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Methodology Article

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Assessing the performance of indicators during their life cycle: the mixed QUID method

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Abstract

Background: Quality indicators (QI) are mandatory in French hospitals. After a decade of use, the Ministry of Health set up an expert workgroup to enhance informed decision-making regarding currently used national QI, i.e. to propose a decision of withdrawing, revising or continuing their use. We report the development of an integrated method for a comprehensive appraisal of quality/safety indicators (QI) during their life cycle, for three purposes, quality improvement, public disclosure and regulation purposes. The method was tested on 10 national QI on use for up to 10 years to identify operational issues.

Methods: A modified Delphi technique to select relevant criteria and a development of a mixed evaluation method by the workgroup. A 'real-life' test on 10 national QI.

Results: Twelve criteria were selected for the appraisal of QI used for regulation goals, 11 were selected for hospital improvement and seven for public disclosure. The perceived feasibility and relevance were studied including hospital workers, patients and health authorities professionals; the scientific soundness of the indicator development phase was reviewed by analyzing reference documents; the metrological performance (limited to the discriminatory power and dynamics of change during the life cycle dimensions) was analyzed on the national datasets. Applied to the 10 QI, the workgroup proposed to withdraw four of them and to modify or suspend the six others.

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Conclusions: The value of the method was supported by the clear-cut conclusions and endorsement of the proposed decisions by the health authorities.

Key words: quality indicators, healthcare, evaluation methodology, methods, health care quality assessment

Background

Quality indicators are in use for decades in western countries, and increasingly in low and middle-income countries [1,2].

The principle of doing a regular appraisal of the QIs during their lifetime course is shared by all stakeholders: 'There should be a plan to review the Key Performance Indicators (KPIs) at regular intervals with a view to refinement in response to stakeholder demands or improved data availability. Health services are continually evolving and it is important that KPIs respond to these changes . . . The review may highlight the need to modify the KPI or aspects of the KPI in response to stakeholder demands' [3,4].

In France, national mandatory QI in acute care have increased in number, from 10 in 2010 to 33 in 2016, and in topics (Table 1). The choice of these indicators was based on improvement priorities, not necessarily on the existence of an automated way to measure them. As a result, measurement is based on record review for the majority of them, which is a real workload in the hospital. For that reason, the introduction of new QI must be compensated by the suppression of others that proved to be less appropriate after a certain period of use. In our experience, the decision to suppress QI was hard because of a lack of evidence. The decision-making was essentially based on informal discussions at national level between the different stakeholders. In 2015, the French Ministry of Health together with the HAS (*Haute Autorité de Santé*—French National Authority for Health) commissioned a national expert workgroup to develop and apply a method for appraising currently used national QI in order to improve the efficacy of the review process. The four constraints given by the commissioners were that the method must be comprehensive, understandable for laypersons, be affordable in terms of time and resources needed, and adapted to the three purposes of these indicators, namely quality improvement, patient information and hospital regulation. In this article, the 'regulation' purpose refers to the external oversight, accountability and pay-for-performance uses [5]; 'patient information' refers to the use by patients and citizens for consumer decision-making purposes; "Quality improvement" refers to internal quality improvement within healthcare facilities.

There is quite a vast literature describing how QI are collected, used and classified in multiple ways [see for example 6–16]. However, research to bring evidence into that review process was found to be scarce, either quantitative [17] or qualitative [18–20]. An essential part of the evaluation of QI is lacking, i.e. a formal, systematic process of assessing patients and healthcare professionals' experiences with the indicators [21].

The QUID (QUality Indicator Dynamics) method was hence developed. The main objectives of this article is to describe the development and testing of that mixed method allowing the overall appraisal of national mandatory QI according to their three purposes.

Methods

Study design

A consensus method between the members of the workgroup to select relevant criteria and method of criteria evaluation. A 'real-life' test on 10 national QI to identify operational issues in the application of the QUID tool.

