examine the proportion of commonly used treatments that are supported by high-quality evidence and those that are not. In their last report, from 2013, they concluded that, among 3,000 treatments analysed, 50% were not supported by controlled trials and were classified as of “unknown effectiveness”. Also, only 11% were classified as “beneficial”. The rest were classified either as “likely to be beneficial” (24%), “trade-off between benefits and harms” (7%), “unlikely to be beneficial” (5%), or “likely to be ineffective or harmful” (3%) (Figure 2) (45).

Figure 2. Proportion of commonly used treatments that are supported by high-quality evidence in the United Kingdom National Health Service



Based on Attia A. Adaptation of international evidence based clinical practice guidelines: The ADAPTE process. Middle East Fertil Soc J [Internet]. 2013 Jun 1 [cited 2020 Jan 3];18(2):123–6. (46).

The difficulty of direct and accurate measurement of appropriateness is explained through the following example. It is appropriate to use diagnostic images in low back pain when the patient has red flags (warning signs/symptoms), and inappropriate in their absence. The red flags are: history of cancer, fracture or suspected fracture, progressive neurological symptoms or infection, osteopenia, osteoporosis or axial spondylarthrosis. In order to determine the prevalence of the inappropriate use of diagnostic images in low back pain, it would be necessary to verify in each case the presence or absence of these red flags.

Due to the degree of detail necessary to establish whether a certain practice has been properly applied or not, the vast majority of appropriateness studies are based on the review of medical records, and therefore, draw on a limited amount of observations. Nowadays, there are not enough tools to carry out large-scale automatic and precise exploitation of the appropriateness (15,27).

Here are some examples and statistics of inappropriateness. One of these is the overuse of antibiotics, a public health problem that implies serious consequences in the form of antimicrobial resistance. In a study in the United Kingdom, the authors analysed the treatments of 568 medical consultations with a diagnosis of respiratory tract infections, finding that, on average, 54% of them were prescribed an antibiotic. An antibiotic was prescribed in 38% of consultations for “colds and upper respiratory tract infections”, in 48% for “cough and bronchitis”, in 60% for “sore throat”, in 60% for “otitis”, and in 91% for “rhino-sinusitis” (29). There are many similar studies that have documented the inappropriateness of the use of antibiotics (47–49).

The following two examples of inappropriateness come from the hospital setting. The first is related to the overuse of percutaneous coronary interventions. This has been documented in several countries; for example, in the United States its prevalence ranges from 4–12%, 10–14% in Germany, 16% in Italy, 22% in Israel and 4% in South Korea (27). A study carried out in Spain evaluated the appropriateness of this intervention, finding an inappropriate use of 22% (50). In these cases of inappropriateness, the patient presents a greater risk derived from the procedure than from his or her health problem.

The second example is about the diagnosis and treatment of pulmonary embolism. Wiener et al. conducted a time trend study to analyse the impact of the computed tomographic pulmonary angiography (CTPA) on the incidence, mortality, and complications of pulmonary embolism treatment in the United States (51). They analysed the age-adjusted data of adults admitted before (1993–1998) and after (1998–2006) the introduction of CTPA, using the national databases of mortality and hospitalisation. As complications, they analysed gastrointestinal bleeding, intracranial bleeding, and secondary thrombocytopenia (e.g., drug-induced).

The researchers identified that the incidence of pulmonary embolism increased substantially (81%) after the introduction of CTPA. Mortality decreased during both periods. However, it decreased more before CTPA (8%) than after (3%). In addition, CTPA was associated with an increase in suspected anticoagulation complications for the treatment of pulmonary embolism: before CTPA the complication rate was stable, but after CTPA it increased by 71%. The authors of the study concluded that the

introduction of CTPA has shown a clear pattern of overdiagnosis and overtreatment since there has been a significant increase in incidence without showing significant changes in mortality and with a significant increase in complications. Reduction in mortality rates before CTPA was attributed to improved prevention and treatment rather than a better diagnosis. CTPA enables the diagnosis of more and smaller emboli, where many of them may be clinically irrelevant, since they do not produce symptoms or death (52).

Regarding underuse, there are several examples of its different forms; for instance, the lack of access to health services (32). This is a problem in both low-income and high-income countries. In high-income countries underuse has been documented to range from as low as 4% (in the United Kingdom) up to 37% (United States) (53). In low-income countries data is scarcer (32).

Underuse in the form of a non-provision of interventions available in the health system is commonly seen as a lack of adherence to recommendations from evidence-based clinical practice guidelines. Lack of adherence to scientific evidence is a fact that has been widely demonstrated, such as the underuse of anticoagulation in patients with non-valvular atrial fibrillation (54). Another example that has been consistently reported in the literature is the use of corticosteroids to reduce morbidity and mortality in preterm births. The first clinical trial showing the efficacy of corticosteroids in reducing the risk of respiratory distress syndrome, intraventricular haemorrhage, and neonatal death was published in 1972. (55). However, in a global survey conducted by the WHO in 2011, it was shown that only 52% of women with threatened premature delivery had received corticosteroids (56).

In the case of underuse due to lack of adherence of patients to pharmacological and non-pharmacological measures, a good example is the secondary prevention of myocardial infarction. A cohort study in the United States showed a low adherence to secondary drug prevention 12 months after discharge: 66% of patients were taking β -blockers, 63% were taking angiotensin-converting enzyme (ACE) or angiotensin (ARA) inhibitors, and 66% took statins (57).

In Spain, multiple studies have been carried out on the appropriateness of clinical practice (48,58–64); most of them have been carried out in a single centre, based on the review of medical records or on prescriptions registers or databases. For example, Granero-Melcon et al. analysed the prevalence and appropriateness of proton pump inhibitor (PPI) prescription at the Emergency Department of the Hospital Universitario de la Princesa in Madrid (58) through a retrospective case series study. They found that prior to their hospital visit only 20.2% of patients had a correct indication and dose, and that 2.9% of the patients had an indication for PPI treatment but it was not prescribed. At discharge, only 28.2% of them had the correct indication and dose, while in 5.7% of cases the PPIs were not prescribed, although doing so was justified.

Another Spanish study on appropriateness is the study by Gómez-García et al. They analysed the appropriateness of the knee magnetic resonance imaging in primary care centres in Elche, Autonomous Community of Valencia (59) by retrospectively reviewing the requests and medical records of patients who underwent an MRI for pain. The study concluded that 45% (41–49%) of applications were inappropriate, in many cases (82%) because it was used as the initial test.

A third example of Spanish studies was published recently by Croche et al. They assessed the prescription of antibiotics in the Emergency Department at the Hospital de la Merced Osuna, in Seville (48) from medical charts of a sample of 104 cases and found that the treatment was considered inappropriate in 51.9% of these cases. Unnecessary treatment was prescribed in 40.7%; the choice of antimicrobial was incorrect in 35.2% and the dosage in 24.1%. The main diseases in which inappropriate prescription occurred were: acute otitis media, wheezing, fever without focus, acute pharyngotonsillitis, and community-acquired pneumonia.

Given the difficulty of measuring inappropriateness directly, there is the possibility of measuring it indirectly, through the analysis of **variability** in clinical practice, which is the analysis of the frequency of use of a given intervention across different geographical areas, or different institutions within the same area, or among different health professionals within the same institution (27).

Variability in the use of health interventions may simply be due to differences in the availability of resources, that is, the number of doctors or beds, or differences in the socio-demographic characteristics of the population. It may, however, also be due to differences in the criteria informing the use of the intervention, or the degree of uncertainty among healthcare professionals (65,66). This last source of variability is the one that is interesting with regard to appropriateness. Unjustified variability, therefore, is present when there is a variation in the frequency of use of a health intervention between two groups that is not explained by the availability of resources, or by the sex or age of the population, or by chance. It may reflect a possible overuse or underuse of health interventions (27,65).

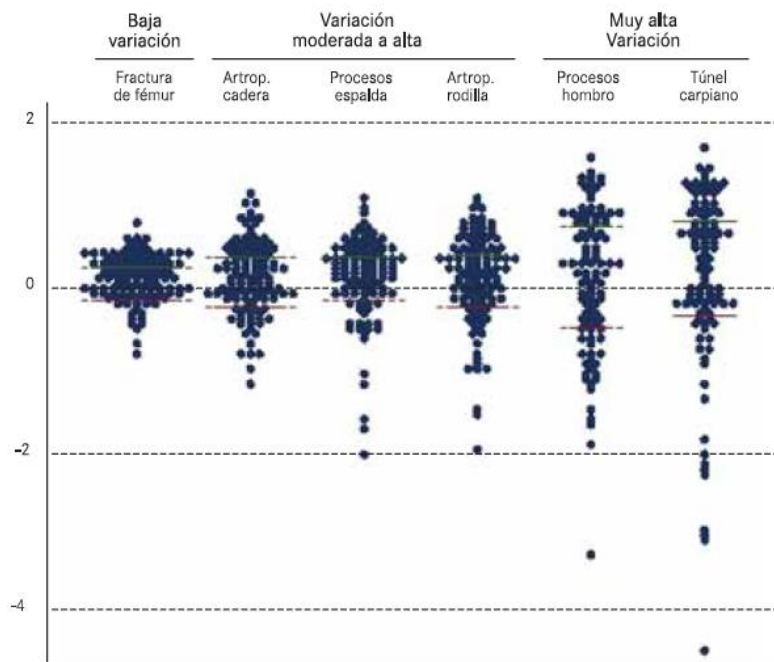
Variability in clinical practice has been documented in thousands of studies since the 1970s (67). More recently, systematic data collection has allowed for the development of variability atlases. These documents are graphic representations of the use of medical interventions according to geographic territories. The best-known are the atlases of the Institute of Clinical Evaluative Science of Ontario (68) and the Dartmouth Atlas (69), from Canada and the United States, respectively. In Spain, there is the Atlas of Variations in Medical Practice of the National Health System, coordinated by the Health Services and Policies Research Unit of the Aragonese Institute of Health Sciences and the Health Services Research Department of the Foundation for the Promotion of Health and Biomedical Research of Valencia Region (66); 17 autonomous communities participate, including Catalonia (70).

Variability atlases analyse several health interventions; for example, the number of visits to acute care hospitals, the use of diagnostic tests or surgeries, or the prescription of drugs. Variability is quantified through different statistics that compare the ratio between areas or populations with the highest and the lowest frequency of use of health interventions.

For example, in the atlas of variations in Orthopaedic Surgery and Traumatology in the Spanish National Health System 2005 (71), it is documented that the femur fracture is one of the procedures that presents the least variability, since its frequency was 2.4 times more in the health area in the 95th percentile of procedure rate, compared to that in the 5th percentile. In contrast, carpal tunnel surgery shows the

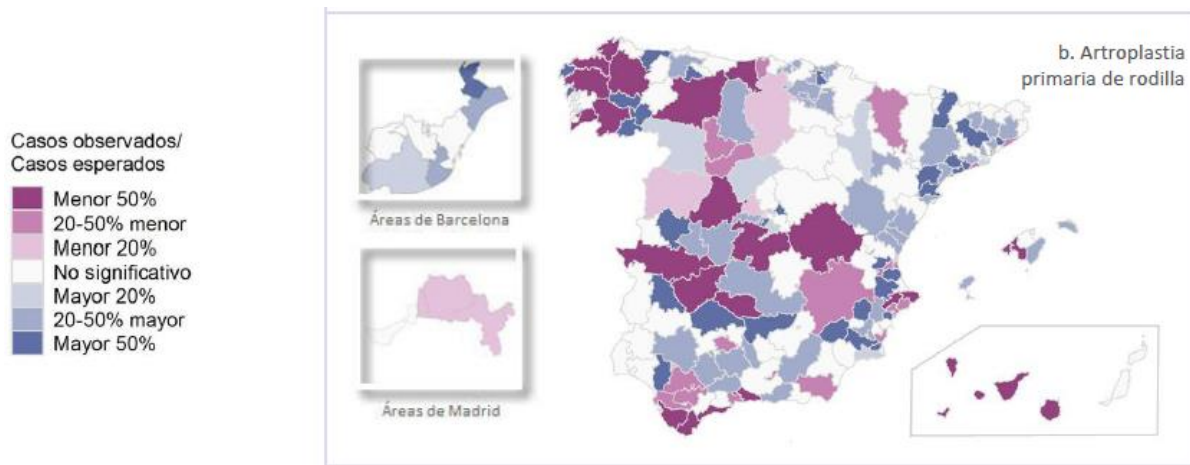
greatest variability, since it represented 62 times more interventions in the 95th percentile area compared to the 5th percentile area. Variability can be represented graphically, either by frequency of use (Figure 3) or by its geographical distribution (Figure 4).

Figure 3. Variability of orthopaedic surgery and traumatology procedures of 2002 in the Spanish National Health System: rates of procedures (logarithmic scale) ordered from the least variable process (femur fracture) to the most variable (carpal tunnel).



Each point represents one of the health areas included in the Atlas. Taken from the Atlas of variations in medical practice: variations in orthopaedic surgery and traumatology in the National Health System of 2005 (71).

Figure 4. Age- and sex-standardised ratio of use of primary knee arthroplasty in the 203 health areas of the Spanish National Health System in 2012.



The range of pink colours represents health areas with expected arthroplasty rates significantly lower than the 203 average. sanitary areas, while the blue range indicates areas with significantly higher rates. The blank areas do not present significant differences with respect to the expected mean for the set of areas. Taken from the Atlas of variations in orthopaedic and trauma surgery in the 2017 National Health System (72).

The variability atlases have shown that there are health interventions with low and high variability. Those with low variability are usually those in which there is broad clinical agreement and that coincide with in “dichotomous” situations; for example, whether or not there is a fracture, or whether or not appendicitis exists. In these situations, it is common for patients’ preferences to coincide with the decisions of healthcare professionals. In contrast, health interventions with high variability are usually those in which there is a severity gradient; for example, osteoarthritis of the hip, in which the clinical spectrum can range from mild pain with a low impact on patients’ functionality and severe pain with great effect on patients’ quality of life (71).

Health interventions with high variability can be a reflection of problems in medical decision-making for various reasons: 1. uncertainty regarding the value of a given intervention, due to lack of scientific evidence of its efficacy, risk-benefit or cost-effectiveness; 2. lack of knowledge of existing scientific evidence or 3. inability to explore and attend to patient preferences (71).

Despite the fact that variability analyses could suggest inappropriateness, these studies do not make it possible to rate clinical practice as appropriate or inappropriate. A geographical area with a high frequency of use of a certain intervention may have a high proportion of appropriateness. Thus, variability studies should be interpreted with

caution (73). Notwithstanding, if the appropriateness criteria of a certain intervention are known in advance, the analysis of variability will be useful for establishing the areas in which there is a possible overuse.

2.4 Causes of inappropriateness

Regarding the causes or conditioning factors of inappropriateness, for years it was argued that it was promoted by the pay-per-activity financing systems that stimulate quantity but not quality of care. However, when comparing countries with high rates of payment by activity, such as the United States, with countries with lower rates, such as Canada or the United Kingdom, the prevalence of low-value practices are similar (74).

Other possible causes could include the lack of conclusive scientific evidence demonstrating the efficacy of diagnostic tests and treatments (45) or the lack of knowledge of the existing evidence (75) or a misinterpretation of it (76).

In addition to this, other causes more inherent to professionals' behaviour have been described, such as defensive medicine, when health professionals overuse diagnostic tests to avoid losing any diagnosis beyond anamnesis and physical examination. Other causes, with the same aetiology, could be conflicts of interest or reaction to pressure from patients or industry (77).

In the case of underuse, some of the causes may be the lack of adherence of professionals to scientific evidence or of patients to the indications of health professionals. However, it is necessary to analyse and quantify the extent to which underuse is due to a lack of adherence or simply due to patients' values and preferences. For example, Alonso-Coello et al. (78) analysed the increased maximum risk of bleeding (threshold risk) that people would tolerate to achieve a reduction of three strokes in 100 patients with atrial fibrillation, finding that the median threshold risk for both patients and clinicians was of 10 additional bleeds, but with wider variability between patients and clinicians (patient range 0–100, physician range 0–

50): one group of patients and physicians would tolerate less than 10 bleeds and another group of patients, but not the doctors, would accept more than 35.

2.5 Consequences of inappropriateness

Inappropriateness has several negative consequences (12). The most important is the physical or emotional damage it may cause to patients, both directly and indirectly.

In the case of diagnostic tests, for example, an inappropriate use may lead to multiple damages. For instance, some tests can produce direct physical damage due to unnecessary exposure to radiation or contrast media and also cause emotional damage due to the anxiety generated by detecting an abnormality that does not involve a disease or that has no implications for survival or quality of life. Furthermore, a diagnostic test carried out in an inappropriate context may produce indirect damage if its results lead unnecessarily to other tests that may cause harm (79,80). Finally, overdiagnosis can lead to unnecessary treatments, which in turn can lead to other problems.

An example of overtreatment that has been considered as potentially very harmful in the elderly is the use of benzodiazepines for the treatment of insomnia, agitation or delirium (81).

Underuse may also be very harmful when the patient is deprived of an intervention that may be of benefit and the consequences could be poor control of symptoms, disability or even death (32).

Another negative consequence of inappropriateness is the impact on healthcare. Overuse of tests and treatments have a direct impact on the timeliness of care because scheduling unnecessary procedures increases the waiting list of diagnostic tests, surgeries, consultations, etc. Also, scheduling unnecessary follow-up visits affects the waiting list (12). Even the results of inappropriate diagnostic tests may lead to a repetition of the same test or to a request for others, increasing the waiting list as well (82–86).

Furthermore, inappropriateness increases the costs in the health system, contributing to increased spending (87). In the case of overuse, it will be due to the direct cost of the intervention and the opportunity cost, when resources cannot be invested in other more suitable interventions (4,18). In the case of underuse, these increased costs are derived from the management of complications, in addition to the costs to society due to disability and absence from work (32).

All the benefits offered by healthcare systems should guarantee their effectiveness and be used in clinical situations where they have been shown to be useful (88). It has been stated that reducing overuse is the next quality frontier (89).

In this context of reducing waste, and to ensure quality and sustainability of the health system, the concept of **disinvestment** has emerged. As Elshaug et al. define it “Disinvestment relates to the processes of withdrawing (partially or completely) health resources from any existing health care practices, procedures, technologies and pharmaceuticals that are deemed to deliver no or low health gain for their cost, and are thus not efficient health resource allocations” (90).

However, the objective of disinvestment is not simply to reduce costs, but to reinvest in effective interventions (91,92). Thus, the above definition of disinvestment continues with the introduction of the concept of **reinvestment**: “Within this is the view to re-allocation/re-investment towards technologies, practices and programs with greater demonstrated (cost-) effectiveness” (90). Countries such as Australia, Canada, and the United Kingdom have explored policies and methodologies for disinvestment and reinvestment (18,90,93,94).

As it has been explained to this point, there are multiple terms that refer to inappropriateness and low-value care, as well as measures to reduce them. Niven et al. (95) documented this fact. They carried out a scoping review on the terminology and current frameworks referring to de-adoption and low-value care. After reviewing 109 citations, they identified 43 terms that related to these concepts. These terms and others are shown in Table 2.

Table 2. Terms referring or related to appropriateness, low-value care and de-adoption (n = 54)

Abandonment	Do not do	Re-appraisal
Appropriateness	Drop in use	Reassess
Change in practice	Evidence-based reassessment	Redeploying resources
Change in use	Health technology reassessment	Reducing waste
Choosing Wisely	Ineffective	Refute
Clinical redesign	Inappropriate use	Re-investment
Contradicted practices	Less is more	Relinquishment
Contradicted practices	Low-value	Removal
De-adoption	Medical reversal	Replacement
Decline in use	Misuse	Re-prioritization
De-commission	Obsolescence	Resource release
Decrease use	Obsolete	Reversal
Defunding	Over use	Slow medicine
De-implementation	Overdiagnosis	Substitutional re-investment
De-list	Overtesting	Too much medicine
Disadoption	Overtreatment	Underuse
Discontinuation	Practice/Intervention Stopping	Unnecessary
Disinvestment	Reallocation	Withdrawal

2.6 Initiatives to improve appropriateness of clinical practice

In the context of this thesis, we have defined *initiative* as any collaborative effort to assess the appropriateness or value of a certain health intervention or to collect data concerning the appropriateness of various interventions.

Even though thousands of publications would respond to this definition, the vast majority correspond to prevalence studies of the inappropriateness of a certain practice (58,96–104). However, our work is focussed on some particular initiatives that have emerged in the last ten years, which have created lists of inappropriate or low-value practices. Some of the most sound are the Do Not Do initiative from the United Kingdom (2009) (17) and the Choosing Wisely Campaign from the United States (2011)(105,106). These initiatives arose or became popular during the worst phase of the world economic crisis suffered between 2007 and 2011, partly as a measure to reduce waste and to contain health spending. Although the identification and elimination of inefficiency has always been a fundamental element of ensuring the

quality and sustainability of health systems, this economic crisis made the improvement of appropriateness a fundamental tool for ensuring their viability (92).

2.7 Justification

The initiatives to improve appropriateness in clinical practice emerging in recent years will be useful as long as they are validated and widely disseminated in order to be adopted and implemented. However, some aspects hinder the consultation of these initiatives, including the diverse terminology used in discussing this topic (95,107) and the scattered availability of all the initiatives, given that they are published in different sources: articles, websites, newspapers, etc. These factors hinder research and knowledge translation aimed at improving the appropriateness of clinical practice (108).

Another key aspect for ensuring success in the implementation of the various initiatives to improve appropriateness is to know their acceptability among health professionals and their applicability in different settings.

This work arises from the need to identify and analyse the multiple existing initiatives to improve the appropriateness of clinical practice and to know the opinion of health professionals regarding these proposals, especially in our closest environment.

The identification and analysis of these initiatives could assist other health professionals and different actors in our health system in facilitating a future implementation. It could also be of use to other researchers in the development of new tools for evaluating and improving the appropriateness of clinical practice. All this contributes to the larger aim of improving quality in the hospitals of the Spanish National Health System.

For the development of its objectives, this article-based PhD thesis has been carried out through a set of five articles concerning three aspects pertaining to the improvement of the appropriateness of clinical practice: 1. the identification and description of the main initiatives that have been developed in recent years worldwide

(Article I); 2. the development of new methods to analyse inappropriateness in the hospital setting (articles II and III); and 3. the analysis of the perception of doctors (Article IV) and nurses (articles IV and V) of a tertiary hospital about inappropriateness and low-value practices.

In addition to the five articles previously described, this thesis includes two appendices corresponding to two publications, one of which describes the work of the Commission for the Improvement of Clinical Practice at the Vall d'Hebron University Hospital as an initiative to improve appropriateness of clinical practice in the hospital setting (Appendix 2.1 Complementary article I). The other appendix is a letter to the editor related to Publication I (Appendix 2.2 Complementary article II).

3. Objectives

3. Objectives

3.1 General

Analyse and develop initiatives and methods to improve the appropriateness of clinical practice in the hospital setting and their acceptability among health professionals.

3.2 Specific

1. Identify and describe national and international initiatives to improve the appropriateness of clinical practice.
2. Develop methodological tools to disseminate initiatives related to improving the appropriateness of clinical practice.
3. Develop tools for assessing the appropriateness of clinical practice that are applicable in the hospital setting.
4. Analyse the perceptions of medical and nursing professionals about inappropriate or low-value practices and about recommendations for improving the appropriateness of clinical practice in the hospital setting.

4. Methods

4. Methods

This thesis is presented as an article-based PhD thesis consisting of five articles that disseminate the results of five studies. In this section we summarise the study methods.

In Study I we developed the three first objectives of this thesis. In order to identify and describe national and international initiatives for improving the appropriateness of clinical practice (Objective 1), we carried out a literature review, consulting databases of scientific articles, experts in the field and other sources on the Internet, such as medical newspapers and magazines. We analysed several aspects of these initiatives, including their authorship, methods and outcomes.

To disseminate initiatives related to improving the appropriateness of clinical practice (objectives 2 and 3), we developed a website that includes a database used to facilitate the consultation of initiatives identified in the literature review and a platform for networking to develop and share new initiatives. In addition to this tool, in studies II and III we developed a series of indicators to assess the appropriateness of clinical practice in two areas of the hospital setting (Objective 3).

Finally, in Studies IV and V we carried out two surveys and a focus group to analyse doctors' and nurses' perceptions about inappropriate or low-value practices and about recommendations for improving the appropriateness of clinical practice in the hospital setting (Objective 5).

4.1 Study I. Development of an online database of appropriateness assessments and recommendations for reducing low-value health interventions

4.1.1 Design

Database development and a retrospective analysis.

4.1.2 Study population

Initiatives aimed at improving the appropriateness of clinical practice by producing or collecting appropriateness analyses or recommendations for reducing low-value practices. In the context of the study we established the following definitions:

- Initiative: Any collaborative effort to evaluate or collect analyses of the appropriateness or the clinical value of health interventions.
- Analysis of appropriateness or clinical value: clinical recommendations, literature reviews or analysis by an expert or group of experts on any health intervention, arguing that the intervention is either of low value, inappropriate or unnecessary, or valuable but underused.
- Health intervention: any treatment (e.g. drug, surgery, procedure, therapy or counselling), diagnostic test (e.g. laboratory test, imaging or diagnostic procedure) or other action (e.g. educational strategy) used in the field of medicine to preserve or improve people's health.

4.1.3 Data collection

We carried out a structured search through the Google internet browser. We searched for the main initiatives aimed at assessing the appropriateness or clinical value of health interventions. Specifically, medical news or articles that referred to these initiatives were sought.

Additionally, we carried out a search in MEDLINE (PubMed) to find articles on the initiatives identified on Google and on other initiatives. The search strategy is shown in Figure 5. The search was limited to articles published after June 2008, without applying any filter by language or publication type. We included any publication type (i.e. research article, letter to the editor, narrative review, etc.) as long as it met the following criteria:

- Publications describing initiatives to improve the appropriateness of clinical practice according to the definition provided above.
- Publications that include listings or a set of interventions that are of low clinical value, inappropriate or unnecessary, either collected by the initiatives identified in the Google search, or other initiatives.
- The authors of the initiative had to belong to non-profit academic or research groups, such as scientific societies or government agencies or institutions.

We retrieved the following information about the initiatives from Google and the references found in Medline: authors, institutions, country, year of launching, financing, objective of the initiative, terms used to describe their objectives, methodology used to perform the analysis of the appropriateness or clinical value of the interventions, and the number of evaluations collected or carried out.

We also collected the following information regarding the appropriateness evaluations provided by these initiatives: type of initiative, publication year, type of intervention (e.g. diagnostic, pharmacological or preventive), medical specialties involved (for example, anaesthesiology or cardiology), direction of the recommendation (i.e. for or against the use of the intervention in question) and keywords identified in the title.

Figure 5. Medline (PubMed) search strategy for identifying initiatives aimed at improving the appropriateness of clinical practice and appropriateness analyses.

```
((((((("inappropriate"[ti]) OR "low-value"[tiab]) OR "unnecessary"[tiab]) OR overused[tiab]) OR overdiagnos*[tiab]) OR overtreat*[tiab]) OR underuse*[ti]) OR Appropriateness[ti])) AND (((Procedures[tiab]) OR Therapies[tiab]) OR Interventions[tiab]) OR "health care"[tiab])
```

4.1.4 Data analysis and online database development

We analysed all the initiatives and appropriateness evaluations included in the database up to July 2015.

We classified the appropriateness analyses by initiative, publication year, type of intervention, medical specialties involved, and direction of the recommendation.

The construction of the online database was carried out with an IT team. We designed the database to achieve two main objectives: 1. to include the initiatives identified in the literature review at the time of the study, and others that might be identified or that appeared afterwards, and 2. to consult the appropriateness evaluations using one or various criteria. Other objectives included to disseminate news about new initiatives or events related to appropriateness and to facilitate networking with other groups.

4.2 Studies II and III. Development of healthcare quality indicators based on systematic reviews of interventions in the hospital setting in delivery care (Study II) and peripheral arterial disease care (Study III)

Studies II and III were based on the same methodology explained below.

4.2.1 Design

Development of healthcare quality indicators based on a review of systematic reviews (overview).

4.2.2 Study population

Systematic reviews (SR) evaluating interventions available in the hospital setting for delivery care (Study II) or for peripheral arterial disease care (Study III).

Two searches were carried out in 2011, one for each topic. We consulted the following databases to identify SR evaluating pharmacological or non-pharmacological interventions in the field of Obstetrics: Cochrane Database of Systematic Reviews (The Cochrane Library, Issue 3, 2009, and updated in 2011), the Database of Abstracts of Reviews of Effects, and Clinical Evidence. We selected all the SR in the field of Obstetrics without applying specific search terms.

In the case of the peripheral arterial disease, we consulted the following databases: the Cochrane Database of Systematic Reviews and the Database of Abstracts of Reviews of Effects (The Cochrane Library, Issue 6, 2011), Clinical Evidence, MEDLINE, EMBASE (OVID), and meta-searchers such as NHS Evidence, Excelencia Clínica and TRIP Database. We used the following search terms: peripheral arterial disease [Mesh], peripheral vascular diseases [Mesh], peripheral arterial disease, peripheral vascular disease and intermittent claudication. They were used as keywords or as part of the title or abstract.

In order to identify additional relevant SR we consulted the following sources of clinical practice guidelines (CPGs): The National Institute for Clinical Excellence of the United

Kingdom (NICE), the New Zealand Guidelines Group, and the main scientific societies in each field.

Two authors independently read the titles and abstracts of the articles retrieved from the search, applying the following selection criteria: systematic reviews of clinical trials of pharmacological and non-pharmacological interventions, applied by healthcare professionals in the field of Obstetrics and Vascular Surgery, applicable in the hospital setting, and regularly registered in medical records or in hospital information systems. Disagreements were resolved with a third author.

4.2.3 Data collection

Two researchers independently collected the characteristics of each SR from the full text, including the outcomes, and assessed their internal validity according to the criteria established by the Scottish Intercollegiate Guidelines Network (SIGN) (109). These criteria assess whether the review question is clearly addressed, whether there is a description of the methodology, whether the search strategy is sufficiently rigorous, whether the quality of individual studies is analysed and considered in the conclusions, and whether study heterogeneity is properly addressed. We selected the SR meeting all the criteria established by SIGN.

4.2.4 Data analysis and indicators development

The analysis was carried out in two phases: 1. generation and grading of clinical recommendations, and 2. development and validation of indicators.

Phase 1. Generation and grading of clinical recommendations. In this phase we used a modified version of the Grading of Recommendations Assessment, Development and Evaluation (GRADE) system (39) that is shown in Table 1 in Appendix 3.2. We classified the outcomes evaluated in the review according to their relevance, placing them into three categories: critical, important and relative. Two authors independently rated the quality of the evidence provided by the review and drafted a clinical recommendation.

The quality of the evidence for the critical outcomes was rated as high, moderate, low or very low, according to the following criteria: limitations in the design of the primary studies; imprecision and inconsistency of effect estimators; the degree to which the evidence was direct and the probability of reporting, publication, or other biases.

The clinical recommendations were drafted based on the risk / benefit assessment of the intervention and the quality of the evidence. We used a modified version of the GRADE system (Table 1 in Appendix 3.2), since we did not consider other aspects of the system such as patient values and preferences and costs or resources. We did not consider these other aspects because we deemed them specific to the context in which the evidence is applied.

The clinical recommendations were graded as strong or weak and in favour or against the intervention, as indicated by the GRADE system (39). The recommendations were graded as strong when the quality of the studies was high and the results were consistent. They could be strongly in favour of the use of the intervention when the beneficial effects outweighed the harm or strongly against if the potential harm outweighed the benefit. By contrast, the recommendations were considered weak when it was unclear whether the beneficial effects outweighed the harm.

Finally, two authors independently selected the recommendations that were graded as strong (either for or against the intervention) based on high-quality evidence, at least for the most critical outcomes. Disagreements were resolved with a third author.

Phase 2. Development and validation of indicators. We developed the indicators using the clinical recommendations created in Phase 1. They were developed following an adaptation of the methods proposed by the American College of Cardiology / American Heart Association (ACC / AHA) and the Agency for Healthcare Research and Quality (AHRQ) (110,111). Table 3 shows the general structure of an indicator and the sources of information required for their calculation. We got most of the information for designing the indicator from the SR; however, in some cases we also consulted some clinical practice guidelines to contrast the information coming from the SR with the expert consensus summarised in the guidelines. Some of the elements of the indicator definition were developed after consultation with clinical experts and additional

literature. These elements were: the sources of information needed to calculate the indicator, the factors that may explain variability in the results, and the characteristics of the context that should be considered when applying the indicators.

To validate the indicators, two specialists in Obstetrics and two in Vascular Surgery were consulted to evaluate the design of the indicators and their relevance in current clinical practice. In Study II we also consulted the SR authors about the extent to which they agreed with the formulation of the indicator.

Table 3. General structure of an indicator.

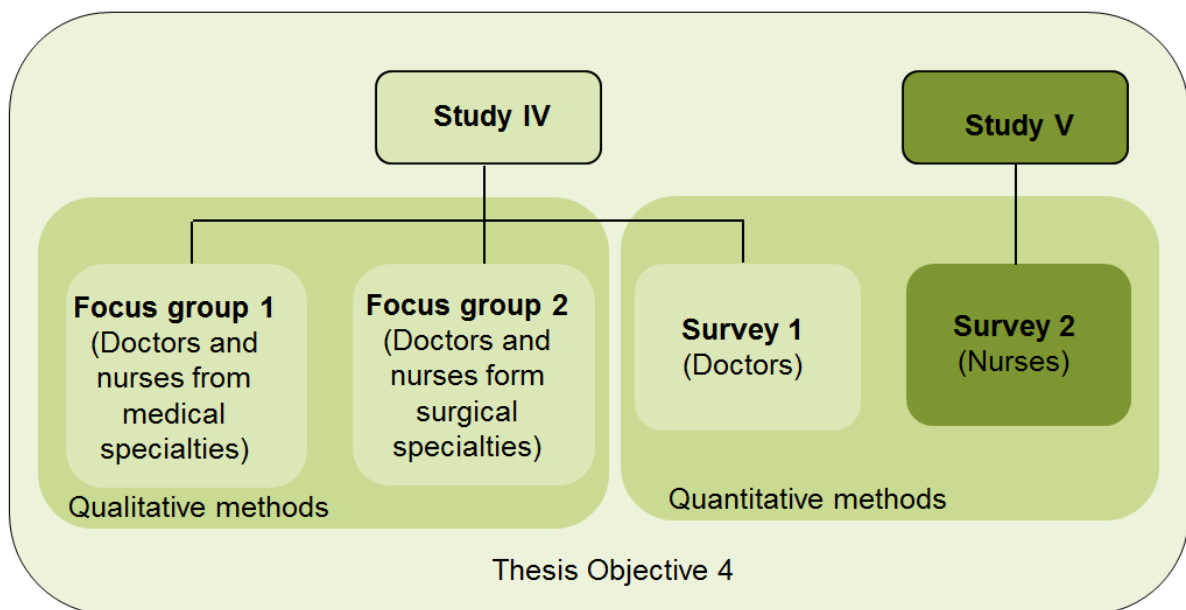
Element	Description	Source of information
a. Title	Brief statement of what is to be assessed	Research team
b. Type of Indicator	<ul style="list-style-type: none"> • Process indicator • Specific indicator of general or medical condition • Indicator of desirable or undesirable events • Indicator based on proportions or means 	Clinical recommendation based on SR
c. Definitions	1. Clinical recommendation (PICO format): Clinical situation, population, intervention, comparison and main outcomes <ul style="list-style-type: none"> • Operational definition of clinical terms in the research question • Definition of contraindications to treatment (if necessary) • Description of the diagnostic and procedure codes ICD-9-CM for the identification of the population 	Clinical recommendation based on SR, ICD-9-CM
d. Target population	Definition of the target population	Clinical recommendation based on SR
e. Rationale	<ul style="list-style-type: none"> • Impact of the clinical condition of interest • Brief description of the selected SR • Summary of the main benefits and / or harms associated with the intervention • Support of the recommendation by main clinical practice guidelines (CPG) 	SR, GPC
f. Supporting literature	Main bibliography that supports the indicator (SR and GPC)	SR, GPC
g. Description of indicator population	Operational definition of the indicator (formula) <ul style="list-style-type: none"> • Numerator / denominator • Exclusion criteria 	Clinical recommendation based on SR, clinical experts
h. Sources of information	Description of the sources of information for computing the indicator: <ul style="list-style-type: none"> • Administrative databases (mainly from inpatient and surgical area) • Clinical documentation (medical history) • Other (survey, etc.) 	Clinical experts
i. Standard	Definition of the standard: <ul style="list-style-type: none"> • Desirable event (↑) • Undesirable event (↓) 	Clinical recommendation based on SR
j. Underlying factors	<ul style="list-style-type: none"> • Factors related to the target population • Factors related to professionals • Factors related to the hospital 	SR, GPC, Clinical experts
k. Notes	Other aspects that complement the information summarised by the indicator.	Clinical experts
l. Desired characteristics of a hospital for ensuring the viability of the indicator	<ul style="list-style-type: none"> • Essential features (associated with the identification of the denominator and the numerator) • Desirable features (associated with an acceptable time investment to measure it) 	Clinical experts

4.3 Studies IV and V. Perceptions of health professionals about inappropriate or low-value practices and about recommendations for improving the appropriateness of clinical practice in the hospital setting

4.3.1 Design

We applied quantitative and qualitative methods to explore the opinions of doctors and nurses on inappropriate or low-value practices and on recommendations for improving the appropriateness of clinical practice (Figure 6). These methods were also adopted in order to identify inappropriate practices possibly present in the hospital, and barriers and facilitators to reduce them. The quantitative methods consisted of two surveys aimed at doctors (Study IV) and nurses (Study V), respectively. The qualitative methods were two focus groups with the participation of both doctors and nurses (Study IV).

Figure 6. Studies IV and V design.



ELECTRONIC SURVEYS

4.3.2 Surveys: study population

The two surveys were carried out at the Vall d'Hebron University Hospital, a tertiary university hospital in Spain of more than 1,000 beds. All staff doctors (n = 689) and nurses (n = 2,063) from the specialties related to a set of recommendations previously selected were invited to participate. Medical and nursing residents were excluded on the grounds that their practice is tutored and under the supervision of the staff.

4.3.3 Surveys: data collection methods

1) Selection of recommendations for reducing low-value practices.

The recommendations on low-value practices were consulted through the website www.DianaHealth.com, the database developed in Study I.

In the survey aimed at doctors, we randomly selected 200 recommendations. From these 200, we chose between five and ten recommendations by specialty in which the intervention was available in the hospital. In cases where two or more recommendations referred to the same population and the same intervention, we kept only one, preferably from a local initiative. When a particular specialty was found to have fewer than five recommendations, the database was consulted again.

In the case of the survey aimed at nurses, given that on DianaHealth.com all the recommendations applicable in nursing are all included under the same specialty, "Nursing", we downloaded all of them and classified them into eight specialties, corresponding to the eight areas of nursing care present in the Vall d'Hebron University Hospital: emergency care, critical care, surgical care, Traumatology, Obstetrics, ambulatory care and hospital care (for adults and paediatric).

After this classification, we established a panel of senior nurses to select the recommendations to be evaluated in the survey. The panel was formed by a nurse from each of the eight areas of care. The nurses were selected based on their clinical

experience and knowledge in the area. Two additional experts were chosen as substitutes in case one expert rejected the invitation to participate.

The panel selected the recommendations with the following criterion: a minimum of five and a maximum of ten recommendations on interventions available in the hospital.

The range of five to ten recommendations for both surveys was decided on as a means of simplifying the questionnaire.

2) Questionnaire

The survey aimed at doctors was carried out in the first semester of 2016 and the one aimed at nurses in the second semester. We sent an email to all the professionals from the specialties involved in the selected recommendations. The message explained the objectives of the study and included a link to the survey questionnaire.

In the questionnaire, participants were asked to specify whether they were specialists or residents and their specialty. Since in some specialties there may be only one person with a given age or gender, we did not include questions about these variables or any other personal information that could lead to the identification of the participants.

Depending on the specialty selected by the participant at the beginning of the questionnaire, the form showed a list of between 5 and 10 recommendations and four questions about each of them, which are shown in Table 4. The questionnaire was evaluated before data collection and it was established that the completion time was between 10 to 20 minutes. Two reminders were sent one and two months after the first invitation letter. Participation in the survey was anonymous, voluntary and did not involve any financial compensation.

Table 4. Surveys questionnaire.

Questionnaire		Outcome definition		
Question	Options and type of variable	Outcome Name	Concept	Operative definition
1. Do you agree with this recommendation?	a. Yes b. No Type of variable: categorical	Agreement	Whether respondent agrees or not to what is stated in the recommendation	n Yes/ n responses Result are expressed as % (percentages over 70% were considered as agreement)
2. If you agree, in your opinion, what is the percentage of adherence to this recommendation in the Hospital, either in your department or in others?	Number between 0 and 100% Type of variable: quantitative	Subjective adherence	Percentage of adherence in the hospital according to participants' opinion	Median of the percentages declared by respondents. Result are expressed as a median % (median percentages over 70% were considered as adherent)
3. If you do not agree, in your opinion, what is the reason?	Multiple choices: -New evidence arose contradicting this recommendation, -The recommendation does not apply in the hospital setting, -The recommendation is not feasible in the hospital setting, -Other reasons Type of variable: categorical	Reasons for disagreement	Reasons why the respondent does not agree with the recommendation	n each option/ n responses Result expressed as % of each category
4. How useful do you consider this recommendation?	-Very useful, -Useful, -Indifferent, -Not so useful, -Useless Type of variable: categorical	Usefulness	Whether respondent considers the recommendation useful or useless in spite of agreeing with it.	Useful + very useful / n responses Results are expressed as % (percentages over 70% were considered as useful)

4.3.4 Surveys: data analysis

We analysed five outcomes: degree of agreement with the recommendation, subjective adherence, reasons for disagreement, utility, and low-value practices possibly present in the hospital.

