

Performance indicators used to assess the quality of primary dental care

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An appropriate quality of medical care including dental care should be an objective of every government that aims to improve the oral health of its population. **Objectives:** To determine performance indicators that could be used to assess the quality of primary dental care at different levels of a health care system, the sources for data collection and finally, the dimensions of quality measured by these indicators. **Method:** An explorative study of the international literature was conducted using medical databases, journals and books, and official websites of organisations and associations. **Results:** This resulted in a set of 57 indicators, which were classified into the following dimensions for each intended user group: For patients: health outcomes and subjective indicators; for professionals: their performance and the rates of success, failure and complications; for health care system managers and policymakers: their resources, finances and health care utilisation. **Conclusion:** A set of 57 performance indicators were identified to assess the quality of primary dental care at the levels of patients, professionals and the health care system. These indicators could be used by managers and decision-makers at any level of the health care system according to the characteristics of the services.

Key words: dental care, dentistry, indicators, management, performance indicators, performance measures, quality.

Introduction

Because oral diseases are not generally a direct cause of death, their importance can be underestimated. They are nonetheless a public health problem due to their high morbidity rates and cost of services. Moreover, they influence general health and can cause local and aesthetic disturbances that affect quality of life.

Some common problems in the day-to-day practice of dental health care are incorrect diagnosis leading to incorrect treatment, poor quality of dental treatment, lack of communication between patients and health care providers, inaccessibility to services and underuse of preventive methods. Appropriately chosen performance indicators can assess these problems. At present, little is known about the quality of dental care, especially at the level of the health care system.

Quality of dental care focuses on all major components of providing and receiving dental services, including diagnosis and treatment planning, technical skills, patient communication and organisational aspects. (Poorterman *et al* 1998).

This paper aims to encourage policymakers, managers and supervisors to use performance indicators to manage the health care system in a way that will improve the quality of primary dental care, and also to encourage providers to improve the quality of their professional performance.

Our research questions were: (1) Which performance indicators are used to assess the quality of primary dental care at different levels of a health care system? (2) What are the sources for data collection? and (3) What

dimensions of quality of dental care can be identified using the indicators?

Method

A literature review was undertaken of performance indicators and quality issues in primary dental care. This explorative study takes a descriptive approach to the international literature.

The indicators were selected if they were mentioned explicitly in routinely collected administrative data or intentionally developed indicators for performance assessment purposes, or implicitly in studies about patterns and trends.

Search strategy: A review was carried out of the literature (journals, books and websites) on quality of care and performance indicators in dentistry. Each indicator that met the criteria was identified and selected once its use in relation to quality was determined. Then the indicator was included if it reflected the key aspects of quality care of appropriateness, accessibility, availability, equity, acceptability, efficiency, effectiveness and patient satisfaction (World Health Organization, 2000 and Klazinga, 1996), or if they were described in a structure, process and outcome framework. Measures suggesting potential use for assessing quality at an aggregated level were taken into account.

The indicators were grouped into dimensions, which means they measure the same aspect of care. As most of the indicators in the literature were implicit, this paper follows an inventory approach for allocating indicators

to each dimension and for constructing a framework. No ranking order was taken into account when determining how the measures were organised.

For allocating the indicators to the dimensions we followed the standard literature on performance indicators, including that of the European Community Health Indicators project (2000), the Joint Commission on Accreditation of Healthcare Organizations (1997) and the Agency for Healthcare Research and Quality (2003).

Most of our efforts were devoted to those measures used by those in managerial positions – in other words, those indicators used by managers, supervisors and policymakers to monitor or improve the performance of professionals, services, policies or the health care system (Øvretveit, 1998).

We also took into consideration the focus target in which the indicator plays the main role for management: patients, professionals and the health care system at any level (e.g. national, subnational (territorial, provincial and district) and local).

Results

In Figure 1, the indicators identified were grouped into the following dimensions:

- For patients: health outcomes, satisfaction and other subjective indicators;
- For professionals: their performance, and rates of success, failures and complications;
- For health care systems: human and material resources, institutions, health care utilisation and finances.

Performance indicators are briefly described in Tables 1 through 5.