Phase 1: development of the method

The two commissioning institutions appointed 14 intuitu personae members for their competencies and experience in QI, representing the large panel of stakeholders. It was composed of a patient's representative, four clinicians (surgeon, oncologist, neurologist, and emergency physician), a hygienist, four epidemiologists, two healthcare facility managers, a quality manager and a sociologist. A project manager was appointed for an 18-month period and two sociologists for a 6-month period (see list of names and profiles in the 'Acknowledgments' section).

The team leader and project manager drew a list of 16 criteria in use for developing and evaluating QI [6–8, 12, 14, 16, 22]. Each criterion was described using a data sheet mentioning the wording of the criterion, the assessed dimension, the evaluation method and the values of the criterion rating scale.

This expert workgroup used the RAND/UCLA appropriateness rating method for selecting the criteria [23]. This rating method is a modified Delphi technique, comprised of literature review, multidisciplinary panel meeting and rounds of anonymous rating. This method has been commonly used to define priorities in public health and specifically in the field of quality indicators development [24,25].

The analysis method for each criterion, described in the result section, was formalized by the workgroup.

Phase 2: test of the method

Ten indicators were selected by the commissioning institutions and the workgroup for the test. The choice of these indicators was a convenient one, based on scientific issues (the workgroup wanted to test the method on different types of indicators) and of political ones (the institutions preferred to choose among the most illustrative or emblematic indicators; Table 1).

In this paper, we detail the presentation of the appraisal to the four HAI indicators, a subset of the 10 indicators (Table 1). Launched between 2005 and 2013 and still in use, these QI assess various dimensions of controlling HAI by measuring the organization, the resources mobilized and the actions. Those composite process indicators include between 11 and 55 items.

An estimation of the average time spent on evaluating one indicator was calculated.

Results

Description of the QUID method

Selected criteria

The workgroup selected 12 criteria for the 'hospital regulation purpose' appraisal: clarity, evidence, importance for the healthcare system, validity, risk adjustment, discriminatory power, dynamics of change, delays related to data production, barriers to implementation,

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Table 1 List of the 2016 French mandatory indicators and results of the QUID appraisal of 10 of them

List of indicators	Workgroup proposal
Healthcare acquired infection (HAI)	
Composite indicator on HAI control organization, the resources mobilized and the actions implemented	Modification
Composite indicator used to reflect the setting's commitment to control infectious risk in surgery	Modification
Volume of hydroalcoholic solution	Not appraised
Composite indicator used to reflect the antibiotic prudent use policy of a setting	Modification
Composite indicator used to reflect the setting's commitment to control multidrug-resistant organism (MDRO) spread	Suppression
In-hospital care of myocardial infarction (MI)	
Drugs prescription at discharge (beta-blockers, platelet antiaggregant, statins, inhibitor of the enzyme conversion)	Suppression
Sensibilisation to hygienic and dietary rules at discharge	Modification
Initial care of stroke	
Date et hour of first symptoms in the medical report	Not appraised
Date of the first evaluation by a rehabilitation professional	Not appraised
Quality of the patient record	Not appraised
Prevention and care of postpartum hemorrhage	
Prévention of hemorrhage during delivery	Not appraised
Minimal clinical supervision in the birth room after delivery	Not appraised
Initial management of immediate postpartum hemorrhage	Not appraised
Care quality of chronic haemodialysis patients	Not appraised
Access to renal transplantation	Not appraised
Composite indicator of follow-up of hemodialysis patients	Not appraised
Monitoring the martial status of the patient treated by agents of erythropoiesis stimulation	Not appraised
Monitoring the phosphocalcic balance	Not appraised
Serological surveillance of hepatitis	Not appraised
Nutritional surveillance - Nutritional status	Not appraised
Composite indicator of the quality of the dialysis	Not appraised
Appreciation of the purification—Prescription of three sessions and 12 h per week	Not appraised
Appreciation of the purification: measurement of the dialysis dose	
Patient satisfaction	
Satisfaction/Experience of patients hospitalized in medicine, surgery and obstetrics more than 48 h	Not appraised
Quality of the patient record	
Keeping the patient's file	Suppression
Quality of the discharge letter'content	Not appraised
Delay for sending the discharge letter	Not appraised
Traceability of pain assessment	Suspension/Modification
Screening for nutritional disorders	Suppression
Weight tracking during hospitalization care at home	Not appraised
Traceability of pressure ulcer risk assessment	Not appraised
Quality of the anesthesia record	
Keeping of the anesthesia record	Not appraised
Traceability of postoperative pain assessment with a scale in the recovery room	Not appraised
Multidisciplinary team meeting in oncology	
Quality of meeting report	Modification