1. Degree of agreement: whether or not the participant agreed with the recommendation. The outcome was quantified as the percentage of positive responses out of the total responses for each recommendation. Percentages equal to or greater than 70% were considered as a good agreement.

2. Reason for disagreement: reasons why the participant did not agree with the recommendation. Participants could choose the main reason from a list of four options (see Table 4). The outcome was quantified as the percentage of each category.

3. Subjective adherence: how much did the participant believe that the hospital professionals were adherent to the recommendation (expressed as a percentage from 0–100%). The outcome was quantified as the mean of this percentage. Percentages equal to or greater than 70% were considered as good adherence.

4. Utility: whether or not the participant considered the recommendation to be very useful, useful, not very useful, not useful, or if they are indifferent. The outcome was quantified as the percentage of the responses rated as “very useful” or “useful” of the total responses for that recommendation. Percentages equal to or greater than 70% were considered useful recommendations.

For these four variables, the unit of analysis was the participant’s response. We compared the results by type of specialty – medical or surgical specialties – and by type of intervention in four categories: diagnostic imaging, diagnostic and analytical procedures, pharmacological therapies, and non-pharmacological therapies.

5. Low-value practices possibly present in the hospital: this is a composite outcome calculated from the variables “degree of agreement” and “subjective adherence”. It is defined as those practices mentioned in recommendations with an agreement of 70%

or more and a subjective adherence of less than 70%. Usefulness was not considered in the composite outcome, as we were interested in identifying practices of low value, even when the participants consider the recommendation as not useful. The data was analysed with SPSS version 23.

FOCUS GROUPS

4.3.5 Focus groups: study population

We carried out two focus groups with specialists from medical and surgical areas, respectively. A convenience sample of 20 health professionals (10 for each focus group) was selected from a database of staff doctors and nurses. We chose the participants based on the following criteria: equal proportion of men and women and age groups (<35, 35-50 and > 50 years), and at least one member of each group had to be an active researcher; another a specialist in diagnostic tests and another a nurse.

4.3.6 Focus groups: data collection

We sent an email with an invitation letter to the doctors and nurses selected for the focus group. In cases where the invitation was declined, another person was selected, following the same criteria.

The two groups worked in face-to-face individual sessions of 90 minutes each. One of the researchers, an external expert with more than ten years of experience in qualitative research methodology, led the sessions, and a second researcher recorded them and took notes. None of them knew the study participants.

A predefined discussion guide was used in the two sessions (see Table I in Appendix 3.3). The discussion included examples of low-value practices and factors leading to their avoidance or reduction. Individual, institutional and social factors were discussed.

4.3.7 Focus groups: data analysis

We analysed the audio records and notes of the two sessions with a phenomenological approach, using the paradigm of grounded theory (112,113). One of the researchers transcribed the audio recordings and notes, keeping the names and specialties of the participants anonymous.

Verbatims were coded using a matrix proposed by the Catalan health technology assessment agency AQuAS, based on a similar study carried out in primary care (114).

In the initial phase, we used an open coding system, creating labels to identify topics. These topics were then classified as barriers or facilitators. In the second phase, we used axial coding to relate themes into constructs called categories. These categories were grouped into four levels: micro (related to individuals –patients and health professionals), meso (related to the doctor / nurse-patient relationship, management, and processes in the institution), macro (related to the health system) and external factors (external to the health system).

All the researchers discussed and reviewed the organisation of the topics until consensus was reached. The analysis included a comparison between medical and surgical specialties. The data was analysed using the Atlas.Ti v.6 software. Once the study results and conclusions were obtained, we sent a report to the participants to get their feedback.

5. Results

5. Results

This article-based PhD thesis is formed by the following five articles:

Article I. Bonfill X, Osorio D (contacting author), Solà I, Pijoan J.I, Balasso V, Quintana M.J, et al. DianaHealth.com, an On-Line Database Containing Appraisals of the Clinical Value and Appropriateness of Healthcare Interventions: Database Development and Retrospective Analysis. PLOS One. 2016 11(2): e0147943. doi:10.1371/journal.pone.0147943.

DOI: <https://doi.org/10.1371/journal.pone.0147943>. Impact factor 2016: 2,806.

Article II. Bonfill X, Roqué M (contacting author), Aller M.B, Osorio D, Foradada C, Vives A, et al. Development of quality of care indicators from systematic reviews: the case of hospital delivery. Implementation Science 2013, 8:42. DOI: <https://doi.org/10.1186/1748-5908-8-42>. Impact factor 2013: 3,470.

Article III. Bellmunt S (contacting author), Roqué M, Osorio D, Pardo H, Escudero J.R, Bonfill X. Healthcare Quality Indicators of Peripheral Artery Disease Based on Systematic Reviews. European Journal of Vascular and Endovascular Surgery 2014 48 (1) 60-9. DOI: <https://doi.org/10.1016/j.ejvs.2014.02.001>. Impact factor 2014: 2,490.

Article IV. Osorio D (contacting author), Ribera A, Solans M, Arroyo L, Ballesteros M, Romea S. Healthcare professionals' opinions, barriers and facilitators towards low-value clinical practices in the hospital setting. Gaceta sanitaria. 2020 34 (5):459–467. DOI: <https://doi.org/10.1016/j.gaceta.2018.11.007>. Impact factor 2019: 1,564.

Article V. Osorio D, Zuriguel E (contacting author), Tiñena M, Martínez M, Romea S, Barba A. Selecting and quantifying low-value nursing care in clinical practice: a questionnaire survey. Journal of Clinical Nursing 2019 Nov;28(21-22):4053-4061. doi: 10.1111/jocn.14989. Epub 2019 Jul 28. DOI: <https://doi.org/10.1111/jocn.14989>. Impact factor 2019: 1,972.

5.1 Summary of Results

The following is a summary of the most relevant results presented in the five articles.

5.1.1 Article I. DianaHealth.com, an On-Line Database Containing Appraisals of the Clinical Value and Appropriateness of Healthcare Interventions: Database Development and Retrospective Analysis

5.1.1.1 Initiatives identified

We identified 22 initiatives that compiled a total of 2,940 inputs in the form of clinical recommendations and appropriateness analyses of numerous health interventions. The initiatives came from several countries, including various European countries, the United States, Canada, and Australia. These analyses included recommendations from clinical practice guidelines and other documents from scientific societies, conclusions from literature reviews and collections of publications on low-value practices promoted by some medical journals (Table 5). All but one initiative was launched in the past decade, and all of them were active at the time of Study I.

While the terms used by the initiatives to describe their objectives were diverse, the most frequent were “low-value practices” or “unnecessary practices.” Most of the initiatives (15 out of 23, 65%) presented their evaluations as evidence-based clinical recommendations or expert consensus, in favour of or against the use of a given intervention. The other initiatives collected evidence-based evaluations or series of articles of different kinds (original research, reviews, and letters). Four Choosing Wisely and Essencial initiatives, in addition to clinical recommendations, also developed informative materials to facilitate doctor-patient communication aimed at improving appropriateness of clinical practice.

5.1.1.2 Development of the online database

We created the website www.DianaHealth.com based on the information collected through the search. The name of the website is an acronym in Spanish that stands for its objective: Dissemination of Initiatives to Analyse Appropriateness in Healthcare.

Table 5. Characteristics of the initiatives for improving the appropriateness of clinical practice that were found in Study I.

Initiative (year of launching/publication)	Authors (Country)	Type of initiative	Results
1. NICE Do not Do Recommendations (2009)	National Institute for Health and Clinical Excellence (NICE) (United Kingdom)	Set of recommendations from clinical guidelines	987 Clinical recommendations (17,115)
2. Cochrane Quality and Productivity topics (2010)	Researchers from the NICE and various universities, (United Kingdom)	Set of conclusions from literature review (Cochrane systematic reviews)	63 Reports drawn from systematic reviews by the Cochrane Collaboration (116)
3. U.S. Preventive Services Task Force A and B recommendations (2010)	U.S. Preventive Services Task Force (United States)	Set of recommendations from clinical guidelines	20 Clinical recommendations rated as A (117)
4. The Canadian Task Force for Preventive Health Care (CTFPHC) Guidelines (2010)	The Canadian Task Force for Preventive Health Care (Canada)	Set of recommendations from clinical guidelines	30 Clinical recommendations (118)
5. JAMA Less is more collection (first article in the collection is from 2010)	JAMA Internal Medicine (International journal based in the US)	Collection of articles	208 Original research papers and other type of publications (119,120)
6. MAPAC Initiative (In Spanish, Mejora de la Adecuación de la Práctica Asistencial y Clínica. In English, Improving the Appropriateness of Clinical Practice and Healthcare (2011)	Centro de Investigación Biomédica en Red de Epidemiología y Salud Pública (CIBERESP) (Spain)	Initiative of our own. It provides clinical recommendations to avoid inappropriate and low-value interventions and to promote valuable interventions	14 Clinical recommendations (121)
7. Elshaug, et al. Article (2012)	Researchers from the Comprehensive Management Framework (CMF) (Australia)	Conclusions from literature review	A list of over 150 potentially low-value health care practices (122)
8. Choosing Wisely® (2012)	ABIM Foundation and national organisations representing medical specialists (United States)	Campaign gathering clinical recommendations from scientific societies	435 Evidence-based recommendations, patient-friendly materials (105)

Table 5. (Continued)

Initiative (year of launching/publication)	Authors (Country)	Type of initiative	Results
9. Doing more does not mean doing better (In Italian, Fare di più non significa fare meglio) (2012)	Slow Medicine (Italy)	Campaign gathering clinical recommendations from scientific societies	209 Clinical recommendations, patient-friendly materials (123,124)
10. Essencial (2013)	Agència d'Avaluació i Qualitat Sanitàries de Catalunya (AQuAS) (Catalonia, Spain)	Campaign gathering clinical recommendations from scientific societies	37 Evidence-based recommendations, patient-friendly materials (114,125)
11. Compromiso por la calidad de las Sociedades Científicas. In English, Commitment to Quality of the Spanish Scientific Societies (2013)	Ministerio de Sanidad, Servicios Sociales e Igualdad (Spain)	Campaign gathering clinical recommendations from scientific societies	105 Clinical recommendations (126,127)
12. Prasad, et al. Article (2013)	Researchers from several centres and universities (United States)	Conclusions from literature review	A list of 146 existing practices found to be no better than a lesser therapy (128)
13. The BMJ Too Much Medicine (first article in the collection is from 2013)	The British Medical Journal (International journal based in the UK)	Collection of articles	139 Original investigations, editorials, or analyses about unnecessary care (129)
14. Choosing Wisely Canada (2014)	Canadian Medical Association/University of Toronto and national societies (Canada)	Campaign gathering clinical recommendations from scientific societies	151 Evidence-based recommendations, patient-friendly materials (130)
15. Choosing Wisely Netherlands Campaign (2014)	Dutch Association of Medical Specialists (OMS), scientific associations and ZonMw (Netherlands)	Campaign gathering clinical recommendations from scientific societies	<i>Wise choices</i> : 25 clinical recommendations, <i>Care evaluation</i> : effectiveness studies, Analyses of the variations in health services activity (131)
16. Prescrire Pour mieux soigner, des médicaments à écarter: bilan (In English, Towards better patient care: drugs to avoid in 2015) (2014-2015)	Prescrire.org (France)	Conclusions from literature review	List of 71 drugs considered more harmful than beneficial (132,133)
17. Recomendaciones No Hacer. In English, Do not Do Recommendations (2014)	Sociedad Española de Medicina de Familia y Comunitaria semFYC (Spain)	Campaign gathering clinical recommendations from scientific societies	30 Clinical recommendations (134)
18. Morgan et al. Article (2014)	Researchers from several centres and universities (United States)	Conclusions from literature review	Review article providing conclusions on 10 overused health care interventions (135)

Table 5. (Continued)

Initiative (year of launching/publication)	Authors (Country)	Type of initiative	Results
19. Smarter medicine (2014)	Swiss Society of General Internal Medicine (Switzerland)	Campaign gathering clinical recommendations from scientific societies	5 Clinical recommendations (136,137)
20. Recomendaciones No Hacer. In English, Do not Do Recommendations (2014)	Sociedad Española de Radiología Médica SERAM (Spain)	Campaign gathering clinical recommendations from scientific societies	38 Clinical recommendations (138)
21. Choosing wisely Australia (2015)	Australia's medical colleges and professional societies and facilitated by NPS MedicineWise (Australia)	Campaign gathering clinical recommendations from scientific societies	27 Clinical recommendations, patient-friendly materials (139)
22. Choosing wisely Japan (2015)	Researchers from the University of Tsukuba (Japan)	Campaign gathering clinical recommendations from scientific societies	5 Clinical recommendations (140)

The website was published in January 2014 and is still active today. It is open access, non-profit, and has no advertising or other commercial interests. It is partially funded by the Spanish public research network CIBERESP. The main sections in DianaHealth.com are: 1. "Initiatives"; 2. "Search Recommendations / Analyses"; 3. "News"; 4. "Report a new recommendation or suggest a new analysis; and 5. "Intranet" (Figure 7).

The section "Initiatives" is a list of a brief profiles of each initiative with the following information: authors, launching year, objective and a link to their website (Figure 7A).

In the section "Search recommendations/analysis", users can consult appropriateness evaluations either by entering free text or by one or more of the following criteria: initiative, medical specialty, type of intervention, appropriateness (high or low value), and publication year (Figure 7B). The website is available in English and Spanish. Search results include the following information: authoring initiative, publication year, and a link to the original source. Additionally, search results can be exported to a csv file (Figure in Appendix 3.1).

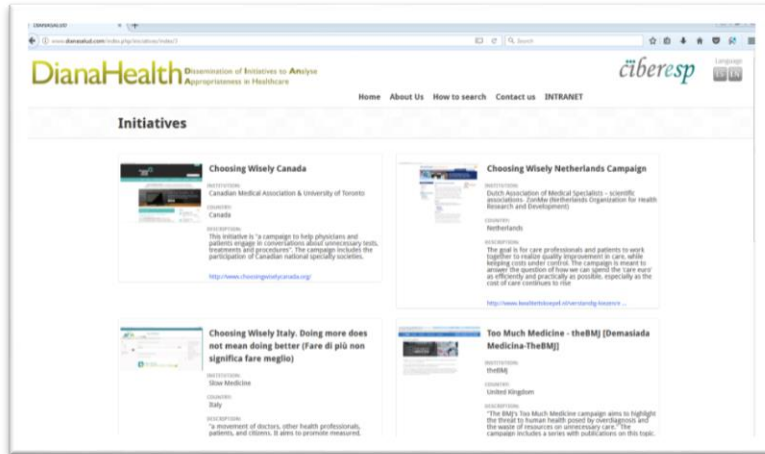
The section “News” announces new initiatives, new evaluations and events of interest (Figure 7C). In the section “Report a new recommendation or suggest a new analysis”, users can suggest the inclusion of new initiatives or evaluations in the database (Figure 7D). Finally, the section “Intranet” is a private area where the MAPAC network members can upload new recommendations or analyses.

Right after it was launched, the website was updated using the search strategy described in the methods of Article 1 (Figure 5). Nowadays, the website is constantly updated with new contents (news, recommendations, appropriateness analyses, etc.) that are identified by the MAPAC network members. We implemented a validation system that automatically detects broken links to the original sources.

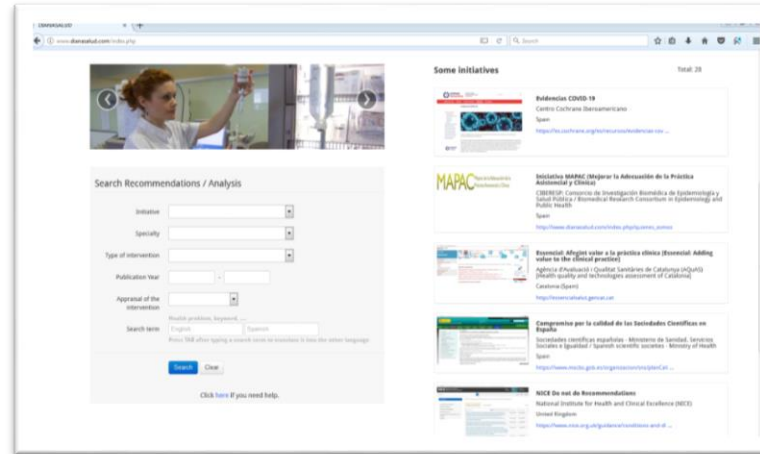
After several updating processes, we observed that the initiatives update their content at different intervals, some on a weekly basis (Less is More and Too Much Medicine), others monthly or every two months (Choosing Wisely and Essencial) or yearly (Prescrire).

Figure 7 Print screens from DianaHealth.com.

A.



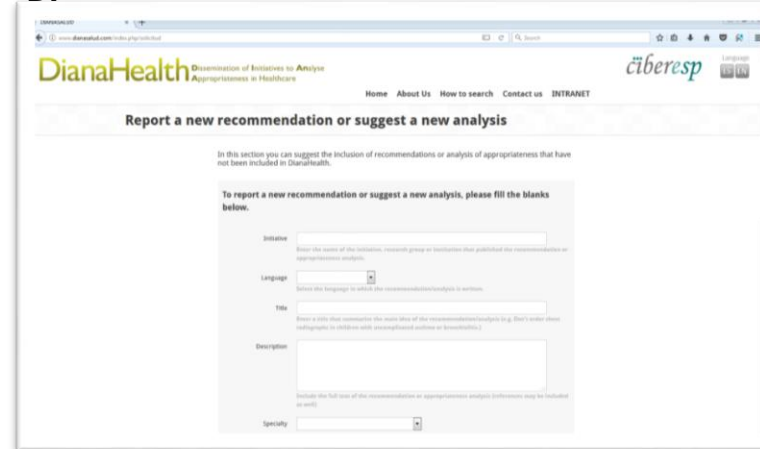
B.



C.



D.



A. Section “Initiatives”; B. Section “Search recommendations/analysis”; C. Section “News”; D. Section “Report a new recommendation or suggest a new analysis”

5.1.2 Article II. Development of quality of care indicators from systematic reviews: the case of hospital delivery

5.1.2.1 Search results and characteristics of the reviews

We obtained 303 systematic reviews with the search strategy. After reading their titles and abstracts, we included a total of 48 Cochrane systematic reviews. None of them were excluded due to poor methodological quality. However, 28 reviews were excluded because they did not provide a solid basis for generating a recommendation for or against the intervention. Finally, we drafted 20 clinical recommendations based on high-quality evidence.

5.1.2.2 Construction and validation of indicators

Approximately 75% of the authors of the selected SR responded to our request to review the indicator. In general, they agreed with the indicators proposal and their comments were used to further improve the indicators definition.

Following the advice of expert obstetric consultants, two indicators were removed. One was about the proportion of women with a single pregnancy at risk of preterm delivery treated with a combination of corticosteroids with a thyrotropin-releasing hormone. It was excluded because this intervention is no longer used in clinical practice. The second indicator that was excluded was the proportion of deliveries by caesarean section because the evidence presented was considered to be controversial. We observed that the feedback from the experts in Obstetrics was more objective than the consultation of the review authors, especially with regard to the relevance of the indicator.

5.1.2.3 Indicators

We obtained 18 indicators from 303 systematic reviews (6%), which are shown in Table 6. Eight indicators apply at the time prior to delivery, another eight during delivery, one in the immediate postpartum period and the other in the management of miscarriages.

All the 18 indicators are expressed in proportions and refer to the care process; no structure or result indicators were generated. All but six indicators describe a desirable event, that is, higher values indicate more appropriate care. The full content of one of the 18 indicators (proportion of women with singleton pregnancies and threatened preterm labour who receive corticosteroids) is shown in the Table 2 of Appendix 3.2 as an example.

After the process of generating the indicators, we consulted the Cochrane Library again to verify the status of the SR that were the source of the indicators. All the SR had been updated between 2009 and 2011. Three SR changed their conclusions; however, none of those changes invalidated the indicators: the first SR, on the use of antibiotics in women with premature rupture of the membranes, concluded that despite the short-term benefits during pregnancy, users should be aware of the unknown long-term effects on new-borns. The second SR, which evaluated the use of antibiotics in prophylaxis during caesarean section, provided a similar warning about the unknown long-term effects in new-borns. The third SR, on active management versus expectant management in the third stage of labour, found potential adverse effects with various uterotonics and concluded that information on benefits and harms should be provided to support an informed choice.

Table 6. Indicators based on systematic reviews in Obstetrics.

Indicator	Target population	ICD-9 Codes ^a	Indicator formula ^b	Standard ^c
1 Proportion of women with singleton pregnancies and threatened preterm labour (TPL) who receive corticosteroids	Women with TPL and preterm labour	644.03, 644.10, 644.13, 644.20, 644.21	D: Singleton pregnancies between 26-34w N: Women who received corticoids E: Corticoids contraindications	≈100
2 Proportion of women who are treated with calcium channel blockers (CCB) for inhibiting preterm labour	Women with TPL and preterm labour	644.03, 644.10, 644.13, 644.20, 644.21	D: Pregnancies between 22-34w N: Women who received CCB E: Contraindication to CCB	≈100
3 Proportion of women with threatened preterm labour (TPL) treated with magnesium sulphate	Women with TPL and preterm labour	644.03, 644.10, 644.13, 644.20, 644.21	D: Women who received pharmacological treatment for TPL N: Women who received magnesium sulphate E: None	≈0
4 Proportion of women with preterm rupture of membranes (PRM) who receive antibiotic treatment	Women with (PRM)	658.10, 658.11	D: Pregnancies between 22-34w with PRM N: Women who received antibiotics E: None	≈100
5 Proportion of women with post-term pregnancy who give birth after 41 weeks of gestation	Women with 41w pregnancy or more	641.X1, 642.X1, 676.X1	D: Women with > =41w pregnancy N: Women with labour induction E: Spontaneous labour, non-urgent caesarean delivery	≈0
6 Proportion of women with severe pre-eclampsia who were treated with magnesium sulphate	Women with severe preeclampsia	642.5	D: Women with severe pre-eclampsia N: Women who received magnesium sulphate E: Contraindication to magnesium sulphate	≈100
7 Proportion of women with eclampsia treated with magnesium sulphate	Women with eclampsia	642.6	D: Women with eclampsia N: Women who received magnesium sulphate E: Contraindication to magnesium sulphate	≈100
8 Proportion of women with term pregnancies and a breech presentation in which external cephalic version is performed or offered	Women with breech presentation	73.91	D: Breech presentation N: Women in whom cephalic version was performed or offered E: None	≈100
9 Proportion of unjustified episiotomies	Women in whom episiotomy was performed	73.6	D: Women in whom episiotomy was performed N: Procedures without any reason documented E: None	≈0

Table 6. (Continued)

	Indicator	Target population	ICD-9 Codes ^a	Indicator formula ^b	Standard ^c
10	Proportion of women whose second-degree perineal tear or episiotomy is repaired with continuous suture	Women with second-degree perineal tear or episiotomy	664.10, 664.11, 644.14, 73.6	D: Women with second-degree perineal tear or episiotomy N: Women in whom continuous suture was performed E: None	≈100
11	Proportion of women who are given an enema during labour	Women in labour	641.X1, 642.X1, 676.X1	D: Women in labour N: Women who were given an enema E: None	≈0
12	Proportion of women having perineal shaving on admission to the delivery room	Women in labour	641.X1, 642.X1, 676.X1	D: Women in labour N: Women for whom perineal shaving was performed E: None	≈0
13	Proportion of women who are administered uterotonics in the third stage of labour	Women in labour	641.X1, 642.X1, 676.X1	D: Women in labour N: Women who received uterotonics E: Contraindication to uterotonics, patient refusal to receive uterotonics	≈100
14	Proportion of women undergoing caesarean section who receive antibiotic therapy	Women on whom caesarean was performed	74.XX	D: Women who received caesarean N: Women who received antibiotics E: None	≈100
15	Proportion of women whose peritoneum is sutured at caesarean delivery	Women on whom caesarean was performed	74.XX	D: Women who received caesarean N: Women for whom peritoneum was sutured E: None	≈0
16	Proportion of health professionals who use double gloves when attending a woman with a blood-borne disease	Health professionals performing surgical procedures	None	D: Health professionals who performed surgical procedures in woman with a blood-borne disease N: Health professionals who used double gloves E: None	≈100
17	Proportion of Rh-negative women who are given Anti-D within 72 hours after the birth of an Rh-positive or Rh-undetermined baby	Rh-negative pregnant women	None	D: Rh-negative women with Rh-positive new-born N: Women who received Anti-D E: Women with prior Rh sensitisation.	≈100

Table 6. (Continued)

	Indicator	Target population	ICD-9 Codes ^a	Indicator formula ^b	Standard ^c
18	Proportion of women with incomplete miscarriage who, if a surgical evacuation of retained products is carried out, undergo a vacuum aspiration	Women with incomplete miscarriage	634.X1 - D: Women with incomplete miscarriage 638.X1	$\frac{N}{N+E}$ N: Women in whom vacuum aspiration was performed E: Contraindication to vacuum aspiration	≈100

^a In this column, the value “X” means any number between 0 to 9.

^b In this column, (D) Denominator, (N) Numerator, (E) Exclusion criteria.

^c Theoretical standards: 100% means a desirable event (higher values indicate appropriate performance) and 0% an undesirable event (lower values indicate inappropriate performance)

5.1.3 Article III. Healthcare Quality Indicators of Peripheral Artery Disease Based on Systematic Reviews

5.1.3.1 Search results and characteristics of the reviews

We identified 1,804 reviews with the search, of which 149 were finally selected. We discarded 19 because they did not provide solid evidence to generate a clinical recommendation. Finally, we selected eight systematic reviews for the construction of the indicators.

5.1.3.2 Construction and validation of indicators

After feedback from vascular surgeons, it was decided to discard an indicator on the materials used in bypass surgery because it had little clinical relevance.

5.1.3.3 Indicators obtained

From the 149 systematic reviews selected from the search we generated six quality indicators (4%) that are shown in Table 7: four on pharmacological interventions (antiplatelet agents, naftidrofuryl, cilostazol and statins) and two on lifestyle interventions (exercise and tobacco cessation). No indicators were generated for diagnostic tests or surgical techniques. Most of the indicators were about treatments for intermittent claudication. The six indicators are proportions and describe a desirable event.

Table 7. Indicators based on systematic reviews in peripheral arterial disease.

	Indicator	Target population	ICD-9 Codes ^a	Indicator formula ^b	Standard ^c
1	Proportion of patients with intermittent claudication to whom antiplatelet agents are prescribed	Patients with peripheral artery disease and intermittent claudication	443.9	D: number of patients with peripheral artery disease and intermittent claudication <hr/> N: number of patients who receive aspirin (75 or 100 mg/day) or clopidogrel (75 mg/day) or ticlopidine 250 mg/day) <hr/> E: exclude from denominator those patients with any contraindication to aspirin, clopidogrel or ticlopidine	≈100
2	Proportion of patients with history of bypass grafting to whom antiplatelet agents are prescribed	Patients with peripheral artery disease and history of bypass grafting	38.38; 38.48; 38.68	D: number of patients with peripheral artery disease and history of bypass grafting <hr/> N: number of patients who receive aspirin (75 or 100 mg/day) or clopidogrel (75 mg/day) or ticlopidine 250 mg/day) <hr/> E: exclude from denominator those patients with any contraindication to aspirin, clopidogrel or ticlopidine	≈100
3	Proportion of patients with intermittent claudication to whom an exercise routine is prescribed	Patients with peripheral artery disease and intermittent claudication	443.9	D: number of patients with peripheral artery disease and intermittent claudication <hr/> N: number of patients with an appropriate exercise routine prescribed <hr/> E: None	≈100
4	Proportion of current smokers, with history of bypass grafting, to whom a tobacco cessation intervention is prescribed	Patients with peripheral artery disease and history of bypass grafting	38.38; 38.48; 38.68	D: number of patients with peripheral artery disease and history of bypass grafting <hr/> N: number of patients with an appropriate intervention for tobacco cessation prescribed <hr/> E: None	≈100

Table 7. (Continued)

	Indicator	Target population	ICD-9 Codes ^a	Indicator formula ^b	Standard ^c
5	Proportion of patients with intermittent claudication, with no control of symptoms, to whom naftidrofuryl or cilostazol is prescribed	Patients with peripheral artery disease and intermittent claudication	443.9	D: number of patients with peripheral artery disease and intermittent claudication <hr/> N: number of patients who receive cilostazol or to naftidrofuryl E: exclude from denominator those patients with any contraindication to cilostazol or to naftidrofuryl	≈100
6	Proportion of patients with peripheral artery disease to whom a statin is prescribed	Patients with peripheral artery disease	443.9	D: number of patients with peripheral artery disease <hr/> N: number of patients who receive a statin <hr/> E: exclude from denominator those patients with any contraindication to statins	≈100

^a In this column, the value “X” means any number between 0 to 9.

^b In this column, (D) Denominator, (N) Numerator, (E) Exclusion criteria.

^c Theoretical standards: 100% means a desirable event (higher values indicate appropriate performance) and 0% an undesirable event (lower values indicate inappropriate performance)

5.1.4 Articles IV and V. Perceptions of health professionals about inappropriate or low-value practices and about recommendations for improving the appropriateness of clinical practice in the hospital setting (Article VI) & Selecting and quantifying low-value nursing care in clinical practice: a questionnaire survey (Article V)

5.1.4.1 Survey to doctors

A total of 169 physicians from 25 specialties participated in the study. They gave their opinion on 5-10 recommendations for their specialty from a selection of 127 recommendations (total responses = 1183). Some of these recommendations are shown as an example in the Table II in Appendix 3.3. The response rate by specialty ranged from 7% to 100%, being on average 28% and 18% in medical and surgical specialties, respectively.

Agreement with the recommendations to reduce low-value practices was 83% overall. It was and on average greater than 70% in all types of recommendations, except for

those on diagnostic tests in the group of surgical specialties, where it was 65% and 62%, respectively.

In 42 recommendations (33%), at least one doctor disagreed. The **reasons for disagreement** were that: they knew recent evidence that contradicts this recommendation (13%); the recommendation is not applicable in the hospital setting (12%); and the recommendation is not feasible in the hospital setting (5%). Other reasons were explained in 70% of the cases; they were mainly related to the use of a test to guide the treatment and fear of missing the right diagnosis.

As for the **subjective adherence** to the recommendations, it was in general 90%. The median percentage was higher than 70% in all types of recommendations, except for diagnostic images in the group of surgical specialties.

Regarding the **usefulness** of the recommendations to reduce low-value practices, in 70% of responses the participants considered them useful or very useful. However, it was less than 70% in all types of interventions in surgical specialties. For example, two of the 14 specialists thought a recommendation that advises not using locally injectable medications for non-specific low-back pain was useful or very useful (utility: 14%).

Finally, regarding the **low-value practices potentially present in the hospital**, in 22 recommendations there was an agreement of 70% or more and a subjective adherence below 70%. They represent 16% of the 134 that were evaluated. The 22 interventions referenced in these recommendations are shown in Table 8. In 14 of the 22 recommendations (64%) the utility was 70% or more.

Table 8. Low-value practices possibly present in the Hospital.

Practices Identified in the surveys				
		Agreement (%)	Sub. Adherence (%)	Usefulness (%)
Identified by doctors				
1	Long-term treatment with bisphosphonates in postmenopausal women with low risk of fractures	100	20	NR
2	Screening and treatment of certain patients with asymptomatic bacteriuria	100	60	100
3	Prescribing PPI as gastric protection in patients without risk factors for gastrointestinal complications	100	50	79
4	Thyroid ultrasound in patients with subclinical hypothyroidism	100	60	67
5	Routine use of antibiotics to treat exacerbations in COPD without severity and a single Antonhisen criteria	100	60	80
6	Repeating imaging studies (MRI and/or CT) in migraine or tension headache without changes in other tests	79	68	68
7	ECG and cardiac testing images in people without symptoms, comorbidities or significant cardiovascular risk	86	50	64
8	Intraoperative pathological diagnosis in cases of particular complexity, without consulting a pathologist	100	35	100
9	Antidepressants in patients with mild major depressive disorder (except history of moderate/severe depression)	91	50	82
10	Keep deep levels of sedation in critically ill patients without a specific indication	100	55	80
11	Preoperative chest X-ray in low-risk patients under 40 years (ASA I or II)	100	45	79
12	Laboratory testing in patients ASA I and II, prior to a low-risk surgery with minimal blood loss estimated	70	5	20
13	Screening of thyroid disease in hospitalised patients	100	60	67
14	Fine-needle aspiration in lymphadenopathy in which a lymphoid origin neoplasm is suspected	100	60	100
15	Continue empirical antibiotic initiated for a severe infection, without assessing relevance and de-escalation	100	55	94
16	Do blood tests routinely without specific clinical indications	85	60	77
17	Routine prescription of long half-life benzodiazepines for treating chronic insomnia as first choice in elderly	96	65	88
18	Skull X-Ray routinely in head trauma (except non-accidental brain damage confirmed/suspected)	100	50	57
19	Abdominal X-Ray in acute abdominal pain (except obstruction/perforation are suspected)	100	30	75
20	Doing a pelvic X-Ray in trauma patients if a full body CT is planned	100	30	100
21	Using antipsychotics as first choice to treat behavioural and psychological symptoms of dementia	73	65	45
22	Benzodiazepines in old people with acute onset of behavioural/cognitive changes and risk of delirium	100	60	100
Identified by nurses				
1	Tepid sponging for the treatment of fever	78	60	85
2	Waking up the patient for routine care unless the patient's condition specifically requires it	100	60	95
3	Continuous electronic foetal heart rate (FHR) monitoring during labour for women without risk factors; without considering intermittent auscultation (IA) first	100	50	72
4	Induction or augmentation of labour without a medical indication	100	40	100

Table 8. (Continued)

Identified by nurses				
5	Hair removal routinely to reduce the risk of surgical site infection	83	50	83
6	Non-iodophor-impregnated incise drapes used routinely for surgery	83	50	83
7	Bandage a primary closure wound in patients with an acute wound surgery	79	60	80
Practices identified by in the focus groups				
1	Routine use of tumour markers in cancer monitoring			
2	Redundant follow-up of a patient, from two or three different specialties			
3	Routine use of stress tests in patients with stable coronary disease			
4	Routine use of coagulation test before minor surgery			
5	Overuse of ointments and dressing in wounds care			
6	Long fasting before surgery			
7	Routine chest X-Ray after thoracic surgery			

Acronyms. ASA: American Society of Anaesthesiologists' classification; COPD: chronic obstructive pulmonary disease; CT: computed tomography scan; ECG: electrocardiogram; MRI: magnetic resonance imaging; NA: No response; PPI: proton-pump inhibitors.

5.1.4.2 Survey to nurses

A total of 265 nurses answered the survey, giving their opinion on 5 to 10 recommendations in their area, from a list of 38 (total responses = 2,247) that were selected by the panel. Some of these recommendations are shown as an example in the Table I in Appendix 3.4. The selected recommendations covered various topics: 15 on wound care, 10 on general practice, seven on catheter care, three on pregnancy care, two on ostomy care, and one on elderly care. The response rate by specialty ranged from 2% (critical area) to 55% (trauma area), with an average of 13%.

Agreement to the recommendations was 96% in total and, on average, greater than 70% in all types of recommendations. Regarding the eight areas of care, the degree of agreement was higher than 70% in all of them; although the recommendations from the adult area showed greater agreement (99%; 95% CI, 98% –100%) compared to the emergency area (88%; 95% CI, 83% - 94%).

In 23 recommendations (61%), at least one nurse disagreed with the recommendation. The **reasons for disagreement** were that: the recommendation was not applicable in their setting (25%); they knew of new evidence that contradicts this recommendation (18%); the intervention is not used in routine practice (15%). Other reasons were

argued in 40% of the responses; mainly, that the recommendation is contrary to their personal experience, or to patients' preferences.

Regarding **subjective adherence** to recommendations in general, it was 80% and the median percentage was higher than 70% in all types of recommendations, except in the obstetric area, where it was 50%.

Regarding the **usefulness** of the recommendations, in 90% of the responses the participants considered them useful or very useful. However, it was less than 70% in the recommendation for the use of the electrosurgical unit.

The composite outcome **low-value practices potentially present in the hospital** showed that in seven recommendations there was agreement of 70% or more and subjective adherence below 70%. These recommendations represent 18% of the 38 evaluated and in all of them the utility was 70% or more.

5.1.4.3 Focus groups

A total of 15 health professionals participated in the focus groups; eight in the group of medical specialties and seven in the group surgical specialties.

Participants gave seven **examples of low-value practices possibly present in the hospital** which are summarised in Table 8.

Regarding the **barriers for reducing low-value practices**, at the micro level (related to the health professional) the most common was defensive medicine (Table 9), the need for self-protection and the management of uncertainty:

“Many times you think you will not find anything abnormal [in the diagnostic tests], but, at least in my case, it is better to have one test more than one test missing. Because, if you miss something [...] that may have dramatic consequences; for instance an undetected recurrence... So, you end up asking for that test. Even though you know... you are 95% sure you will not find anything”.

Table 9. Distribution of verbatims on barriers to reduce low-value practices by type of specialty.

Level	Category	Topic	M	S
Micro	Defensive medicine	Self-protection		
		Previous bad experiences		
		Management of uncertainty		
	Scientific evidence	Scepticism due to contradictory scientific evidence		
	Attitudes	Routine and resistance to change		
		Corporatism		
	Education	Lack of continuing education		
	Patients' literacy/knowledge	Expert patient		
		Patients' expectations		
	Meso	Leadership in the department	Lack of leadership	
Lack of interaction between health professionals				
Low uniformity in doctors' activities				
Lack of cohesion between professionals				
Leadership in the hospital		Little legal support from the institution		
		Organisational inertia		
		Lack of mission and/or strategy		
		Economic incentives / penalties		
		Lack of budget in the hospital to reduce low-value care		
		Information	Infoxication	
Macro	Healthcare provision	Lack of information systems tools		
		Workload		
		Little time for consultation		
	Health system	Low technology availability		
		Low equipment accessibility		
		Lack of coordination between institutions		
		Lack of legislation/policies on low-value practices		
		Differences in guidelines between regions		
External factors	Media and social networks			
	Political context (e.g. Spanish financial crisis)			

Acronyms: M. Medical specialties; S. Surgical specialties.

Colour shade represents the frequency of the topic in the speech

Furthermore, evidence-based resources were considered excessive and sometimes outdated and even contradictory by participants, leading to low confidence and low adherence to clinical recommendations. Regarding patients, high patient literacy and knowledge were considered as a barrier when, for example, expert patients demand specific tests that doctors may consider of low value in a given context.

At the meso level, the lack of leadership and interaction between professionals, and also the low uniformity in the activities of the doctors, were perceived as important barriers; for example, duplication of diagnostic tests between departments during follow-up, or variability of criteria when ordering diagnostic tests or prescribing treatments. Duplication was classified as a barrier at the meso level because the majority of cases/k are related to the lack of coordination at the institutional level;

however, there are duplications that may be related to the misuse of tests by professionals. This can happen when, for example, tests are performed more frequently than necessary, such as the measurement of thyroid stimulating hormone (TSH) before six weeks after modifying treatment, or taking daily samples in critically ill patients, which, for example in the elderly, can induce anaemia in the elderly.

When comparing between medical and surgical groups, medical specialties mentioned topics that did not appear in the surgical group, for example, managing uncertainty or excess information (infoxication). On the other hand, the surgical specialties expressed concerns about the legal support of the institution. This concern was not mentioned in the medical specialties group (Table 9).

Regarding **facilitators to reducing low-value practices**, all group contributions were related to barriers at the meso level (Table 10). The discussion focused mainly on management and leadership, where teamwork was considered as a facilitator:

"It's a matter of... teamwork is essential... because if one team member starts to turn the wheel, and another team member does the same, after a while the wheel will turn automatically."

Some other examples of verbatims about barriers and facilitators for reducing low-value care are shown in Table V (barriers) and Table VI (facilitators) in the Appendix 3.3.

Table 10. Distribution of verbatims on facilitators to reduce low-value practices by type of specialty.