In this study the main sources of information for dental indicators found were patient records, health statistics, census and surveys. Regarding professional performance, three main methods for data collection in dentistry are described: treatment observation, assessment of treatment outcomes and evaluation of dental records. Regarding the evaluation of quality dental care, there is no substitute for clinical assessment.

Discussion

Groups of Performance Indicators and the relationship with quality

Oral Health Outcomes (Table 1)

Health outcomes measure changes in the health of individuals or populations that are attributable to care. They are measured in terms of mortality, morbidity, disability and functioning. Oral health status indicators are used in dentistry to determine the outcomes; they indicate quality only when we draw conclusions from reliable indicators evaluated before and after care. These indicators provide a major vehicle for monitoring the health of the population.

In a comprehensive framework, Bader and Ismail (1999) classified outcome measures as biological status, clinical status and psychosocial and economic costs.

Outcome measures have also been criticised with regard to quality assessment because health care is

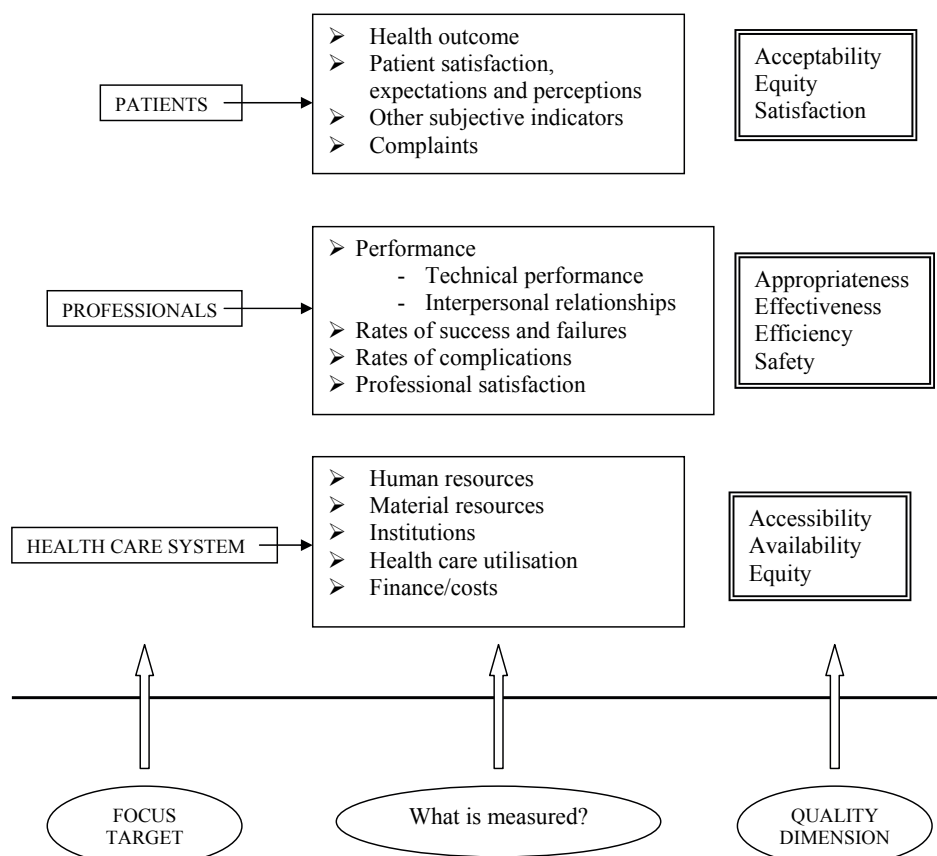


Figure 1. Framework for obtaining and evaluating information and reaching conclusions about quality from a managerial perspective.

Table 1. Oral Health Outcome indicators.