potential risks/side effects, benefit/ability to take decision, providers influence on results/gaming (Table 2). Four criteria were rejected according to the rules of the RAND/UCLA appropriateness rating method: 'perimeter covered by the indicator' (positive if relevant in all hospitals) was initially considered because, in a limited set of indicator, it was thought that the indicators reflecting situations found in all hospitals should be preferred; this characteristic was rejected to allow the inclusion of disease-specific indicators. The criterion 'validity of the indicator' was rejected as it is only relevant for the development phase; the validity is not supposed to evolve with time if the measurement conditions remain stable. The third and fourth ones, 'ability of the indicator to help identifying improvement actions' and 'evidence of the effectiveness of improvement actions related to the indicator', were grouped with a third one 'indicator reflecting actionable solutions', into a single criteria here named 'Benefit/ability to take decision based on the results', because it was difficult to separately analyze these three criteria.

During the two following consensus processes, dedicated to the selection of criteria for QI evaluation targeted to local improvement and patient information purposes, some of these 12 criteria were rejected. In Table 2, we quote them using a generic term "not relevant", which means that the target population either may not be aware of the answer or may not feel concerned by the criteria: regarding the 'Importance of the quality characteristic captured for the healthcare system (national priority)' for example, the perceived need by hospital professionals, for their internal quality improvement, was thought not to be necessarily related to national priorities.

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Table 2 appraisal criteria (name and analysis method type) according to the three purposes

	Hospital regulation (12)	Quality improvement (11)	Patient information (8)	Analysis method
Feasibility criteria				
Clarity of definitions (of the indicator and its application)	✓	✓	✓	Semi-structured interviews
Delays related to data production	✓	✓	✓	
Barriers to implementation due to data collection effort	✓	✓	Not relevant	
Relevance criteria				
Potential risks/side effects	✓	✓	✓	Semi-structured interviews
Benefit/ability to take decision based on the results	✓	✓	✓	
Importance of the quality characteristic captured for the healthcare system (national priority)	✓	Not relevant	Not relevant	Document analysis
Current metrological performance				
Discriminatory power	✓	✓	✓	Statistical analysis
Dynamics of change	✓	✓	✓	
Providers influence on indicators results/gaming	✓	✓	✓	Mixed: semi-structured interviews and quantitative analyses
Scientific soundness of indicator development				
Need for risk adjustment	✓	✓	✓	Document analysis
Evidence-based indicator	✓	✓	Not relevant	
Validity assessment during Indicator development	✓	✓	Not relevant	

Appraisal method. The QUID appraisal process consisted of 2 successive stages: analyses of each criterion and final evaluation (Figure 1).

The 'analysis of each criterion' borrows from three methodological approaches (Figure 1 and Table 2).

First, the review of source documents on indicator development was performed to judge whether good practices were applied when developing the indicator, for four criteria: importance of the quality characteristic captured for the healthcare system (national priority); Need for risk adjustment; Evidence-based indicator; validity assessment during Indicator development (Table 1). Source documents included all documents that allow the understanding of the choices and the means used to develop and update the indicators. During the test, these documents were provided by the institution that contributed to the development or piloting of the indicator. The list of documents required can be found in the Supplementary File W1.