Level ^a	Category	Topic	M*	S*
Meso	Management and leadership	Supervision of team tasks by the head of department		
		Teamwork and snowball effect to solve resistance to change		
		Consensus or negotiation when implementing changes in a given department, more than vertical structures with a top-down approach		
		Keeping new strategies for the long term		
		Reducing staff turn-over		
	Improvements on processes	Delegating some medical tasks to nurses; for example, collecting clinical information		
		Surveillance of interactions between professionals from different departments and better coordination between services		
		Improving the availability of internal healthcare statistics, even at departmental level		
	Information flow	Ensuring the quality, access and dissemination of recommendations from protocols and clinical practice guidelines		
		Improvement proposals	Information flow	Use of campaigns, promoting a single key message on clinical practice, as a way to reduce variability
Improving of corporate e-mail messaging				
Mail lists inside departments to reduce variability in clinical practice				
Alarms in the information system in case of duplicities in diagnostic tests petitions; especially among different departments				

a. We obtained no verbatim quotations related to the micro and macro levels or external factors; Acronyms: M. Medical specialties; S. Surgical specialties
 Colour shade represents the frequency of the topic in the speech

5.2. Full text of articles

5.2.1 Article I

**Bonfill X, Osorio D (contacting author), Solà I, Pijoan J.I, Balasso V, Quintana M.J, et al. DianaHealth.com, an On-Line Database Containing Appraisals of the Clinical Value and Appropriateness of Healthcare Interventions: Database Development and Retrospective Analysis. PLOS One. 2016 11(2): e0147943. doi:10.1371/journal.pone.0147943.
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RESEARCH ARTICLE

DianaHealth.com, an On-Line Database Containing Appraisals of the Clinical Value and Appropriateness of Healthcare Interventions: Database Development and Retrospective Analysis

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Abstract

Objective

To describe the development of a novel on-line database aimed to serve as a source of information concerning healthcare interventions appraised for their clinical value and appropriateness by several initiatives worldwide, and to present a retrospective analysis of the appraisals already included in the database.

Methods and Findings

Database development and a retrospective analysis. The database DianaHealth.com is already on-line and it is regularly updated, independent, open access and available in English and Spanish. Initiatives are identified in medical news, in article references, and by contacting experts in the field. We include appraisals in the form of clinical recommendations, expert analyses, conclusions from systematic reviews, and original research that label any health care intervention as low-value or inappropriate. We obtain the information necessary to classify the appraisals according to type of intervention, specialties involved, publication year, authoring initiative, and key words. The database is accessible through a search engine which retrieves a list of appraisals and a link to the website where they were

Competing Interests: The authors have declared that no competing interests exist.

published. DianaHealth.com also provides a brief description of the initiatives and a section where users can report new appraisals or suggest new initiatives. From January 2014 to July 2015, the on-line database included 2940 appraisals from 22 initiatives: eleven campaigns gathering clinical recommendations from scientific societies, five sets of conclusions from literature review, three sets of recommendations from guidelines, two collections of articles on low clinical value in medical journals, and an initiative of our own.

Conclusions

We have developed an open access on-line database of appraisals about healthcare interventions considered of low clinical value or inappropriate. DianaHealth.com could help physicians and other stakeholders make better decisions concerning patient care and healthcare systems sustainability. Future efforts should be focused on assessing the impact of these appraisals in the clinical practice.

Introduction

Healthcare systems worldwide must promote the most effective interventions and avoid those that are of low-value or inappropriate in order to face the challenge of remaining sustainable without jeopardising the quality of care [1–3]. Assessing appropriateness in health care involves three dimensions: 1. effectiveness, including the risk-benefit trade-off based on valid evidence; 2. cost-effectiveness, taking into account the available resources, and 3. characteristics, values and preferences of the individual, the community and society [4,5]. In recent years, the concept of value in healthcare, defined as outcomes relative to costs, has been introduced to better reflect whether a medical procedure is justified in the face of its benefits and costs [6]. Other authors have preferred the terms overuse or underuse to describe inappropriate interventions [7].

Using one term or another and applying a variety of methods, several researchers and clinical experts around the world have assessed or given their opinion about the appropriateness or the value of many healthcare interventions. Over the last years, a number of initiatives have been established to address this topic [8–14]. Information about these initiatives and their appraisals has been disseminated through different formats, such as research articles, letters, institutional reports and websites. Furthermore, the information is widely dispersed, making it difficult and inefficient for any potential user, either caregivers, policy makers, or patients, to form a complete view of what has been published on this topic. To solve these problems and to disseminate these initiatives and their results as widely as possible, we developed an on-line database that could serve as a fast, user-friendly, and constantly updated source of information concerning healthcare interventions appraised for their clinical value and appropriateness. In this article we describe the process of building the on-line database and we present the features of the website where it is hosted and the results of a retrospective analysis about the initiatives and the appraisals that were included in the website until July 2015.

Materials and Methods

Database development

In order to develop the database we established the following definitions:

- Appraisal: any assessment or critical judgment about any healthcare intervention considered either as low-value, inappropriate or unnecessary, or valuable but underused, in the form of a clinical recommendation, literature review or an expert’s analysis.
- Healthcare intervention: any treatment (e.g. drug, surgery, procedure, therapy or counseling), any test (e.g. laboratory, imaging, or any diagnostic procedure) or any other action (e.g. educational or management strategy) used in any field of healthcare to improve health or to help with a particular problem.
- Initiative: any collaborative effort to either appraise the appropriateness or the value of healthcare interventions or to collect clinical value and appropriateness appraisals.

The development of the on-line database started in Jun 2012. First, we searched the initiatives worldwide assessing the appropriateness or the value of healthcare interventions and their appraisals. We then defined and obtained the information necessary to build the database. Finally we designed the website where the database would be hosted, including a search engine to consult the database. The process to create the database ended in January 2014 with the launching of the website.

Search strategy and selection of references. We searched the main worldwide initiatives that aimed to assess the appropriateness or the value of healthcare interventions and their appraisals by following medical news and article references, and by contacting experts in the field. We also searched articles related to the initiatives in MEDLINE (PubMed) using the strategy shown in Fig 1. The search was limited to articles published after June 2008 but no language restrictions were applied. Additionally, we used Google to search more information about the initiatives and about the authors of the appraisals.

We selected any type of publication (e.g. research article, letter, review, etc) as long as it met all the following criteria:

```

((((((((("inappropriate"[ti]) OR "low-value"[tiab]) OR "unnecessary"[tiab]) OR overused[tiab]) OR overdiagnos*[tiab]) OR overtreat*[tiab]) OR underuse*[ti]) OR Appropriateness[ti])) AND
(((Procedures[tiab]) OR Therapies[tiab]) OR Interventions[tiab]) OR "health care"[tiab])
    
```

Fig 1. Search strategy to identify initiatives.

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- The reference either contains a set of appraisals about low-value, inappropriate or unnecessary interventions or it is part of an established initiative according to the definition provided above.
- The authors of the appraisal and of the initiative, if they are different, must belong to non-profit research or academic groups, such as scientific societies, or to governmental agencies or institutions.

We also searched for other appraisals published by the initiative but not included in the publication found with the search strategy.

Data extraction and database building. A team of trained physicians retrieved the following information regarding the initiatives: institutions involved, country, year of launching, funding, aim of the initiative and methodology used to make the appraisal. The team also obtained the following information regarding the appraisals: initiative, publication year, type of intervention (e.g. diagnostic, pharmacologic or preventive), related specialties (e.g. anaesthesiology or cardiology), recommended action regarding the intervention (i.e. in favour or against its use), and keywords identified in the title. When appraisals were in languages other than English or Spanish and the titles clearly stated the population and the intervention, the team translated the title directly into English and Spanish with the support of a translator. If titles were not clear, they added a short explanation in English and Spanish.

The database was created after identifying, selecting, classifying and translating the appraisals.

Website design. We designed and created the website with the help of a team of IT engineers. The design included a search engine to retrieve the appraisals from the database and other content such as a news section, a list of the authoring initiatives, and a section where users could suggest new content for the website.

The web app was developed in Hypertext Pre-processor (PHP) 5. We used the latest technologies in web development, such as Hyper Text Markup Language (HTML5), cascading style sheets (CSS3) and Asynchronous JavaScript-XML (Ajax). We also used MySQL 5 as a database management system in order to perform query optimization. The application was installed on a Linux server with redundant elements to ensure stability, and Secure Sockets Layer (SSL security).

Retrospective analysis

We analysed the initiatives and the appraisals included in the database until July 2015. Data for this analysis were obtained directly from the website. We described the following characteristics of the initiatives: researchers and institutions involved, country, year of launching or publication, type of initiative, terms used to describe their aims, and number and type of appraisals.

We analysed the appraisals included in the database according to the following characteristics: specialty, type of intervention concerned in the recommendation, and publication year. We also analysed the appraisals that had been published on selected topics and some findings of the database maintenance process.

Results

Features of the on-line database

[Fig 2](#) summarises the database development.

The on-line database is hosted at www.DianaHealth.com in English, and also at www.DianaSalud.com in Spanish. The name of the website is an acronym that stands for its objective: Dissemination of Initiatives to Analyse Appropriateness in Healthcare (Divulgación de

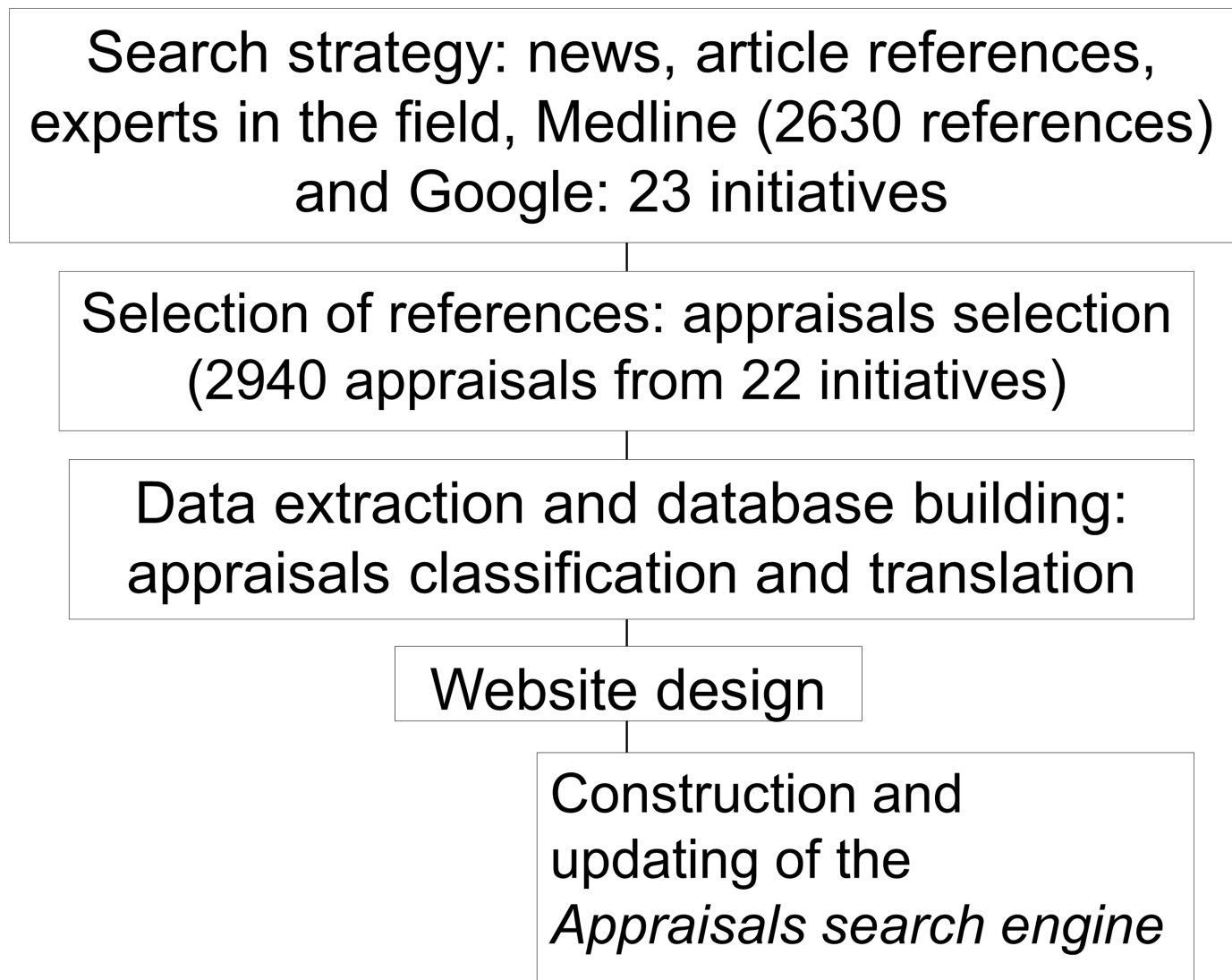


Fig 2. Process to create the on-line database www.DianaHealth.com.

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Iniciativas para Analizar la Adecuación en Salud). The database and the website where it is hosted are open access; they meet the Open Source Initiative criteria.

The website has seven sections: *Initiatives*, *Search recommendations/analysis*, *News*, *Report a new recommendation or suggest a new analysis*, *Contact us*, *About us*, and *How to search*.

The section *Initiatives* comprises a brief profile of each initiative which includes the following information: authors, year of launching, aim, and a link to its respective website.

In the section *Search Recommendations/Analysis*, users can consult the appraisals database through a search engine. The engine admits one or more of the following criteria: initiative, medical specialty, type of intervention, type of appraisal (high value or low value) or publication year. The search engine also admits specific free-text search terms related to any health problem or topic, such as, aortic aneurysm, epilepsy, bevacizumab, or vaccines. The search terms can be entered in either English or Spanish. After running a search, the list of results is displayed on the right. Each item in the list is an appraisal of the value or appropriateness of a

given healthcare intervention. By clicking on any result, users can find additional information such as the authoring initiative, title, publication year, specialties involved, type of intervention, and a link to the original source where it was published. Furthermore, the search results can be exported into an Excel spreadsheet (*.csv) containing all this information.

The *news* section announces new initiatives and appraisals included in the website. It also posts events such as conferences and meetings on topics of interest, such as overdiagnosis, right care and clinical value.

In the section *Report a new recommendation or suggest a new analysis*, users can suggest the inclusion of new initiatives or appraisals not yet included in the database. In the section *Contact us*, users can find our e-mails to suggest improvements to the website and collaborative proposals. In the sections *About us*, and *How to search* we provide information about the operation of the website. Moreover, the website has *Facebook* and *Twitter* accounts to increase dissemination of the included initiatives and their appraisals.

The website is financially independent and not for profit. It does not receive financial support of any kind from the pharmaceutical or technology industries. It has been partially funded by the CIBERESP, a governmental research consortium in Spain (see the Funding section at the end of the article).

To keep the website updated, we identify new initiatives applying the same search strategy described in the methods, every one or two months. To keep the database valid, we check the sources where the included initiatives and the appraisals were identified every month or two, looking for modifications in the appraisals, such as withdrawals. Finally, to ensure that the links to the original sources are always functional, our IT engineers developed a system that automatically detects broken or misleading links to the original sources. The system generates a weekly report with the dysfunctional links, so we can fix them almost as soon as they change.

Retrospective analysis

Since its launching in January 2014 until July 2015, we identified 23 initiatives (Tables 1, 2 and 3) and included 2940 appraisals of healthcare interventions from 22 initiatives in the database. The appraisals from one initiative (the ACR Appropriateness Criteria [14]) have not yet been included in the database. None of the 22 initiatives included until July 2015 was identified through the option “Report a new recommendation”.

The 23 initiatives were: eleven campaigns gathering clinical recommendations from scientific societies, five sets of conclusions from literature review, four sets of recommendations from guidelines, two collections of articles on low clinical value in medical journals, and an initiative of our own (Tables 1, 2 and 3). These initiatives came from scientific societies, governmental health institutions, and universities from high-income countries. All the initiatives but one were launched in the last decade, and they were all still active at the time of inclusion. Two initiatives, the Right Care Alliance from the US [36] and the Right Care programme from UK [37], were not included as such in DianaHealth.com since they do not provide appraisals of the clinical value or appropriateness of any particular intervention. However, they were included in the DianaHealth.com news section. The US Right Care initiative is an interesting network of healthcare professionals and citizens who promote avoidance of overuse in medicine through educational materials and other resources. The UK Right Care programme focuses on describing variability in clinical practice and compiling local examples of commissioning innovations.

The terms used by the included initiatives to describe their aims were varied. For example, Elshaug et al [12], Prasad et al [13], and the Spanish initiatives ‘Essencial’ [24] and ‘Compromiso por la Calidad de las Sociedades Científicas’ [25] refer to “low-value practices.” The US Choosing Wisely [9], the Canadian Choosing Wisely [10] and the Australian Choosing Wisely

Table 1. Characteristics of the initiatives aimed at reducing low-value or inappropriate healthcare interventions included in DianaHealth.com until July 2015. Results are shown in order of year of launching.

Initiative (year of launching/publication)	Authors (Country)	Type of initiative	Results
1. ACR Appropriateness Criteria® (1993)	American College of Radiology (United States)	Set of guidelines obtained from literature review and expert consensus	Appropriateness Criteria on over 208 clinical conditions [14,15]*
2. NICE Do not Do Recommendations (2009)	National Institute for Health and Clinical Excellence (NICE) (United Kingdom)	Set of recommendations from clinical guidelines	987 Clinical recommendations [8,16]
3. Cochrane Quality and Productivity topics (2010)	National Institute for Health and Clinical Excellence (NICE) (United Kingdom)	Set of conclusions from literature review (Cochrane systematic reviews)	63 Reports drawn from systematic reviews by the Cochrane Collaboration [16,17]
4. U.S. Preventive Services Task Force A and B recommendations (2010)	U.S. Preventive Services Task Force (United States)	Set of recommendations from clinical guidelines	20 Clinical recommendations rated as A [18]
5. The Canadian Task Force for Preventive Health Care (CTFPHC) Guidelines (2010)	The Canadian Task Force for Preventive Health Care (Canada)	Set of recommendations from clinical guidelines	30 Clinical recommendations [19]
6. JAMA Less is more collection (first article in the collection is from 2010)	JAMA Internal Medicine (International journal based in the US)	Collection of articles	208 Original investigations and other type of publications [20,21]
7. MAPAC Initiative (In Spanish, Mejora de la Adecuación de la Práctica Asistencial y Clínica. In English, Improvement of Appropriateness in the Clinical Practice and Healthcare) (2011)	Centro de Investigación Biomédica en Red de Epidemiología y Salud Pública (CIBERESP) (Spain)	Initiative of our own. It provides clinical recommendations to avoid inappropriate and low-value interventions and to promote valuable interventions	14 Clinical recommendations
8. Elshaug, et al. Article (2012)	Researchers from the Comprehensive Management Framework (CMF) (Australia)	Conclusions from literature review	A list of over 150 potentially low-value health care practices [12]
9. Choosing Wisely® (2012)	ABIM Foundation and national organizations representing medical specialists (United States)	Campaign gathering clinical recommendations from scientific societies	435 Evidence-based recommendations [9]; patient-friendly materials.

*The ACR Appropriateness criteria have not yet been included in the website.

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[34] described the interventions as “unnecessary.” Other initiatives did not use a specific term but referred to interventions that “should be discontinued or not used routinely” (Do not Do [8]), or to practices “that confer no benefit but have true risks” (Less is More [21]).

Most of the initiatives (15 out of 23) presented their appraisals as clinical recommendations (in favour or against the use of a given intervention), either evidence-based or based on expert consensus while eight initiatives did not provide recommendations: six of them provided evidence-based assessments, and two initiatives were topic collections and article series from two medical journals respectively, gathering articles of different types (original investigations, reviews, and letters) that appraise the value or appropriateness of healthcare interventions (Tables 1, 2 and 3). Four of the Choosing Wisely initiatives and *Essencial*, in addition to providing clinical recommendations, also developed informative materials to facilitate doctor-patient communication in order to improve appropriateness.

As for the 2940 appraisals included in the database, most of them were about low value or inappropriate interventions (96%, n = 2830). The rest (4%) were about appropriate interventions. We also included these appraisals in the website. Table 4 shows some characteristics of the appraisals included in DianaHealth.com by July 2015.

Table 5 shows an example of the number of appraisals retrieved by the search engine using three keywords: cancer, pregnancy and heart disease. Another example of the options of the

Table 2. Characteristics of the initiatives aimed at reducing low-value or inappropriate healthcare interventions included in DianaHealth.com until July 2015. Results are shown in order of year of launching.

Initiative(year of launching/publication)	Authors (Country)	Type of initiative	Results
10. Doing more does not mean doing better (In Italian, Fare di più non significa fare meglio) (2012)	Slow Medicine (Italy)	Campaign gathering clinical recommendations from scientific societies	209 Clinical recommendations [22,23]; patient-friendly materials
11. Essencial (2013)	Agència d'Avaluació i Qualitat Sanitàries de Catalunya (AquAS) (Catalonia, Spain)	Campaign gathering clinical recommendations from scientific societies	37 Evidence-based recommendations [24]; patient-friendly materials
12. Compromiso por la calidad de las Sociedades Científicas (In English, Scientific Societies' Commitment for quality) (2013)	Ministerio de Sanidad, Servicios Sociales e Igualdad (Spain)	Campaign gathering clinical recommendations from scientific societies	105 Clinical recommendations [25]
13. Prasad, et al. Article (2013)	Researchers from several centres and universities (United States)	Conclusions from literature review	A list of 146 existing practices found to be no better than a lesser Therapy [13]
14. TheBMJ Too Much Medicine (first article in the collection is from 2013)	The British Medical Journal (International journal based in the UK)	Collection of articles	139 Original investigations, editorials, or analyses about unnecessary care [26]
15. Choosing Wisely Canada (2014)	Canadian Medical Association/ University of Toronto and national societies (Canada)	Campaign gathering clinical recommendations from scientific societies	151 Evidence-based recommendations [10]; patient-friendly materials
16. Choosing Wisely Netherlands Campaign (2014)	Dutch Association of Medical Specialists (OMS), scientific associations and ZonMw (Netherlands)	Campaign gathering clinical recommendations from scientific societies	<i>Wise choices</i> : 25 clinical recommendations [11]; <i>Care evaluation</i> : effectiveness studies; Analyses of the variations in health services activity
17. Prescrire Pour mieux soigner, des médicaments à écarter: bilan (In English, Towards better patient care: drugs to avoid in 2015) (2014–2015)	Prescrire.org (France)	Conclusions from literature review	List of 71 drugs considered more harmful than beneficial [27,28]

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Table 3. Characteristics of the initiatives aimed at reducing low-value or inappropriate healthcare interventions included in DianaHealth.com until July 2015. Results are shown in order of year of launching.

Initiative (year of launching/publication)	Authors (Country)	Type of initiative	Results
18. Recomendaciones No Hacer (In English, Do not Do Recommendations) (2014)	Sociedad Española de Medicina de Familia y Comunitaria semFYC (Spain)	Campaign gathering clinical recommendations from scientific societies	30 Clinical recommendations [29]
19. Morgan et al. Article (2014)	Researchers from several centres and universities (United States)	Conclusions from literature review	Review article providing conclusions on 10 overused health care interventions [30]
20. Smarter medicine (2014)	Swiss Society of General Internal Medicine (Switzerland)	Campaign gathering clinical recommendations from scientific societies	5 Clinical recommendations [31,32]
21. Recomendaciones No Hacer (In English, Do not Do Recommendations) (2014)	Sociedad Española de Radiología Médica SERAM (Spain)	Campaign gathering clinical recommendations from scientific societies	38 Clinical recommendations [33]
22. Choosing wisely Australia (2015)	Australia's medical colleges and professional societies and facilitated by NPS MedicineWise (Australia)	Campaign gathering clinical recommendations from scientific societies	27 Clinical recommendations [34]; patient-friendly materials
23. Choosing wisely Japan (2015)	Researchers from the University of Tsukuba (Japan)	Campaign gathering clinical recommendations from scientific societies	5 Clinical recommendations [35]

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Table 4. Characteristics of the appraisals included in DianaHealth.com until July 2015.

Characteristic	n (%)
Specialty (n = 5334)*	
Internal Medicine	661 (12)
Family Medicine	547 (10)
Paediatrics	292 (6)
Cardiology	235 (5)
Gynaecology	241 (4)
Surgical specialties [#]	868 (16)
All the other specialties [¥]	2490 (47)
Type of intervention concerned in the recommendation n = 2940	
Drugs (non-chemotherapy drugs)	935 (32)
Diagnostic (Images)	447 (15)
Diagnostic (Laboratory tests)	314 (11)
Diagnostic (Procedures)	217 (7)
Surgical procedures	205 (7)
Preventive interventions	126 (4)
Others	106 (4)
Other non-pharmacological therapies	105 (4)
More than one type of intervention	102 (3)
Chemotherapy drugs	75 (3)
Rehabilitation	60 (2)
Educational interventions	55 (2)
Radiotherapy	41 (1)
Small procedures	41 (1)
Management	35 (1)
Psychological interventions	31 (1)
Alternative Therapies	28 (1)
Diet and lifestyle	17 (1)
Publication year (n = 2940)	
2015	500 (17)
2014	585 (20)
2013	517 (17)
2012	1198 (41)
Before 2012	140 (5)

*Some appraisals were related to more than one specialty.

[#]Anaesthesiology, Cardiac surgery, General surgery, Maxillofacial medicine/surgery/Dentistry, Obstetrics, Otolaryngology/Head & Neck Surgery, Plastic and reconstructive surgery, Thoracic, surgery, Trauma and Orthopaedics, Urology, Vascular surgery.

[¥]Anatomical pathology, Clinical analysis/biochemistry, Clinical Microbiology, Clinical Pharmacology, Critical care, Dermatology, Emergency, Endocrinology, Gastroenterology, Geriatric medicine/Elderly medicine, Haematology, Immunology/Allergology, Infectious diseases, Nephrology, Neurology/ Neuropsychology, Nuclear medicine, Nursing, Nutrition and dietetics, Occupational and Environmental Medicine, Oncology, Ophthalmology, Palliative care, Psychiatry/Mental health, Public health, Pulmonology, Radiology, Radiotherapy, Rehabilitation, Rheumatology, and a special category several specialties.

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Table 5. Example of the number of appraisals retrieved by the DianaHealth.com search engine in July 2015 (n = 2940), on three different health topics. The results are classified according to the initiative.

Initiative	Cancer*	Pregnancy [#]	Heart disease [¥]
1. NICE Do not Do Recommendations (UK)	92	60	20
2. Cochrane Quality and Productivity Topics (UK)	3	4	0
3. U.S. Preventive Services Task Force A recommendations (USA)	2	9	0
4. The Canadian Task Force for Preventive Health Care (CTFPHC) Guidelines (Canada)	7	0	0
5. JAMA Less is more collection (USA)	21	1	7
6. MAPAC Initiative (Spain)	2	0	0
7. Elshaug, et al. article (Australia)	19	2	3
8. Choosing Wisely [®] (USA)	53	3	23
9. Doing more does not mean doing better (Fare di più non significa fare meglio) (Italy)	13	4	3
10. Essencial (Spain)	4	1	1
11. Compromiso por la calidad de las Sociedades Científicas (Spain)	9	1	4
12. Prasad, et al. article (USA)	6	2	15
13. TheBMJ Too much medicine (UK)	23	1	1
14. Choosing Wisely Canada (Canada)	15	2	2
15. Choosing Wisely Netherlands Campaign (Netherlands)	1	0	0
16. Prescrire Pour mieux soigner, des médicaments à écarter: bilan(France)	4	0	0
17. Recomendaciones No Hacer semFYC (Spain)	1	0	2
18. Morgan et al. article (USA)	1	0	0
19. Smarter medicine (Switzerland)	1	0	0
20. Recomendaciones No Hacer SERAM (Spain)	2	0	0
21. Choosing wisely Australia (Australia)	2	1	1
22. Choosing wisely Japan (Japan)	1	0	0
Total	282	91	82

* Using the search term *cancer*.

[#]Using *pregnan* as a root word to find *pregnancy* and *pregnant*.

[¥]Combining results of two searches (*coronary, infarct*).

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search engine is shown in the [S1 Appendix](#). This is an Excel spreadsheet obtained when selecting Vascular Surgery in the field of medical speciality (n = 73 appraisals). The search engine also allows users to identify common or similar appraisals provided by different initiatives, and contrast them. For example, the use of images for low back pain in the absence of red flags was analysed in 22 appraisals against this practice, provided by 11 initiatives (Choosing Wisely from US, Canada, and Australia; Smarter Medicine, Doing more does not mean doing better; Do Not Do; Compromiso por la calidad de las Sociedades Científicas; Essencial; Less Is More; SemFYC recommendations; and Elshaug et al.).

After several updating processes, we observed that the initiatives updated their contents at different intervals. For instance, Less is More and Too Much Medicine posted new items weekly (sometimes daily), Choosing Wisely and Essencial published new recommendations every one or two months, and the Prescrire Initiative published a new report after a year [28]. Furthermore, we observed that some appraisals of some of the initiatives have been withdrawn by the authoring initiative, for instance, some appraisals from the NICE Do not Do recommendations database.

During the updating processes, we also identified new initiatives. In the last updating, we identified two Choosing Wisely-like new initiatives from UK [38], and Germany [39], but we were unable to identify any appraisal.

Discussion

Principal findings

We have developed a website named DianaHealth.com, an on-line database of appraisals about healthcare interventions considered low value or inappropriate in clinical practice. The website is open access, independent and constantly updated. It is available in English and Spanish and has a search engine to retrieve the appraisals using one or more search criteria.

Up to July 2015, the database included 2940 appraisals from 22 initiatives. Most of the initiatives ($n = 11$) were campaigns gathering clinical recommendations from scientific societies, outside the context of a clinical practice guideline document. The rest of initiatives were sets of conclusions from literature review ($n = 5$), sets of recommendations from clinical practice guidelines ($n = 3$), collections of articles on low clinical value in medical journals ($n = 2$), and an initiative of our own. The appraisals were mostly recommendations on pharmacological and diagnostic interventions, made by clinical experts from 22 initiatives of different kinds. Most appraisals were from scientific societies.

Strengths and weaknesses of this project

DianaHealth.com contributes to disseminating initiatives and their results, facilitating the search for information about appropriateness in healthcare. The website is user-friendly because no registration is required and the initiatives and appraisals are accessible with a few clicks. Since its contents are available in English and in Spanish, DianaHealth.com makes the information accessible to people in many countries. Finally, the exportable format to a comma-separated values file (CSV file) allows users to make further analyses related to their interest, for example, identifying interventions that have been appraised by more than one initiative and may have more consensus regarding their low value.

We have identified the following weaknesses. First, some initiatives might not have been detected since we did not carry out a systematic search. However, the most well-known initiatives worldwide have been included and the website allows the inclusion of new initiatives at any moment. Second, new appraisals might not be available in DianaHealth.com until one or two months after they are published in their original sources. Third, the nature of the appraisals is diverse; for instance, some are evidence-based clinical recommendations, and others are a judgment of one or two experts, which might have an impact on the quality of the appraisals. DianaHealth.com provides links to the information published in a variety of sources, but the responsibility for their quality rests entirely on the authors, since we do not have the resources to assess the soundness of the appraisals included in the website. Finally, the impact assessment of DianaHealth.com is still limited. Even though we have received positive comments through the website's contact service, its Facebook, and Twitter accounts, we do not yet have any statistics of usability, or other feedback.

Strengths and weaknesses in relation to other studies and databases

As far as we know, the DianaHealth.com project is unique. We have not found any other databases that collect the main initiatives and appraisals about clinical value and appropriateness from recent years in a single site. Some of the websites of the initiatives included in DianaHealth.com [8,9,24] provide tools to search their appraisals, but these tools offer few options and allow somewhat limited searches.

Several of the initiatives included in DianaHealth.com have been referenced by other authors. For instance, Hurley [40] wrote an interesting article describing the Choosing Wisely-like initiatives, but did not mention other initiatives pursuing the same objective.

Implications for clinicians and policymakers

The information collected in DianaHealth.com promotes awareness of initiatives concerning inappropriate or low-value interventions. Identifying and decreasing these interventions is crucial to improve the quality and sustainability of healthcare systems. Despite the importance of these appraisals, however, some caution is necessary before applying any of them to a particular setting because certain aspects analysed when conducting the appraisals (such as, cost or necessary resources for implementation), might differ between countries, between health systems, or over time. Moreover, patients' values and preferences must always be taken into account.

Future actions

The database has short and long-term objectives: to expand the contents of the database by including references containing a single appraisal, searching other databases beyond MEDLINE, and including the terms *disinvestment* and *de-implementation* in the search strategy; to increase the database audience, making its contents available in other languages other than English and Spanish; and to measure the impact of the database by implementing quantitative indicators, such as the number of visits. It would also be of interest to find effective ways to present the appraised interventions to patients and to assess the impact of the appraisals on the use of the interventions in the clinical practice. Finally, it would be useful to have a search filter in Medline and other databases to identify literature about low-value or inappropriate interventions.

Supporting Information

S1 Appendix. Excel spreadsheet obtained when selecting Vascular Surgery in the field of medical speciality (n = 73 appraisals).
(XLSX)

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Author Contributions

Conceived and designed the experiments: XB DO IS JIP. Performed the experiments: XB DO VB MJQ. Analyzed the data: DO. Contributed reagents/materials/analysis tools: XB. Wrote the paper: XB DO IS JIP VB MJQ TP IB GU JZ JIE AGC IFG.

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5.1.2 Article II

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RESEARCH

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Development of quality of care indicators from systematic reviews: the case of hospital delivery

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Abstract

Background: The objective of this research is to generate quality of care indicators from systematic reviews to assess the appropriateness of obstetric care in hospitals.

Methods: A search for systematic reviews about hospital obstetric interventions, conducted in The Cochrane Library, clinical evidence and practice guidelines, identified 303 reviews. We selected 48 high-quality evidence reviews, which resulted in strong clinical recommendations using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) system. The 255 remaining reviews were excluded, mainly due to a lack of strong evidence provided by the studies reviewed.

Results: A total of 18 indicators were formulated from these clinical recommendations, on antepartum care (8), care during delivery and postpartum (9), and incomplete miscarriage (1). Authors of the systematic reviews and specialists in obstetrics were consulted to refine the formulation of indicators.

Conclusions: High-quality systematic reviews, whose conclusions clearly claim in favour or against an intervention, can be a source for generating quality indicators of delivery care. To make indicators coherent, the nuances of clinical practice should be considered. Any attempt made to evaluate the extent to which delivery care in hospitals is based on scientific evidence should take the generated indicators into account.

Keywords: Quality improvement methodologies, Quality indicators, Healthcare, Evidence-based medicine, Obstetrics and gynaecology, Evaluation methodology

Background

Quality of care has been defined as the degree to which health services increase the likelihood of desired health outcomes for individuals and populations and are consistent with current professional knowledge [1]. Scientific knowledge is not the only component of the quality of care that must be taken into account, as other structural factors such as process or outcome are also important. In addition, local and particular circumstances of each situation and patients' preferences cannot be ignored when assessing the appropriateness of a decision [2]. Nevertheless, evaluation of clinical practice through

the filter of scientific evidence is an essential enterprise, coherent with the goals of a public health system, the ethical principles of health professionals and the basic rights of citizens, given the possibility that patients might receive inappropriate health care [3,4].

Too little attention has been paid to the correlation between the availability of scientific evidence and clinical practice. A series of studies [5-7] faced the burden of having to analyse *de novo* the evidence relevant to each case. The establishment of *a priori* clinical indicators to be used as performance measures might be more efficient for systematically assessing the degree to which scientific evidence is applied in clinical practice.

Development of indicators based on professional consensus has a long history [8,9], while systematic and explicit methods to incorporate scientific evidence have been developed to a lesser extent. Some recent initiatives, however, followed a systematic approach [10]. Moreover, a

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successful approach developed by the RAND Corporation combines scientific evidence with professional consensus: the process starts with defining topics of interest, continues with selecting available evidence from different sources, and ends with formulating indicators that are ultimately evaluated by panels of experts through a structured consensus method [11].

In the present study, we restricted the source of indicators of quality of care to systematic reviews (SR), based on the assumption that they provide the highest degree of reliability [12], are increasingly available, and that decision makers increasingly rely on them to cope with the ever-growing volume of healthcare research. Obstetric care during childbirth is particularly suitable for evaluation through evidence-based indicators because it is a field with a relatively high production of SRs. The Cochrane Pregnancy and Childbirth Cochrane Review Group had published hundreds of full SRs, which have been the basis for numerous recommendations and clinical practice guidelines (CPGs) [13]. In addition, some authors have challenged many indicators currently used in obstetrics; a recent study analysed the main indicators currently available (176 in total) and concluded that most did not meet the requirements to measure quality of care [14]. Similar results have been reported in other areas of healthcare [10].

In summary, we generated a set of quality indicators of obstetric care related to childbirth, based on SRs, which could be applicable in different settings and circumstances.

Methods

The first phase of our project consisted of a literature search and generation of a set of recommendations based on sound evidence, either in favour or against

interventions in delivery care; the second phase consisted of developing and validating a set of indicators.

First phase

Table 1 summarizes the sequential steps followed in the first phase. This mainly consisted of identifying evidence, appraising literature, and generating and grading clinical recommendations. Only SRs of randomized clinical trials were considered.

Literature search

A literature search was conducted in the Cochrane Database of Systematic Reviews (The Cochrane Library, Issue 3, 2009, and updated in 2011), the Database of Abstracts of Reviews of Effects, and Clinical Evidence to identify SRs assessing obstetric interventions performed in a hospital setting. To retrieve supplementary relevant SR, we consulted the available CPG from the main obstetrical medical societies (the Royal College of Obstetricians and Gynaecologists, the American College of Obstetricians and Gynaecologists) and CPG of obstetric care from main guideline producers (the National Institute for Clinical Excellence (NICE), and the New Zealand Guidelines Group).

Selection of systematic reviews

Two researchers (MA and DR) independently applied selection criteria to the identified SR: pharmacological or non-pharmacological interventions, under the responsibility of the clinical team and registered at the clinical record or any other database. In case of disagreement, the criterion from a third author (XB) was applied.

Table 1 First phase: generation of clinical recommendations from systematic reviews

1. Literature search	Design and execution of a specific search strategy for identifying systematic reviews (SR).
2. Selection of SR	SR were included based on: <ul style="list-style-type: none">○ Field of interest: obstetrics○ Setting: hospital○ Relevant to the health topic○ Intervention of interest: pharmacological or non-pharmacological treatment, under the responsibility of the clinical team and potentially registered at the clinical record or any database.
3. Appraisal of SR	An assessment of the methodological quality of each SR; we excluded those documents that did not meet one or more internal validity criteria of SIGN*.
4. Generation of clinical recommendations (CR)	Generation of a clinical recommendation (for or against a particular intervention) from each SR. Definitions were provided for population, intervention, comparison and outcomes of interest.
5. Grading of Recommendations	Assessment of the quality of evidence and strength of recommendation based on the GRADE† system. Only those recommendations that were considered strong and supported by high quality evidence remained selected.

*SIGN: Scottish Intercollegiate Guidelines Network; †GRADE: Grading of Recommendations Assessment, Development and Evaluation.

Appraisal of selected reviews

Two researchers (MA and DR) independently appraised each SR and restricted the inclusion to SR that met all internal validity items established by the Scottish Intercollegiate Guidelines Network (SIGN) [15], as assessed on the review's full text. These criteria assess whether a formulated question is clearly addressed, a description of the methodology is included, the search strategy is sufficiently rigorous, the quality of individual studies is analysed and taken into account, heterogeneity is evaluated and the original authors tried to explain it.

Generation and grading of recommendations

For each selected SR, we classified the outcomes by relevance (critical, important and relative). Two authors (MA and DR) independently rated the quality of evidence and assessed the strength of recommendations based on the Grading of Recommendations Assessment, Development and Evaluation (GRADE) system [16]. Applicability of the GRADE system to generate quality indicators has been described previously [17,18]. Quality of evidence of critical outcomes was rated high, moderate, low or very low, based on: limitations in design of the primary studies; imprecision, inconsistency and indirectness of the estimates of effects; and likelihood of reporting bias and other biases. A set of clinical recommendations was generated based on balancing the desirable and undesirable consequences of an intervention and the quality of evidence. We used an adaptation of GRADE system, and patients' values, preferences and resource use were not considered because they are context-specific. Additional file 1: Table S4 shows the modified GRADE system we applied.

Two authors (MA and DR) independently selected recommendations that were considered strong (either in favour or against the application of a given intervention) and based on high quality evidence, at least for the most critical outcomes. In case of disagreements, a third author (XB) was consulted.

Second phase

Development and validation of indicators

From the selected clinical recommendations, we proceeded to construct indicators, following an adaptation of the methods proposed by the American College of Cardiology/American Heart Association (ACC/AHA) [19] and the Agency for Healthcare Research and Quality (AHRQ) [20]. Table 2 shows the general structure of an indicator and the sources of information for each section. Most of the information came either from the SR or current guidelines that summarize both evidence and clinical expertise. Specific sections such as the identification of sources of information to compute the indicator, factors that may explain variability in the results, and

specific setting characteristics to ensure the viability of the indicator were needed from clinical experts' input as well as additional supporting literature.

We subsequently consulted two specialists in obstetrics (CF and AV) to assess our design interpretation of the indicators, and the relevance of the indicators in current practice. This was followed by an email consultation with the authors of the SR on which the indicators were based, asking to what extent they agreed with the formulation of the indicator (content validity, robustness and reliability). The comments received from the review authors or consultants led us to modify or redefine various indicators.

Results

Search and selection of systematic reviews

Figure 1 shows the study flowchart. We identified 303 SR, 301 from the search in The Cochrane Library and 2 more [21,22] from the CPG consulted; 102 were excluded for not targeting acute care interventions, 149 for not providing clear evidence (there was no benefit/harm associated with the intervention), and 4 because interventions were not implemented by clinical teams, or the clinical processes were not sufficiently measurable. Then, 48 SR were provisionally selected for further consideration [21-43].