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1. DMF-T: Mean number of decayed, missing and filled teeth. (WHO, 1997)
 2. Oral Health Scoring Index (OHS): Assessment of patient comfort, patient aesthetics, patient functionality, periodontal assessment, wear-and-tear assessment, occlusion assessment, mucosa assessment and denture assessment. (Burke *et al.*, 2003)
 3. Population with no experience of caries: Number and percentage of children free of dental caries. (WHO, 1997; CDC and National Centre for Health Statistics, 2000)
 4. Untreated caries: Number and percentage of population with non-treated caries. (WHO, 1997; CDC and National Centre for Health Statistics, 2000)
 5. Population with all their permanent teeth: Number and percentage of population in a particular age group with all their permanent teeth. (WHO, 1997; CDC and National Centre for Health Statistics, 2000; New South Wales Health Department, 2000)
 6. Tooth loss: Average number of permanent teeth lost by age groups 18, 35-44 and 65-74. (WHO, 1997)
 7. Loss of all permanent teeth: Percentage of people age 65 and older who have lost all their natural permanent teeth. (WHO, 1997)
 8. Basic Periodontal Examination (BPE): Examination of sextants for bleeding, plaque retentive factors and pocket depth. (Referral policy and parameters of care, 2002)
 9. Artificial Denture Status: Denture status and needs classified into upper or lower denture and total, partial or fix. (WHO, 1997)
 10. Dental Aesthetic Index (DAI): Components: missing teeth; crowding in incisal segments; spacing in incisal segments diastema; anterior irregularity in maxilla; anterior irregularity in mandible; anterior maxillary overjet; anterior mandibular overjet; vertical anterior openbite; antero-posterior molar relation. (WHO, 1997)
 11. Oral Hygiene Indices: Sum of the average number of tooth surfaces scored for debris and calculus. (WHO Collaborative Centre, Faculty of Odontology, Malmö, Sweden, 2003)
 12. Screening for early detection of oral and pharyngeal cancer: Percentage of adults aged 40 years and above reported to have had an oral cancer examination within the past 12 months. (National Oral Surveillance System. CDC's Division of Oral Health and Association of States and Territorial Directors, 2001)
 13. Incidence rate of cancer: Annual incidence rate of cancer per 100,000 inhabitants.
Calculated by: $d/y \times 100\ 000$; d: number of new cancer cases, y: number of persons at risk. (WHO Collaborative Centre, Faculty of Odontology, Malmö, Sweden, 2003)
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Table 2. Patient satisfaction and other subjective indicators

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14. Presence of oral pain: Percentage of patients reporting toothaches in the previous 12 months. (Ireland *et al.*, 2001)
 15. Patient satisfaction with appearance and function : Percentage of patients reporting satisfaction with appearance and function. (Ireland *et al.*, 2001)
 16. Dental Satisfaction Index: Obtained through a survey, it includes dimensions of general satisfaction, cost, pain, quality, access, availability and continuity of care. (Brennan *et al.*, 2001)
 17. Dental Anxiety Scale (DAS): A four-item dental anxiety questionnaire with a total score ranging from 4 (not anxious at all) to 20 (extremely anxious). (Aartman *et al.*, 2000)
 18. Complaints: Number of complaints in a given period. (Donabedian, 1988)
 19. Premature termination of care: Number of patients that terminate membership in a health plan and/or seek care outside the plan. Donabedian, A. (1988)
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only one determinant of health and there are other factors that have important effects on health outcomes (Mant, 2001). Process measures may indicate that the care delivered reduced damage. Nevertheless, indicators measuring the stages and continuity of dental care are rarely reported.

Oral health indicators allow clinicians to improve quality in dental care by assessing the influence which any intervention they provide has on the health status of their patients (Ireland *et al* 2001). In addition, it is

possible for practitioners to compare the success of their interventions with those of their colleagues, thus fostering evidence-based dental care (Brennan, 2001).

Patient satisfaction and other subjective indicators (Table 2)

Bader and Ismail (1999) affirmed that patient satisfaction is considered an indicator of the outcome of care, although some studies suggest this may have more to do with patients' interpersonal relationships with dentists.

Patients' perceptions of oral health status may be

measured by the presence of pain. This is an important indicator for treatment, and the resolution of pain is an outcome indicator of effective care. Patient satisfaction with appearance and function is an effective indicator because professional measurements of disease are not the only measurements of oral health that should be considered. The perceived oral health status indicator reflects the association with predisposing characteristics, dental care utilisation and the actual clinical status of the patient. Overall perception of oral health allows for a closer appreciation of behaviours and oral-health-related quality of life (Ireland *et al.*, 2001).