Second, the qualitative analysis was carried out through semi-structured interviews to get a feedback from targeted 'laypersons', i.e. persons on the field: three types of stakeholders (healthcare professionals, regulators and patients) were involved in semi-structured interviews (see Supplementary File W2 for the interview guide). The interviewees were selected by the workgroup using the purposive sampling technique. During the test, patients' representatives were selected from the main nationwide patient organization engaged in the fight against adverse event, health professionals and healthcare managers were selected regarding their specialty and geographical location by members of the workgroup, regulators were selected within resource persons in regional health agencies. For each QI, the purposive sample included a total of 12 to 15 interviewees with a very limited refusal rate which was <15%. Each interview lasted 45 min on average (see Supplementary File W1).

Third, statistical analyses of QI results were conducted using nationwide data on at least two consecutive periods. The 'discriminatory power' criterion was analyzed by presenting the spread of results, the quartiles and the percentage of extreme values identified through the Tuckey method. The 'dynamics of change' criterion was analyzed with the percentage of healthcare facilities undergoing a statistically significant improvement or regression, and the comparison of medians between performance categories two by two with the Wilcoxon test (in France, thresholds are defined during the QI development phase in order to categorize the hospitals into four or five categories). More details about the statistical analyses can be found in the Supplementary File W1.

During the 'final evaluation', the workgroup went through each criterion analyses and suggested a scoring reflecting the output. A four-level Likert-type scale was used with strong (4), moderate (3), low (2), very low (1). The rule of the agreement of the majority was used.

A final synthesis for the QI was drafted out by the workgroup together with proposals of:

- maintaining the indicator, when the majority of the criteria were in line with the dimensions evaluated,
- modifying the indicator when the evaluations showed the need for maintaining a QI while modifying the structure of the indicator (suppressing or adding items),
- suspending the indicator when the evaluation demonstrated a very low potential for improvement while being relevant; data collection should, therefore, occur every three to 4 years instead of the current 2-year periodicity,
- suppressing the indicator when the majority of the evaluation criteria did not come up to the expectations.

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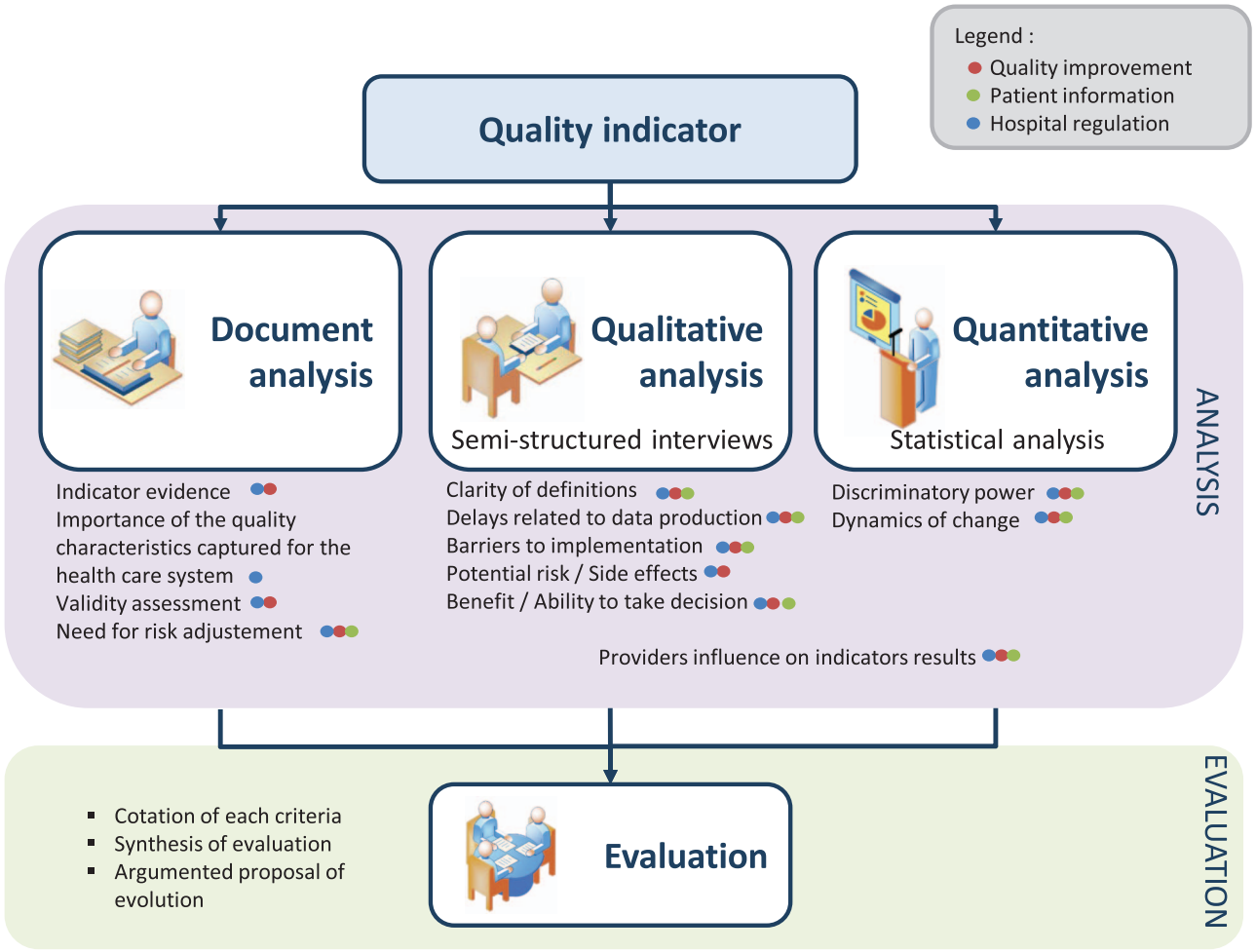