Quality of evidence assessment and generation of clinical recommendations

The selected reviews consisted exclusively of Cochrane reviews. No SR was excluded based on their quality assessment. In the following stage, 28 SR were excluded for not providing a base for any strong recommendation (either in favour or against an intervention). Thus, we generated 20 clinical recommendations that were both strong and based on high-quality evidence.

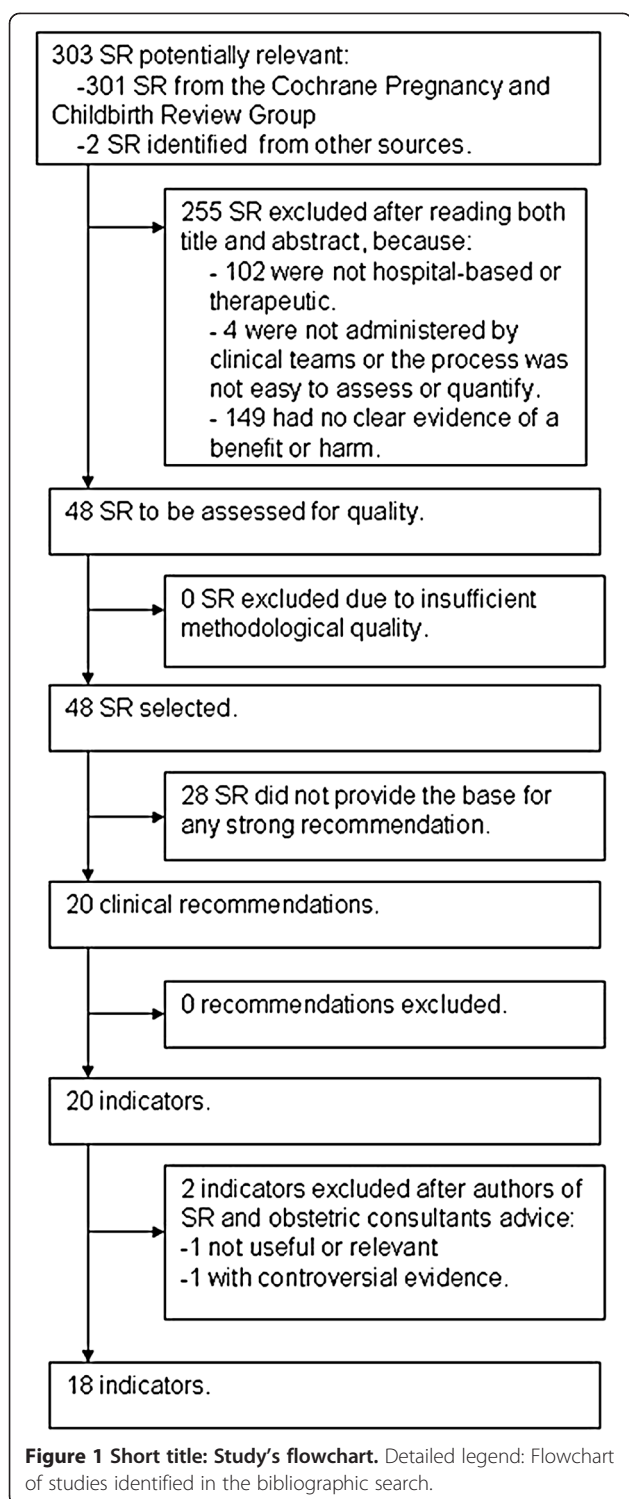
Construction and validation of indicators

Approximately 75% of the authors of the selected SR responded to our request to review the indicator. Overall, they agreed on the indicator proposal, and their comments were used for further improvement of their definition and formulation.

Following advice of the obstetric consultants, two indicators were removed: the proportion of women with singleton pregnancies at risk of preterm delivery to be treated with a combination of corticosteroids with thyrotropin-releasing hormone [33], and the proportion of breech deliveries carried out by caesarean section [32]. The main reasons for excluding these indicators were: the first is an intervention no longer used in clinical practice, and the existing evidence on the second is controversial in nature.

Table 2 General structure of an indicator

Element	Description	Source of information
a. Title	Brief statement of what is to be assessed	Research team
b. Type of Indicator	<ul style="list-style-type: none"> • Process indicator • Specific indicator of general or medical condition • Indicator of desirable or undesirable events • Indicator based on proportions or means 	Clinical recommendation based on SR
c. Definitions	<p>1. Clinical recommendation (PICO format): Clinical situation, population, intervention, comparison and main outcomes</p> <ul style="list-style-type: none"> • Operational definition of clinical terms in the research question • Definition of contraindications to treatment (if necessary) • Description of the diagnostic and procedure codes ICD-9-CM for the identification of the population 	Clinical recommendation based on SR, ICD-9-CM
d. Target population	Definition of the target population	Clinical recommendation based on SR
e. Rationale	<ul style="list-style-type: none"> • Impact of the clinical condition of interest • Brief description of the selected SR • Summary of the main benefits and/or harms associated with the intervention • Support of the recommendation by main clinical practice guidelines (CPG) 	SR, CPG
f. Supporting literature	Main bibliography that supports the indicator (SR and CPG)	SR, CPG
g. Description of indicator population	<p>Operational definition of the indicator (formula)</p> <ul style="list-style-type: none"> • Numerator / denominator • Exclusion criteria 	Clinical recommendation based on SR, clinical experts
h. Sources of information	<p>Description of the sources of information to compute the indicator:</p> <ul style="list-style-type: none"> • Administrative databases (mainly from inpatient and surgical area) • Clinical documentation (medical history) • Other (survey, etc.) 	Clinical experts
i. Standard	<p>Definition of the standard:</p> <ul style="list-style-type: none"> • Desirable event (↑) • Undesirable event (↓) 	Clinical recommendation based on SR
j. Underlying factors	<ul style="list-style-type: none"> • Factors related to the target population • Factors related to professionals • Factors related to the hospital 	SR, CPG, Clinical experts
k. Notes	Other aspects that complement the information summarized by the indicator.	Clinical experts
l. Desired characteristics of a hospital to ensure the viability of the indicator	<ul style="list-style-type: none"> • Essential features (associated with the identification of the denominator and the numerator) • Desirable features (associated with an acceptable time investment to measure it) 	Clinical experts



The 18 indicators eventually accepted are shown in Table 3. These indicators are intended to assess the delivery of care during the antepartum period (8 indicators [22-30]), during delivery (8 indicators [21,31,34-40]), at the immediate postpartum (one indicator [41]), and the management of miscarriages (one indicator [42]).

Indicators are expressed in proportions and refer to process of care, while none refer to structure or outcome. To illustrate the process (see Additional file 2: Table S5) presents the full content of one indicator (proportion of women with singleton pregnancies and threatened preterm labour who receive corticosteroids) and includes an example of its computation.

In 2011, we consulted the Cochrane Library in order to verify the updating status of SR that supports the indicators: all of them have been updated between 2009 and 2011. Three SR changed their conclusions; however none of those changes invalidate the indicators. The first SR, about using antibiotics in women with preterm rupture of membranes, concludes that despite the benefits at short term, during pregnancy, users should be aware of the unknown long term effects on newborns. The second SR, which likewise assesses the use of antibiotics in prophylaxis during caesarean section, provided a similar warning about the unknown long term effects in newborns. The third SR, about active versus expectant management in the third stage of labour, found potential adverse effects with several uterotonics and concludes that information about the benefits and harms should be provided in order to support an informed choice.

Discussion

The degree of justification or appropriateness of an intervention is directly related to the scientific evidence that supports its implementation and use in practice. Consequently, it seems logical to generate quality indicators through an explicit and systematic process and this has been our purpose. Other recent studies that have developed indicators in a variety of fields, including performance measures [19], clinical practice guidelines [44-46], or a mixed process of evidence appraisal and expert opinion [47,48], have been published. However, to our knowledge, the present study is unique in its focus on SRs.

Several authors warned about potential errors that could be made using quality indicators [49,50]. The most common criticism warns against a construction of quality indicators that is too mechanical. Such a construction would infringe upon the principle that clinical decisions should be flexible in nature, with a lack of individual assessment of each patient and circumstances before applying a particular intervention. Other concerns highlight potential consequences of inflexibility resulting from dichotomizing quality of care into adequate or inadequate in relation to a particular practice, and frequent methodological errors made in the design and construction of indicators [14].

SRs are one of the main instruments for synthesizing available evidence, although they remain little used to generate healthcare explicit quality indicators. In this

Table 3 Quality of care indicators generated in the project

Indicator	Target population	ICD-9 codes ^a	Indicator formula ^b	Standard ^c
1 Proportion of women with singleton pregnancies and threatened preterm labour (TPL) who receive corticosteroids ²⁵	Women with TPL and preterm labour	644.03, 644.10, 644.13, 644.20, 644.21	D: Singleton pregnancies between 26-34w N: Women who received corticoids E: Corticoids contraindications	≈100
2 Proportion of women who are treated with calcium channel blockers (CCB) for inhibiting preterm labour ²⁶	Women with TPL and preterm labour	644.03, 644.10, 644.13, 644.20, 644.21	D: Pregnancies between 22-34w N: Women who received CCB E: Contraindication to CCB	≈100
3 Proportion of women with threatened preterm labour treated with magnesium sulphate ²⁷	Women with TPL and preterm labour	644.03, 644.10, 644.13, 644.20, 644.21	D: Women who received pharmacological treatment for TPL N: Women who received magnesium sulphate E: None	≈0
4 Proportion of women with preterm rupture of membranes (PRM) who receive antibiotic treatment ²⁸	Women with PRM	658.10, 658.11	D: Pregnancies between 22-34w with PRM N: Women who received antibiotics E: None	≈100
5 Proportion of women with post-term pregnancy who give birth after 41 weeks of gestation ²⁹	Women with ≥41w pregnancy	641.X1, 642.X1, 676.X1	D: Women with >=41w pregnancy N: Women with labour induction E: Spontaneous labour, non-urgent caesarean delivery	≈0
6 Proportion of women with severe pre-eclampsia who were treated with magnesium sulphate ³⁰	Women with severe preeclampsia	642.5	D: Women with severe pre-eclampsia N: Women who received magnesium sulphate E: Contraindication to magnesium sulphate	≈100
7 Proportion of women with eclampsia treated with magnesium sulphate ^{22,23,24}	Women with eclampsia	642.6	D: Women with eclampsia N: Women who received magnesium sulphate E: Contraindication to magnesium sulphate	≈100
8 Proportion of women with term pregnancies and a breech presentation in which external cephalic version is performed or offered ³¹	Women with breech presentation	73.91	D: Breech presentation N: Women in whom cephalic version was performed or offered E: None	≈100
9 Proportion of unjustified episiotomies ³⁴	Women in whom episiotomy was performed	73.6	D: Women in who episiotomy was performed N: Procedures without any reason documented E: None	≈0
10 Proportion of women whose second-degree perineal tear or	Women with second-degree perineal tear or episiotomy	664.10, 664.11, 644.14, 73.6	D: Women with second-degree perineal tear or episiotomy	≈100

Table 3 Quality of care indicators generated in the project (Continued)

	episiotomy is repaired with continuous suture ³⁵			N: Women in whom continuous suture was performed E: None	
11	Proportion of women who are given an enema during labour ³⁶	Women in labour	641.X1, 642.X1, 676.X1	D: Women in labour N: Women who were given an enema E: None	≈0
12	Proportion of women having perineal shaving on admission to the delivery room ³⁷	Women in labour	641.X1, 642.X1, 676.X1	D: Women in labour N: Women for whom perineal shaving was performed E: None	≈0
13	Proportion of women who are administered uterotonics in the third stage of labour ³⁸	Women in labour	641.X1, 642.X1, 676.X1	D: Women in labour N: Women who received uterotonics E: Contraindication to uterotonics, patient refusal to receive uterotonics	≈100
14	Proportion of women undergoing caesarean section who receive antibiotic therapy ³⁹	Women on whom caesarean was performed	74.XX	D: Women who received caesarean N: Women who received antibiotics E: None	≈100
15	Proportion of women whose peritoneum is sutured at caesarean delivery ⁴⁰	Women on whom caesarean was performed	74.XX	D: Women who received caesarean N: Women for who peritoneum was sutured E: None	≈0
16	Proportion of health professionals who use double gloves when attending a woman with a blood-borne disease ⁴³	Health professionals performing surgical procedures	None	D: Health professionals who performed surgical procedures in woman with a blood-borne disease N: Health professionals who used double gloves E: None	≈100
17	Proportion of Rh-negative women who are given Anti-D within 72 hours after the birth of an Rh-positive or Rh-undetermined baby ⁴¹	Rh-negative pregnant women	None	D: Rh-negative women with Rh-positive newborn N: Women who received Anti-D E: Women with prior Rh sensitization.	≈100
18	Proportion of women with incomplete miscarriage who, if a surgical evacuation of retained products is carried out, undergo a vacuum aspiration ⁴²	Women with incomplete miscarriage	634.X1 -638.X1	D: Women with incomplete miscarriage N: Women in who vacuum aspiration was performed E: Contraindication to vacuum aspiration	≈100

^a In this column, the value "X" means any number between 0 to 9.

^b In this column, (D) Denominator, (N) Numerator (E) Exclusion criteria.

^c Theoretical standards: 100% means a desirable event (higher values indicate appropriate performance) and 0% an undesirable event (lower values indicate inappropriate performance).

study, a strategy for the formulation of indicators was based on two basic and differentiated approaches. First, the use of good quality SRs: in this case, predominantly Cochrane reviews as the primary source of evidence to identify interventions for which the potential benefits far outweigh the possible drawbacks; reviews in which that positive balance is not sufficiently significant were excluded. Priority was given to updated secondary sources of literature, so it is unlikely that any subsequent landmark clinical trials for the proposed indicators were missed.

Second, a rigorous and systematic process was conducted to extract relevant data from each review, and the strength of recommendations was assessed by a standardized method (GRADE) [16] to construct each indicator. Only high-quality evidence was considered and this resulted in a strong recommendation (in favour of, or against, the intervention) for the generation of indicators. It implies, according to the GRADE system, that most patients should receive the recommended intervention, or that it can be adopted as a policy in most situations [16]. Moreover, discussions with the obstetric consultants and SR authors resulted in improving additional aspects in the formulation, interpretation and applicability of the indicators. This might be considered a more informal consultation process than other methodologies, such as the aforementioned RAND Corporation approach [11]. Focusing, however, only on highly evidence-based interventions decreases the need to consult experts.

At the end of the process, 18 quality indicators for the delivery of obstetric care in hospitals were identified. Illustrated in Table 2, each proposed indicator has a clear definition, including specific inclusion and exclusion criteria that are consistent with those used in the studies that are the source of evidence, and establishes the population that could benefit from each intervention. All aspects that need to be taken into account for the use of the indicator are described, including clinical situations in which an intervention might not be suitable for a particular patient, meaning that the patient must be excluded from the calculation of the indicator. The possible rejection of the intervention by the patient has also been considered in the formulation of each indicator. This strategy permits one to overcome the classical tension between the generic approach that usually has recommendations contained in a policy document (*e.g.*, a clinical guideline) and the necessity of providing personalized care to individuals who are different. In our opinion, only with such an approach can the evaluation of quality of care provided be made, taking the existing evidence and the characteristics and values of each patient simultaneously into account.

The 18 generated indicators represent a conservative sample of the available evidence, since the criteria of

consistency, meaningfulness and applicability had priority. We do not expect them to be unique; however, we propose that they should be included in any quality assessment or performance measurement that is made relating to the delivery of care. Since they have been formulated while taking criteria of flexibility and feasibility into account, they could be applied in very different hospital obstetric settings [51].

Some potential limitations of the present study should be noted. First, since indicators help to identify quality problems over time, their applicability and usefulness may depend on the evolving needs of their potential users: policy-makers, health professionals, medical societies, etc., and, theoretically, indicators that specifically address all the issues that are relevant for different stakeholders should be available. However, one characteristic of our methodology is that we have generated indicators based on strong evidence, which should be equally important for all involved parties (*e.g.*, assessing that an episiotomy was not performed unless justified). Second, the identified indicators reflect only those aspects of care that are supported by adequate evidence, which do not necessarily cover all the desirable dimensions; however, the reviews represented in the Cochrane Pregnancy and Childbirth Group encompass the most used interventions in the field. Therefore, the results of the present study are very specific (a limited number, if any, of the generated indicators are false positives in relation to their capacity for measuring quality of care) but probably less sensitive (some indicators could be lacking due to the aforementioned limitations) in relation to all possible cases. Third, the rigour applied in our methodology for defining indicators, necessary to guarantee its internal validity, might limit its external validity or applicability in clinical practice. Strictly defining the target population might reduce its applicability, leaving out large groups of people for whom an indicator is not suitable. Finally, calculation of detailed indicators in daily practice might involve the need for accurate information systems and is quite sensitive to the quality of clinical data registration. If clinicians know in advance the criteria applied for calculating quality indicators, they will likely be more aware of the actions that must be considered in each clinical scenario and the necessity of registering them or justifying an alternative. Indicators could not only be included in local clinical guidelines, but could also be part of electronic alarms or clinical reminders to be activated when the hospital information system detects one of the situations labelled as a priority (*e.g.*, reminding the administration of antibiotics when a caesarean section is programmed). Future research should concentrate on establishing the corresponding standards for the proposed indicators and interpreting the influence of local circumstances and patient preferences on their observed values.

Conclusions

The present study demonstrated that the generation of healthcare quality indicators from SRs is feasible and efficient. This is not a simple process, and not all reviews are equally useful in generating indicators. We believe that the thoroughness of the proposed methodology makes these indicators essential references to assess the extent to which the delivery of care is based on scientific evidence. We propose that this methodology be applied to other areas of care where there is sufficiently sound evidence.

Additional files

Additional file 1: Table S4. Adapted GRADE system for assessing clinical recommendations. Table presenting the adapted GRADE system used in this project to assess clinical recommendations derived from sound systematic reviews.

Additional file 2: Table S5. Example of an indicator. Full text of a quality indicator developed in this project and an example of computation based on fictional data.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

MA and DR carried out the search selection, data extraction, and evidence assessment. MR and DO helped to methodologically refine the indicators. AV and CF helped to interpret the clinical data and refine the quality indicators. XB conceived the study and participated in its design and coordination. MR, DR and XB drafted the manuscript. All authors read and approved the final manuscript.

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5.2.3. Article III

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Healthcare Quality Indicators of Peripheral Artery Disease Based on Systematic Reviews

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WHAT THIS PAPER ADDS

Six quality indicators of peripheral artery disease based on strong recommendations and high methodological evidence have been defined. These indicators could play a key role in assessing the appropriateness of healthcare provided to patients with this disease, with respect to pharmacological and lifestyle issues.

Objectives: Peripheral artery disease (PAD) is a major health problem whose clinical management includes multiple options regarding risk factor control, diagnosis, and medical and surgical treatment. The aim was to generate indicators based on systematic reviews to evaluate the quality of healthcare provided in PAD.

Methods: Electronic searches were run for systematic reviews in The Cochrane Library (Issue 6, 2011), MEDLINE, EMBASE, and other databases (up to June 2011). Conclusive systematic reviews of high methodological quality were selected to formulate clinical recommendations. Indicators were derived from clinical recommendations with moderate to very high strength of evidence as assessed by the GRADE system.

Results: From 1,804 reviews initially identified, 29 conclusive and high-quality systematic reviews were selected and nine clinical recommendations were formulated with a moderate to very high strength of recommendation. Six indicators were finally generated: four on pharmacological interventions, antiplatelet agents, naftidrofuryl, cilostazol, and statins; and two lifestyle interventions, exercise and tobacco cessation. No indicators were derived for diagnostic tests or surgical techniques. Most indicators targeted patients with intermittent claudication.

Conclusions: These quality indicators will help clinicians to assess the appropriateness of healthcare provided in PAD. The development of evidence-based indicators in PAD is limited by the lack of methodological quality of the research in this disease, the inconclusiveness of the evidence on diagnostic and surgical techniques, and the dynamic nature of the vascular diseases field.

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Keywords: Peripheral vascular disease, Quality indicators, Delivery of healthcare

INTRODUCTION

The Institute of Medicine (IOM) defines quality of healthcare as “the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge”.¹ Quality of care can be measured by deriving indicators for each of its main components: structure, processes and outcomes.² The indicators of processes are more clinically specific, easier to interpret, and more sensitive to differences than indicators of structure and outcomes.^{3,4} Process indicators are direct measures of the quality of care provided when there is a link between a

given process and outcome of interest. If there is no evidence that a given process is closely related to an outcome, there is no justification for the use of a process indicator.³ Evidence about any possible linking between process and outcome comes from the analysis and synthesis of the literature. Process indicators commonly aim to measure adherence to clinical practice guidelines (CPGs) in clinical practice.^{5,6} The American College of Cardiology and the American Heart Association developed a structured methodology to create performance measures through a sequence of tasks.⁶ This process considers critical issues such as the strength of evidence, the clinical relevance of the outcome, and the magnitude of the relationship between performance and outcome. This methodology uses clinical recommendations of CPGs as a source of evidence to generate performance measures to assess the quality of care in acute coronary syndrome,⁷ cardiac failure,⁸ and atrial fibrillation and atrial flutter.⁹

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Table 1. General structure of a quality indicator.

Item	Description	Source of information
a. Title	Brief statement of what is to be assessed	Research team
b. Type of indicator	<ul style="list-style-type: none"> • Process indicator • Indicator of desirable or undesirable events • Indicator based on proportions or means 	Clinical recommendation based on SR
c. Definitions	<p>Clinical recommendation (PICO format): Clinical situation, population, intervention, comparison and main outcomes.</p> <ul style="list-style-type: none"> • Definition of contraindications to treatment (if necessary) • Description of the diagnostic and procedure codes ICD-9-CM for the identification of the population. 	Clinical recommendation based on SR, ICD-9-CM
d. Target population	Definition of the target population	Clinical recommendation based on SR
e. Rationale	<ul style="list-style-type: none"> • Impact of the clinical condition of interest • Brief description of the selected systematic review • Summary of the main benefits and/or harms associated with the intervention 	SR, CPG
f. Supporting literature	Main bibliography that supports the indicator (SR ± CPG)	SR, CPG
g. Description of indicator population	<p>Operational definition of the indicator (formula).</p> <ul style="list-style-type: none"> • Numerator/denominator • Exclusion criteria 	Clinical recommendation based on SR, clinical experts
h. Sources of information	<p>Description of the sources of information to compute the indicator:</p> <ul style="list-style-type: none"> • Administrative databases (mainly from inpatient and surgical area) • Clinical documentation (medical history) • Other (e.g. survey) 	Clinical experts
i. Standard	<p>Definition of the standard:</p> <ul style="list-style-type: none"> • Desirable event (↑) • Undesirable event (↓) 	Clinical recommendation based on SR
j. Underlying factors	<ul style="list-style-type: none"> • Factors related to the target population • Factors related to professionals • Factors related to the hospital 	SR, CPG, Clinical experts
k. Notes	Other aspects that complement the information summarized by the indicator	Clinical experts
l. Desired characteristics of a hospital to ensure the viability of the indicator	<ul style="list-style-type: none"> • Essential features (associated with the identification of the denominator and the numerator) • Desirable features (associated with an acceptable time investment to measure it) 	Clinical experts

Note. SR = systematic review; ICD-9-CM = International Classification of Diseases, Ninth Revision, Clinical Modification; CPG = clinical practice guideline.

A modified version of this methodology has been applied in the field of obstetrics to generate healthcare process indicators based on good-quality systematic reviews.¹⁰ Healthcare process indicators could be useful in many specialties, particularly those where different diagnostic or therapeutic criteria are available to manage the same disease, such as vascular pathology. Peripheral artery disease (PAD) is an important disease within the vascular field because it is prevalent in all developed countries and is a strong risk marker for cardiovascular events and mortality.^{11,12} The appropriate clinical approach to PAD aims to decrease cardiovascular morbidity and mortality, reduce the risk of amputation, and increase patients' functional status and quality of life.^{13–16} It is necessary to ensure the quality of patient care through quality indicators based on interventions supported by strong evidence. Such evidence could be derived from the numerous systematic reviews on diagnosis and therapy for PAD. Nevertheless, process indicators based on systematic reviews are lacking in PAD.

The aim of this study was to develop a set of process indicators based on systematic reviews to evaluate the appropriateness of healthcare provided in PAD.

METHODS

A comprehensive search of systematic reviews (SRs) and clinical practice guidelines (CPGs) in PAD was conducted. The search terms: peripheral arterial disease [Mesh], peripheral vascular diseases [Mesh] and peripheral arterial disease, peripheral vascular disease, and intermittent claudication were used as keywords or as a part of title or abstract.

To be included, the SR of peripheral artery disease had to be quantifiable and related to therapeutic or diagnostic interventions. The electronic search was conducted in the following databases: the Cochrane Database of Systematic Reviews and the Database of Abstracts of Reviews of Effects (The Cochrane Library, Issue 6, 2011), Clinical Evidence, MEDLINE, EMBASE (OVID), and meta-searchers such as NHS Evidence, Excelencia Clínica and TRIP Database. The databases were searched up to June 2011.

CPGs in vascular disease were searched to identify additional SRs cited on their references. The search for recent CPGs was conducted in MEDLINE, EMBASE, NHS Evidence, and Trip Database (published between 2006 and 2011). The guidelines published by the main vascular surgery societies and organizations that produce CPGs were also consulted: the National Institute for Clinical Excellence (NICE), National Guideline Clearinghouse, and Guia Salud.

Duplicate references and those which were not in English or Spanish were discarded.

Two authors (DO and HP) independently examined the retrieved systematic reviews and selected those with strong conclusions for or against a particular intervention. The selection process was performed by consensus. In case of disagreement, a third author (MR) was consulted.

Methodological quality was then evaluated according to SIGN criteria,¹⁷ which assess five internal validity criteria: clear formulation of the question, description of the methodology used, comprehensive search strategy, assessment of the quality of studies included in the SR, and assessment of the heterogeneity of the included studies. SRs with an overall positive assessment of the internal validity criteria were selected. When two or more SRs assessed the same intervention, that with the highest validity from among the most recent SRs was selected.

Two researchers (DO, and HP or MR) generated clinical recommendations (CRs) from selected SRs. All CRs included an intervention, a target population of the intervention, and the effects of the intervention on outcomes of interest. The quality and strength of evidence supporting each CR was evaluated with an adaptation of the GRADE system.¹⁸ The quality and strength of evidence was rated as very high, high, moderate, low, or very low. Only those CR rated as very high, high, or moderate were selected as the basis for building indicators. The generation and selection of CRs was also performed by consensus and with the agreement of two expert vascular surgeons (SB and JE).

The methodology for developing indicators has been described previously.¹⁰ From the selected CR, indicators were constructed using an adaptation of the method proposed by the American College of Cardiology/American Heart Association (ACC/AHA),⁶ and the Agency for Healthcare Research and Quality (AHRQ).¹⁹ Table 1 shows the general structure of an indicator. Most of the information presented in an indicator was derived from the SR, but additional information was drawn from current guidelines and the clinical expertise provided by two clinical experts (SB and JE). Feedback from these surgeons was used to identify the validity of each indicator, sources of clinical data needed to compute each indicator, causes of variability in results, and characteristics of a clinical setting that ensure viability of the indicator.

RESULTS

Results of the search

The initial search in electronic databases yielded 1,804 SR and 940 CPGs (Fig. 1). After applying the selection process, 27 SRs with consistent results and of high methodological quality (Table 2) were identified. By using the GRADE system seven moderate or high CRs were obtained, based on eight of these reviews.^{20–27} Feedback from vascular surgeons led to the discarding of a CR about materials used in bypass surgery,²⁵ because it generated an indicator of little clinical relevance. Finally, six quality indicators related to PAD were generated; part of their structure (title, clinical recommendation, rational and standard) is described below. The rest of the structure is presented in Tables 3–5, grouped by topic: anti-platelet treatment (Table 3), lifestyle (Table 4), and other drugs (Table 5). All six indicators describe a desirable event and higher values indicate more appropriate performance.

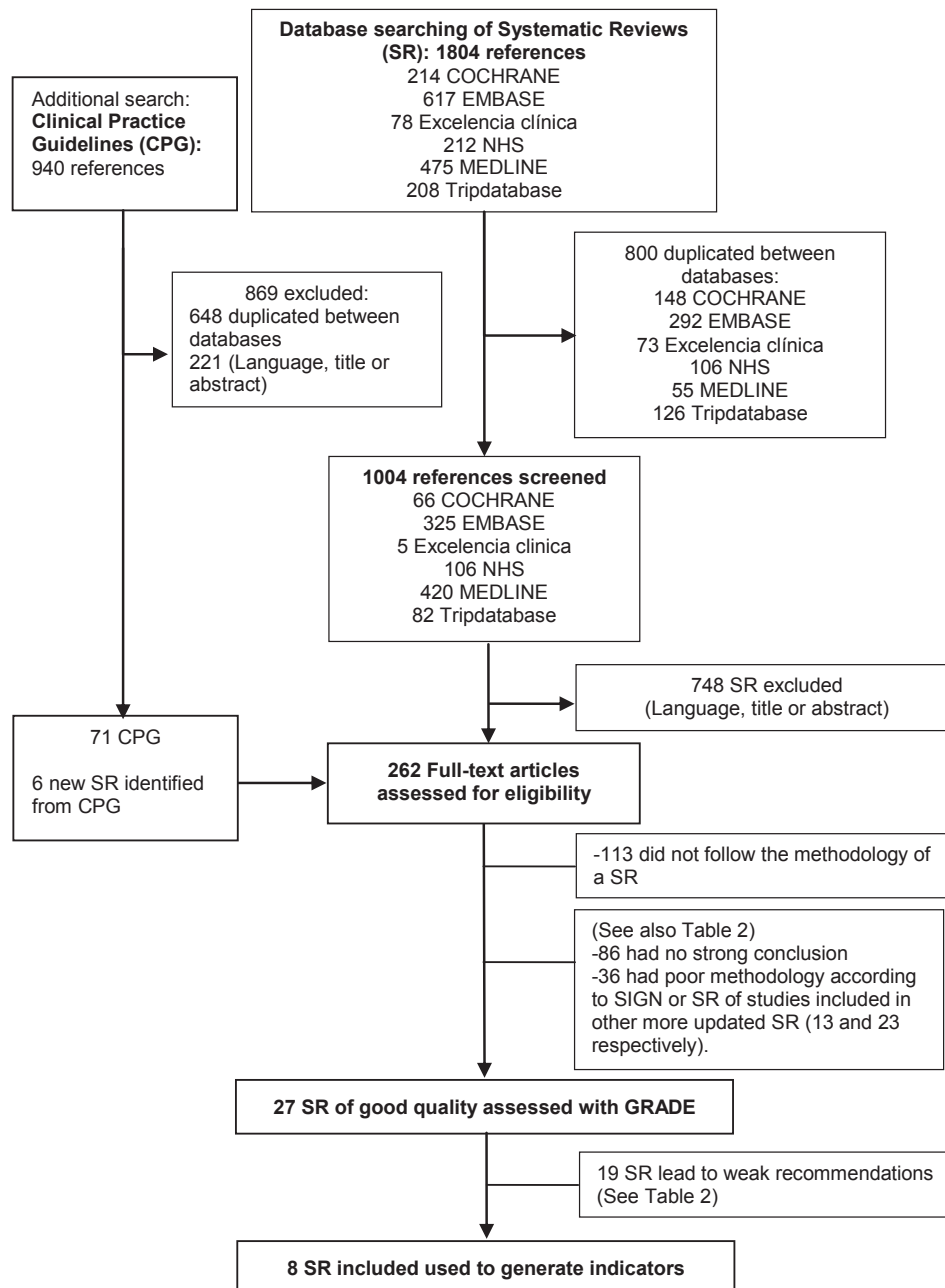


Figure 1. Flow diagram. *Note.* SR = systematic review; CPG = clinical practice guideline.

Healthcare quality indicators

Proportion of patients with intermittent claudication to whom antiplatelet therapy is prescribed. *Definition:* If a patient has intermittent claudication, then an appropriate antiplatelet agent should be administered, unless it is contraindicated, because antiplatelet agents have been shown to reduce cardiovascular mortality and the need for revascularization.

Evidence description: Two systematic reviews of good quality^{20,23} showed benefits with antiplatelet use. Wong et al.²³ (3,926 patients) compared antiplatelet agents (thienopyridine derivatives) versus placebo and found lower mortality for all causes (RR 0.76; 95% CI 0.60–0.98) and less revascularization (RR 0.65; 95% CI 0.43–0.97).²³ In the

second review, including 6,263 intermittent claudication patients, the Trialists' Collaboration group concluded that antiplatelet agents caused an odds reduction of major cardiovascular events of 23% compared to placebo.²⁰ Additionally, in an evidence-based guideline,¹⁵ the authors recommended either aspirin or clopidogrel as the antiplatelet agent of choice for PAD patients, based on evidence from patients with cardiovascular disease or at high vascular risk.

Proportion of patients with a history of bypass grafting to whom antiplatelet agents are prescribed. *Definition:* If a patient has peripheral artery disease and a history of bypass grafting, then an appropriate antiplatelet should be administered, unless it is contraindicated because antiplatelet agents have shown higher graft patency at 12 months.

Table 2. Distribution of systematic reviews throughout the selection process (grouped by intervention categories).

Intervention	Strong conclusions		SIGN ++/ Not replaced by newer SR ^a		CR moderate, high or very high (modified GRADE)	
	No (N = 86)	Yes (N = 63)	No (N = 36)	Yes (N = 27)	No (N = 19)	Yes (N = 8)
A. Diagnosis	(4)	(15)	(9)	(6)	(6)	(0)
Ankle-brachial index	1	2	2	0	0	0
Ultrasonography	0	2	2	0	0	0
CT angiography	1	2	2	0	0	0
Magnetic resonance angiography	0	5	2	3	3	0
Treadmill	0	1	1	0	0	0
Clinical examination	0	1	0	1	1	0
Spectroscopy	1	0	0	0	0	0
C-reactive protein	1	0	0	0	0	0
Various diagnostic procedures	0	2	0	2	2	0
B. Pharmacological treatment	(27)	(29)	(17)	(12)	(7)	(5)
Antithrombotics (various)	3	6	3	3	3	0
Antiplatelets	4	11	5	6	3	3
Anticoagulants	1	1	1	0	0	0
Thrombolytics	2	3	2	1	1	0
Prostanoids	2	2	2	0	0	0
Vasodilators (various)	3	1	0	1	0	1
Buflomedil	1	1	1	0	0	0
Naftidrofuryl	1	1	1	0	0	0
Antihypertensives (various)	1	0	0	0	0	0
Beta-blockers	2	1	1	0	0	0
ACEI	1	0	0	0	0	0
Lipid-lowering statins	1	1	0	1	0	1
Homocysteine lowering	2	0	0	0	0	0
Sexual hormones	1	0	0	0	0	0
Various drugs	2	1	1	0	0	0
C. Surgical treatment	(26)	(4)	(2)	(2)	(1)	(1)
Amputation	3	0	0	0	0	0
Angioplasty	17	3	2	1	1	0
Bypass	4	1	0	1	0	1
Various surgical procedures	2	0	0	0	0	0
D. Lifestyle	(9)	(7)	(3)	(4)	(2)	(2)
Exercise	6	4	2	2	1	1
Smoking cessation	0	1	0	1	0	1
Diet/glucose control	2	1	0	1	1	0
Various lifestyles interventions	1	1	1	0	0	0
E. Other interventions	(18)	(8)	(5)	(3)	(3)	(0)
Brachytherapy	1	1	1	0	0	0
Stem cell	1	0	0	0	0	0
Alternative/complementary medicines ^b	7	2	2	0	0	0
Sympathectomy/spinal cord stimulation	3	1	0	1	1	0
Pneumatic leg compression	2	1	0	1	1	0
Gene therapy	2	1	0	1	1	0
Dressings for leg ulcers	1	0	0	0	0	0
Prevention of infection	0	1	1	0	0	0
Physical rehabilitation	0	0	0	0	0	0
Chelation therapy	1	1	1	0	0	0
F. Treatment in general	1	0	0	0	0	0
G. Diagnosis and treatment in general	1	0	0	0	0	0

Note. SR = systematic review; CR = clinical recommendation; ACEI = angiotensin-converting enzyme inhibitors.

^a SR whose studies were included in other more updated SR were discarded.

^b Includes: acupuncture, biofeedback, chelation therapy, CO₂-applications and dietary supplements: garlic, ginkgo, omega-3 fatty acids and vitamin E.

Table 3. Description of the indicators related to antiplatelet treatment (indicators 1 and 2).

	Indicator 1	Indicator 2
a. Title	Proportion of patients with intermittent claudication to whom antiplatelet agents are prescribed	Proportion of patients with history of bypass grafting to whom antiplatelet agents are prescribed
b. Type	Process indicator about a desirable event based on proportions	
c. Other definitions	Contraindications to treatment: familial or acquired bleeding disorder, thrombocytopenia, allergy, active bleeding or lesions likely to bleed, within 72 hours of major surgery with risk of severe bleeding, severe renal or hepatic impairment or other contraindications known Diagnostic and procedure codes. Peripheral vascular disease, unspecified (ICD-9-CM Diagnosis Code 443.9)	Contraindications to treatment. Familial or acquired bleeding disorder, thrombocytopenia, allergy, active bleeding or lesions likely to bleed, within 72 h of major surgery with risk of severe bleeding, severe renal or liver impairment or other contraindications known Diagnostic and procedure codes. Resection Of Vessel With Anastomosis, Lower Limb Arteries (ICD-9-CM Procedure Code 38.38); Resection Of Vessel With Replacement, Lower Limb Arteries (ICD-9-CM Procedure Code 38.48); Other Excision Of Vessels, Lower Limb Arteries (ICD-9-CM Procedure Code 38.68)
d. Target population	Patients with peripheral artery disease and intermittent claudication	Patients with peripheral artery disease and history of bypass grafting
e. Description of indicator population	Numerator = number of patients who receive aspirin (75 or 100 mg/day) or clopidogrel (75 mg/day) or ticlopidine 250 mg/day) Denominator = number of patients with peripheral artery disease and intermittent claudication Exclusion criteria = exclude from denominator those patients with any contraindication to aspirin, clopidogrel or ticlopidine	Numerator = number of patients who receive aspirin (75 or 100 mg/day) or clopidogrel (75 mg/day) or ticlopidine 250 mg/day) Denominator = number of patients with peripheral artery disease and history of bypass grafting Exclusion criteria = exclude from denominator those patients with any contraindication to aspirin, clopidogrel or ticlopidine
f. Sources of information	<ul style="list-style-type: none"> • Clinical documentation (medical history) • Administrative databases 	<ul style="list-style-type: none"> • Clinical documentation (medical history) • Administrative databases
g. Setting characteristics	Good clinical documentation and pharmacy record	Good clinical documentation and surgery records

Evidence description: A systematic review of good quality²² with 966 patients undergoing infrainguinal bypass surgery compared antiplatelet agents (ASA and/or dipyridamol) versus placebo, another antiplatelet agent or an alternative treatment. It found a benefit in graft patency at 12 months compared to no treatment in patients with peripheral bypass (OR 0.59; 95% CI 0.45–0.79). This benefit was greater in the subgroup of patients with an artificial graft (OR 0.22; 95% CI 0.12–0.38) than in the subgroup of patients with a vein graft (OR 0.69; 95% CI 0.48–0.99).

Proportion of patients with intermittent claudication to whom an exercise routine is prescribed. Definition: If a patient has peripheral artery disease and intermittent claudication, then an exercise routine appropriate for the patient's health status should be prescribed, because exercise benefits walking time and distance.

Evidence description: A systematic review of good quality²⁶ compared exercise regimens versus placebo, pharmacological treatment, or surgery. Compared with placebo, exercise improved maximal walking time (255 patients; improvement of 5.12 minutes; 95% CI 4.51–5.72), pain-free walking distance (322 patients; improvement of 82.19 m; 95% CI 71.73–92.65), and maximum walking distance (391

patients; improvement of 113.20 m; 95% CI 94.96–131.43). Improvements were seen for up to 2 years. Evidence for the comparison of exercise and pharmacological and surgical treatments was weak because the comparisons included a small number of trials and participants.

Proportion of current smokers with a history of bypass grafting, to whom a tobacco cessation intervention is prescribed. Definition: If a patient with a history of bypass grafting currently smokes, then a tobacco cessation intervention should be prescribed, because continued smoking after lower limb bypass surgery increases the risk of graft failure. Smoking cessation, even when started after the operation, could restore graft patency to that of never smokers.

Evidence description: A systematic review of good quality²⁷ with 1,198 patients compared graft patency between smokers and non-smokers. It showed a threefold greater risk of graft failure in smokers than in non-smokers (RR 3.09; 95% CI 2.34–4.08).

Proportion of patients with intermittent claudication, with no control of symptoms, to whom naftidrofuryl or cilostazol is prescribed. Definition: If a patient has peripheral artery disease and intermittent claudication, and his or her symptoms are not controlled, *then* naftidrofuryl or cilostazol

Table 4. Description of the indicators related to lifestyle (indicators 3 and 4).