Patient satisfaction with the health care system is considered to be a desired product of health care in relation to the quality delivered. It makes it possible to understand patient behaviour and to evaluate dental providers, services and facilities (Brennan, 2001). A review of patient satisfaction literature (Newsome and Wright, 1999) showed that these studies dealt with a generic list of five issues that affect patient satisfaction with regard to dental care: technical competence, interpersonal factors, convenience, cost and facilities.

Professional Performance (Table 3)

Indicators of professional performance assess how well health care providers deliver that care.

The technical performance of the dentist and the interpersonal relationship he or she establishes with patients are two important components for measuring professional performance. Technical performance is based on the dentist's knowledge and comprises treatment skills and the management of pain and disease. Dentist-patient interaction is strongly influenced by the doctor's attitudes and character. It involves the dentist's ability to obtain information that will lead to a diagnosis, and to inform the patient of his or her health condition and treatment options.

Performance in clinical practice is assessed by selecting a topic and developing the indicator. (Bailit, 1980). For example the assessment of restorative care using the ARC Index. This instrument measures the quality of restorative dental care, conceptualised as the diagnosis of caries and the assessment of restoration in the molar and pre-molar regions (Poorterman, 1993).

Another way to assess a dentist's performance is to determine the rates of success, failure and complications. These measurements can be collected prospectively, currently or retrospectively from dental records or surveys. They imply the performance of the service: for example, a high rate of alveolitis/extraction could be related to incorrect procedures during the extraction of the teeth, but it could also be the consequence of a lack

Table 3. Professional Performance Indicators.

20. Fillings needing to be replaced: Percentage of fillings requiring replacement before the statistically average life span has been reached. (Harr, 2001)
21. Extraction and filling rates: Number of extractions divided by the number of fillings. (Cuban Ministry of Public Health, Bureau of Dentistry, 2002)
22. Alveolitis and extraction rate: Number of patients complicated by alveolitis after extraction divided by the number of extractions. (Cuban Ministry of Public Health, Bureau of Dentistry, 2002)
23. Rate of success of endodontics procedures: Successful endodontics procedures divided by the number of endodontics procedures. Clinical success was indicated by the absence of signs and symptoms. Radiographic success was determined by the following criteria: 1) no periapical lesion or lesion in progress present at the time of obturation; 2) periapical lesion present at time of obturation disappeared completely or was considerably reduced in size. (Coelho Travassos <i>et al.</i> , 2003)
24. Rate of success of apicectomy procedures: Successful apicectomy procedures divided by the number of apicectomies. Clinical, radiographic and histological observations are the criteria for evaluating success. (O'Keefe, 1998)
25. Success rate of implants: Success of implants divided by the number of implants. The resultant implant support does not preclude the placement of a planned functional and aesthetic prosthesis that is satisfactory to both patient and dentist. There is no pain, discomfort, altered sensation, or infection attributable to the implants. Individual unattached implants are immobile when tested clinically. The mean vertical bone loss is less than 0.2 mm annually following the first year of function. (Harr, 2001; O'Keefe, 1998)
26. Success rate of dentures: Success of the denture divided by the number of dentures. Success means they are functional (stable and retentive), comfortable and aesthetically acceptable. (Harr, 2001)
27. Success rate of periodontal treatment: Patients who had successful periodontal treatments divided by the number of patients treated for periodontal disease. Criteria for success include ease of maintenance, absence of inflammation (no bleeding on probing), shallow probing depths, absence of subjective symptoms, and overall plaque control. Patient feedback for aesthetics (recession, gingival colour and interproximal spacing) and comfort (positive patient feedback and decreased tenderness, mobility and sensitivity post treatment). (Levine and Shanaman, 1995)
28. Rate of complications after wisdom tooth surgery: Complications after wisdom tooth surgery divided by the number of wisdom tooth operations. (Gorter <i>et al.</i> , 1999)
29. Dentists' Experienced Work Stress Scale (DEWSS): Stress factors faced by dentists: measurements of work pressure, financial aspects, patient contacts, work content, career perspectives, team aspects and professional and personal life. (Gorter <i>et al.</i> , 1999)

Table 4. The system's resources for dentistry and financial issues.