Figure 1 The 2 successive stages of the QUID appraisal process.

Scorings were only a guide for a decision, and no criterion was decisive on its own. The workgroup also took into account the importance of the topic of the indicator in the national quality and safety priorities, in particular, the existence or not of other indicators in that topic. The recommendations could also lead to the creation of another indicator.

For each indicator, the evaluation was reported with (i) an identity sheet of the indicator with its definition, its design, its aims, its dates of update or public disclosure, (ii) the main findings from the analyses, (iii) a synthesis of scorings and evaluations done by the experts and (iv) the suggestions regarding changes and a well-argued presentation with the benefits, risks and measures for supporting change management.

Test and refinement of the QUID method

This two-phase approach was applied on 10 indicators (Table 1). The method used is presented in the previous paragraph. We here present the output of the appraisal of one of the healthcare-associated infection (HAI) indicators for the regulation purpose with all 12 criteria (Table 3, see Supplementary File W3 for all HAI indicators).

The time and the competencies needed for the appraisal was one of the major operational issues of the QUID instrument (Table 4). The analyses of criteria required different competencies: for the analysis of source documents, expertise in the studied theme and in epidemiology (two experts); for qualitative and quantitative analysis, expertise in sociology and in statistics including the automatization of the criteria algorithms. Needed data were diverse: documents related to the development/updating of the indicators, databases to target persons (on purpose) for interviews, results of collection campaigns (at least two collection campaigns for the QI) together with the results of external controls on the quality of collections, when available.

Discussion

The QUID method aims at enhancing informed decision-making regarding the continuation of national indicators on healthcare quality and safety. The analysis of perceptions is the main breakthrough of the QUID method compared with previous instruments based on expert consensus and the analysis of existing data. Combining qualitative and quantitative evaluations, it offers a solid methodological ground for thoroughly appraising each indicator. Hence, it allows a comprehensive, structured and argued, consensual analysis, implying all stakeholders. During the test, it led to clear-cut recommendations to help deciding upon the usefulness of changing indicators used for more than 10 years and well anchored in the landscape of national indicator policies. The proposed decisions were endorsed by the health authorities and put into practice: accordingly, to our

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Table 3 Appraisal results of a composite indicator used to reflect the setting's commitment to control infectious risk in surgery with the QUID method