	Indicator 3	Indicator 4
a. Title	Proportion of patients with intermittent claudication to whom an exercise routine is prescribed	Proportion of current smokers, with history of bypass grafting, to whom a tobacco cessation intervention is prescribed
b. Type	Process indicator about a desirable event based on proportions	
c. Other definitions	Contraindications to treatment. Exercise routine must be appropriate for each case Diagnostic and procedure codes. Peripheral vascular disease, unspecified (ICD-9-CM Diagnosis Code 443.9)	Contraindications to treatment. Tobacco cessation intervention must be appropriate for each case Diagnostic and procedure codes. Resection Of Vessel With Anastomosis, Lower Limb Arteries (ICD-9-CM Procedure Code 38.38); Resection Of Vessel With Replacement, Lower Limb Arteries (ICD-9-CM Procedure Code 38.48); Other Excision Of Vessels, Lower Limb Arteries (ICD-9-CM Procedure Code 38.68)
d. Target population	Patients with peripheral artery disease and intermittent claudication	Patients with peripheral artery disease and history of bypass grafting
e. Description of indicator population	Numerator = number of patients with an appropriate exercise routine prescribed Denominator = number of patients with peripheral artery disease and intermittent claudication Exclusion criteria = None	Numerator = number of patients with an appropriate intervention for tobacco cessation prescribed Denominator = number of patients with peripheral artery disease and history of bypass grafting Exclusion criteria = None
f. Sources of information	<ul style="list-style-type: none"> • Clinical documentation (medical history) • Administrative databases 	<ul style="list-style-type: none"> • Clinical documentation (medical history) • Administrative databases
g. Notes	None	Advice for tobacco cessation should be given to every patient. However, we consider that measuring this indicator in all population could be difficult; so patients with history of bypass grafting were prioritized
h. Setting characteristics	Good clinical documentation (medical history)	Good clinical documentation and surgery record

should be administered unless it is contraindicated, because this medication has been shown to increase maximal and pain-free walking distance.

Evidence description: A health technology assessment systematic review of good quality²⁴ presented evidence on naftidrofuryl and cilostazol. Meta-analysis of 1,479 patients with intermittent claudication estimated that, compared to placebo, cilostazol increased maximal walking distance by 57.27 m (95% CI 24.93–86.57). Network meta-analyses estimated that both naftidrofuryl and cilostazol significantly increased maximal walking distance and pain-free walking distance.

Proportion of patients with peripheral artery disease to whom a statin is prescribed. Definition: If a patient has peripheral artery disease, then a statin should be prescribed, because these agents reduce revascularization and cardiovascular morbidity.

Evidence description: A systematic review of good quality²¹ included trials comparing lipid-lowering therapy versus placebo. It showed that lipid-lowering therapy reduced the risk of total cardiovascular events (9,120 patients; OR 0.74; 95% CI 0.55–0.98) and revascularization (7,102 patients; OR 0.73 95% CI 0.64–0.83).

DISCUSSION

A systematic search and analysis of available literature to identify interventions for peripheral artery disease supported by strong evidence, in order to generate healthcare quality indicators was conducted. The available evidence generated four indicators on pharmacological interventions, antiplatelets, naftidrofuryl, cilostazol, and statins, and two lifestyle interventions, exercise and tobacco cessation.

It was not possible to obtain any indicators about diagnostic tests or surgical techniques because there were no studies with strong conclusions or the quality of such studies was low. It is surprising that no strong evidence was found to support consolidated revascularization techniques widely used in clinical practice. There are several possible explanations. Researchers may consider it unethical to compare the effectiveness of widely accepted techniques such as limb bypass against medical treatment or placebo. Another possibility is that the rapid development of new endovascular techniques and materials could lead to a lack of studies with a sufficient number of cases and of an acceptable quality. It is less surprising that solid evidence on less studied and experimental interventions for PAD such as genetic therapy, stem cell, brachytherapy, arterial ulcer

Table 5. Description of the indicators related to the use of other drugs (indicators 5 and 6).

	Indicator 5	Indicator 6
a. Title	Proportion of patients with intermittent claudication, with no control of symptoms, to whom naftidrofuryl or cilostazol is prescribed	Proportion of patients with peripheral artery disease to whom a statin is prescribed
b. Type	Process indicator about a desirable event based on proportions	
c. Other definitions	Contraindications to treatment: Known hypersensitivity to cilostazol or to naftidrofuryl; severe renal or hepatic impairment; congestive heart failure; pregnancy; known predisposition to bleeding; history of heart arrhythmia or history of hyperoxaluria or recurrent calcium stones or other contraindications known Diagnostic and procedure codes. Peripheral vascular disease, unspecified (ICD-9-CM Diagnosis Code 443.9)	Contraindications to treatment: Hypersensitivity to statins; active liver disease or unexplained persistent isolated elevations of serum transaminases; pregnancy or lactation or other contraindications known Diagnostic and procedure codes. Peripheral vascular disease, unspecified (ICD-9-CM Diagnosis Code 443.9)
d. Target population	Patients with peripheral artery disease and intermittent claudication	Patients with peripheral artery disease
e. Description of indicator population	Numerator = number of patients who receive cilostazol or to naftidrofuryl Denominator = number of patients with peripheral artery disease and intermittent claudication Exclusion criteria = exclude from denominator those patients with any contraindication to cilostazol or to naftidrofuryl	Numerator = number of patients who receive a statin Denominator = number of patients with peripheral artery disease Exclusion criteria = exclude from denominator those patients with any contraindication to statins
f. Sources of information	<ul style="list-style-type: none"> • Clinical documentation (medical history) • Administrative databases 	<ul style="list-style-type: none"> • Clinical documentation (medical history) • Administrative databases
g. Setting characteristics	Good clinical documentation and pharmacy record	Good clinical documentation and pharmacy record

care, or chelation, interventions whose benefits and harm are still under debate was not found.

An additional contribution of this study is the quality assessment it provides on the systematic reviews carried out to date in this field. PAD has been extensively researched and is the subject of many systematic reviews, but a great percentage of these have poor methodological quality. Better research practices need to be implemented to optimize human and monetary resources invested in research.²⁸ Implementing sound methodological practices in systematic reviews may help to design better and more conclusive clinical trials.

The continuous innovation in the field of peripheral artery disease makes it difficult to develop evidence-based indicators of quality that are relevant to clinical practice. When high-quality evidence becomes available for a given intervention, clinical practice may have changed. A good example is the clinical recommendation that was rejected in this study, namely prioritizing Dacron grafts over PTFE in limb revascularization. The choice between these two graft materials was controversial only a few years ago, while now the dilemma is whether limb revascularization should be performed with open surgery or by endovascular techniques.¹⁴

The strength of evidence observed in the present study is similar to that in CPGs about PAD.^{13,14} As in this study, these guidelines based most recommendations regarding

revascularization or diagnostic techniques on a low level evidence¹⁴ and most recommendations regarding pharmacological and lifestyle interventions were based on sound evidence.^{13–15} However, healthcare quality indicators go a step further than clinical recommendations in CPGs because they are based on clinical practices that are almost mandatory.

Healthcare quality indicators can only be based on recommendations in CPGs that explicitly mention and assess the sources and quality of the evidence. A good example is the work by Alonso et al. 2012,¹⁵ where evidence tables are provided applying the GRADE system. In the present study, the availability of such recommendations for PAD would have eliminated the need to search for and assess systematic reviews to define clinical recommendations.

In a study similar to this, published in 2010, the authors developed a set of seven performance measures for adults with PAD.¹⁶ Their methodology was based on translating guideline recommendations Class I and Class III and expert opinion into process measures. The performance measures which were developed concerned ankle brachial index (ABI) measurement, use of cholesterol-lowering medications, administration of antiplatelet therapy, smoking cessation, prescription of supervised exercise, graft surveillance (with ABI and duplex ultrasound), and monitoring of abdominal aortic aneurysms. Although they were similar, the two projects had marked differences. First, the scope of the

disease differed, because this work was restricted to lower limb PAD, excluding abdominal aortic aneurysms and carotid disease. Second, the evidence threshold established in their project was lower, because their Class I and Class III recommendations were based on single randomized clinical trials. The evidence on ABI measurement and duplex ultrasound, for example, emanated from single trials. Finally, the fact that they included expert opinion also led to differences between their performance measures and these. For example, they recommended antiplatelet therapy in critical limb ischemia on the basis of indirect evidence from patients with intermittent claudication or other cardiovascular diseases.

This study has limitations concerning its design and the applicability of the indicators. First, the indicators generated do not incorporate patient preferences and costs, possibly limiting their usefulness. Neither do they take into account the commercial distribution of some drugs, such as cilostazol, which is only available in five countries in Europe, limiting the applicability of the indicator. Furthermore, the use of a filter to discard systematic reviews without strong conclusions for or against a particular intervention is debatable because it could introduce bias by discarding more recent or high-quality SRs. Difficulties applying the GRADE system to assess diagnostic techniques were also encountered as it was not designed to assess such clinical questions.

In conclusion, six quality indicators were defined, based on strong recommendations and high methodological evidence. These indicators could play a key role in assessing the appropriateness of health care provided to patients with PAD concerning pharmacological and lifestyle issues.

ETHICAL APPROVAL

For the development of this project, no human subjects or animals were involved. The development of quality indicators was based on the review of published literature.

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CONFLICT OF INTEREST

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5.2.4. Article IV

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Original Article

Healthcare professionals' opinions, barriers and facilitators towards low-value clinical practices in the hospital setting

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ABSTRACT

Objective: To explore healthcare professionals' opinions about low-value practices, identify practices of this kind possibly present in the hospital and barriers and facilitators to reduce them. Low-value practices include those with little or no clinical benefit that may harm patients or lead to a waste of resources.

Method: Using a mixed methodology, we carried out a survey and two focus groups in a tertiary hospital. In the survey, we assessed doctors' agreement, subjective adherence and perception of usefulness of 134 recommendations to reduce low-value practices from local and international initiatives. We also identified low-value practices possibly present in the hospital. In the focus groups with professionals from surgical and medical fields, using a phenomenological approach, we identified additional low-value practices, barriers and facilitators to reduce them.

Results: 169 doctors of 25 specialties participated (response rate: 7%-100%). Overall agreement with recommendations, subjective adherence and usefulness were 83%, 90% and 70%, respectively. Low-value practices from 22 recommendations (16%) were considered as possibly present in the hospital. In the focus groups, the professionals identified seven more. Defensive medicine and scepticism due to contradictory evidence were the main barriers. Facilitators included good leadership and coordination between professionals.

Conclusions: High agreement with recommendations to reduce low-value practices and high perception of usefulness reflect great awareness of low-value care in the hospital. However, there are several barriers to reduce them. Interventions to reduce low-value practices should foster confidence in decision-making processes between professionals and patients and provide trusted evidence.

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Opiniones, barreras y facilitadores de los profesionales de la salud hacia las prácticas clínicas de poco valor en el ámbito hospitalario

RESUMEN

Palabras clave:

Prácticas de poco valor

Hospital

Encuesta

Investigación cualitativa

Grupos focales

Adecuación

Objetivo: Explorar las opiniones de profesionales sanitarios sobre las prácticas de poco valor, identificar aquellas posiblemente presentes en el hospital y las barreras y los facilitadores para reducirlas. Las prácticas de poco valor incluyen aquellas con poco beneficio clínico que pueden perjudicar a los pacientes o desperdiciar recursos.

Método: Usando una metodología mixta se llevaron a cabo una encuesta y varios grupos focales en un hospital terciario. En la encuesta se evaluó el grado de acuerdo, la adherencia subjetiva y la percepción de utilidad de 134 recomendaciones para reducir las prácticas de poco valor de iniciativas locales e internacionales, y se identificaron aquellas que podrían estar realizándose en el hospital. En dos grupos focales con profesionales de campos médicos y quirúrgicos, utilizando un enfoque fenomenológico, se identificaron prácticas de poco valor adicionales, barreras y facilitadores para reducirlas.

Resultados: En la encuesta participaron 169 médicos de 25 especialidades (tasa de respuesta: 7-100%). El acuerdo con las recomendaciones, la adherencia subjetiva y la utilidad fueron del 83%, el 90% y el 70%, respectivamente. Se identificaron prácticas de poco valor de 22 recomendaciones (16%) posiblemente presentes en el hospital. En los grupos focales se identificaron siete prácticas de poco valor adicionales; la medicina defensiva y el escepticismo debido a evidencia contradictoria como principales barreras; y un buen liderazgo y la coordinación entre profesionales como facilitadores.

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Conclusiones: El alto grado de acuerdo con las recomendaciones para reducir las prácticas de poco valor y la alta percepción de utilidad reflejan una gran concienciación sobre este problema en el hospital. Sin embargo, existen numerosas barreras para eliminarlas. Las intervenciones para reducirlas deberían fomentar la confianza en la toma de decisiones entre profesionales y pacientes, y proporcionar una evidencia confiable.

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Introduction

Low-value practices include doing tests and treatments in contexts with little or no clinical benefit. They are of low-value because: 1) they do more harm than good; or 2) lack proven effectiveness; or 3) are unnecessary because they do not modify clinical decision-making; or 4) are interventions providing little or no benefit in health at high costs.^{1–4} All interventions of this kind should be avoided, because they threaten patients' safety and the quality and sustainability of health systems.^{5–8}

Many initiatives worldwide have been established to address low-value practices. Some of the best known are the Choosing Wisely Campaigns, where scientific societies provide recommendations to reduce practices whose necessity should be discussed. These campaigns have taken place in several countries, including the United States of America, Canada, Australia and Italy.^{9–12} Initiatives in other countries have adopted some of these recommendations and developed several more, for instance, the Spanish initiatives *Essencial*,¹³ and *Commitment to quality of the Spanish scientific societies*.¹⁴

Even though proposing recommendations to reduce low-value practices is a big first step, their detection at local settings and understanding health professionals' views on this problem are crucial in developing effective interventions to reduce them. Several studies have assessed doctors' perspectives about the concept of low-value care. However, almost all them have taken place in the primary care setting,^{15–19} and scarce studies have analysed the hospital setting, where health spending is higher. Studies in the hospital setting have assessed the concept of low-value care in general,²⁰ or consulted the opinion of directors and division chiefs.^{21,22} Yet, as far as we know, little is known about barriers and facilitators in this setting.

The aims of this study were to explore healthcare professionals' opinions about low-value practices, identify practices of these kind possibly present in the hospital and barriers and facilitators to reduce them.

Method

Study design and setting

We used a mixed methodology through an online survey and two focus groups. The study took place between January 2016 and June 2017 in the Vall d'Hebron University Hospital, a tertiary university hospital in Spain with more than 1000 beds. It was approved by the Vall d'Hebron Clinical Research Ethics Committee.

In the on-line survey we assessed doctors' opinions about a set of recommendations to reduce low-value practices, and practices of this kind possibly present in the hospital. Survey results were complemented with focus groups with health professionals to identify additional low-value practices possibly present in the hospital and barriers and facilitators to reduce them.

Online survey

1) Selection of recommendation to reduce low-value practices

The recommendations were obtained from DianaHealth.com, an open access on-line database of appraisals about health-care interventions considered of low value by several initiatives worldwide.²³ From the recommendations available in the database, we randomly preselected 200 and then, we selected from five and up to ten recommendations per specialty where the intervention and the specialty in reference were available in the hospital. When recommendations related to the same population and the same intervention were selected, we kept only one, preferably from a local initiative. When a given specialty was found to have less than five recommendations, the database was consulted again.

2) Survey's sample and process

The survey was aimed at all doctors from the specialties related to the included recommendations, residents were excluded.

In the questionnaire, participants were asked to specify whether they were specialists or residents and their specialty. No personal information was asked. According to doctors' specialty, the form displayed a list of 5 to 10 recommendations and four questions about them that are shown in [Table 1](#). The questionnaire was tested before collecting data; completion time was between 10–20 minutes.

We sent an email to invite doctors to participate in the survey explaining the purpose of the study and a link to the questionnaire. Two reminders were sent one and two months later. Participation was anonymous, voluntary and not economically compensated.

3) Survey analysis

Doctors' opinion was assessed through the following outcomes: agreement, subjective adherence, reasons for disagreement and usefulness. Outcomes definition are shown in [Table 1](#). The unit of analysis was doctors' response. We compared results by type of specialty: medical and surgical specialties and by type of intervention in four categories: diagnostic images, diagnostic laboratory tests and procedures, pharmacological therapies and non-pharmacological therapies.

The low-value practices possibly present in the hospital were identified through a composite outcome defined as those practices from recommendations with an agreement over 70% and a subjective adherence under 70%. Usefulness was not taken into account in the composite outcome since we were interested in identifying low-value practices, even when doctors may consider the recommendation as not useful. Data was analysed with SPSS v.23..

Table 1
Survey questionnaire and outcome definition.

Survey questionnaire		Outcome definition		
Question	Options	Name	Concept	Operative definition
1. Do you agree with this recommendation?	Yes No	Agreement	Whether respondent agrees or not to what is stated in the recommendation	n yes/n responses Result expressed as percentage (percentages over 70% were considered as agreement)
2. If you agree, in your opinion, what is the percentage of adherence to this recommendation in the Hospital, either in your department or in others?	Number between 0 and 100%	Subjective adherence	Adherence in the hospital according to participants' opinion	Mean percentage. Result expressed as percentage (percentages over 70% were considered as adherent)
3. If you do not agree, in your opinion, what is the reason?	Multiple choices: - New evidence arose contradicting this recommendation - The recommendation does not apply in the hospital setting - The recommendation is not feasible in the hospital setting - Other reasons	Reasons for disagreement	Reasons why the respondent does not agree with the recommendation	n each option/n responses Result expressed as percentage of each category
4. How useful do you consider this recommendation?	- Very useful - Useful - Indifferent - Not so useful - Useless	Usefulness	Whether respondent considers the recommendation useful or useless in spite of agreeing with it	useful + very useful/n responses Expressed as percentage (percentages over 70% were considered as useful)

Focus group

1) Focus groups' sample and process

One focus groups included professionals from the surgical field and the other from the medical field. A convenience sample of 20 participants (10 per group) was selected from the staff database using the following criteria: even distribution according to sex and age (<35, 35-50 and >50 years) and at least one active researcher, one specialist in diagnostic tests and one nurse should be included.

We sent an invitation letter by email to the participants. In cases where the invitation was declined, we looked for another candidate following the same selection criteria. The two groups worked in face-to-face single sessions of 90 minutes each. Before the session, all the participants gave verbal consent to participate in the study and to audio-record the session. One of the researchers (LAM), an external expert with over ten years of experience in qualitative research methodology, conducted the sessions, and a second researcher (MSD), recorded them and made notes. None of them knew the participants.

A pre-defined discussion guide available in [Table I in the online Appendix](#) was used in the session. The discussion included examples of low-value practices; individual, institutional and social factors leading to low-value practices or difficulties when trying to avoid them; and factors that help to reduce or avoid low-value practices.

2) Focus groups analysis

We analysed the audio-records and notes of the two sessions with a phenomenological approach, using the paradigm of grounded theory.^{24,25} LAM transcribed audio-records and notes, keeping participants names and specialties anonymised.

Verbatim were coded using a matrix proposed a priori by the Agency for Health Quality and Assessment of Catalonia, based on a similar study carried out in primary care (in process of publication). In a first phase, we used an open coding, creating labels to identify topics; and then we classified them as barriers or facilitators. In a second phase we used axial coding to relate topics in constructs

called categories. These categories were grouped into four levels: micro (related to individuals: patients and health professionals), meso (related to Doctor-Patient relationship and management and processes in the institution), macro (related to the Health system) and external factors (outside the Health system).

All researchers discussed and reviewed the organisation of themes until consensus was achieved. The analysis included a comparison between medical and surgical specialties. Data was analysed with the software Atlas.Ti v.6. The results and conclusions of the analysis were returned to participants for comment and feedback.

Results

Survey

From 2475 recommendations and appraisals to reduce low-value practices available in DianaHealth.com, we included 134 recommendations applicable interventions available in our hospital: 65 (49%) on diagnostic tests, 53 (40%) on pharmacological therapies and 16 (12%) on non-pharmacological therapies, including surgery and physical therapy. The recommendations, specialty, type of intervention, and source are shown in [Table II in the online Appendix](#).

A total of 169 doctors from 25 specialties responded the survey. They gave their opinion on 127 of the 134 recommendations (total of responses = 1183). Response rate by specialty ranged from 7% to 100% ([Figure I in the online Appendix](#)), being 28% and 18% in medical and surgical specialties respectively.

1) Agreement

[Figure 1](#) A shows aggregated results of doctors' agreement by specialty and type of intervention. The proportion of responses where doctors agreed with a recommendation was over 70% in all type of recommendations, except in those on diagnostic tests in the group of surgical specialties. For example, one out of 11 urologists (agreement of 9%) agreed on a recommendation about prostate biopsy for histological confirmation if clinical suspicion of

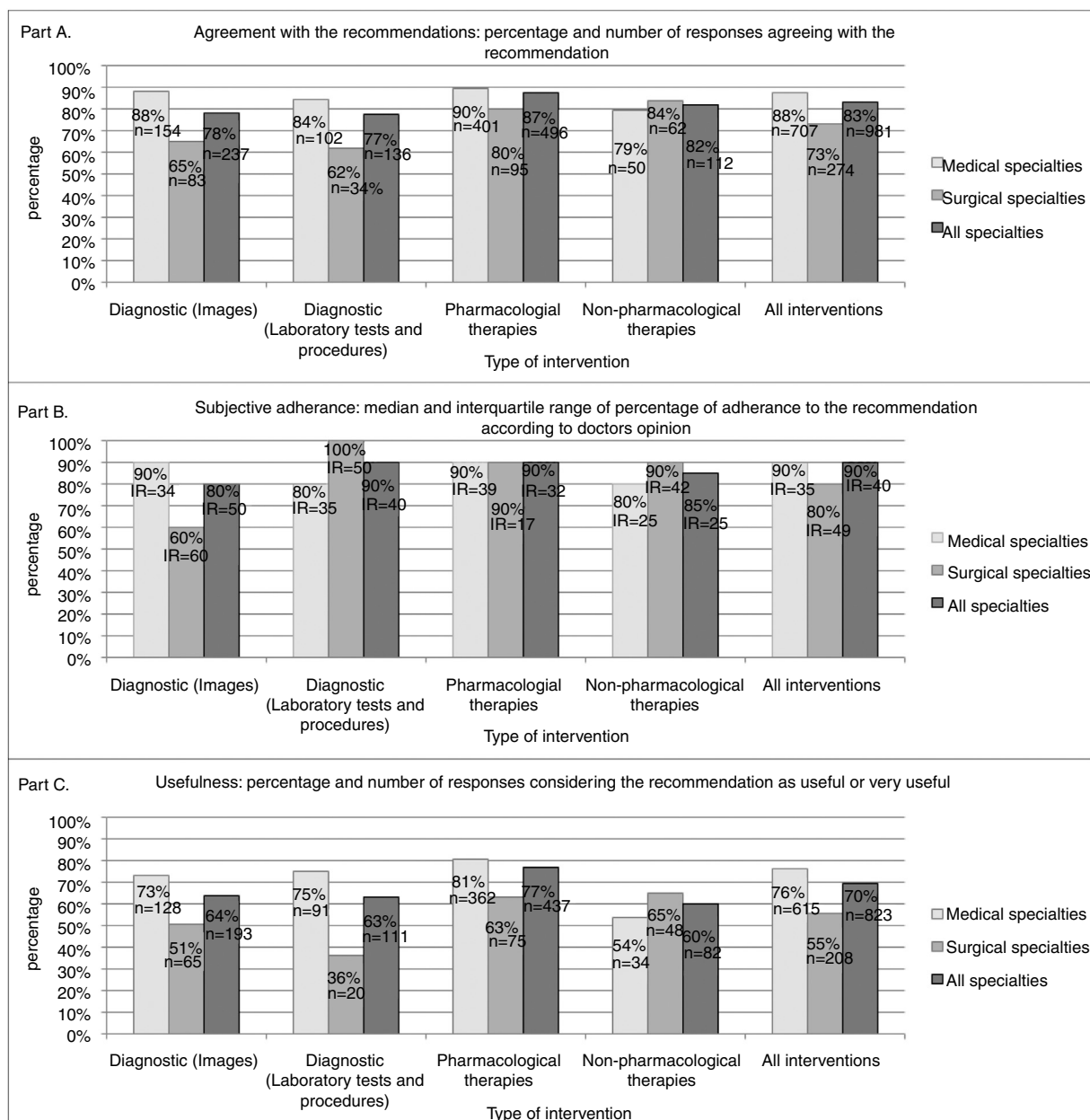


Figure 1. Agreement (part A), subjective adherence (part B), and usefulness (part C) of recommendations by type of specialty and type of intervention.

prostate cancer is high (results of individual recommendations are shown in [Table III in the online Appendix](#)).

In 42 (33%) recommendations, at least one doctor did not agree with the recommendation. Reasons of disagreement were: new evidence arose contradicting this recommendation (9 out of 66 responses = 13%); recommendation did not apply in the hospital setting (12%); and recommendation was not feasible in the hospital setting (5%). Other reasons were explained in 70% (n = 46) of cases; they were related mainly to the use of a test to orientate the treatment and concerns about missing the right diagnosis.

2) Subjective adherence

[Figure 1 B](#) shows aggregated results of subjective adherence. The median percentage of subjective adherence was over 70% in all

type of recommendations, except in those on diagnostic images in the group of surgical specialties.

3) Usefulness of recommendations

[Figure 1 C](#) shows aggregated results of usefulness. In total, in 70% of responses, participants considered the recommendations as useful or very useful. However, it was under 70% in all type of interventions in the surgical specialties. For example, two out of 14 specialists considered a recommendation advising not to use injectable drugs locally for nonspecific low back pain as useful or very useful (usefulness: 14%).

4) Low-value practices possibly present in the hospital

Practices from 22 recommendations had an agreement of 70% or more and subjective adherence under 70%; they represent 16%

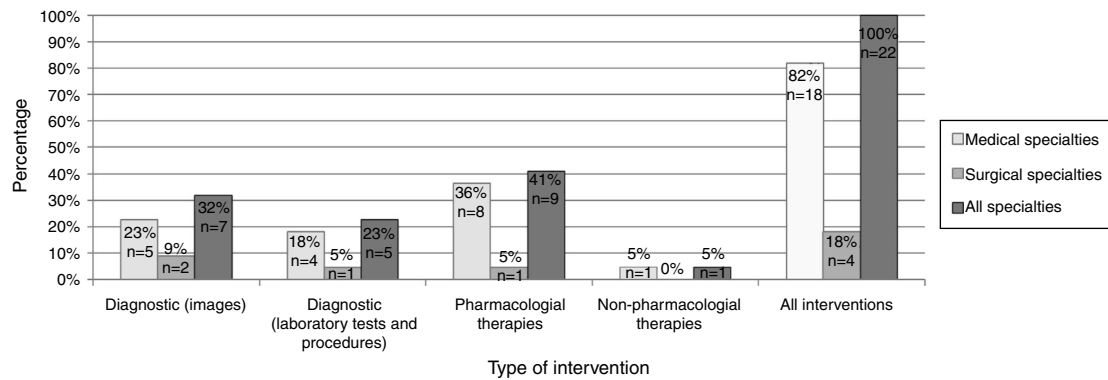


Figure 2. Composite outcome: low-value practices possibly present in the hospital by type of specialty and type of intervention.

of the 134 recommendations. The distribution of these practices by specialty and type of intervention is shown in the [Figure 2](#). In 14 out of the 22 (64%) recommendations usefulness was 70% or more.

Focus group

Eight professionals participated in the group of medical specialties and seven in the surgical group. Five doctors could not attend the session. The composition of each group is described in [Table IV in the online Appendix](#).

1) Low-value practices possibly present in the hospital

Participants gave seven examples of low-value practices present in the hospital that are summarised in [Table 2](#).

2) Barriers for reducing low-value practices

Most of the quotations were about barriers. Several topics were about individuals (micro level) and interactions between professionals and the organisation (meso level). At the micro level, the most common barrier was related to the category of defensive medicine ([Table 3](#)): “. . .in my case, is better to have one test more than one test missing. Because, if you miss something that may have dramatic consequences, for instance an undetected recurrence. So, you ended up asking for that test. Even though you know. . . you are 95% sure you will not find anything bad”.

Regarding scientific evidence, participants considered evidence-based resources excessive and sometimes outdated and even contradictory, leading to a low confidence and low adherence to clinical recommendations. Patients’ literacy and knowledge was considered as a barrier when expert patients demand specific tests that doctors may consider of low-value in a given context.

At the meso level, lack leadership, lack of interaction between professionals and low uniformity in doctors’ activities were perceived as important barriers; for instance: duplicity in diagnostic tests between departments during follow-up, or criteria variability when ordering diagnostic tests or prescribing treatments. Duplicity was classified as a barrier at the meso level because most of the cases it is related to lack of coordination at an institutional level; however, there are duplicities that may be related to professionals’ misuse of tests, for instance when tests are made unnecessarily often, e.g. the measurement of thyroid-stimulating hormone before 6 weeks after modifying the dose, or taking daily sampling in critical patients (that may induce anaemia in elderly).

When comparing between medical and surgical groups, medical specialties mentioned topics that did not appear in the surgical group, for instance the management of uncertainty or excess of

information (infocination). On the other hand, surgical specialties expressed concerns about legal support from the institution that were not mentioned in the medical specialties’ group ([Table 3](#)).

3) Facilitators for reducing low-value practices

All the facilitators suggested by the participants were related to the meso-level barriers. Discussion was mostly about management and leadership where teamwork was considered as a facilitator: “. . .You will always find 20% of people that will not agree with you. teamwork is essential. because if one team member starts to turn the wheel, and another team member does the same, after a while the wheel will turn automatically”. See more examples of verbatim in [Tables V and VI in the online Appendix](#). Some verbatim were specific improvement proposals that may reduce low-value practices ([Table 4](#)).

Discussion

Key findings in relation to previous literature

The aims of this study were to explore healthcare professionals’ opinions about low-value practices, identify practices of these kind possibly present in the hospital and barriers and facilitators to reduce them.

Specialists showed an acceptable agreement with 134 recommendations aimed to reduce low-value practices (83%), and in most responses the recommendations were considered useful or very useful (70%). Recommendations from Choosing Wisely campaigns and similar seem to be good at identifying low-value practices, as concluded by other authors.¹⁵ According to our results, local campaigns such as *Esencial*¹³ and *Commitment to quality of the Spanish scientific societies*¹⁴ may be also good.

Agreement in general, was lower in surgical specialties than in medical specialties, reflecting different perceptions of low-value care of professionals according to their specialty, as reported in *Colla et al.*¹⁵ in the primary care setting. There was also a smaller proportion of surgeons considering useful or very useful the recommendations on low-value practices (55% versus 76%). Reasons why a given recommendation to reduce a low-value practices is considered useless may varied: is considered incapable of producing any change in clinical practice; it refers to uncommon tests or treatments; the low value of the practice is too obvious to be reinforced through a recommendation. These reasons should be explored in future studies.

From the 134 recommendations analysed in the survey, 22 (16%) were about practices possibly present in the hospital according to doctors’ opinion. In the focus groups we identified seven more. These numbers may seem small, and the amount of low-value

Table 2
Low-value practices possibly present in the hospital.^a

		Agreement (%)	Sub. Adherence (%)	Usefulness (%)
<i>Identified in the survey</i>				
1	Long-term treatment with bisphosphonates in postmenopausal women with low risk of fractures	100	20	NR
2	Screening and treatment of certain patients with asymptomatic bacteriuria	100	60	100
3	Prescribing PPI as gastric protection in patients without risk factors for gastrointestinal complications	100	50	79
4	Thyroid ultrasound in patients with subclinical hypothyroidism	100	60	67
5	Routine use of antibiotics to treat exacerbations in COPD without severity and a single Antonhisen criteria	100	60	80
6	Repeating imaging studies (MRI and/or CT) in migraine or tension headache without changes in other tests	79	68	68
7	EKG and cardiac testing images in people without symptoms, comorbidities or significant cardiovascular risk	86	50	64
8	Intraoperative pathological diagnosis in cases of particular complexity, without consulting a pathologist	100	35	100
9	Antidepressants in patients with mild major depressive (except history of moderate/severe depression)	91	50	82
10	Keep deep levels of sedation in critically ill patients without a specific indication	100	55	80
11	Preoperative chest X-ray in low-risk patients under 40 years (ASA I or II)	100	45	79
12	Laboratory testing in patients ASA I and II, prior to a low-risk surgery with minimal blood loss estimated	70	5	20
13	Screening of thyroid disease in hospitalized patients	100	60	67
14	Fine-needle aspiration in lymphadenopathy in which a lymphoid origin neoplasm is suspected	100	60	100
15	Continue empirical antibiotic initiated for a severe infection, without assessing relevance and de-escalation	100	55	94
16	Do blood tests routinely without specific clinical indications	85	60	77
17	Routine prescription of long half-life benzodiazepines for treating chronic insomnia as first choice in elderly	96	65	88
18	Skull X-Ray routinely in head trauma (except non-accidental brain damage confirmed/suspected)	100	50	57
19	Abdominal X-Ray in acute abdominal pain (except obstruction/perforation are suspected)	100	30	75
20	Doing a pelvic X-Ray in trauma patients if a full body CT is planned	100	30	100
21	Using antipsychotics as first choice to treat behavioural and psychological symptoms of dementia	73	65	45
22	Benzodiazepines in old people with acute onset of behavioural/cognitive changes and risk of delirium	100	60	100
<i>Identified in the focus groups</i>				
1	Routine use of tumour markers in cancer monitoring			
2	Redundant follow-up of a patient, from two or three different specialties			
3	Routine use of stress tests in patients with stable coronary disease			
4	Routine use of coagulation test before minor surgery			
5	Overuse of ointments and dressing in wounds care			
6	Long fasting before surgery			
7	Routine chest X-Ray after thoracic surgery			

ASA: American Society of Anaesthesiologists' classification; COPD: chronic obstructive pulmonary disease; CT: computed tomography scan; ECG: electrocardiogram; MRI: magnetic resonance imaging; NA: No response; PPI: proton pump inhibitors.

^a See the [online Appendix](#) to read the full text of the recommendation supporting the low-value practice.

practices that are really present in the hospital may be more or less than this, however, we consider them a good point to start working to reduce them.

Regarding barriers to reduce low-value care, defensive medicine was identified as an important barrier perceived by professionals to reduce low-value practices, especially in the medical specialties. Other studies have identified this as a factor for low-value practices.^{16,20} The origin of this barrier have been associated with doctor-patient communication.²⁶ Dialog between doctors and patients is probably becoming more complex due to increasing patients' literacy and knowledge. Furthermore, expert patients' demands for tests that doctors may consider of low-value suggest a paradox: while it is a low-value practices, it may contribute to building trust between professionals and patients. Talking about low-value practices is perceived as difficult; for

instance, Brandt et al.²⁷ found that, even though 91% of doctors would choose high-value care; in almost all cases they would not include the concept of value in their conversations with patients. However, emerging evidence shows that patients seem ready to de-adopt low-value practices.¹⁷ Provision of education to patients can help improve knowledge around unnecessary care.

Scepticism due to excessive and contradictory scientific evidence was another important barrier. Even though evidence of good quality is fundamental, Grover et al.¹⁸ found that greater knowledge of guidelines to reduce low-value practices is associated with greater cost-consciousness; however, it is not associated with less use of low-value interventions. This should make us aware that knowledge is not enough to reduce low-value care, and that other resources are needed.²⁸

Table 3
Distribution of verbatim quotations about barriers to reduce low-value practices by type of specialty. Coding was done based on topics, categories and levels.

Level	Category	Topic	M	S
Defensive medicine		Self-protection		
		Previous bad experiences		
		Management of uncertainty		
Scientific evidence		Scepticism due to contradictory scientific evidence		
		Routine and resistance to change		
Micro	Attitudes	Corporatism		
		Lack of continuing education		
Education		Lack of continuing education		
		Expert patient		
Patients' literacy/knowledge		Patients' expectations		
		Lack of leadership		
Leadership in the department		Lack of interaction between health professionals		
		Low uniformity in doctors activities		
		Lack of cohesion between professionals		
Meso	Leadership in the hospital	Little legal support from the institution		
		Organizational inertia		
		Lack of mission and/or strategy		
Information		Economic incentives / penalties		
		Lack of budget in the hospital to reduce low-value care		
Information		Infocation		
		Lack of information system's tools		
Macro	Healthcare provision	Workload		
		Little time for consultation		
		Low technology availability		
		Low equipment accessibility		
Health system		Lack of coordination between institutions		
		Lack of legislation/policies on low-value practices		
External factors		Differences in guidelines between regions		
		Media and social networks		
External factors		Political context (e.g. Spanish financial crisis)		

M: medical specialties; S: surgical specialties.

Facilitators included teamwork in order to defeat resistance to change from some individuals; more consensus, instead of top-down instructions and better information flow. Interventions aimed to reduce low-value should be multicomponent,²⁹ involving both patient and clinician roles, as well as bottom-up and top-down interventions. We obtained fewer verbatim quotations about facilitators, in comparison with the number of quotations about barriers; this was because both groups spent less time discussing this section.

Differences between specialties found in the survey might be explained either by the recommendations selected for the survey, or by a different perception of low-value care among doctors from surgical specialties. However, differences were also found in the focus groups, reinforcing the second hypothesis. In the focus groups, while surgical specialties remarked legal support, medical specialties showed more concern about contradictory evidence and management of uncertainty. Legal concerns are not a surprise considering that lawsuits have been traditionally more common in surgical than in medical specialties.

Strengths and weaknesses of this study

The main limitation of our study is a low representativeness in some specialties where the response rate was low. Probably those responding to the survey are “early adopters” or the most conscious about low-value care. However, most of our findings are consistent with other studies,^{15,18,19,27} even in studies

Table 4
Distribution of verbatim quotations about facilitators to reduce low-value practices by type of specialty. Coding was done based on topics, categories and levels.

Level*	Category	Topic	M	S
Supervision of team tasks by the head of department		Supervision of team tasks by the head of department		
		Team-work and snow-ball effect to solve resistance to change		
		Consensus or negotiation when implementing changes in a given department, more than vertical structures with a top-down approach		
Meso	Management and leadership	Keep new strategies for a long term		
		Reduce staff turn-over		
Improve processes	Information flow	Delegating some medical tasks to nurses; for example, collecting clinical information		
		Surveillance of interactions between professionals from different departments and a better coordination between services		
		Improving of availability of internal healthcare statistics, even at department's level		
Improve proposals	Information flow	Ensure the quality, access and dissemination of recommendations from protocols and clinical practice guidelines		
		Use of campaigns, promoting a single key message on clinical practice, as a way to reduce variability		
Information flow		Improving of corporate e-mail messaging		
		Mail lists inside departments to reduce variability in clinical practice		
Alarms in the information system in case of duplicities in diagnostic tests petitions; especially among different departments		Alarms in the information system in case of duplicities in diagnostic tests petitions; especially among different departments		

M: medical specialties; S: surgical specialties.
*We obtained no verbatim quotations related to the micro, macro levels or external factors.

M: medical specialties; S: surgical specialties.
*We obtained no verbatim quotations related to the micro, macro levels or external factors.

assessing a different set of recommendations from the same or other initiatives. Strengths include the mixed methodology using quantitative and qualitative methods that gave us complementary views on the low-value practices issue. Furthermore, as far as we know this is the first study comparing medical and surgical specialties, and assessing agreement, adherence and usefulness for individual recommendations in the hospital setting. Several studies have assessed doctors' perspectives either about the concept of low-value care in general,^{17–20,26–29} or focussing on recommendations on only one specialty^{15,18,19,21,27,30} and most of them in the primary care setting.^{15–19} Besides, our methodology led us to identify potential low-value practices present in the hospital.

Implications for clinicians and policymakers

This work shows caregivers, healthcare managers, policy-makers, and academics key elements for developing interventions to reduce low-value care. The survey led us to identify 22 potential low-value practices in our hospital, and the focus groups seven more, as well as the main barriers and facilitators to reduce low-value care; highlighting that interventions to reduce low-value practices should facilitate decision-making and doctors' and patients' confidence in medical decisions. This methodology may be applied by other hospitals and medical centres in order to identify low-value practices, barriers and facilitators in their own settings.

Based on the results of our study, a new commission was created in our hospital to address low-value practices, including a mailbox to facilitate their reporting and a multidisciplinary team to work in the development of strategies to reduce them.³¹

Recommendations for further research

Future research should focus on the development and assessment of strategies to facilitate doctor-patient communication specifically related to low-value practices. These tools should take into possible differences between medical and surgical specialties, and also, differences between diagnostic and therapeutic interventions.

Conclusions

High agreement to recommendations to reduce low-value practices and high perception of usefulness probably reflect great awareness of low-value care in the hospital setting. Future interventions to reduce low-value care should be designed to foster confidence in decision-making process between professionals and patients and teamwork. These interventions should take into account different needs and perceptions found between medical and surgical specialties. Surveys and focus groups applied locally to know health professionals' opinions may contribute to identify low-value practices locally in the hospital.

What is known about the topic?

Low-value care includes practices with little or no clinical benefit that may harm patients, and lead to a waste of resources. Interventions of this kind threaten patients' safety and the quality and sustainability of health systems. Interventions to reduce them are needed.

What does this study add to the literature?

The survey led us to identify 22 low-value clinical practices possibly present in the hospital, and the focus groups seven more, as well as the main barriers and facilitators related to low-value practices in the medical and surgical fields. Interventions to reduce these practices should include mechanisms to facilitate decision-making and doctors' and patients' confidence in medical decisions.

Editor in charge

Clara Bermúdez-Tamayo.

Transparency declaration

The corresponding author on behalf of the other authors guarantee the accuracy, transparency and honesty of the data and information contained in the study, that no relevant information has been omitted and that all discrepancies between authors have been adequately resolved and described.