<i>Group of Indicators</i>	<i>Performance Indicators</i>
Workforce distribution (WHO Collaborative Centre, Faculty of Odontology Malmö, Sweden, 2003; Areas Resource File (ARF), USA, 2001)	<i>Total number per 10,000 inhabitants:</i>
	30 Active dentists
	31 Qualified dentists
	32 Specialists
	33 Dental chairside assistants/Dental nurses ^I
	34 Dental therapists ^{II}
	35 Hygienists
	36 Laboratory technicians
	37 Number of dentists and type of employment: working in public services/private practice/mix/universities/other
Resources for education (WHO Collaborative Centre, Faculty of Odontology, Malmö, Sweden, 2003; Zillén and Mindak, 2000; Brennan <i>et al.</i> , 1998)	<i>Number of schools for:</i>
	38 Dentistry
	39 Dental chairside assistants/Dental nurses
	40 Hygienists
	41 Therapists
	42 Laboratory technicians
Facilities	43 Number of dental services per country or region distributed per type of service delivered (WHO Collaborative Centre, Faculty of Odontology, Malmö, Sweden, 2003).
	44 Accessibility to dental offices: measurement in terms of patients' ability to get quick access to the clinic, the dentist and to dental care (Goedhart <i>et al.</i> , 1996).
Financial contribution	45 Number of people covered by dental insurance, private insurance, social insurance and direct payments. Percentage delivered by public services and private practices (ECHI project, RIVM, 2000).
	46 Cost: measured by direct and indirect costs (Bader and Ismail, 1999).

^ITheir function is to provide chairside assistance to the dentist.

^{II}Their function is to provide patients with routine dental care. They can refer patients to the dentist for more specialised dental treatment.

Table 5. Indicators of health care utilisation.

47. Treatment per visit: Number of dental treatments per visit. (Brennan <i>et al.</i> , 1998)
48. Type of service delivered: Number of people receiving the following kinds of services: restorative, diagnostic, prevention, tooth extraction, prosthodontics, periodontal treatment, orthodontics and surgery. (National Oral Surveillance System. CDC's Division of Oral Health and Association of States and Territorial Directors, 2001; New South Wales Health Department, 2000; Brennan <i>et al.</i> , 1998)
49. Annual patient visits: Number of annual patient visits. (National Oral Surveillance System. CDC's Division of Oral Health and Association of States and Territorial Directors, 2001; Brennan <i>et al.</i> , 1998)
50. Routine dental visits: Percentage of people who visit the dentist at least once a year for a general check-up. (National Oral Surveillance System. CDC's Division of Oral Health and Association of States and Territorial Directors, 2001; New South Wales Health Department, 2000; Brennan <i>et al.</i> , 1998)
51. Teeth cleaning: Percentage of people who have their teeth cleaned at least once a year. (National Oral Surveillance System. CDC's Division of Oral Health and Association of States and Territorial Directors, 2001; Brennan <i>et al.</i> , 1998)
52. Waiting list for oral surgery: Total number of patients on the waiting list. (Department of Health, United Kingdom, 2002)
53. Patients referred for treatment: Number of patients referred for treatment. (Department of Health, United Kingdom, 2002)
54. Population receiving fluoride: Percentage of population receiving fluoride from either natural or artificial sources. (WHO Collaborative Centre, Faculty of Odontology, Malmö, Sweden, 2003)
55. Patients receiving oral health education: Number of patients receiving dental health education. (Department of Health, United Kingdom, 2002)
56. Prevention programmes and campaigns: Number of programmes and campaigns for prevention, and for the promotion of oral health (e.g. activities for curbing tobacco use). (WHO Collaborative Centre, Faculty of Odontology, Malmö, Sweden, 2003)
57. Placement of sealant: Percentage of children receiving protective sealant on the occlusal surface of a permanent molar. (CDC and National Centre for Health Statistics, 2000)

of hygiene in the dental office. Harr (2001) pointed out that the values of these rates cannot be used to compare different dental offices.

Despite the fact that rates of failure and success are an efficient way of assessing professional performance, they are still underused. These rates are seldom mentioned in research on the quality of dental care. Because of this, what constitutes a reasonable threshold for dental care has not been established. These rates vary across services and countries, which suggests that failure rates could be associated with deficiencies in the quality of dental care.