ICA-LISO description	
■ National QI implemented in 2012—ICA-LISO (indicateur composite de lutte contre les infections du site opératoire—composite indicator on the fight against HAI on the operating site)	
■ Aim: assessing in a setting the surgical site infection prevention organization, the resources mobilized and the actions implemented to reflect the setting's commitment to control infectious risk in surgery	
■ Composite process indicator including 15 items presented as a score out of 100 and a performance class (A–E)	
Feasibility criteria	Scoring (1–4)
Clarity of definitions (of the indicator and its application)	**3**
Delays related to data production	**2**
Barriers to Implementation due to data collection effort	**3**
Relevance criteria	
Potential risks/Side effects	**3**
Benefit/ability to take decision based on the results	**3**
Importance of the quality characteristic captured for the healthcare system	**4**
Current metrological performance	
Discriminatory power	**2**
Dynamics of change	**1**
Providers influence on indicators results/gaming	**2**
Scientific soundness of indicator development	
Need for risk adjustment	**3**
Indicator evidence	**3**
Validity assessment during Indicator development	**2**
■ Final evaluation drafted by the workgroup	
The indicator is scarcely known by on-site professionals and is perceived as relatively irrelevant by teams of hygienists because the results are not disclosed per surgical specialty/operating room and the QI is not the infection rate per operating site. While health professionals consider the topic as highly valuable, they do not endorse the collection procedure and are most often not aware of the results. This does not help in initiating a momentum of improving quality locally. One way to increase the motivation of health professionals would be to link this process evaluation to the infection rate on the operating site.	
The repartition of performance classes shows a ceiling effect (76% of healthcare facilities were in class A in 2014) however with a residual progress margin within the scores in class A. The results are similar according to the types of facilities. This indicator is coming to an end, particularly because of the ceiling effect. Because of the importance of the topic, the workgroup recommends the indicator to be maintained with substantial changes to decrease the number of items by suppressing those related to now well-defined procedures and by selecting items with discriminating capacity. Displaying the revamped indicator by specialty and linking it with an indicator of results (surgical site infection rate) seems advisable for a better appropriation on the field and for a better answer to patients' expectancies.	

Table 4 Estimation of the average time spent for appraising one QI, excluding extracting quantitative data and identifying source documents

Step	Tasks	Resource persons	Hourly volume	Total
Analyses	Document analysis ■ Retrieving the documents ■ Analyzing with the tool ■ Synthesizing and reporting	Two experts	3 h	6 h
	Qualitative analysis (on the basis of 12–15 interviewees) ■ Identifying and contacting potential interviewees ■ Interviewing ■ Reporting ■ Synthesizing and presenting	One survey officer	30 h	30 h
	Quantitative analysis ■ Software programming ■ Program execution and interpretation ■ Synthesis and presentation	One statistician	4 h	4 h
Evaluation	■ Criteria scoring ■ Conclusion of the evaluation ■ Proposal for changes	Committee of 14 experts	3 h	42 h
Estimated time for the evaluation of 1 QI				82 h

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conclusions, four indicators were suppressed and the six others were modified or are under modifications [26].

The methodology implemented by the workgroup is unprecedented both at the national and the international level as it assesses all dimensions and all purposes. The principles used are in accordance with the reflection of the UK National Institute for Health and Care Excellence presented at the 10th G-I-N conference in 2013 [27].

Limits of the QUID instrument

The QUID method enabled the individual evaluation of each indicator; together with the characteristics of single indicators, the strengths and weaknesses of indicator sets (HAI, myocardial infection, quality of the medical record etc.) are also important to assess the value of performance measurement: in this case, it did not provide an assessment of the ability of the existing QI to cover a topic in its entirety, in terms of synergies, overlapping between indicators or lack of coverage of important aspects of the topic. This additional evaluation of indicators of the same specialty or nature would require refinements in the method and is a lead topic for future research.

The method was not tested on all kinds of QI. It still has to be demonstrated how QUID works on outcome indicators, in particular on standardized ratios. Finally, an international research project would provide opportunities to identify cultural differences in the evaluation method (the type of criteria, type of interviewed stakeholders).