Authorship contributions

D. Osorio, S. Romea-Lecumberri, M. Solans-Domenech and L. Arroyo-Moliner contributed to development of the study methods. D. Osorio, S. Romea-Lecumberri, M. Solans-Domenech and L. Arroyo-Moliner directed and managed implementation of the study. D. Osorio, M. Solans-Domenech and L. Arroyo-Moliner provided data collection and management. D. Osorio, S. Romea-Lecumberri, A. Ribera, M. Ballesteros, M. Solans-Domenech and L. Arroyo-Moliner led analysis and interpretation of the

findings reported here. D. Osorio and L. Arroyo-Moliner wrote the manuscript, with contributions from S. Romea-Lecumberri, A. Ribera, M. Ballesteros and M. Solans-Domenech. All authors read and approved the final submission.

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Conflicts of interest

None.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.gaceta.2018.11.007.

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5.2.5. Article V

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Selecting and quantifying low-value nursing care in clinical practice: A questionnaire survey

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Abstract

Aims and objectives: To evaluate the opinion of hospital nurses on a group of recommendations aimed at reducing low-value nursing care and, based on these results, to detect low-value practices probably existing in the hospital.

Background: Low-value nursing care refers to clinical practices with poor or no benefit for patients that may be harmful and a waste of resources. Detecting these practices and understanding nurses' perceptions are essential to developing effective interventions to reduce them.

Methods: We conducted a survey in a tertiary hospital. STROBE guidelines were followed. The questionnaire appraised nurses' agreement, subjective adherence and perception of usefulness of a group of recommendations to reduce low-value nursing care from Choosing Wisely and other initiatives. Practices described in recommendations with an agreement over 70% and a subjective adherence under 70% were categorised as low-value practices probably existing in the hospital.

Results: A total of 265 nurses from eight areas of care participated in the survey. The response rate by area ranged between 2%–55%. From the 38 recommendations evaluated, agreement was 96% (95% confidence interval [95%CI], 95%–97%), median subjective adherence was 80% (95%CI, 80%–85%), and usefulness was 90% (95%CI, 89%–92%). Based on these results, we detected seven (0–15) low-value practices probably existing in our hospital, mostly on general practice, pregnancy care and wound care.

Conclusions: We found a great understanding of low-value care between nurses, given the high agreement to recommendations and perception of usefulness. However, several low-value practices may be present in nursing care, requiring actions to reduce them, for instance, reviewing institutional protocols and involving patients in de-implementation.

Relevance to clinical practice: Hospitals and other settings should be aware of low-value practices and take actions to identify and reduce them. A survey may be a simple and helpful way to start this process.

KEYWORDS

appropriateness, evidence-based practice, low-value care, patient safety, qualitative research, quality improvement, survey

1 | INTRODUCTION

Low-value care comprises clinical practices considered either inappropriate or unnecessary because they: (a) do more harm than good, or (b) have no proven effectiveness, or (c) do not modify clinical decision-making, or (d) provide poor or no benefit in health at high costs (Redberg, 2011; WHO Regional Office for Europe, 2000). Low-value interventions have negative consequences on patients' safety, quality and sustainability of health systems (Elshaug, Hiller, Tunis, & Moss, 2007; MacLeod, Musich, Hawkins, & Schwebke, 2018).

2 | BACKGROUND

Implementing an evidence-based clinical practice leads to high-quality health outcomes (Wilson et al., 2015). This is why there is an increasing motivation by scientific societies and quality agencies to develop recommendations to reduce low-value care. However, in spite of the well-known benefits of evidence-based clinical practice, compared with that based on personal experience (Melnyk, Fineout-Overholt, Gallagher-Ford, & Kaplan, 2012; Melnyk et al., 2016), low-value clinical practices are still existing in health care (Miller, Hayes, & Carey, 2015). These practices have been well documented in medicine (Chambers et al., 2017; Niven et al., 2015; Osorio et al., 2019; de Vries, Struijs, Heijink, Hendrikx, & Baan, 2016). However, this is not the case in nursing (Verkerk et al., 2018).

Several initiatives around the world have been launched to reduce low-value care. For instance, in the Choosing Wisely Campaigns from US, Canada, Australia, Italy and Spain (ABIM Foundation, 2018; Agència d'Avaluació i Qualitat Sanitàries de Catalunya (AquAS) (2018); García-Alegría et al., 2017; NPS MedicineWise, 2018; Slow Medicine, 2018;), the organisers consult scientific societies about tests or treatments whose appropriateness should be discussed. Furthermore, some of these initiatives have reached the hospital setting in order to reduce low-value care (Lee, Chiu, & Rolko, 2017; Osorio et al., 2018).

Detecting local low-value care and understanding nurses' perspectives are essential in developing effective interventions to reduce it (Harvey & McInnes, 2015). The objectives of this study were to evaluate the opinion of hospital nurses on a group of recommendations aimed at reducing low-value nursing care and, based on these results, to detect low-value practices probably existing in the hospital.

3 | METHODS

3.1 | Design

A cross-sectional descriptive study was carried out through an online survey. The study took place in Vall d'Hebron University Hospital (Barcelona, Spain), one of the largest tertiary hospitals in Europe that provide health services to a population of over 500,000 people. The study was approved by the Vall d'Hebron University Hospital (Barcelona, Spain) Clinical Research Ethics

What does this paper contribute to the wider global clinical community?

- Identifying low-value nursing care is crucial to generating a culture of continuous improvement of appropriateness based on evidence.
- Nurses agree that there are low-value practices in the hospital setting that could be reduced and could identify which of them are more frequent. However, it is necessary to develop strategies aimed at guaranteeing evidence-based care.

Committee, and it was conducted according to the Declaration of Helsinki standards. Participants completed the survey between September–December 2016. STROBE guidelines for cross-sectional studies (von Elm et al., 2008) were followed in reporting this study (see Appendix S3).

3.2 | Data collection

3.2.1 | Participants

The universe of the study was all staff nurses of the Hospital ($n = 2,063$). The staff nurses work in the following eight areas of care: outpatient care, critical care, surgical care, emergency care, adult inpatient care, paediatric inpatient care, trauma care and pregnancy care. No sample was selected since all staff nurses were invited to participate. Nurse residents were excluded considering that their practice is tutored and under the supervision of nursing staff.

3.2.2 | Search and selection of recommendations

In order to find recommendations to reduce low-value nursing care, we consulted the website DianaHealth.com, an open-access online database of recommendations and other appraisals of low-value healthcare interventions made by several initiatives worldwide (Bonfill et al., 2016), including the Choosing Wisely initiatives and several more. We carried out a search in May 2016 using a filter created by the website developers to retrieve recommendations in Nursing.

A panel of expert nurses was convened to select the recommendations that would be assessed in the survey from the search results in DianaHealth.com. The criteria for selecting the recommendations to include in the survey were as follows: a minimum of five and up to ten recommendations about interventions available in the areas of care of the hospital. The range of five to ten recommendations was decided by the researchers in order to make the questionnaire simpler for participants.

The panel was formed by one nurse expert in one of the eight areas of care of our hospital: outpatient care, critical care, surgical care, emergency care, adult inpatient care, paediatric inpatient care,

trauma care and pregnancy care. The panel of expert nurses was selected based on their clinical experience and knowledge in the area of care. Two additional experts were chosen as substitutes in case an expert declined the invitation to participate.

3.2.3 | Survey

The survey contained the 5–10 recommendations selected for the eight areas of care. Each recommendation was followed by four questions asking whether the participant agrees with it; what was the reason to not agree; how adherent to the recommendation the participant believes nurses are in the hospital (expressed as a percentage); and how useful they considered it (Table 1). Comprehension and time of completion were tested before the study. At the beginning of the questionnaire, participants were asked to declare whether they were staff nurses or nurse residents, and the area of care where they spent most of their time, in order to display only those recommendations related to her or his area of care.

We sent an invitation email to all staff nurses included in the distribution list of the Hospital, explaining the objectives of the study and including a link to the questionnaire. Data were collected for four months. We sent two reminders one and two months after the invitation email. No personal information was asked to ensure anonymity in participation. Also, participation was voluntary and had not any economical compensation. Surveys from residents were excluded from the analysis.

3.3 | Data analysis

We analysed five outcomes: agreement, subjective adherence, reasons for disagreement, usefulness (see operative definitions in Table 1) and low-value practices probably existing in the hospital. This fifth outcome was a composite outcome defined as any practice from recommendations with an agreement over 70% and a subjective adherence under 70%. Usefulness was excluded from the composite outcome because the purpose was to detect low-value practices, even when nurses think the recommendation is not useful. These outcomes have been used before to analyse low-value care between medical doctors (reference blinded for peer review). Outcomes are analysed in general and by area of care. The unit of analysis was the response of each nurse, except for the composite outcome where the unit of analysis was the recommendation. Missing data were excluded from the analysis. Descriptive statistics were used to analyse data using SPSS v.23.

4 | RESULTS

We obtained 80 recommendations to reduce low-value nursing care from the search in DianaHealth.com, using the Nursing filter. From these 80, 38 were about interventions available in our hospital, and some recommendations were found to apply to more than one area. The selected recommendations covered several topics: 15 on wound

TABLE 1 Survey questionnaire and outcome definitions

Questionnaire		Outcome definition		
Question	Options and type of variable	Outcome Name	Concept	Operative definition
1. Do you agree with this recommendation?	a. Yes b. No Type of variable: categorical	Agreement	Whether respondent agrees or not to what is stated in the recommendation	<i>n</i> Yes/ <i>n</i> responses Results are expressed as % (percentages over 70% were considered as agreement)
2. If you agree, in your opinion, what is the percentage of adherence to this recommendation in the Hospital, either in your department or in others?	Number between 0%–100% Type of variable: quantitative	Subjective adherence	Percentage of adherence in the hospital according to participants' opinion	Median of the percentages declared by respondents. Results are expressed as a median % (median percentages over 70% were considered as adherent)
3. If you do not agree, in your opinion, what is the reason?	Multiple choices: -New evidence arose contradicting this recommendation, -The recommendation does not apply in the hospital setting, -The recommendation is not feasible in the hospital setting, -Other reasons Type of variable: categorical	Reasons for disagreement	Reasons why the respondent does not agree with the recommendation	<i>n</i> each option/ <i>n</i> responses Result expressed as % of each category
4. How useful do you consider this recommendation?	-Very useful, -Useful, -Indifferent, -Not so useful, -Useless Type of variable: categorical	Usefulness	Whether respondent considers the recommendation useful or useless in spite of agreeing with it.	Useful + very useful/ <i>n</i> responses Results are expressed as % (percentages over 70% were considered as useful)

care, 10 on general practice, seven on catheter care, three on pregnancy care, two on ostomy care and one on elderly care (see the full text of the recommendations in Appendix S1).

A total of 265 nurses participated in the survey. Response rate was 13% overall, ranging from 2% (critical care) to 55% (trauma care) within areas. Nurses gave their opinion on 5–10 of the 38 recommendations, obtaining a total of 2,247 responses. Agreement, subjective adherence and usefulness of recommendations by area of care are shown in Figure 1.

4.1 | Agreement

Overall, agreement with the recommendations was 96% (95% confidence interval [95%CI], 95%–97%). It was over 70% through all the recommendations. However, taking into account the lower bound of the 95% confidence interval, four recommendations could have an agreement of <70% (see Appendix S2): (a) Tepid sponging is not recommended for the treatment of fever (78%; 95%CI, 68%–88%); (b) Do not use hair removal routinely to reduce the risk of surgical

site infection (83%; 95%CI, 62%–100%); (c) Do not use non-iodophor-impregnated incise drapes routinely for surgery as they may increase the risk of surgical site infection (83%; 95%CI, 62%–100%); and (d) Do not use diathermy for surgical incision to reduce the risk of surgical site infection (82%; 95%CI, 59%–100%).

Agreement was also over 70% in all the eight areas of care. Recommendations related to interventions in adult inpatient care showed a significant high agreement (99%; 95%CI, 98%–100%), while it was slightly lower in emergency care (88%; 95%CI, 83%–94%), compared with the overall agreement (Figure 1).

In 23 out of 38 recommendations (61%), at least one nurse did not agree with the recommendation. The recommendation with more disagreement was about not bandaging a primary closure wound, with 21 out of 111 (19%) responses disagreeing. Reasons for disagreement with the recommendations varied: recommendation was not feasible in our hospital (18 out of 73 responses, 25%), mostly due to hospital protocols or standards; they know about new evidence contradicting this recommendation (18%, $n = 13$); and recommendation did not apply in the regular practice (15%, $n = 11$). Other

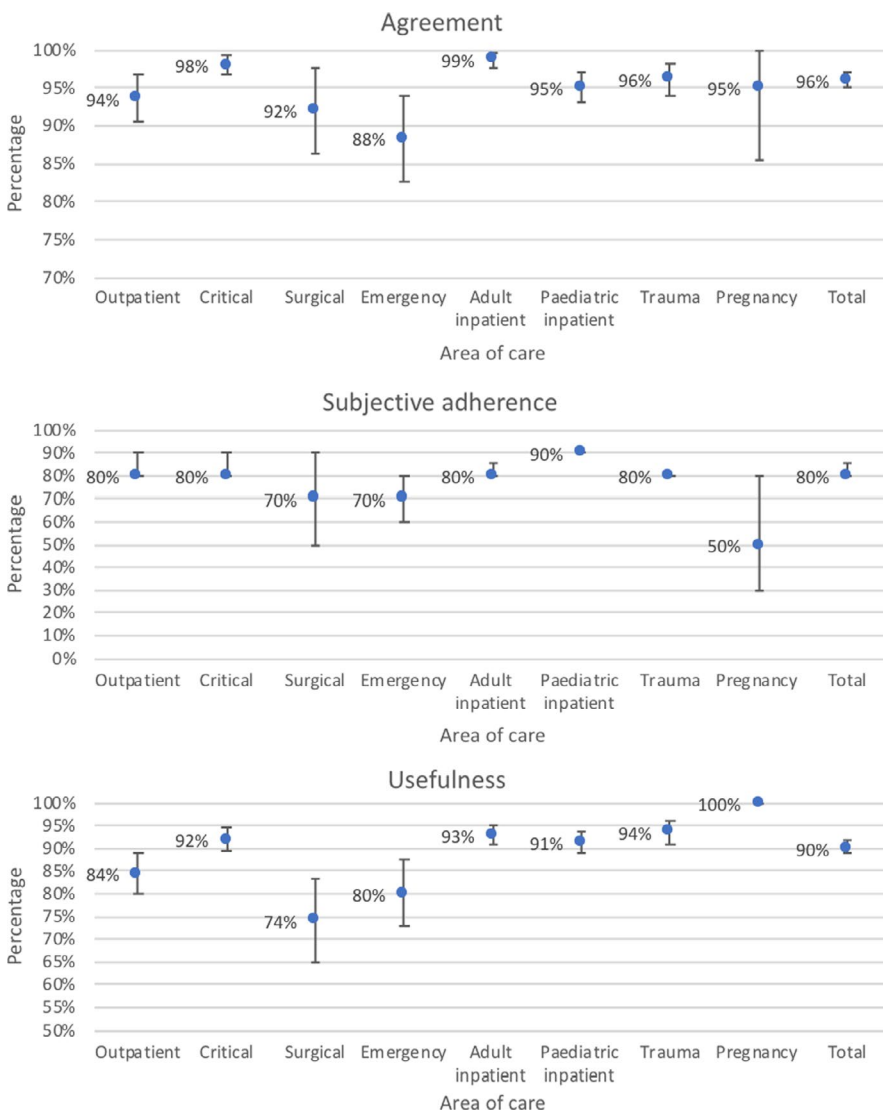


FIGURE 1 Agreement with the recommendations, subjective adherence and usefulness by area of care (point estimate and 95% confidence intervals)

reasons were argued in 40% ($n = 29$) of responses, related mainly to the nurse's personal experience of effectiveness, or because of the patient's preferences.

4.2 | Subjective adherence

The median percentage of subjective adherence (how adherent to the recommendation nurses are in the hospital, according to respondent's opinion) was in general of 80% (95%CI, 80%–85%; interquartile range 38). Seven recommendations showed a subjective adherence of <70%, and they are explained below in the section *Low-value practices probably existing in the hospital*. Taking into account the 95% confidence interval, the number of recommendation could be between 0 (upper bound)–12 (lower bound. See Appendix S2).

Regarding differences between areas of care, subjective adherence was over 70% in all the areas, except in pregnancy care, where it was of 50% (95%CI, 30%–80%). It could be also under 70% in surgical and emergency care, taking into account the lower bound of their 95% confidence interval (see Figure 1).

4.3 | Usefulness of recommendations

In 90% of responses (95%CI, 89%–92%), nurses rated the recommendations as useful or very useful. Only in one recommendation (3% of the 38 recommendations assessed) less than 70% of responses were rated as useful or very useful: Do not use dextranomer for debridement in the management of surgical site infection (60%; 95%CI, 30%–90%). Nevertheless, taking into account the 95% confidence interval, the number of recommendations with usefulness of <70% could be between 0–10 (See Appendix S2).

Analysing by area of care, usefulness was 70% or more in all the areas (see Figure 1) being lower in the surgical (74%; 95%CI, 65%–83%) and emergency areas (80%; 95%CI, 73%–87%) compared with the overall results and to other areas such as inpatient care, trauma and pregnancy (see Figure 1).

4.4 | Low-value practices probably existing in the hospital

Clinical practices from seven recommendations (18% of the 38 recommendations assessed) were categorised as probably existing in the hospital (Table 2) because the agreement was over 70% and subjective adherence was under 70%. Three were related to wound care: hair removal routinely in the surgical site, the use of non-iodophor-impregnated incise drapes and the use of bandage in primary closure wounds. Two practices were related to the topic of general practice in nursing: the use of tepid sponging for the treatment of fever and waking up the patients at night unless really needed. The other two practices were related to pregnancy care: the routine use of electronic foetal heart rate monitoring during labour and inducing labour where there is not a clear indication for doing so. In all the seven recommendations, usefulness was 70% or more. However,

taking into account the 95% confidence interval of both agreement and subjective adherence, the number of low-value practices probably existing in the hospital could be between—and 15 (0%–39% of the 38 recommendations assessed; see Table 2).

Analysing by area of care, the emergency care showed 3 low-value practices probably existing in the hospital, and the number may range from 0–7, taking into account the 95% CI of the agreement and subjective adherence. Surgical care had 3, ranging from 0–6, followed by pregnancy care (2; ranging from 0–6), trauma care (2; ranging from 0–6) and paediatric inpatient care (2; ranging from 0–3). Adult inpatient and outpatient care ranged from 0–3, and critical care ranged from 0–2.

The number of responses, percentage of agreement, percentage of subjective adherence and percentage of nurses considering the recommendations as either very useful/useful or not so useful/useless are shown in Appendix S2.

5 | DISCUSSION

This study shows the opinion of hospital nurses on low-value nursing care and allowed us to detect some low-value practices probably existing in the hospital. We carried out a survey including 38 recommendations to reduce low-value nursing care about interventions available in the eight areas of our hospital to assess nurses' agreement, subjective adherence and usefulness of these recommendations. The selected recommendations included some of the those proposed by the American Academy of Nursing (2018) and by the Canadian Nurses Association (CAN; Shellian & Levinson, 2016). They refer to the same topics as those covered in the works carried out by Verkerk et al. (2018) and by a multidisciplinary group from the Netherlands (Ubbink, Brölmann, Go, & Vermeulen, 2015).

The response rate was not high; this is not surprising considering that low response rates to surveys have been a common problem in research, especially in health care (Cooper & Brown, 2017). Participation of nurses was unequal between areas, being quite low between nurses from critical and surgical care. This fact showed us that it is necessary to work on generating greater awareness of low-value nursing care among professionals in these areas.

The participants showed high agreement with most of the recommendations in the eight areas. These results reflect a relatively good knowledge of nurses on evidence-based practices, contrary to the conclusions of Miller et al. where the authors stated that some nurses may need more education about certain evidence-based guidelines (Miller et al., 2015). It may be the case in some recommendations in our study, where the agreement was not high, for instance "in acute wounds do not apply bandage on primary closure wounds." One of the next steps after this study is to check our clinical protocols and its clarity regarding low-value clinical practices, and also to reinforce education to follow protocols and guidelines. In the case of wound care, previous studies have shown that the care received by patients could be dependent upon factors such as individual characteristics of the nurse, for instance,

TABLE 2 Low-value practices probably existing in the hospital: recommendations with agreement of 70% or more and a subjective adherence of 70% or less

Recommendation	n	Agreement		Subjective adherence			Usefulness		Low-value practice probably existing in the hospital ^a		
		%	95% CI	Median	95% CI	IQR	%	95% CI	Based on PS	Based on 95% CI LB	Based on 95% CI UP
1. Using urinary catheters routinely in patients with acute stroke and urinary incontinence	43	95	89	100	75	80	35	81	69	93	x
2. Keeping an urinary catheter more than 48 hr after a gastrointestinal surgery	52	98	94	100	80	80	40	91	83	98	x
3. Tepid sponging for the treatment of fever	64	78	68	88	60	70	45	85	77	94	x
4. Waking up the patient for routine care unless the patient's condition specifically requires it	141	100	100	100	60	70	40	95	91	99	x
5. Neglecting to advise patients with cancer to get physical activity and exercise during and after treatment to manage fatigue and other symptoms	84	98	94	100	70	80	40	93	87	98	x
6. Prescribing ambulatory oxygen therapy in COPD patients with partial pressure of oxygen in arterial blood (PaO ₂) higher than 55 mmHg, and without exercise-induced desaturation	25	92	81	100	70	80	30	72	54	90	x
7. Continuous electronic foetal heart rate (FHR) monitoring during labour for women without risk factors; without considering intermittent auscultation (IA) first	17	100	100	100	50	70	35	72	52	93	x
8. Induction or augmentation of labour without a medical indication	4	100	100	100	40	70	30	100	100	100	x
9. Separating mothers and their newborns at birth unless medically necessary. Instead, help the mother to place her newborn in skin-to-skin contact immediately after birth and encourage her to keep her newborn in her room during hospitalisation after the birth	4	100	100	100	70	80	30	100	100	100	x
10. Using dextranomer for debridement in the management of surgical site infection	11	100	100	100	80	100	45	60	30	90	x
11. Hair removal routinely to reduce the risk of surgical site infection	12	83	62	100	50	100	84	83	62	100	x
12. Using razors for hair removal, because they increase the risk of surgical site infection	29	97	90	100	70	100	73	93	84	100	x
13. Non-iodophor-impregnated incise drapes used routinely for surgery	12	83	62	100	50	90	40	83	62	100	x
14. Bandage a primary closure wound in patients with an acute wound	101	79	71	87	60	80	60	80	72	88	x
15. Using aloe vera on skin to prevent or treat radiodermatitis	7	100	100	100	80	100	30	86	60	100	x

Abbreviations: CI, confidence interval; IQR, interquartile range; LB, lower bound; n, number of responses; PS, punctual estimation; UP, upper bound.

^aRecommendations considered as potential low-value practices present in the hospital due to an agreement of 70% or more and a subjective adherence of 70% or less.

education and training with respect to wound care (Dugdall & Watson, 2009).

Adherence should be improved for some recommendations, for instance, the recommendation about the use of intermittent auscultation as a first option over the use of continuous automatic monitoring of the foetal heart rate during labour. Automatic monitoring apparently remains as a routine practice in our hospital, despite the fact that it has recently been reviewed as having more problems than benefits (Alfirevic, Devane, Gyte, & Cuthbert, 2017). Interventions to promote intermittent auscultation are needed to improve the control of foetal monitoring by nurses in the delivery units (Patey et al., 2017).

It is interesting to see that even though nurses agree with a given recommendation and consider it useful, adherence is low. This was the case of surgical hair removal to prevent surgical site infection. Preliminary evidence shows that the dissemination of recommendations alone is not enough to guarantee a behaviour change and that additional specific interventions are required (Wammes et al., 2016). Continuous revision and updating of protocols, in this case, skin preparation for surgery is crucial and must include the participation of all the professionals involved and the inclusion of recommendations based on the best evidence.

Regarding the usefulness of the recommendations, only one recommendation showed a percentage of usefulness under 70%. There are several reasons why a recommendation aimed at reducing low-value care may be rated as useless, for instance, it is about uncommon clinical practices; or it refers to a practice that is so obvious that is of low-value, that they consider unnecessary to advise against its use; or the low-value practice is so rooted in everyday life that they consider the recommendation is not able to change people's behaviour.

A tendency of lower agreement, lower usefulness and more low-value practices observed in the emergency care area may suggest that reducing low-value practices is hard in that context. Emergency care may be a challenging scenario for health decision-making, and probably, it is harder for health professionals to avoid low-value practices or to discuss them with patients. Probably, this area of care deserves special consideration when designing tools and strategies to reduce low-value care.

The survey allowed us to detect seven low-value practices probably existing in the hospital. This study represents a step forward, compared with the available studies where lists of low-value practices are retrieved either after scientific societies' consensus or after a systematic review. In this study, we selected a sample of these recommendations and consulted agreement, adherence and usefulness to practitioner nurses, and used this information in order to detect low-value practices in our context.

5.1 | Limitations of this study

The number of recommendations assessed in the survey is just a sample of hundreds of recommendations that have been identified by all initiatives existing to reduce low-value care. We chose

to assess up to 10 recommendations by area to make the survey friendly and agile for participants. Besides, as in the study of Verkerk et al. (2018), we did not verify the quality of the evidence supporting each recommendation. However, we verified that they were still valid by the time we sent the survey to participants.

As mentioned before, the response rate was low in spite of two electronic reminders and one round of personal reminders made by supervisors. This could be due to the fact of being an anonymous online survey. In order to respect participants' anonymity, no ID or email account was required to access to the survey, which could have been a mechanism of control in order to improve the response rate. Low response rate affected the statistical power of estimations as reflected in the low-value practices probably existing in the hospital, which may rate between 0–15. The low response rate may also affect the generalisability of study results, since they may reflect only a part of our Hospital's reality. Probably, the outcome subjective adherence may be more susceptible to this threat. Perhaps, the real adherence to the recommendations to reduce the seven low-value practices probably existing in our hospital is more than 70%, and therefore, they may not be a big issue in our setting. However, measuring low-value practices in the real world is difficult, given that the information available in information systems is not detailed enough to determine the appropriateness of a given practice, and even the notes in the medical chart are insufficient to assess adherence (Brownlee et al., 2017). However, staff nurses were self-critic enough to admit that some low-value practices take place in the hospital. They admit for instance, that waking up the patient for routine measurement of vital signs when the patient's condition does not specifically require it, it is a low-value practice that exists in the hospital, despite the absence of evidence supporting any benefit of this intervention (Pilkington, 2013).

Also, during four months that the survey was available, nurses could have had the opportunity to talk about recommendations. In any case, we consider that this possible contamination would tend to underestimate the number of low-value practices probably existing in our hospital; still, several low-value practices were identified.

5.2 | Recommendations for further research

Further research should emphasise on developing and evaluating tools and actions to facilitate nurse–patient communication aimed at reducing low-value care. Patients are a key element in reducing low-value care, but probably it is necessary to develop mechanisms to increase awareness and participation of patients in this process.

Reasons for poor adherence to recommendations to reduce low-value nursing care should be explored in detail. Evidence-based practice has shown to be a milestone in health care (Wilson et al., 2015); however, knowledge translation seems to be insufficient. Some evidence-based guidelines and screening protocols are not put in practice if they are considered as a barrier to stop the patient flows (Kirk & Nilsen, 2016). Other barriers identified in previous studies also included insufficient collaboration between nursing staff and doctors (O'Connell et al., 2018).

6 | CONCLUSIONS

The survey suggests a great understanding of low-value care between nurses, given the high agreement to recommendations and perception of usefulness. However, there are some low-value practices existing in nursing care. From 38 practices analysed, we detected 18% that probably exist in our context. Further actions should be taken, such as reviewing our institutional protocols to place emphasis on avoiding low-value practices, and stimulating dialogue between health professionals and patients about their de-implementation.

Recommendations from initiatives such as the Choosing Wisely campaigns seem to be useful; they provide guidelines on which low-value practices should be avoided according to the scientific evidence. Nevertheless, it is necessary to assess health professionals' opinion and to analyse which practices exist in the local context, in order to guide improvement actions.

7 | RELEVANCE TO CLINICAL PRACTICE

Hospitals and other settings should be aware of low-value practices and take actions to identify and reduce them. A survey may be a simple and helpful way to start this process; its results may contribute to generating more awareness about low-value nursing care among caregivers, healthcare managers, policymakers and academics, which may foster interventions to reduce it.

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CONFLICT OF INTEREST

Authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Development of the study methods: DO, EZ, MT, MM, SR, AB; Implementation of the study: DO, MM, AB; Data management: DO; Analysis and interpretation of the findings: DO, EZ, MT, MM; Writing manuscript: DO, EZ with contributions from MT and MM. All authors read and approved the final submission.

DATA AVAILABILITY STATEMENT

The data sets used and/or analysed during the current study are available from the corresponding author on reasonable request.

ETHICS APPROVAL

This project was approved by the Vall d'Hebron Hospital Clinical Research Ethics Committee (approval No. 319).

CONSENT FOR PUBLICATION

This article does not report individual patient data in the form of images, videos, voice recordings or other.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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6. Discussion

6. Discussion

This thesis has aimed to analyse and develop initiatives and methods for improving the appropriateness of clinical practices in the hospital setting and their acceptability among health professionals. In the course of this research, we identified and described the most recognised initiatives worldwide, provided some tools for measuring appropriateness, and analysed factors related to the appropriateness and inappropriateness of clinical practice in the hospital setting.

6.1 Initiatives to improve appropriateness of clinical practice

6.1.1 The most relevant initiatives and their characteristics

Worldwide, there are several initiatives to improve the appropriateness of clinical practice. Study I enabled us to identify and describe 23 initiatives responding to this objective, according to the definition given in the methods.

Some of the most relevant initiatives are those that emerged in the context of the Choosing Wisely campaign. The first of these emerged in 2012 in the United States, led by the ABIM Foundation (105). In this initiative, the national scientific societies are invited to generate clinical recommendations on diagnostic tests, treatments or procedures that doctors and patients should discuss because they could be unnecessary. This campaign is especially relevant because its example has been followed by other countries.

Another initiative to highlight from Study I is the “Do not do” database by the National Institute for Health and Care Excellence (NICE) in the United Kingdom. Initially, this initiative was a list of recommendations from the clinical practice guidelines generated by NICE that refer to practices without evidence of effectiveness or with evidence of little effectiveness or a negative risk-benefit analysis. Nowadays, this initiative is no longer maintained in the form of a list, as was originally the case when it appeared in 2015. However, the concept of “Do not do” continues to be in force at NICE through another resource available on its website called “Cost saving and resource planning” (115). This resource highlights the “Do not do recommendations” within the NICE

guidelines and estimates the economic impact of implementing these recommendations.

Other relevant initiatives are Too Much Medicine of the British Medical Journal (129) and Less is More of The Lancet journal (119,120). They both offer selections of articles dedicated to overuse, its consequences for patient safety and the economic impact on healthcare systems. Its relevance lies in the high impact that these publications have in the medical field.

Locally in Spain, there is the initiative Compromiso por la Calidad de las Sociedades Científicas en España (Commitment to Quality of the Spanish Scientific Societies, in English), promoted by the Ministry of Health (127). Although it has a different name, it shares the same objectives and methodology of the Choosing Wisely Campaign; they have also generated lists of unnecessary practices with the collaboration of Spanish scientific societies. In Catalonia, there is the Essencial Project, promoted by the Catalan Agency for Health Quality and Evaluation (AQuAS), which, in addition to generating recommendations with Catalan scientific societies, has developed informative materials for patients and has given a great boost to the improvement of appropriateness, especially in the primary care setting (141).

Another local initiative is MAPAC. Its name is an acronym that summarises its objective in Catalan: Millora de l'Adequació de la Pràctica Assistencial i Clínica (Improving the Appropriateness of Clinical Practice and Healthcare, in English). It is a group of commissions created in several hospitals in Spain, aimed at reducing interventions that may be inappropriate or of low value in their own field of operations. These interventions include either those identified by initiatives such as Choosing Wisely or others identified by their own clinicians. The first MAPAC commission was established in the Hospital de la Santa Creu i Sant Pau in Barcelona, led by Dr Xavier Bonfill in 2011 (121). Nowadays there are several commissions in different Spanish hospitals such as the Donostia Hospital, the Consorci Sanitari de Terrassa and the Vall d'Hebron University Hospital. The MAPAC initiative is coordinated by the Clinical Epidemiology and Public Health Service of the Hospital de la Santa Creu i Sant Pau. The experience of the Vall d'Hebron University Hospital is summarised in the article included as Appendix 2.1.

6.1.2 Impact of the initiatives

In recent years, the initiatives identified in Study I have made various contributions in terms of improving the appropriateness of clinical practice, as explained below.

First, they have contributed to developing and consolidating the concepts of appropriateness and value in healthcare. They have provided concrete examples of low-value practices and have identified hundreds of them, while also creating several educational and dissemination materials. Part of this activity is reflected, for example, in the publications that Choosing Wisely's campaigns have on Pubmed, which now surpass 1000 in number.

Second, they have given visibility to the problem of inappropriateness and have influenced the creation of new campaigns in other countries, regions or institutions. For instance, the example set by the Choosing Wisely campaign in the United States has been followed by another 19 countries as of April 2020, adopting many of the recommendations issued by the American scientific societies, although they have also developed new ones with the collaboration of local societies. Another example of this influence is the MAPAC commissions that have been created after the one that was formed by the Hospital de la Santa Creu i Sant Pau (121).

Third, they have created networks and established collaborations. For example, since 2013, seven international Preventing Overdiagnosis conferences have been held, promoted by several institutions, including The British Medical Journal and The Dartmouth Institute (142). Locally, MAPAC initiatives have signed collaboration agreements between hospitals to share their recommendations, experiences and data for benchmarking in order to improve the appropriateness of hospitals in Spain. Another example of collaboration is the Wiser Healthcare research network, promoted by a group of academics from Australia, which aims to reduce overdiagnosis and overtreatment (143).

Fourth, the vast majority of initiatives have evolved and developed more resources for improving the appropriateness of clinical practice. For example, the Choosing Wisely

campaigns, in addition to clinical recommendations, have created informational materials for patients about the pros and cons of a particular benefit, in order to encourage dialogue and shared decision-making. They also offer access, through their website, to other resources developed by collaborating scientific societies, such as the resources of the American College of Physicians, which has generated tutorials and teaching materials to promote dialogue on low-value practices and guidelines for patients on the proper use of emergency and hospitalisation resources, among other things (144).

The MAPAC initiative has developed the GRAMA application (145) to facilitate and standardise the production of clinical recommendations for improving the appropriateness of clinical practice, based on the GRADE system (39). The application is multilingual, freely accessible, and it guides the user throughout the entire process recommended by GRADE. As a result, the user obtains a PDF file with a datasheet with the recommendation, the rationale and other information. This datasheet is included in the DianaHealth.com online database. Although it was initially developed to produce recommendations for therapeutic interventions, it is expected to help with recommendations for other kinds of interventions in the future.

Furthermore, some initiatives have made progress in developing strategies to modify clinical practice. For example, the Essencial AQUAS initiative of Catalonia-Spain has launched a project in which primary care professionals are the ones who design and implement interventions to apply the recommendations proposed by the Essencial Project (114).

Another example, also in Spain, is that of the Navarra Health Service, Osasunbidea that has regulated the coverage of two benefits based on the recommendations made by their MAPAC commission, created in March 2019. Instruction 11/2019 (146) regulates the use of platelet-rich plasma and derivatives in the treatment of tendinopathies, osteoarthritis, pseudoarthrosis and muscle injury. Their use is allowed “exclusively in the context of a clinical study authorised by the clinical research ethics committee of Navarra”. This instruction also regulates the screening of vitamin D, specifying not only the clinical scenarios in which it is funded, but those that are not.

6.1.3 Criticisms of the initiatives

Despite the achievements of the initiatives in improving the appropriateness of clinical practice, some of them have received criticism, as explained below.

First, this criticism points to the lack of methodological rigor in the process of identifying low-value practices. This is the case for the recommendations of the Choosing Wisely campaigns and the ACR Appropriateness Criteria® of the American College of Radiology. In both initiatives, the process is mainly based on expert opinion and is complemented by a review of the literature, as indicated by the RAND Corporation methodology. Andrew et al. (147) take, as an example, the Choosing Wisely critical care recommendations developed by the Critical Care Societies Collaborative. They point out that these recommendations do not follow the standards of reliable clinical practice guidelines, because a systematic process for reviewing the evidence was not carried out and a transparent criterion was not used to grade its quality. This fact was verified in Study I.

However, some initiatives do follow a rigorous methodology. This is the case with the NICE “Do not Do” recommendations and the MAPAC recommendations. Both are based on the GRADE system (39). One aspect that can hinder the production of recommendations to improve appropriateness based on strong scientific evidence is publication bias. This bias, which has been extensively documented in the literature (36,148), consists in a low visibility of negative results in scientific research, including no-effect, non-superiority or adverse events.

Second, the relevance of some of the recommendations included in the lists of the Choosing Wisely campaigns has also been questioned. Morden et al. (149) take as an example two of the recommendations of the American Academy of Orthopedic Surgeons, one about the use of glucosamine and chondroitin sulfate supplements in osteoarthritis of the knee and the other about needle irrigation in osteoarthritis of the knee. The supplement is an over-the-counter drug and the second, a very rare procedure. They do not include recommendations on interventions that have shown great variability in clinical practice, as is the case with knee replacement, which in the

United States represents a significant percentage of the income from surgical activity of these specialists.

This is not the case for all the recommendations, since some non-value practices included in the Choosing Wisely recommendations are highly prevalent, at least in the United States. Such practices include, for example, routine cardiology tests and dual energy X-ray absorptiometry, which have been documented as inappropriate in 13% and 10% of Medicare patients, respectively (150).

Third, Morden et al. (149) also refer to a lack of self-criticism, since the recommendations often refer to the exercise of other specialties. The criticism is that the reduction of the low-value practice in question would have direct implications for the billing of other specialties, but not for the specialty that authored the recommendation. However, regardless of the monetary interests involved, it is clear that for patients there is a clear benefit in reducing these kinds of practices.

Fourth, Choosing Wisely recommendations have been questioned because few of them provide evidence of cost-effectiveness. Pandya et al. (10) estimated that only 2% of the recommendations of the American initiative include economic studies, and that only 29% include any word related to costs. However, it is important to highlight that the main arguments of the recommendations are related to a poor clinical outcome or harm to the patient.

Fifth, several authors have documented the difficulty of measuring low-value practices in “real life”. This limitation is explained in more detail in section 6.2, Assessment of the appropriateness of clinical practice.

Finally, there is concern that the lists of inappropriate practices may have a negative impact when implementing disinvestment strategies. Although they could be useful tools for defining the benefits' coverage and as a pay-for-performance guide, their use may undermine the use of a given intervention in contexts where it could be of value. Possibly, divestment strategies should first be introduced in experimental settings, where their impact and possible collateral damage could be assessed, before being routinely applied.

6.2 Assessment of the appropriateness of clinical practice

The first step for assessing the appropriateness of clinical practice is to establish the criteria for judging whether a given intervention is appropriate in a given context (151). The DianaHealth.com website developed in Study I, in addition to contributing to the dissemination of initiatives to improve clinical practice, may facilitate the evaluation of appropriateness, offering quick access for the consultation of several recommendations and appropriateness analyses that provide the criteria for such evaluation.

The next step, once the criteria have been established, is the evaluation in day-to-day clinical practice. As mentioned in the introduction to this document, measuring inappropriateness in clinical practice is difficult because of the degree of detail that is needed to establish whether or not a particular practice has been appropriate. In the literature there are multiple appropriateness studies. However, most of them are of small scale, as they are based on the review of medical records.

Various authors have analysed the possibility of automatically measuring some low-value practices, using indicators calculated from information systems and administrative databases. In what follows I offer some examples.

A group of Australian researchers developed a set of hospital use indicators based on the Choosing Wisely recommendations (152). They selected the most suitable recommendations to develop the indicator set, based on four criteria related to the intervention. These criteria establish that the intervention should: be observable in the hospital setting, be linked to an existing code, possess a clear indication and be systematically coded each time it was indicated. Of the 824 recommendations identified in the Choosing Wisely lists from the United States, Canada, Australia and the United Kingdom in January 2017, only 18 (2%) met all four criteria. During the process, 34% of the recommendations were discarded because they did not belong to the hospital setting; of these, 38% were discarded because they were not encodable (including all recommendations on medications, because there are not encoded in their system); of these, 72% were excluded because the appropriateness criteria were

not clear; and finally, of these, 81% were discarded because the intervention was not systematically coded.

Other authors have reached this same conclusion. Duckett et al. (153) detected that of the low-value practices indicated in the publication by Prasad et al. (128) and a selection of NICE's "Do not do" recommendations only 0.4% could be measured using databases from the hospital setting in Australia. Sprenger et al. (154) concluded that only 7.5% of the low-value practices from five initiatives would be measurable in the primary care setting in Austria.