French patients still are rarely involved in collaborative co-produced quality improvement projects across all care settings, as is becoming common in the UK, Canada, Australia, the USA and Nordic nations; therefore, we had a real challenge to involve patients. We needed a number of persons with ample lived experience as recipients of healthcare services that are relevant to the study and must limit our recruitment to patients from associations, which might be a bias.

Findings and strengths of the QUID method

The evaluation of QI belongs to the field of the evaluation of complex interventions as defined by the Medical Research Council guidance, which strongly emphasizes the value of a mixed-method process evaluation (28).

For the qualitative analysis, a single guide for interviewing all stakeholders is suitable as criteria may be adjusted during the interview (see Supplementary File W2). The case studies proved the efficiency of the purposive sampling technique. The sample was relevant to identify meaningful characteristics and possible deviant cases. After 12 to 15 interviews, information saturation occurred.

The final appraisal was performed by the workgroup, which guarantees the reproducibility between the QI.

Complex quantitative analysis methods, such as those proposed by the HCUP-QI project, were not used because the commissioning institutions believed that they were too difficult to understand by 'lay people' involved in the national consultation conducted annually in France with all stakeholders (hospital's representatives, physician's representatives etc.): these stakeholders must have an easy and clear understanding of the arguments used by the expert group to take ownership of the proposed changes. Our experience is that a limited information about the indicator dynamics was enough to reach a consensus.

Lastly, during the final evaluation, carrying out a formal consensus method did not prove to be necessary.

Recommendations for the use of the QUID instrument

The QUID instrument is intended to be used by a multidisciplinary expert group for a nationwide evaluation of QI during their life cycle. Some parts may also be used for the appraisal of indicators at the local level, e.g. in healthcare facilities or regional health agencies.

Looking at this experience, key factors can be noted as follows:

- political support and working schedule suitable for the public authorities to take into account the results (in France, the annual list of QI is published by the Ministry of Health after a stakeholder consultation process in February for a publication in March [12], so the results have to be available in September the year before),
- availability of an expert group known for its skills and competencies,
- an operational team with a statistician and a sociologist without competing interests with the studied themes and the indicators,
- access to source documents drafted out during the development/updating,
- availability of all collected data, including individual data when the collection was carried out by sampling,
- Gaining a purposive sampling for the qualitative analysis based on a balance between interviewees' profiles, types of facilities, etc., producing global and transversal advice for all indicators related to a given topic,
- Producing a well-argued text to support the proposals in terms of expected benefits and risks and change management.

Conclusions

The QUID Instrument is an operational tool that enables the appraisal of national QI. It is innovative because it may be applied to all QI purposes (quality improvement, patient information, and hospital regulation) and it encompasses all dimensions of the evaluation (feasibility, relevance, metrological performance, and scientific soundness of indicator development). The synergy of qualitative and quantitative analyses represents a solid base for evaluating criteria and for dynamic QI management. The efficiency of the tool was suggested with the clear-cut conclusions reached after the evaluations during the testing period, and endorsement of the proposed decisions by the health authorities.

Supplementary material

Supplementary material is available at *INTQHC Journal* online.

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Authors' contributions

Philippe Michel and Laurie Fraticelli led the development of the method. Pierre Parneix was the expert referent for the tested QI. All authors participated in the QUID working group. Philippe Michel wrote the initial draft of the paper, to which all the authors contributed. Philippe Michel is the method guarantor. The QUID Workgroup comprised: Hugo Bertillot (researcher in sociology), Alain-Michel Ceretti (patient representative), Valentin Daucourt (epidemiologist), Julien Delonca (quality manager), Antoine Duclos (epidemiologist), Carlos El Khoury (emergency physician), Olivier Farges (surgeon), Isabelle Gasquet (epidemiologist), Jean-Patrick Lajonchere (hospital CEO), Emmanuel Luigi (hospital CEO), Philippe Michel (epidemiologist), Bertrand Millat (surgeon), Pierre Parneix (hygienist), Isabelle Ray-Coquard (oncologist), France Woimant (neurologist), Estelle Aragona (sociologist), Audrey Baron-Gutty (sociologist), Laurie Fraticelli (project manager).

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