In Spain, researchers from AQuAS have also attempted to automatically quantify some of the low-value practices highlighted in the Essential initiative, based on population databases. Their research included, for example, the recommendation to avoid routine prescription of long-lived benzodiazepines as the first choice in older adults for the chronic treatment of insomnia. They determined that, in 2014, in Catalonia, there were 117,523 patients over the age of 65 with an active diagnosis of insomnia, which corresponds to a prevalence of 11.27%. Of these patients, 5.71% had an active prescription for long-lived benzodiazepines. This consumption corresponded to an approximate annual public cost of 95,000 euros (155).

Also, in Spain, in 2016, a group of researchers from the Instituto Aragonés de Ciencias de la Salud (Aragonese Institute of Health Sciences, in English) evaluated the feasibility of building indicators to evaluate the implementation of the recommendations of the initiative Commitment to Quality of the Spanish Scientific Societies, promoted by the Ministry of Health (156). They concluded that only six out of 22 (27%) recommendations were measurable; another 11 (50%) would be measurable in principle; however, they consider that the information systems currently available in our Health System do not have the specificity required to make the necessary calculations possible. Finally, it was not possible to build indicators to evaluate the implementation of five recommendations. The main limitation on building the indicators was the ambiguity in their definition. For instance, some recommendations including words such as "routinely" (e.g. Do not use anticoagulants routinely in the treatment of acute stroke), or a poor definition of the target population (e.g. the elderly or kids, without specifying the age group).

Studies II and III allowed us to develop another tool for assessing the appropriateness of clinical practice: a series of indicators based on systematic reviews, applicable in two clinical conditions in the hospital setting: delivery care (18 indicators) and peripheral arterial disease care (six indicators).

Generating appropriateness indicators based on good quality systematic reviews is possible. This method guaranties that the indicator is based on the best evidence available. However, the use of systematic reviews as a source for detecting inappropriateness requires that considerations be taken into account, as explained below.

In studies II and III we documented that the number of indicators obtained was low in relation to the amount of systematic reviews published in the literature, both in delivery care and in peripheral arterial disease care. In the case of delivery care, 58% (149 of 255) of the reviews were discarded in the first instance because they did not find clear evidence of benefit or harm from the intervention in question. Of this, 58% were ruled out (28 of 48) because there were not enough elements to produce a strong recommendation for or against the use of the intervention.

In the case of the indicators on peripheral arterial disease, 58% (86 of 149) of reviews were discarded because they did not find clear evidence of benefit or harm. In the next step, 70% (19 of 27) of reviews were discarded because there were not enough elements to produce a strong recommendation.

Garner et al. used Cochrane systematic reviews to identify inappropriate practices. They conducted an overview of systematic reviews, obtaining 28 practices that may be of low-value (116). Their findings were similar to ours since these practices were considered of low-value due to the lack of evidence of effectiveness from randomised studies, rather than due to solid evidence of clear lack of effectiveness or risk.

A second consideration to keep in mind when using systematic reviews as a source for detecting inappropriateness is that a certain practice may be inappropriate in one clinical context but appropriate in others. When using systematic reviews either to

create indicators or to identify low-value practices, it is necessary to describe in detail the clinical context in which the intervention would be inappropriate. In the study by Garner et al. it was also concluded that, although Cochrane systematic reviews help to identify low-value practices, each review should be interpreted in the context where it is applied and that additional analysis is required to implement its conclusions.

However, even if solid evidence emerges to produce good indicators to assess appropriateness, we consider that at present information systems are not sufficiently sensitive to determine the clinical context in which the intervention has been used.

6.3 Factors related to appropriateness and inappropriateness of clinical practice

Day-to-day clinical practice is a complex reality involving several cultural, economic and political factors. These factors and their interaction influence to a greater or lesser extent the appropriateness of clinical practice, forming barriers or facilitators to reduce low-value practices and enhance those that are more appropriate (157).

Various barriers and facilitators have been described in the literature, including: lack of appropriateness criteria, ignorance of these criteria, defensive medicine, clinical inertia, personal beliefs, and the influence of negative leaders (151,158–163). Regarding facilitators, they include constant training and updating, information systems' tools, positive leadership, and alignment of funding models and institutional policies with appropriateness, among others (151,158–161,164).

In this thesis we identified and analysed some of these factors in our environment.

6.3.1 Availability of appropriateness criteria

One of the main determinants of the appropriateness of clinical practice is the availability of criteria for determining which practices are inappropriate or of low value and which are adequate (151).

The appropriateness of a certain benefit in a specific clinical context must be defined by scientific evidence from clinical studies of a high methodological quality. Clinical practice guidelines are the main source of evidence-based clinical recommendations. However, most of them indicate when a certain practice is appropriate, and often include fewer recommendations for reducing inappropriate or low-value practices. (165). Clinical practice guidelines, in addition to helping guide healthcare professionals in making decisions about the appropriate use of interventions, can help reduce unjustified variability in clinical practice (166). Furthermore, those that are developed by national initiatives can help determine access to health services, the costs of technologies and coverage within the health system.

In Study I we document how various initiatives have emerged in the last decade focused on identifying and highlighting inappropriate practices; some of them provide clinical recommendations to reduce them. However, the evidence on inappropriateness is not as abundant, as we concluded from Studies II and III, when observing a low number of systematic reviews with strong evidence against an intervention.

6.3.2 Knowledge and acceptance of appropriateness criteria

In addition to having appropriateness criteria and clinical recommendations, it is also essential that professionals know and agree with them (167). On the one hand, in Study I we created a web page to increase the dissemination of initiatives aimed at improving the appropriateness of clinical practice, providing criteria, recommendations and other resources.

On the other hand, in study IV we explored the degree of agreement with some recommendations to reduce low-value practices, identified in Study I, through two surveys aimed at medical and nursing professionals, respectively. The degree of agreement was high, both among doctors (83%) and nurses (96%). The degree of subjective adherence, analysed as the median percentage of adherence to the recommendation in the hospital according to the health professional's opinion, was also high in both groups (90% and 80% respectively). Likewise, the utility of the recommendations was 90% in the nursing group and 70% in the medicine group.

Another study led by Bonfill et al. explored how much doctors from a sample of Spanish hospitals know about the initiatives included in DianaHealth.com (168,169). They found that professionals knew, on average, four of the 12 initiatives evaluated. Among them, the NICE's Do not Do initiative was the best known. In addition, a high degree of agreement with the recommendations included in DianaHealth and its usefulness was confirmed, with percentages similar to those found in Study IV (85% in both outcomes).

In the United States, a survey on the Choosing Wisely campaign developed by the ABIM Foundation in 2014 and updated in 2017 (170) found that 40% of doctors know or have heard of this initiative and 92% find it more or less useful. These results have been corroborated in another study (162).

In Study IV we also observed that recommendations to reduce low-value practices are necessary. We analysed a compound variable called "Low-value practices potentially present in the hospital", based on the degree of agreement and subjective adherence. It was defined as those responses where the professional agreed with the recommendations and considered subjective adherence to be under 70%. In the physician survey, 22 practices were identified, representing 16% of the recommendations evaluated. In the nursing survey, seven practices met these criteria, being 18% of the total.

From these data, we concluded that health professionals know at least one initiative to improve the appropriateness of clinical practice. We also concluded that they agree with their recommendations, find them useful, and that they appear necessary. Therefore, it is necessary to continue and to further disseminate these initiatives, as well as to update and produce new clinical recommendations to reduce low-value practices.

Although many professionals agree with most of the recommendations for reducing low-value practices, the percentage that does not should not be ignored. The reasons for disagreement were explored in Study IV. Some doctors and nurses reported that they knew of evidence that contradicts the recommendation (13% and 18%

respectively). This reason also emerged as a barrier to reducing practices of low-value in the focus groups, when the participants expressed that they found a lack of consistency and coherence in the scientific evidence.

Prasad and Ioannidis (159) describe this phenomenon as “wars of evidence”, hinting that when strong evidence emerges that a certain intervention is not effective, or that it carries more risks than benefits, some detractors expose counter-evidence focusing on minor outcomes, highlighting subgroup analyses, conducting additional studies with control groups that include healthy people or meta-analyses with personalised eligibility criteria and selection of results to show some benefit.

These authors acknowledge that this “war” constitutes a barrier to reducing low-value practices. They propose that, to totally or partially “revive” a low-value practice, there should be equally solid evidence, including outcomes and control groups as rigorous as the study showing inappropriateness. Until such evidence is obtained, payers should discourage its use. In order to avoid these “wars of evidence”, all initiatives to improve appropriateness of clinical practice should employ a rigorous methodology for producing appropriateness criteria.

6.3.3 Health professionals’ beliefs and attitudes

In Study IV we observed that defensive medicine and managing uncertainty are the most important barriers to reducing low-value practices among health professionals. These two factors have been documented in other studies in primary care (171,172) but their relevance in the hospital setting have been little explored.

Uncertainty, meaning being uncertain of the correct diagnosis or treatment, is always present in clinical practice. However, the correct management of this feeling may determine an over or underuse of tests or treatments. Some authors consider that health professionals are poorly trained in this skill (173) and have described resources that can be helpful; for example, deferring the indication of the test or the treatment while waiting for more signs or symptoms to clarify the clinical picture. This strategy requires great collaboration from the patient, highlighting the key role of good communication and a good relationship.

Some interventions aimed at changing professionals' behaviour have been shown to be useful. The "default" prescription of drugs in information systems, the intrinsic motivation to maintain reputation, peer confirmation or constant feedback on low-value practices to clinicians are some examples (74,174–178).

6.3.4 Patients' role

The patient is undoubtedly a fundamental actor in the improvement of clinical practice. Their role in decision-making has changed radically in recent decades, from a passive position in the paternalistic model of the doctor-patient relationship to a very active role in an environment where citizens are much more informed and empowered (179). In Study IV, health professionals identified high literacy patients or expert patients as a barrier to reducing low-value practices, given the difficulty of dealing with requests for tests or treatments that the health professional does not consider necessary or appropriate.

It has been documented that explaining clinical and safety-related reasons are the most common arguments that encourage patients from avoiding low-value practices (171). Once again, communication with the patient emerges as a key element to improving appropriateness, highlighting the necessity of enhancing the communication skills of healthcare professionals (178).

6.3.5 Characteristics of the hospital environment

Another barrier to reducing low-value practices found in Study IV was the lack of coordination between work teams. Positive leadership and teamwork were also identified as facilitators. Sauro et al. also identified that there are negative leaders, with strong personal preferences that can be a barrier to eliminating low-value practices since they tend to impose their own criteria, based on their particular experience and not on quality scientific evidence. On the other hand, positive leadership can also help to reduce clinical inertia and resistance to change.

In Study IV, the focus group of surgical professionals mentioned the lack of institutional support in case of lawsuits as a barrier to reducing low-value practices. Clinical

practice guidelines and institutional protocols based on quality evidence may play an important role, establishing the appropriate standard of care in the event of legal conflicts (180,181).

There are resources applicable in the hospital setting that may also contribute to improving appropriateness; for example, electronic tools to aid in decision-making, such as alarms when requesting tests or prescribing treatments, may be helpful as a means to inform clinicians in case of inappropriateness or duplicities (74,182,183).

A second resource is the analysis of the healthcare process; in the case of the hospital setting, this should begin with the first contact with the patient (i.e. in the emergency room or the consultation) and be followed up throughout the entire healthcare chain until the patient is discharged. The process analysis may reveal variability in clinical practice, duplicities, lack of adherence to protocols and guidelines, among other problems in appropriateness. Methods such as Lean are helpful for performing this analysis. In Appendix 2.1 the experience of the Vall d'Hebron University Hospital in improving the appropriateness of clinical practice by analysing the healthcare process is explained.

6.3.6 Situating health systems within their social environments

In Study IV health professionals did not perceive many barriers or facilitators at this level. However, some characteristics of the health system considered within its larger social setting have been described as having an influence on the appropriateness of clinical practice.

One of these characteristics is the health system financing model. In Spain, our model is considered to have a lower risk of inappropriateness than others, mainly as it is mostly financed by a capitation system and fixed salaries for health professionals. This form of financing tends to incur underuse rather than overuse, in contrast to other models, such as payment for services or payment for activity (157).

In the case of the hospital setting, our financing model probably tends more towards stimulating underuse, since hospitals have a global budget, in contrast to those systems in which payment is calculated per day of hospitalisation (157). A symptom of this tendency in our system may be the waiting lists. On the other hand, the payment model based on diagnosis-related groups (DRGs), which was recently introduced into our system, may lead to overuse when the price of a certain DRG is high relative to the healthcare cost, becoming an incentive to select some patients above others.

Another characteristic, the degree of integration between settings (primary care, acute-care hospitals and long-term facilities), may also have an influence on the appropriateness of clinical practice. In Spain, the poor integration between levels may be a risk factor for overuse, derived from duplicities of tests or treatments.

Out-of-pocket cost for patients/citizens has also been observed to influence over or underuse. Some health systems have introduced the co-payment as a way of regulating overuse by patients (157). However, co-payment in people at social risk may be a determinant of underuse or even increase the use of other resources. For example, a co-payment on medication may increase the use of emergency services due to decompensation or an exacerbation of a chronic disease. Co-payments in preventive services can also lead to under-utilisation, which can have an impact on increased spending on other services.

Regarding society, the influence of the media and advertising may be a factor related to the appropriateness of clinical practice when promoting new diagnostic technologies or experimental treatments (171).

The effective improvement of the appropriateness of clinical practice requires the alignment of both the expectations and the initiatives of patients, health professionals, institutions that provide health services, payers or insurers, decision-makers at the political level and society in general. Such alignment will only take place if there is a constant public debate about it (1) and when there is clear leadership, both political and academic, that sets guidelines and coordinates improvement strategies.

Academic leadership begins to be visible with initiatives such as the Cochrane Collaboration with the recent establishment of the Sustainable Healthcare Cochrane Field (184). This field seeks to develop an international network to work on various aspects of overuse of diagnostic tests and unnecessary treatments, including the production and synthesis of evidence, prioritisation of research questions, formulation of policies, development and implementation of guidelines, education for professionals, and the improvement and measurement of quality and clinical decision-making.

6.4 Strengths and limitations

6.4.1 Strengths

This thesis work covers, through its five articles, various aspects related to the improvement of appropriateness of clinical practice in the hospital setting. First, it provides a review of the most relevant initiatives worldwide focused on identifying low-value practices and promoting actions to reduce them. In addition, it proposes a new methodology for generating indicators to assess the appropriateness of clinical practice in childbirth and peripheral arterial disease. This methodology could be replicated by application to other topics. Finally, it analyses the barriers to and facilitators of the reduction of low-value practices present in our near environment.

In addition, three different but complementary methodologies were used throughout the thesis: evidence review, surveys and focus groups. This approach allowed us to obtain information from different sources and to enrich the discussion.

We also provide evidence from our near environment on health professionals' perceptions about appropriateness in clinical practice. This information may be useful for developing other studies, and for the operation of the various clinical practice improvement commissions that have been set up in Spain in recent years. To our knowledge, Study IV was the first to explore nurses' opinions and perceptions on low-value practices in our country.

Additionally, as a result of the thesis work, we created a website. This format for the dissemination of information has some advantages with respect to the publication of articles in scientific journals. It allows for the extension and updating of information on initiatives to improve appropriateness in a more efficient way, with regard to both the recommendations and appropriateness analyses and to novelties and events of interest. In addition, it makes it possible to broaden the scope of understanding on the subject among professionals, patients and decision-makers, not only because access to the website is free, but because it is available in Spanish and English. Today DianaHealth.com constitutes one of the outstanding CIBERESP projects in Clinical Epidemiology.

It should also be noted that all the articles that make up thesis have been disseminated in indexed journals and have passed through a peer review process, guaranteeing their quality. Likewise, the journals where they have been accepted are relevant in their field, with a notable level of dissemination and impact factor (range of impact factor: 1,564 to 3,470).

Finally, the experience accumulated by the PhD candidate in the course of conducting this thesis work allows her to contribute to the development of a unit and a clinical commission for the improvement of appropriateness of clinical practice at the Vall d'Hebron University Hospital in Barcelona.

6.4.2 Limitations

The limitations of this thesis work correspond to those of the five studies that comprise it.

Regarding the identification of initiatives to improve the appropriateness of clinical practice, some initiatives may not have been detected. The strategy for identifying initiatives included the consultation of references for key articles and experts on the field. We also carried out a search that included the most common terms related to appropriateness of clinical practice. However, the search was run only on Medline, and other databases such as Embase or Central were not consulted. However, the website format allows us to include initiatives, recommendations and other contents

at any time. Since its launching in 2014, the website has been updated, including the addition of new initiatives, recommendations, appropriateness analyses, and events.

As for the indicators for assessing the appropriateness of clinical practice, the main limitation is the feasibility of their calculation, since some of them require a high degree of detail of the clinical information. For example, to determine the appropriateness of the use of calcium channel inhibitors to inhibit preterm labour, it would be necessary to know if the patient has any contraindications to these medications to exclude her from the denominator. This degree of detail necessarily depends on the quality of both information in the medical records and their codification. This is a limitation that not only affects the calculation of indicators based on systematic reviews, but also other quality indicators. Another limitation of these indicators is their dependence on the quality of the systematic review from which they were created. We tried to minimise this risk by applying the GRADE system (39), a well-recognised tool for producing clinical recommendations.

Finally, the limitations of the analysis of professionals' perceptions of inappropriate or low-value practices and recommendations to improve appropriateness include the low representativeness in some specialties where the response rate in the surveys was low and for specialties that were not represented in the focus groups. However, our findings are consistent with other studies, including those analysing a different set of recommendations from the same initiative or from others.

6.5 Implications for clinical practice

- There are various initiatives to improve the appropriateness of clinical practice worldwide. These initiatives are pertinent and accepted by healthcare professionals, although existing ones and others that may arise should improve the methodological quality of research used to produce recommendations or appropriateness criteria in order to guarantee that they are based on quality scientific studies and not on experts' opinions.

- The DianaHealth.com website is a source of consultation for people interested in improving the appropriateness of clinical practice, including patients, clinicians, researchers or policy-makers. The website has had a positive and visible impact, as evidenced by the following facts:

1. It is frequently consulted by a considerable number of people; according to the operating statistics of the website, in 2019 it had about 70,000 visits. This number suggests that DianaHealth.com is an effective means of disseminating initiatives to improve appropriateness and that it should continue updating and incorporating new initiatives, recommendations and other contents of interest.

2. DianaHealth.com has proven to be useful for developing other projects to improve appropriateness. At the Hospital del Mar in Barcelona, the information system of the Diagnostic Imaging Department was modified to improve the appropriateness of the request process for diagnostic images. The system now includes recommendations to reduce low-value practices that were identified using DianaHealth.com. In an interview conducted on February 27, 2020, Dr José María Maiques, head of this department, commented that when he had the idea of incorporating recommendations to improve the appropriateness of the tests, he searched on the internet for do not do recommendations. The result that best satisfied this need was DianaHealth.com, since it allowed him to consult several initiatives through a single source, to obtain all the recommendations in an Excel file and to have these classified by specialty.

3. MAPAC commissions use DianaHealth.com as a source to consult about low-value practices suitable to be evaluated in their own hospitals, for example in the Vall d'Hebron University Hospital and in the Consorci Sanitari de Terrassa (185).

- With regard to the assessment of the appropriateness of clinical practice, the indicators based on systematic reviews allow us to analyse whether clinical practice is based on quality scientific evidence. However, their use is limited by the quality of clinical information and the encoding of such information, as observed in the limitations. Possibly, artificial intelligence tools can help solve this problem in the near future.

- Defensive medicine and uncertainty management remain major barriers to reducing low-value practices. It is essential to strengthen support for healthcare professionals and give them tools for overcoming these barriers. Clinical practice guidelines should include more recommendations against low-value practices, as well as institutional protocols. Greater support is also necessary for the formation of health policies and regulation of health products when there is solid evidence on the inappropriateness of a given practice. Finally, it is essential to strengthen the communication skills of health professionals in their interactions with patients in order to improve the management of uncertainty and demands for low-value practices by the patient.

- The knowledge and experience accumulated during this thesis work has contributed to the creation of a commission for the improvement of clinical practice at the Vall d'Hebron University Hospital. The foundation and work of this new commission are described in the article included as Appendix 2.1.

- The results of this thesis work have contributed to the design of the course “Reduction of low-value practices” that is taught to professionals at the Vall d'Hebron University Hospital in two groups, annually.

- The collaboration agreements that have been signed between MAPAC hospitals to share recommendations, data and experiences on appropriateness are a sign of a willingness to network and work collaboratively. In some meetings it has been shown that many of the appropriateness problems and solutions are similar between hospitals. However, there is still a need for a stronger benchmarking culture in order to learn from both successes and mistakes.

6.6 Implications for research

- In this thesis work we identified initiatives, recommendations and analyses for improving the appropriateness of clinical practice. Even though these initiatives are a big step in the direction of reducing harmful or unnecessary health interventions, many of them were developed with a poor methodology. Future research should evaluate the evidence supporting these recommendations and analyses. Some recommendations have already been analysed (186–188), but there are still many to

study. A series of descriptive studies is currently being carried out at the Hospital de Sant Pau to describe the quality of the evidence that supports the recommendations included in DianaHealth.com using the GRADE system.

- Clinical practice guidelines developers should consider including a greater number of recommendations for reducing low-value practices where there is solid evidence. This step may facilitate decision-making for health professionals in their routine clinical practice and for divestment at the health system level.

- Measuring the appropriateness of clinical practice continues to be a difficult process given the limited sources of information, that is, clinical records and administrative databases. Future research could develop methods to improve the quality of this information and new forms of data exploitation.

- In this thesis work, it was identified that the patient is fundamental to the improvement of clinical practice, given the influence of the patient's values and preferences on clinical decision-making. This is why the patient's values and preferences should be integrated into both the production and the application of appropriateness criteria and recommendations for reducing low-value practices.

- In addition to considering values and preferences during the production of new recommendations and appropriateness criteria, more evidence should be provided on the effectiveness of strategies to facilitate doctor/nurse-patient communication specifically related to low-value practices.

7. Conclusions

7. Conclusions

- There are several initiatives worldwide that have developed various resources for improving the appropriateness of clinical practice. The best-known initiatives are those that have produced recommendations for reducing inappropriate or low-value practices, coming from scientific societies. In Spain, various initiatives have emerged, including one from the Ministry of Health and others from the governmental institutions of autonomous communities and hospitals.

- These initiatives have made important contributions; however, they have some limitations. The most important is the lack of a rigorous and standardised methodology for the production of recommendations or lists of low-value practices to guarantee that they are based on the best evidence available.

- As a product of this thesis work, we developed a website that includes a database for disseminating and facilitating the consultation of various initiatives to improve the appropriateness of clinical practice.

- It is possible to create indicators to assess the appropriateness of clinical practice based on systematic reviews. This methodology would make it possible to assess appropriateness based on the best evidence available and could be applied to any topic, as has been demonstrated in the case of delivery care with the generation of 18 indicators and peripheral arterial disease with another six.

-The production of indicators based on systematic reviews has some limitations. On the one hand, the amount of indicators that could be formulated is limited by the lack of solid evidence on practices that are considered of low value. On the other hand, its implementation depends on the degree of detail of the clinical information that is encoded and computerised.

- Doctors and nurses, in general, agree with the recommendations to reduce low-value practices formulated by the initiatives and find them useful. However, they consider

that sometimes there is contradictory evidence that limits their adherence to these recommendations.

- Scientific evidence should be the base used to define the appropriateness of a given practice. However, the improvement of the appropriateness of clinical practice implies other aspects related to the beliefs and attitudes of health professionals, the doctor/nurse-patient relationship, the hospital environment and the dynamics of the health system and the society in general. These aspects should be worked on simultaneously and with the same intensity that should be devoted to ensuring the quality of the scientific evidence that supports all the initiatives.

8. Bibliography

8. Bibliography

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9. Appendixes

9. Appendices

Appendix 1: Acronyms

ACR: Appropriateness Criteria

AQuAS: Agència de Qualitat i Avaluació Sanitàries de Catalunya (AQuAS)

CIBERESP: Consorcio de Investigación Biomédica en Red de Epidemiología y Salud Pública

CTPA: Computed tomographic pulmonary angiography

COPD: chronic obstructive pulmonary disease

CPG: Clinical Practice Guidelines

IOM: Institute of Medicine

IT team: Information Technology Team

MAPAC: Millora de l'Adequació de la Pràctica Assistencial i Clínica (Improving the Appropriateness of Clinical Practice and Healthcare, in English).

NICE: National Institute for Health and Care Excellence

WHO: World Health Organization

RAND Corporation: Research and Development Corporation

SR. Systematic reviews

Appendix 2. Complementary articles

Appendix 2.1. Complementary article 1

Osorio D, Ballesteros M, Romea S, Bellmunt S, Martínez M, Ochoa A, et al. [The experience of the Vall d'Hebron University Hospital in improving appropriateness of clinical practice]. Ann Med [Internet]. 2018;101(3):2012–4. Available from: <http://annals.academia.cat/index.php?idpub=7&idrev=902>.

L'experiència de l'Hospital Universitari Vall d'Hebron en la millora de l'adequació de la pràctica clínica

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Resum

En aquest article presentem l'experiència de l'Hospital Universitari Vall d'Hebron en la implementació d'un programa de millora de l'adequació de la pràctica clínica, com a element clau del model de transformació organitzativa i cultural impulsat per la Direcció del centre des de l'any 2015. Explicuem els inicis del programa, per què i com hem reorientat la metodologia de treball inicialment implementada per assolir les nostres expectatives i com hem aconseguit promoure l'interès dels professionals en la identificació i reducció de pràctiques de poc valor.

Introducció

L'adequació de la pràctica clínica engloba les següents dimensions: l'efectivitat, basada en la millor evidència disponible del balanç risc-benefici; l'eficiència, en relació amb el balanç cost-benefici; i les característiques, valors i preferències dels pacients i la societat¹. El Sistema Nacional de Salut ha de promoure, entre altres, una assistència sanitària adequada, fent un especial esforç a reduir i evitar aquelles prestacions de poc valor o inadequades amb la finalitat de mantenir la seva sostenibilitat sense sacrificar la qualitat assistencial².

L'Hospital Universitari Vall d'Hebron va implementar el 2015 el Programa de Millora de la Pràctica Clínica amb l'objectiu de donar suport als professionals per generar i mantenir una cultura de millora contínua de l'adequació, mitjançant la promoció de pràctiques adequades i la identificació i reducció de pràctiques o models organitzatius innecessaris, inadequats o de poc valor clínic per al pacient. En aquest article presentem l'experiència de l'Hospital Universitari Vall d'Hebron en la implementació d'aquest programa i els resultats obtinguts fins ara.

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Inici del programa

L'Hospital compta des de fa anys amb diverses comissions i grups de treball dedicats a la millora de l'adequació, entre aquests s'inclouen les comissions reglamentàries del Sistema Nacional de Salut (per exemple la Comissió de Mortalitat o la Comissió Farmacoterapèutica), així com altres comissions que s'han constituït per tractar temes específics (per exemple, la Comissió de Seguretat o la Comissió del Dolor).

L'any 2015, la Direcció de l'Hospital va decidir iniciar un programa per identificar i reduir específicament pràctiques inadequades o de poc valor. El programa, inicialment, es va concentrar en la constitució d'una comissió multidisciplinària anomenada Comissió de Millora de la Pràctica Clínica (MPC). Aquesta comissió va estar formada per 27 professionals mèdics i d'infermeria procedents d'àrees assistencials, serveis de suport i membres de les direccions assistencials, de sistemes, de processos i econòmica. A més, va comptar amb la participació d'una epidemiòloga, que donava suport per desenvolupar les anàlisis d'adequació. Es va fer difusió del programa mitjançant sessions informatives a diversos serveis de l'Hospital durant el primer trimestre de 2016.

En el marc de la comissió s'analitzava l'adequació de diferents intervencions diagnòstiques o terapèutiques proposades pels professionals membres. L'anàlisi incloïa una revisió de l'evidència científica mitjançant una metodologia de *rapid reviews* i l'obtenció de la prevalença d'ús de la prestació a l'hospital a partir de les dades d'activitat de l'hospital proporcionades per la Direcció de Sistemes d'Informació. Amb la informació obtinguda mitjançant aquestes dues fonts, es realitzaren reunions amb els professionals assistencials i la Direcció Assistencial per comentar les troballes i dissenyar i engegar accions de millora que es consideressin pertinents.

Necessitat d'un canvi

Després d'un any de funcionament, vàrem fer una avaluació dels resultats obtinguts. Vàrem detectar que malgrat que l'acceptabilitat del programa era en general positiva, el nombre de temes proposats era escàs en relació amb les

nostres expectatives. Es van analitzar tres prestacions (Taula 1, columna de l'esquerra). Pensem que potser el concepte de pràctiques inadequades no havia estat suficientment entès pels membres de la comissió i que no s'havia aconseguit entendre-ho suficientment a la resta de professionals del centre. Atribuïm això al fet que històricament els professionals sanitaris estem acostumats que se'ns indiqui què hem de fer, quina prova diagnòstica funciona o quin tractament és eficaç, però usualment no ens detenim a analitzar si tot allò que fem per rutina és realment necessari.

Explorarem també la possibilitat d'analitzar les prestacions inadequades identificades per les diferents iniciatives que han tractat aquests temes a través de recomanacions per reduir pràctiques de poc valor, com ara els projectes Essencial³, Compromiso por la Calidad de las Sociedades Científicas Españolas⁴ i Choosing Wisely⁵, consultades a través del portal DianaSalud⁶. En alguns casos, els professionals no estaven d'acord amb la inadequació assenyalada pels autors de les recomanacions; en altres casos, tot i estar d'acord amb la inadequació, no ho consideraven prou freqüent com per emprendre accions de millora i, en altres casos, no identificarem líders clínics per dur a terme l'anàlisi o les accions de millora.

Davant aquest panorama, vam decidir reorientar el funcionament del Programa de Millora de la Pràctica Clínica aprofitant la conjuntura de l'actual model de gestió de l'hospital, basat en tres pilars per donar una assistència centrada en el pacient: flux, seguretat i coneixement. El pilar del flux fa referència a l'optimització de tots els processos assistencials, reduint totes aquelles accions que no aporten valor al pacient per ser més àgils i eficients. El pilar de la seguretat reuneix les accions per prevenir, detectar i minimitzar situacions de risc presents durant el procés assistencial tant per als pacients com per als professionals. Finalment, el pilar del coneixement, que canalitza la Comissió de Millora de la Pràctica Clínica, correspon a l'assistència basada en la millor evidència disponible d'eficàcia i efectivitat, garantint sempre l'adequació de la pràctica clínica.

El model promou una organització orientada al procés assistencial, trencant amb la clàssica estructura basada en unitats i serveis. Per implementar el model s'estan impulsant a l'Hospital diverses accions, principalment formatives i d'autoavaluació, basades en els tres pilars. La formació es duu a terme a través de tallers, en els quals hi participen professionals de tots els estaments, en metodologies per a l'optimització dels processos assistencials (*lean* [gestió sanitària ajustada] o *design thinking* [pensament de dissenyador], entre d'altres), la garantia de la seguretat i la millora de l'adequació. Les accions d'autoavaluació es duen a terme a través de diverses reunions en les quals, conjuntament, professionals de medicina, infermeria i teràpies, auxiliars d'infermeria, zeladors i administratius analitzen el procés de l'atenció al pacient, iden-

tificant problemes, interrupcions, dificultats i ineficiències que dificultin la fluïdesa, la seguretat i l'adequació de la pràctica clínica.

Aquestes reunions han estat l'escenari ideal per identificar les pràctiques de poc valor, ja que espontàniament es posen de manifest situacions de variabilitat injustificada en la pràctica clínica que reflecteixen manca d'unitat en el criteri clínic, sobreutilització, subutilització o ús inadequat de determinades proves diagnòstiques o tractaments. També ens ha permès analitzar l'adequació de les interconsultes de l'hospital, la duplictat de proves o les mancances en l'adherència a protocols i procediments.

Amb aquest nou enfocament, considerem que hem aconseguit promoure l'interès dels nostres professionals en la identificació i reducció de pràctiques de poc valor, ja que el nombre de sol·licituds d'avaluació de prestacions procedents dels professionals s'ha incrementat considerablement, de 3 en un any a 8 en sis mesos (Taula 1, columna de la dreta). Les reunions d'anàlisi del procés també ens han servit com a vehicle d'accions de millora, les quals molt sovint estan relacionades amb millorar la comunicació entre els professionals i consensuar criteris clínics a través de nous protocols i procediments. Altres accions de millora han estat la realització de cursos formatius (per exemple, sobre l'ús adequat de l'oxigenoteràpia) i ajustos en els sistemes informàtics de l'hospital per tal de facilitar l'adherència a les recomanacions per reduir pràctiques de poc valor.

TAULA 1. Nombre de prestacions analitzades amb l'estratègia centrada en la comissió versus l'estratègia integrada en la gestió per processos

Estratègia centrada en la comissió (n = 3 en 12 mesos)	Estratègia integrada en la gestió per processos (n = 8 en 6 mesos)
1. AngioTAC en el diagnòstic de l'embolisme pulmonar	1. Ecocardiograma portàtil en atenció primària
2. Reacció en cadena de la polimerasa en la sospita de la sèpsia neonatal	2. Alcohol iodat en quiròfan
3. Electromiografies en la síndrome de túnel carpià	3. Rasurat del lloc quirúrgic
	4. Antiangiogènics en el tractament de l'edema macular
	5. Oxigenoteràpia d'ús hospitalari
	6. Indicació i durada adequada del monitoratge fetal en consultes externes
	7. Prehabilitació en pacients amb hemofília
	8. Cura del cordó umbilical del nou-nat

Noves perspectives

Els diferents temes tractats al llarg de gairebé tres anys ens han permès introduir progressivament els conceptes relacionats amb la millora de l'adequació. Ara, cada vegada més escoltem els professionals referir-se a variabilitat injustificada, pràctica inadequada, pràctica de poc valor, ús inadequat, etc. El temps també ens ha permès identificar líders clínics (metges i infermeres) amb un gran interès per millorar l'adequació de la pràctica clínica en els seus camps d'experiència professional. D'aquesta manera, hem tornat a veure la necessitat de crear un espai per exposar les propostes que els professionals fan en analitzar els processos assistencials, així com per aprofundir en la metodologia de la millora de l'adequació i dissenyar noves estratègies per a la reducció de pràctiques de poc valor. Per aquest motiu hem redissenyat la Comissió de Millora de la Pràctica Clínica, ara com a grup coordinador del programa MPC.

La nova edició de la comissió té 16 membres, quatre dels quals pertanyien a l'edició anterior. Està presidida per un cap de servei i compta amb dues vicepresidències, la responsable del programa d'MPC i l'adjunta d'infermeria de gestió del coneixement i avaluació. Un dels aspectes que destaquem de l'experiència de la millora de l'adequació integrada a la gestió per processos és l'important paper dels professionals d'infermeria en la millora de l'adequació, proposant tant temes per analitzar com accions de millora.

Aquesta nova comissió integra quatre subcomissions: avaluació de noves tecnologies; avaluació de guies, protocols i procediments; avaluació de tècniques de diagnòstic *in vitro*; i excel·lència en cures d'infermeria. Aquesta integració busca garantir l'adequació de les prestacions diagnòstiques i terapèutiques, tant les ja implantades com les de nova incorporació i tant de l'àmbit de medicina com d'infermeria.

Fins ara, a la comissió s'han identificat diferents temes proposats pels seus membres, que s'han prioritzat a partir de la disponibilitat d'un líder clínic per emprendre accions de millora, la seva potencial transversalitat a tota l'organització, l'impacte que pugui tenir la pràctica se-

gons el nombre de pacients que pugui afectar i l'impacte pressupostari de la reducció de la pràctica analitzada.

Conclusions

El nostre principal repte en implementar una comissió de millora de la pràctica clínica a l'Hospital Universitari Vall d'Hebron ha estat aconseguir atreure l'atenció dels professionals assistencials cap al "no fer" i com eliminar les pràctiques innecessàries, inadequades o de poc valor.

En la nostra experiència, el model de gestió basat en processos amb un exercici constant d'autoavaluació ha estat l'escenari ideal per a la identificació de pràctiques de poc valor. Aquest model comporta l'anàlisi multidisciplinària i retrospectiva del nostre dia a dia, la qual cosa posa de manifest de forma espontània pràctiques de poc valor i ajuda a la identificació de les accions de millora necessàries, que en el nostre cas ha inclòs, per exemple, millores en la comunicació o ajustos en els sistemes d'informació.

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Appendix 2.2. Complementary article 2

Osorio D, Bonfill X. Do not do initiatives and the DianaSalud.com portal. Aten primaria [Internet]. 2016 Aug [cited 2018 Feb 1];48(7):501. DOI:

<https://doi.org/10.1016/j.aprim.2015.05.012>

Available from: <http://linkinghub.elsevier.com/retrieve/pii/S0212656716000202>

Las iniciativas de *No hacer* y el portal DianaSalud.com[☆]



Do not do initiatives and the DianaSalud.com portal

Sr. Editor:

Hemos leído con gran interés el editorial de la Sociedad Española de Medicina Familiar y Comunitaria (semFYC) sobre las diferentes iniciativas que han surgido en los últimos años, en diferentes países, para reducir el uso de pruebas innecesarias y prescripciones inadecuadas en la asistencia sanitaria¹.

En la misma línea de los autores, nosotros desde el Hospital de Sant Pau, Centro Cochrane Iberoamérica, con el apoyo del Programa de Epidemiología Clínica del Centro de Investigación Biomédica en Red de Epidemiología y Salud Pública (CIBERESP), hemos desarrollado el portal DianaSalud (<http://www.dianasalud.com>)², cuyo nombre deriva de su objetivo: Divulgación de Iniciativas para Analizar la Adecuación en Salud.

El portal DianaSalud.com constituye un repositorio de las diferentes iniciativas que han evaluado la adecuación o el valor de múltiples prestaciones en salud y sus resultados. Entre las iniciativas incluidas en el portal están las mencionadas por los autores de la editorial de la semFYC, y otras que hemos identificado (n=20). El portal DianaSalud.com incluye, además, un buscador que permite consultar fácil y rápidamente los resultados de las diferentes iniciativas (n=2.454), a través de criterios como la especialidad (p. ej., medicina familiar y comunitaria), el tipo de prestación (p. ej., diagnóstica, terapéutica), el año de publicación o utilizando términos libres (p. ej., dolor lumbar). Los

[☆] El portal DianaSalud.com fue presentado en el 22nd Cochrane Colloquium, el 21-26 de septiembre de 2014 en la modalidad de póster.

contenidos de la *web* se actualizan constantemente y están disponibles en español e inglés con el fin de hacer la máxima difusión de las iniciativas entre los profesionales de la salud y los ciudadanos a nivel nacional e internacional.

Estamos convencidos que el portal DianaSalud.com puede contribuir a que se alcancen los objetivos que plantean los autores del editorial en el apartado «próximos pasos», con respecto a la aplicación de dichas recomendaciones y la evaluación de su impacto en la práctica clínica¹.

Financiación

El portal DianaSalud.com que se menciona en la carta ha sido financiado parcialmente por el Programa de Epidemiología Clínica del Centro de Investigación Biomédica en Red de Epidemiología y Salud Pública (CIBERESP).

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<http://dx.doi.org/10.1016/j.aprim.2015.05.012>

Escenarios de simulación clínica creados por alumnos de medicina: descripción de la experiencia de 2 años[☆]



Clinical simulation scenarios designed by medical students: The description of a two-year experience

Sr. Editor:

Tradicionalmente, los alumnos aprenden conocimientos teóricos en clases magistrales, y habilidades clínicas en

[☆] Parte de este manuscrito ha sido un Trabajo Fin de Grado (JT), y se ha presentado como comunicación oral en el III Congreso de la Sociedad Española de Simulación Clínica y Seguridad del Paciente (SESSEP) en 2014.

hospitales y centros de atención primaria, pero en situaciones de urgencias médicas reales es complicada la participación de los mismos. Para suplir esta deficiencia adquiere gran relevancia la simulación como metodología de enseñanza¹, ya que es reconocida como herramienta que promueve la integración de conocimientos², y aumenta el grado de retención de lo aprendido³. Además, permite a los profesores observar cómo se desenvuelven los alumnos, reforzar los conocimientos, y detectar y corregir los errores que surjan durante la simulación.

En nuestra facultad, los escenarios de simulación clínica están incorporados en las asignaturas de respiratorio, neurología, alergología, cuidados paliativos y en la optativa técnicas en simulación avanzada (TSA). Estos escenarios, igual que en otras facultades⁴, son preparados por los responsables de las asignaturas.

En respuesta al buen resultado docente de la simulación, nos planteamos dar un paso más involucrando a los estudiantes en la creación y desarrollo de un escenario. Así,

Appendix 3. Additional figures and tables from articles I to V

Appendix 3.1 Additional figure from Article I

Figure. Excel spreadsheet print screen obtained when selecting Vascular Surgery in the field of medical speciality (n = 73 appraisals).

Anexo 3.1. Anexo publicación 1. Excel ejemplo descarga DianaSalud.com - Microsoft Excel																					
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1																					
2			DIANAHEALTH																		
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14	Id	Initiative	Initiative Nat	Institution	Language	Title	Description	Publication Y	Speciality	Intervention	Recommend	Keywords	Source								
15	2569	25	Recomendac	Sociedad Esp	Spanish	Do not perfor	-	2015	Vascular surg	Diagnostic (I	Low value	-	Link to the document								
16	2866	29	Choosing Wi	The Royal Au	English	Don't reques	For further in	2015	Vascular surg	Diagnostic (I	Low value	-	Link to the recommendation in the								
17	2889	19	Choosing Wi	The Canadiar	English	Don't perfor	For further in	2015	Vascular surg	Other non-ph	Low value	Peripheral Ar	Link to the recom								
18	2890	19	Choosing Wi	The Canadiar	English	Don't perfor	For further in	2015	Vascular surg	Surgical proci	Low value	Carotid Enda	Link to the recom								
19	2891	19	Choosing Wi	The Canadiar	English	Don't perfor	For further in	2015	Vascular surg	Surgical proci	Low value	Abdominal A	Link to the recom								
20	2892	19	Choosing Wi	The Canadiar	English	Don't perfor	For further in	2015	Vascular surg	Surgical proci	Low value	Asymptomat	Link to the recom								
21	2893	19	Choosing Wi	The Canadiar	English	Don't perfor	For further in	2015	Vascular surg	Diagnostic (I	Low value	Small Abdom	Link to the recom								
22	2755	24	Too Much M	Johansson M	English	Estimating ov	For further in	2015	Radiology, V	Diagnostic (I	Low value	Overdiagnosi	Link to the article in the BMJ collection ?Too Much								
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24	2809	2	Choosing Wi	Society for V	English	Avoid routine	For further in	2015	Vascular surg	Diagnostic (I	Low value	Fistulogram,	<a href="http://www.choosingwisely.org/clinician-lists/society-vascular-surgery-routine-ultrasound-fistulogram-of-well-ft								
25	2810	2	Choosing Wi	Society for V	English	Don't use IV	For further in	2015	Vascular surg	Other non-ph	Low value	Inferior Vena	<a href="http://www.choosingwisely.org/clinician-lists/society-vascular-surgery-ivc-filters-as-primary-prevention-of-pulm								
26	2811	2	Choosing Wi	Society for V	English	Don't use int	For further in	2015	Vascular surg	Small proced	Low value	Intermittent	<a href="http://www.choosingwisely.org/clinician-lists/society-vascular-surgery-interventions-as-first-line-treatment-for-								
27	2812	2	Choosing Wi	Society for V	English	Avoid use of	For further in	2015	Vascular surg	Diagnostic (I	Low value	Ultrasound, C	<a href="http://www.choosingwisely.org/clinician-lists/society-vascular-surgery-ultrasound-for-routine-surveillance-of-ca								
28	1591	2	Choosing Wi	American Ac	English	Avoid perfor	For further in	2014	Trauma and	Diagnostic (I	Low value	-	<a href="http://www.choosingwisely.org/doctor-patient-lists/american-academy-of-orthopaedic-surgeons/" target="_blar								
29	1604	2	Choosing Wi	American Col	English	Don't perfor	For further in	2014	Vascular surg	Diagnostic (I	Low value	-	<a href="http://www.choosingwisely.org/doctor-patient-lists/american-college-of-chest-physicians-and-american-thoraci								
30	1944	19	Choosing Wi	Canadian Ort	English	Avoid perfor	For further in	2014	Trauma and	Diagnostic (I	Low value	-	<a href="http://www.choosingwiselycanada.org/recommendations/canadian-orthopaedic-association-2/" target="_blank"								
31	2056	6	Less Is More	Prasad V, et	English	The Inferior	For further in	2013	Vascular surg	Surgical proci	Low value	-	Link to the article in the colle								
32	2057	6	Less Is More	Sarosiek S, et	English	Indications, C	For further in	2013	Vascular surg	Surgical proci	Low value	-	Link to the article in the colle								
33	1803	8	Prasad, et al.	Autores de di	English	Long-term ou	For further in	2013	Vascular surg	Surgical proci	Low value	-	<a _blank""="" abstract""="" article="" href="" http:"" s0025-6196(13)00405-9"" target="" www.mayoclinicproceedings.								
34	1808	8	Prasad, et al.	Autores de di	English	Immediate R	For further in	2013	Vascular surg	Surgical proci	Low value	-	Link to the pu								
35	1835	8	Prasad, et al.	Autores de di	English	A decade of r	For further in	2013	Cardiology, V	Surgical proci	Low value	-	Link to the pu								
36	1911	8	Prasad, et al.	Autores de di	English	Revasculariz	For further in	2013	Vascular surg	Surgical proci	Low value	-	Link to the pu								
37	1913	8	Prasad, et al.	Autores de di	English	Extended-Rel	For further in	2013	Vascular surg	Drugs (non-cl	Low value	-	Link to the pu								
38	2177	21	Doing more d	Hospital S. Cr	Spanish	Do not perfor	*Limiting it o	2013	Vascular surg	Surgical proci	Low value	-	<p><a href="http://www.lowmedicine.it/fare-di-piu-non-significa-fare-meglio/pratiche-a-rischio-di-inappropriatezza-in-it								

Appendix 3.2 Additional tables from Article II

Table 1. Adapted GRADE system to assess the quality of evidence and grade the strength of recommendations (This table corresponds to Table 4 of Article II).

Assess the quality of evidence:	<p>Quality from randomized clinical trials is considered initially as "high". Factors that could lower the quality of evidence were:</p> <ul style="list-style-type: none"> - Limitations in the design and execution of studies - Inconsistent results between studies - No direct evidence - Imprecision of results - Reporting bias - Other relevant sources of bias
Grade the strength of recommendations	<p>Factors considered when moving from evidence to recommendations:</p> <ol style="list-style-type: none"> 1. Balance between benefits and risks 2. Quality of scientific evidence <p>Neither costs nor values and preferences were taken into account.</p> <p>Definitions:</p> <p><u>Strong recommendation:</u> Beneficial effects outweigh the harms (or vice versa), so most patients should receive the recommended course of action. The recommendation can be adopted as a policy in most situations.</p> <p><u>Weak Recommendation:</u> It is not clear if beneficial effects outweigh the harms (or vice versa), so different choices will be appropriate for different patients and clinicians must help each patient to arrive at a decision consistent with his or her values and preferences. Policy making will require substantial debate and involvement of many stakeholders</p>
Representation of the quality of scientific evidence and the strength of recommendations	<p>Quality of scientific evidence:</p> <ul style="list-style-type: none"> - High ⊕⊕⊕⊕ - Moderate ⊕⊕⊕ - Low ⊕⊕ - Very Low ⊕ <p>Strength of recommendations:</p> <ul style="list-style-type: none"> - Strong recommendation: ↑↑ or ↓↓ - Weak recommendation: ↑? or ↓?

Table 2. Example of an indicator. (This table corresponds to Table 5 of Article II).

Element	Description
1. Title	Proportion of women with singleton pregnancies and threatened preterm labour (TPL) who receive corticosteroids
2. Type of Indicator	<ul style="list-style-type: none"> • Process indicator • Specific indicator of medical condition • Indicator of a desirable event • Indicator based on proportions
3. Definitions	<p>If a woman with a singleton pregnancy is at risk of preterm delivery between 24 and 34 weeks' gestation, then corticosteroids should be administered, unless contraindicated, because its administration accelerates foetal lung maturation and reduces the risk of: perinatal death, respiratory distress syndrome, cerebroventricular haemorrhage, necrotising enterocolitis, infectious morbidity, need for assisted ventilation and admission to neonatal intensive care units.</p> <p>Definition of the terms used in the definition of the indicator:</p> <p>*Threatened preterm labour (ICD-9-CM: Diagnostic code: 644.00, 644.03, 644.10, 644.13, 644.20, 644.21), preterm labour that begins after 22 completed weeks and before 37 completed weeks' gestation. Target population is limited to those women with a gestation between 24 and 34 completed weeks.</p> <p>*Contraindications to corticosteroids: systemic infections (such as tuberculosis or chorioamnionitis). Careful assessment of corticosteroid administration in women with severe hypertension or diabetes mellitus is needed.</p>
4. Target population	Women with singleton pregnancies at risk of preterm labour (between 24 and 34 weeks' gestation).
5. Rationale	<p>Preterm birth entails a series of health problems of the new-born resulting from the immaturity of their organs. A systematic review (Roberts 2006, 21 RCTs, 4269 new-born) notes that the administration of one dose of antenatal corticosteroids (betamethasone, dexamethasone or hydrocortisone) reduces neonatal death, respiratory distress syndrome and cerebroventricular haemorrhage in the premature new-born. The treatment does not increase the incidence of maternal death, maternal infection, foetal death, neonatal chronic lung disease or low birthweight. Additionally, it is associated with a reduction in the incidence of neonatal necrotizing enterocolitis and systemic infections in the first 48 hours of life, and a reduced need for respiratory support or admission to the neonatal intensive care unit. The use of antenatal corticosteroids reduces neonatal death even if the delivery occurs within 24 hours after the first dose administration. The quality of evidence is particularly high in women with gestation periods ranging from 24 to 34 completed weeks. In pregnancies over 34 weeks the risk of foetal morbidity and mortality is lower and the benefit associated with treatment is not as clear. There is no evidence to support the use of corticosteroids in multiple pregnancies. Both the Clinical Evidence (Hass 2006) and the WHO Reproductive Health Library (Cuervo 2006) reviews have classified the neonatal corticosteroid intervention as beneficial in women with threatened preterm labour. The clinical practice guidelines identified (RCOG guideline No 7, Crane 2003) also recommended its administration (grade A recommendation).</p>

Table 2. (Continued)

Element	Description
6. Supporting literature	-Roberts D, Dalziel S. Antenatal corticosteroids for accelerating foetal lung maturation for women at risk of preterm birth. Cochrane Database of Systematic Reviews: Reviews 2006 Issue 3. Chichester, UK: John Wiley & Sons, Ltd. DOI: 10.1002/14651858.CD004454. -Hass DM. Preterm birth. Clin Evid 2006; 15:1-3. -Crane J., Armson A., Brunner M., De La Ronde S., Farine D., Keenan-Lindsay L. <i>et al.</i> Antenatal corticosteroid therapy for foetal maturation, <i>J Obstet Gynaecol Can</i> 2003;25:45-52 -Royal College of Obstetricians and Gynaecologists. Antenatal corticosteroids to prevent respiratory distress syndrome. Royal College of Obstetricians and Gynaecologists; 2004. Guideline No.7. -Cuervo LG. Intervenciones para prevenir o mejorar el resultado del parto a término o postérmino: Aspectos prácticos de la BSR (last review: 6 de Agosto de 2004). Biblioteca de Salud Reproductiva de la OMS, N° 9, Update Software Ltd, Oxford, 2006.
7. Description of indicator population	<p><u>Numerator</u>: Women with singleton pregnancies and threatened preterm labour (between 24 and 34 weeks' gestation) who are given antenatal corticosteroids.</p> <p><u>Denominator</u>: Women with singleton pregnancies and threatened preterm labour (between 24 and 34 weeks' gestation).</p> <p>Exclusion: Women with contraindications to corticosteroids (Absolute contraindications: systemic infections such as tuberculosis or chorioamnionitis).</p>
8. Sources of information	Hospitalization and surgical databases, medical history.
9. Standard	Desirable event (higher values indicate better performance).
10. Underlying factors	<ul style="list-style-type: none"> • Related to women: Women who refuse the administration of corticosteroids. • Related to professionals: Difficulties in collecting data. • Related to the organization: Clinical practice protocols at the hospital.
11. Notes	<ul style="list-style-type: none"> - The corticosteroids of choice must be able to cross the placental barrier. - Administration of corticosteroids should be accepted as routine practice in women with singleton pregnancies and threatened preterm labour (between 24 and 34 weeks' gestation). - Women should be informed about the importance of the administration of corticosteroids for foetal lung development. - The hospital pharmacotherapeutic guide should discourage the administration of thyrotropin- releasing hormone in combination with corticosteroids in women with threatened preterm labour.
12. Desired characteristics of a hospital for ensuring the viability of the indicator	<p>Essential (for identification of the denominator):</p> <ul style="list-style-type: none"> - Hospital database accessible. - Diagnostic Coding. <p>Desirable (for the complete calculation of the indicator from computerized databases):</p> <ul style="list-style-type: none"> - Registration of number of weeks' gestation at admission. - Computerized record of the treatment administered to women during hospitalization.

Table 2. (Continued)

Element	Description
13. Example of computation	<p>As an example, we will compute the indicator using fictional data from an obstetrics unit in a tertiary hospital with 1600 annual deliveries. The target population was identified from a retrospective review of the hospitalization database and medical histories. From the hospital database 37 cases were selected with diagnostic codes corresponding to threatened preterm labour (644.00, 644.03, 644.10, 644.13, 644.20, 644.21). An additional review reduced these cases to a target population of 27 women with a singleton pregnancy between 24 and 34 completed weeks. Review of individual medical histories informed that none of them presented contraindications for corticosteroids. The denominator of the indicator would be the target population of 27 women.</p> <p>Administration of corticosteroids was confirmed for 23 of these women, which constituted the numerator of the indicator. The quotient between both terms gave a final value for the indicator of 85%. Since no real data is available for comparison with similar hospitals in the area, this result can only be compared to the benchmark of 100% complete appropriateness of care, suggesting that there is ample room for improvement.</p>

Appendix 3.3 Additional figures and tables from Article IV

Table I. Focus groups discussion guide (original version was in Catalan)

Topic	Duration	Instructions
Welcome - Welcome greeting - Informed consent	15 minutes	<p>Welcome participants.</p> <p>Explain the objective, methodology and duration of the focus group and results publication plan. Solve participants' questions.</p> <p>The purpose of this focus group is to explore opinions and attitudes of clinical professionals towards low-value care in the hospital, in order to develop future theory-based interventions to reduce it. Specifically, we aimed to assess your opinion about recommendations to reduce low-value practices and to identify barriers and facilitators to reduce low-value care.</p> <p>In the qualitative methodology, we analyse the content of the participants' speech, to identify ideas and concepts that are difficult to identify with other methodologies. It is important that you understand that all your comments during the session will be treated confidentially. We will omit any information that may put in evidence your participation in the session or any of your comments.</p> <p>Your participation in the study is limited to this session. It will last between 75 and 90 minutes.</p> <p>During the session we will introduce a few questions in order to know your opinion on low-value interventions, which is the objective of the study.</p> <p>The results of this study will contribute to improve professionals' performance in the hospital, at the individual level, as well as at team and organisational level.</p> <p>The comments of this session will be analysed by the research team and written in a report. The report will be presented to you first, in a session similar to this. Secondly, to the board of directors of the hospital, and then to the scientific community.</p> <p>Do you have any questions?</p> <p>If you agree to participate, please remain seated. The session will start in a few minutes.</p> <p>Feel free to leave the room now or at any moment during the session if you decide not to participate in the study. Your declination to participate in the study will not be communicated to the rest of the research team, your boss or any other person.</p> <p>Do you accept to participate in this study? Do you accept to record this meeting in an audiotape to carry on the analysis of the focus group?</p> <p>Any question before we continue?</p> <p>(Start recording)</p>

Table I. (Continued)

Topic	Duration	Instructions
<ul style="list-style-type: none"> - Thanks message - Introduction of the facilitator and the assistant - Aims - Schedule - Confidentiality - Rules for participation - Introduction of participants 	<p>5 minutes</p>	<p>Welcome to the discussion group and thanks for participating in this study. We appreciate that you found a spot in your agenda to participate on it. Your contributions are of great value considering your role in the daily healthcare activities. I am (facilitator's name) and I will be the facilitator of the session. (Assistant's name), will be the assistant, as assistant she will be observing, taking notes and recording the session.</p> <p>Since we will record the discussion, we kindly ask you to speak loudly and clearly. Any opinion, experience or suggestion is very important for the project, and we do not want any contribution to go unnoticed.</p> <p>In order to ensure that you feel comfortable to share your own opinions, attitudes and values with the rest of participants, we set the following rules for the session:</p> <ul style="list-style-type: none"> • We would like to hear the opinion of every one • There are no good or bad answers. There are different opinions and we invite you to respect all of them. • This is very important: we need to speak one at a time and give space to present arguments, listening carefully when another participant speaks. • Finally... Please turn off all your electronic devices, in order to avoid unnecessary interruptions. <p>Any question before we continue? Ok then. Let's move on to a brief introduction of ourselves. We would appreciate if you say your name, specialty, how long have you been working in the hospital setting and which is your workplace (unit or department).</p>
<p>The concept of low-value interventions</p> <p>Icebreakers questions</p>	<p>15 minutes</p>	<p>1. In your opinion, what is a low-value intervention? 2. Could you give us some example? Some of the examples that have been reported in scientific articles are: 1. Proton pump inhibitors in patients over 65 years or polimedicated. 2. Preoperative chest radiography in asymptomatic persons. 3. Do you think low-value interventions are common in our daily routine?</p>
<p>Barriers to reduce low-value care</p>	<p>25 minutes</p>	<p>1. In your opinion, what is the cause or the causes why a doctor or a nurse would indicate or carry out a low-value intervention? 2. In your opinion, what is the cause or the causes why a doctor or a nurse would not indicate an intervention that have been proved to be valuable according to scientific evidence? 3. When a patient asks for a diagnostic test or a treatment that you consider is unnecessary, how do you manage the situation? Do you consider it is difficult to explain? Could you explain what kind of difficulties have you had?</p>

Table I. (Continued)

Topic	Duration	Instructions
Aids to reduce low-value care: protocols and guidelines - Availability, accessibility, usability, limitations	10 minutes	1. What is the first thing you would think if we mention the words protocols, guidelines and clinical recommendations? 2. Do you use them? Do you think they are useful? 3. Do you know or have you read recommendations aimed to reduce low-value interventions? If so, please specify which. 4. Where have you heard or read about them? 5. What limitations have you experienced when trying to follow recommendations to reduce low-value interventions?
Facilitators to reduce low-value care - Brainstorming on possible solutions - Prioritisation	15 minutes	In your opinion, what can be done to reduce low-value interventions? How can we motivate health practitioners and the community in general to reduce low-value interventions? What is needed in order to reduce low-value interventions? In your opinion, what is the role of practitioners, managers, board of directors, patients and their relatives, and society in general?
Summary and conclusions - Main topics during the session - Last comments	5 minutes	By the end of the session, the assistant does a quick summary of the main topics, highlights agreements and disagreements related to each topic. In your opinion, have we forgotten to talk about anything important? Do you think we have discussed all the most important aspects related to low-value interventions?
Closing comments		Ok... We are at the end of this session. I would like to thank you for your cooperation. Thank you for sharing your opinions, experiences, concerns and suggestions. We will contact with you soon to present the results and conclusions of this session. Have a good day.

Table II. Topic, intervention, specialty and source of the first 10 recommendations assessed in the survey. This table corresponds to part of the Table II shown in the appendix of Article IV

ID ^a	Recommendation	Topic	Intervention	Type of intervention	Specialties responding	Source ^{b-g}
15	In postmenopausal women with low risk of fractures, long-term treatment with bisphosphonates represents a risk that overcomes the benefit.	Osteoporosis	Bisphosphonates	Drugs (non-chemotherapy drugs)	Rheumatology	Essencial
17	In cases of normal childbirth, episiotomy should not be done routinely.	Delivery	Episiotomy	Surgical procedures	Gynaecology/obstetrics	Essencial
23	If the clinical suspicion of prostate cancer is high, do not offer prostate biopsy for histological confirmation, unless this is required as part of a clinical trial.	Prostate cancer	Prostate biopsy	Diagnostic (procedures)	Anatomical pathology, urology	NICE do not do Recommendations
25	Biopsy of the prostatic bed should not be performed in men with prostate cancer who have had a radical prostatectomy.	Prostate cancer	Biopsy of the prostatic bed	Diagnostic (procedures)	Anatomical pathology, urology	NICE do not do Recommendations
73	Patients with suspected or biopsy proven Stage I NSCLC do not require brain imaging prior to definitive care in the absence of neurologic symptoms.	Non-small cell lung cancer	Brain imaging	Diagnostic (images)	Pulmonology	Choosing Wisely®
730	Avoid elective, non-medically indicated inductions of labour between 39 weeks, 0 days and 41 weeks, 0 days unless the cervix is deemed favourable.	Pregnancy	Inductions of labour	Drugs (non-chemotherapy drugs)	Gynaecology/obstetrics	Choosing Wisely®
733	Do not screen and treat patients with asymptomatic bacteriuria, including patients with urinary catheter, except in pregnancy or urological surgical procedures.	Asymptomatic bacteriuria	Screening	Diagnostic (laboratory tests)	Internal medicine	Commitment to quality of the Spanish scientific societies
736	Testing natriuretic peptides is not recommended for treatment decision making in chronic heart failure.	Chronic heart failure	Testing natriuretic peptides	Diagnostic (laboratory tests)	Internal medicine	Commitment to quality of the Spanish scientific societies
738	Do not schedule revisions, or colonoscopy within 5 years postpolypectomy in patients with one or two adenomas smaller than 1cm, without high- dysplasia, completely removed in a high quality colonoscopy.	Colon cancer	Colonoscopy	Diagnostic (procedures)	Gastroenterology	Commitment to quality of the Spanish scientific societies

Table II. (Continued)

ID ^a	Recommendation	Topic	Intervention	Type of intervention	Specialties responding	Source ^{b-g}
739	Do not prescribe antibiotic prophylaxis to people with mild acute pancreatitis.	Acute pancreatitis	Antibiotic prophylaxis	Drugs (non-chemotherapy drugs)	Gastroenterology, internal medicine	Commitment to quality of the Spanish scientific societies

^aID corresponds to the identification number of the recommendation in DianaHealth.com

^bEssencial: Adding value to the clinical practice. Catalonia-Spain. Available from <http://essencialsalut.gencat.cat>

^cNICE Do not do Recommendations. United Kingdom. Available from:

<https://www.nice.org.uk/savingsAndProductivity/collection?filter=&impact=&page=1&pageSize=2000&published=&type=Do+not+do>

^dSERAM Do Not Do recommendations. Spanish Society of Medical Radiology. Spain. Available from:

<http://seram.es/modules.php?name=webstructure&lang=ES&idwebstructure=100>

^eChoosing Wisely Canada. Available from <https://choosingwiselycanada.org/>

^fChoosing Wisely Italy. Doing more does not mean doing better (Fare di più non significa fare meglio). Available from:

<http://www.choosingwiselyitaly.org/index.php/en/>

^gChoosing Wisely®. United States. Available from <http://www.choosingwisely.org/>

^hCommitment to quality of the Spanish scientific societies. Ministry of Health. Spain. Available from

http://www.mssi.gob.es/organizacion/sns/planCalidadSNS/cal_ssc.htm

Table III. Number of responses, percentage of agreement, percentage of subjective adherence and percentage of usefulness. Results from the first 10 recommendations assessed in the survey. This table corresponds to part of the Table III shown in the appendix of Article IV

ID	Recommendation	n total responses	Agreement		Subjective adherence			Usefulness		Potential low-value practice present in the hospital ^a
			n positive responses	%	n responses	median %	IR	n positive responses	%	
15	In postmenopausal women with low risk of fractures, long-term treatment with bisphosphonates represents a risk that overcomes the benefit.	1	1	100	1	20	NA	0	0	X
17	In cases of normal childbirth, episiotomy should not be done routinely.	1	1	100	1	70	NA	1	100	
23	If the clinical suspicion of prostate cancer is high, do not offer prostate biopsy for histological confirmation, unless this is required as part of a clinical trial.	11	1	9	1	100	NA	1	9	
25	Biopsy of the prostatic bed should not be performed in men with prostate cancer who have had a radical prostatectomy.	11	9	82	8	100	0	3	27	
73	Patients with suspected or biopsy proven Stage I NSCLC do not require brain imaging prior to definitive care in the absence of neurologic symptoms.	10	10	100	8	90	42	9	90	
730	"Avoid elective, non-medically indicated inductions of labour between 39 weeks, 0 days and 41 weeks, 0 days unless the cervix is deemed favourable.	3	1	33	1	100	NA	1	33	

Table III. (Continued)

ID	Recommendation	n total responses	Agreement		Subjective adherence			Usefulness		Potential low-value practice present in the hospital ^a
			n positive responses	%	n responses	median %	IR	n positive responses	%	
733	Do not screen and treat patients with asymptomatic bacteriuria, including patients with urinary catheter, except in pregnancy or urological surgical procedures.	4	4	100	3	60	NA	4	100	X
736	Testing natriuretic peptides is not recommended for treatment decision making in chronic heart failure.	13	9	69	9	80	15	7	54	
738	Do not schedule revisions, or colonoscopy within 5 years postpolypectomy in patients with one or two adenomas smaller than 1cm, without high-grade dysplasia, completely removed in a high quality colonoscopy.	1	1	100	0	Missing	Missing	1	100	
739	Do not prescribe antibiotic prophylaxis to people with mild acute pancreatitis.	1	1	100	0	Missing	Missing	1	100	

Table IV. Composition of the focus groups: medical specialties and surgical specialties.

Age (years)	Medical specialties		Surgical specialties		Total (n participants involved in research)
	Women	Men	Women	Men	
<35	1	0	1	1	3 (0)
35-50	1	3	2	0	6 (2)
>50	2	1	1	2	6 (4)
Total	4	4	4	3	15 (6)
Specialties ^a	Endocrinology, medical oncology, paediatrics, internal medicine, cardiology, genetics, nursing		Thoracic surgery, ophthalmology, anaesthesiology, plastic surgery, anaesthesiology, radiology, surgical nursing		

^aSpecialties are not reported separately in order to protect confidentiality

Table V. Examples of verbatims about barriers for reducing low-value care.

Level	Category	Topic	Example
Introduction	Concept of low-value care		<p>1. Before, our grandparents and parents had fewer tests, and they did not make so many mistakes, they use to make fewer mistakes than us.</p> <p>2. You mean things that we are doing since many years ago, but with scientific evidence supporting they do not work? Many of them.</p>
	Examples of low-value care		<p>Medical specialties group: Routine use of pharmacological treatment of acute bronchiolitis; Routine use tumour markers in monitoring cancer; Duplicity in diagnostic tests between different departments or units during follow-up; Routine use of ultrasound in patients with subclinical hypothyroidism; Routine use of stress tests in patients with stable coronary disease; Routine use of dopamine in critically ill patients.</p> <p>Surgical specialties group: Routine use of coagulation tests before surgery; Routine use of imaging (i.e. Ultrasound or MRI) in patients with corneal leukoma; Routine use of ointments and dressings in wounds; Routine use of chest X-Ray after thoracic surgery; Long pre-operative or post-operative fasting regimen; Routine use of imaging in patients with acute diverticulitis.</p>
Micro-level	Defensive medicine	Self-protection	<p>3. Is defensive Medicine... Many times you think you will not find anything abnormal (in the diagnostic tests), but, at least in my case, is better to have one test more than one test missing. Because, if you miss something; something that may have dramatic consequences, for instance an undetected recurrence... So, you ended up asking for that test. Even though you know... you are 95% sure you will not find anything bad. And then... many times nobody else assumes the risk... Radiologic reports conclude many times: "it cannot be discarded..." which means: "you decide".</p>
		Previous bad experiences	
	Scientific evidence	Management of uncertainty	<p>4. Well, if you have done things the same way all your life, you have the feeling ... that even if they tell you that it is not good (effective), you have the feeling that the two thousand people you've been treated that way, it worked ... Although there are articles that prove it's not true ... but is hard for you believe it...</p>
		Scepticism regarding the scientific evidence	
Attitudes	Routine and resistance to change	<p>5. When you have been doing the same, all your life, you have the feeling that...that even when somebody tells you that it does not work, you have the feeling that after having two thousand cases, when you use it, it works... So, it is hard to stop doing it. That's how it is... Even when there are studies proving that it is no true. But it happens to you, happens to (participant mentioned a specific department), happens to many people... I mean ... In (participant mentioned his department) I would say is one of the best examples, with a disease that you think: every year, it is always the same story... and we still have not enough knowledge. And then we find out that the same patient, depending on who is treating, receives one treatment or another.</p>	

Table V. (Continued)

Level	Category	Topic	Example
Micro-level	Education	Lack of continuing education	6. ...But all this is not being facilitated by the hospital. You have to look for the information by yourself, in external sources.
	Patients' literacy/knowledge	Expert patient	7. Yes... every time there are more. Sometimes is the patient's daughter, or a friend of your patient. You may say: why don't you do the surgery? You try to explain the best you can, but sometimes you may think: why don't you do the surgery? We show respect, and people deserve to know, but sometimes you have the feeling that there is no point having that information.
		Patients' expectations	
Meso-level	Trust	Doctors credibility	8. To help you, when you do not want to ... when you have this attitude ... One thing that, in our experience, I think helps a lot: It is an intervention explicitly advised not to do in guidelines, right? So, you have an argument that gives you support; when you have doubts about doing something or not, especially when you are in front of your patient, right? You tell him/her there are some recommendations, and you should not do it ... it's a very solid thing, isn't it?
	Communication	Lack of communication skills/instruments	12. I believe this is another barrier: not everywhere applies this homogeneously. And then, let's not talk about differences between Autonomous Communities (i.e. Administrative division of Spain). Because every Autonomous Community has its own legislation... In my opinion, these are the main barriers, the results are spectacular, but how do you apply them? And how do you explain it to the patient?
	Leadership in the department	Lack of leadership	10. Obviously, if you do not understand a thing you may say: why do I have to do this? And they have to explain it to you, and it has to make sense to you. You cannot say: the bottle is going to be placed here because I tell you (...) Sometimes we (the nurses) participate looking for the best solution, and we explain it to the rest of the staff.
		Organizational inertia	11 You're in a smaller hospital and say: hey! Go right. And in five minutes, you are there... This is the problem of big institutions... In smaller hospitals, all these concepts are much easier to incorporate... Here, all these practices you low-value, well... the idea is not bad, but we could simplify it a lot more. It is difficult because we are a lot of people here, many ways of working ... and everything cost a big effort sometimes ... There are people who are more open-minded and there are people who are not, and they do not change.

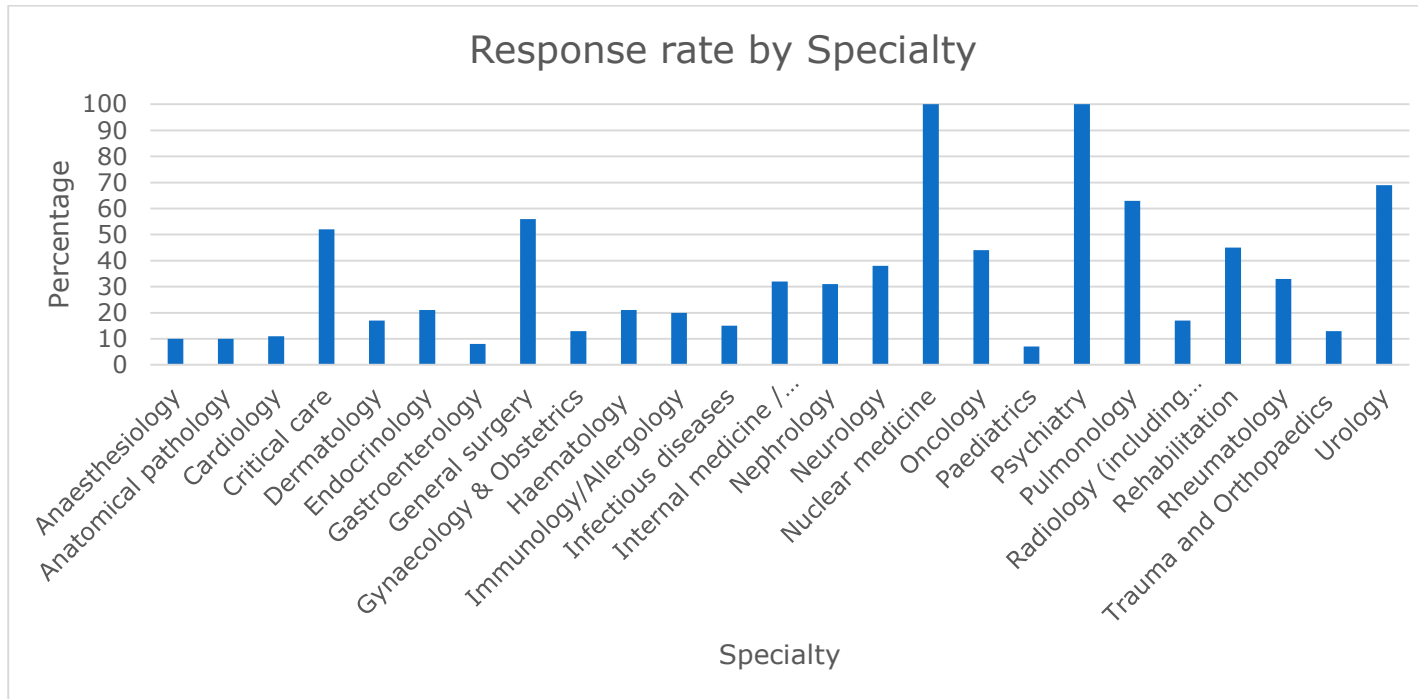
Table V. (Continued)

Level	Category	Topic	Example
Macro-level	Health System design	Lack of consistency and coordination between professionals	9. Honestly, I see that sometimes, in the follow-up of these patients, they are followed by three different services doing the same; the same tests ... and we see the patient for the same reason three times... We try not to do it but it is difficult...
		Differences in guidelines between regions	12. I believe this is another barrier: not everywhere applies this homogeneously. And then, let's not talk about differences between Autonomous Communities (i.e. Administrative division of Spain). Because every Autonomous Community has its own legislation

Table VI. Examples of verbatim quotations about facilitators for reducing low-value care.

Level	Category	Topic	Example
Meso-level	Leadership in the department	Team-work could be a good strategy to solve resistance to change; acting as a snow-ball	13. You have to talk to everybody... Of course not everybody will agree with you... no matter what you do or what you say. You will always find 20% of people that will not agree with you... It's a matter of... teamwork is essential... because if one team member starts to turn the wheel, and another team member does the same, after a while the wheel will turn automatically. Others will eventually say: have you seen how do they work?
	Leadership in the hospital	Delegate some medical tasks to nurses; for example, collecting clinical information	14. In my opinion, the preoperative assessment is part of the medical chart. It collects the clinical history. A nurse is as capable as doctors to ask patients about history of allergies. All you have to do is to ask, and write it down. And nothing more!
	Information	Mail lists inside departments to reduce variability in clinical practice	15. We in (participant mentions his department) ... people use their e-mail (meaning the corporate e-mail) on their way, time and information are wasted ... sometimes risking patient safety... that's why, two years ago the nurse supervisor and me gathered nurses, auxiliary nurses, residents, and other doctors to create a single communication network in our department. We asked them to voluntarily give us their personal e-mail. We created three distribution lists. Every week we sent an e-mail with documents of interest such as protocols and guidelines, also circuits, incidents and indicators of performance, to motivate the change. We motivated them to give us some feedback. And we actually received feedback from several units and professionals. This helped to have better standardization in our way of working. Then the system evolved... after six months or so, we created a server, hosted in the hospital intranet, to access either at the hospital or home, with a registry. All the protocols, circuits and other documents were shared... also links to make suggestions ... Then, any situation was managed through this server and all the staff was involved in the change. The truth is that it was really helpful to change the work dynamic and make our treatments more homogeneous... Because you talk about things in the emergency room, things that happen in the last twenty years ago, they tell you they do not know what to do; some people wonder ... So, we are about a century behind you, talking about applying the last molecule.... We are talking about not doing X-Rays to every patient who falls ... That was one of the resources raised from our own initiative; but it helped to standardize our work.

Figure I. Response rate by specialty.



Appendix 3.4 Additional tables from Article V

Table 1. Topic, intervention, and area of the first 10 recommendations assessed in the survey. This table corresponds to part of the Table shown in the Appendix A of Article IV

ID ^a	Recommendation	Topic	Intervention	Areas responding
1510	Do not use urinary catheters routinely in patients with acute stroke and urinary incontinence ^b	Catheter care	Urinary catheters	Critical care
1736	Don't place, or leave in place, peripherally inserted central catheters for patient or provider convenience ^c	Catheter care	Peripherally inserted central catheters	Inpatient care, Critical care
1955	Don't place, or leave in place, urinary catheters without an acceptable indication (such as critical illness, obstruction, palliative care) ^d	Catheter care	Urinary catheters	Inpatient care
2169	Don't use bladder training (repeated closure of the catheter) before urinary catheter removal ^e	Catheter care	Urinary catheters	Critical care
2515	Don't place or maintain a urinary catheter in a patient unless there is a specific indication to do so ^c	Catheter care	Urinary catheters	Inpatient care, Critical care
3192	An exhaustive evaluation should be carried out in order to avoid the unnecessary use of central venous catheter in the hospital setting ^f	Catheter care	Central venous catheter	Inpatient care, Critical care, Outpatient care
2279	Do not keep an urinary catheter more than 48 hours after a gastrointestinal surgery ^g	Catheter care	Urinary catheters	Critical care, Emergency care
2512	Don't let older adults lay in bed or only get up to a chair during their hospital stay ^c	Elderly care	Bed rest	Inpatient care
290	Do not use polythene gloves for clinical interventions ^h	General practice	Polythene gloves	Inpatient care, Outpatient care, Emergency care, Pregnancy care
296	Forehead chemical thermometers are unreliable and should not be used by healthcare professionals ^h	General practice	Forehead chemical thermometers	Inpatient care

a. ID corresponds to the identification number of the recommendation in DianaHealth.com

b. Essencial: Adding value to the clinical practice. Catalonia-Spain. Available from <http://essencialsalut.gencat.cat>

c. Choosing Wisely®. United States. Available from <http://www.choosingwisely.org/>

d. Choosing Wisely Canada. Available from <https://choosingwiselycanada.org/>

e. Choosing Wisely Italy. Doing more does not mean doing better (Fare di più non significa fare meglio). Available from:

<http://www.choosingwiselyitaly.org/index.php/en/>

f. Less is more. McDonald E. JAMA Intern Med. 2015;175(7):1232-1234. Available from

<https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/2289125>

g. Commitment to quality of the Spanish scientific societies. Ministry of Health. Spain. Available from

http://www.mssi.gob.es/organizacion/sns/planCalidadSNS/cal_sccc.htm

h. NICE Do not do Recommendations. United Kingdom. Available from:

<https://www.nice.org.uk/savingsAndProductivity/collection?filter=&impact=&page=1&pageSize=2000&published=&type=Do+not+do>

Table 2. Number of responses, percentage of agreement, percentage of subjective adherence, percentage of nurses considering the recommendations as either very useful/useful or not so useful/useless, and low-value practices probably existing in the hospital. Results from the first 10 recommendations. This table corresponds to part of the Table shown in the Appendix B of Article IV

ID	Recommendation	n	Agreement			Subjective adherence			Usefulness			Low-value practice probably existing in the hospital ^a			
			%	95% CI	95% CI	Median	95% CI	IQR	%	95% CI	95% CI	Based on Punctual estimation	Based on 95% CI Lower Bound	Based on 95% CI Upper Bound	
1510	Do not use urinary catheters routinely in patients with acute stroke and urinary incontinence	43	95	89	100	75	50	80	35	81	69	93		X	
1736	Don't place, or leave in place, peripherally inserted central catheters for patient or provider convenience	95	99	97	100	90	80	90	21	93	88	99			
1955	Don't place, or leave in place, urinary catheters without an acceptable indication (such as critical illness, obstruction, palliative care)	35	100	100	100	87.5	75	90	41	97	92	100			
2169	Don't use bladder training (repeated closure of the catheter) before urinary catheter removal	40	100	100	100	90	80	100	20	90	81	99			
2515	Don't place or maintain a urinary catheter in a patient unless there is a specific indication to do so	138	100	100	100	90	90	95	20	97	94	100			
3192	An exhaustive evaluation should be carried out in order to avoid the unnecessary use of central venous catheter in the hospital setting	114	99	97	100	80	75	80	37	96	93	100			
2279	Do not keep an urinary catheter more than 48 hours after a gastrointestinal surgery	52	98	94	100	80	60	80	40	91	83	98		X	
2512	Don't let older adults lay in bed or only get up to a chair during their hospital stay	33	100	100	100	80	75	90	21	97	91	100			
290	Do not use polythene gloves for clinical interventions	47	91	84	99	90	90	90	19	91	83	99			
296	Forehead chemical thermometers are unreliable and should not be used by healthcare professionals	46	100	100	100	100	100	100	0	80	68	92			

^a Recommendations considered as potential low-value practices present in the hospital due to an agreement of 70% or more and a subjective adherence of 70% or less. Numbers in bold letters represent in each case: Agreement of 70% or more, Subjective adherence of less than 70%, or Usefulness of 70% or more.

Acronyms: CI: confidence interval; IQR: Interquartile Range; n: number of responses.

Table 3. STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Page No
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	1-2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	4
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6 and Table 1
Data sources/measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6
Bias	9	Describe any efforts to address potential sources of bias	6
Study size	10	Explain how the study size was arrived at	4-5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-7
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	6-7
		(b) Describe any methods used to examine subgroups and interactions	7
		(c) Explain how missing data were addressed	7
		(d) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(e) Describe any sensitivity analyses	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	7
		(c) Consider use of a flow diagram	N/A

Table 3. (Continued)

	Item No	Recommendation	Page No
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7
		(b) Indicate number of participants with missing data for each variable of interest	7
Outcome data	15*	Report numbers of outcome events or summary measures	7-9 and Appendix B
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	7-11
		(b) Report category boundaries when continuous variables were categorized	9
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	8-11
Discussion			
Key results	18	Summarise key results with reference to study objectives	11-14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	14-15
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11-14
Generalisability	21	Discuss the generalisability (external validity) of the study results	14-15
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Title page

*There were not exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