Dental care consists mainly of restorative treatment to maintain existing teeth and to avoid oral pain and discomfort. Several studies have demonstrated that a major component of a dentist's work is the re-restoration of previously restored teeth (Jokstad *et al.*, 2001). This is why the quality of the treatment is monitored according to the material used and for each region of the mouth. Successful rates of endodontics procedures, apicectomy and implants are the outcome measures of safe and effective dental care.

We can arrive at an indicator for each dental procedure simply by comparing its durability with the average life expectancy. For example, the average life expectancy of composite resins ranges from 6.5 years to 8.5 years (NHS Centre for Review and Dissemination, 1999).

The system's resources for dentistry and financial issues (Table 4)

Distribution of the workforce is an important tool management can use for dealing with human resources planning and training.

Insurance coverage information indicates the degree to which governments assume responsibility for achieving universal access and equity.

High-quality essential care in dentistry is also defined by cost-based criteria. Economic outcomes include both direct and indirect costs, and the use of these indicators depends on the perspective of patients and providers (Bader and Ismail, 1999; Goedhart *et al.*, 1996).

Health Care Utilisation (Table 5)

These indicators are those most commonly used by policymakers, especially those appearing in the list of activities mentioned under the subheading 'Type of Service Delivered' (which indicates the level of everyday activities performed by providers, services and dental care systems). These indicators allow decision-makers and managers to monitor utilisation patterns and access to dental care.

Information about prevention indicators suggests how well a dentist or a health care system is performing. The quantity and quality of these activities indicate the level of concern shown by the health care system, services and providers for improving or maintaining the population's oral health.

Performance indicators for management at different levels of the health care system

A range of indicators has been identified that assesses quality of care either directly or indirectly. All of them

can contribute to the management function at any level of a health care system. The degree of applicability of these indicators varies among countries because this depends on the structure of the dental services in the health care system, its financing and the authorities that are interested in measuring the quality of dental care.

For applying a quality programme it is assumed that the health care organisation has a mechanism for implementing policy. Thus, a set of measures should be designed for local use within the context of planning, monitoring and evaluating a comprehensive health care system. At the service level, these measures are useful tools for self-evaluation and performance improvement.

For the selection of the indicator, managers should bear in mind the possibility of sharing aggregated information to facilitate comparison among similar quality programmes.

Sources for data collection at different levels

Health care utilisation indicators can be monitored more systematically by using routine data collected through information systems, dental records or surveys. In the case of quality problems, more in-depth research can be done to detect malpractice by using clinical indexes, for example, on the quality of restorative treatment or root canal treatment. In such cases, the high cost of assessing quality by direct clinical examination is justified.

To monitor the performance of dental care, the information systems should be used efficiently. This means requiring information to be reported and determining its frequency, who will receive it and who will be accountable for analysis and decision-making.

Dimensions for measuring the quality of dental care

In dentistry, Donabedian's dimensions of structure, process and outcomes are the main way to evaluate quality. In this case, a framework suggested in Figure 1 was created to match the focus target of the evaluation with the quality dimensions.

The framework starts with the focus target of a dental quality evaluation: the patient, the professionals and the health care system.

The first health outcome measure is the oral health status, because a health care system's ultimate goal is a healthy population. Subjective indicators and in particular patient satisfaction are proxies of quality delivered because these indicators reflect the interpersonal relationships between patients and the care provider, which is a noteworthy component of professional performance. The way in which patients and providers perceive the health care system are outcome indicators that show how the health care system is performing as a whole.

Professional performance indicates the process of good care. These measurements allow for the detection and monitoring of malpractice and thus, the establishment of policies. The rates of success, failure and complications indicate the appropriateness and safety of dental treatment. The effectiveness of dental treatment is part of quality assessment because it shows what the dental care has achieved.

Health care utilisation indicators are quantitative measures of the day-to-day activities of dental services. They are related to quality because they allow comparison at any level, and the identification of inappropriate or inefficient care. They also provide data elements for accessibility and rates of success, failure and complications, which suggest either good or poor performance.

The indicators, workforce and facilities and resources for education are parameters that determine the availability of and accessibility to dental care. This relationship to quality can be explained by the system's ability to generate resources and allocate and use them appropriately (effectiveness) and at a minimum cost (efficiency). Therefore, efficiency, effectiveness and equity should be reflected by the delivery of good-quality care. These parameters are influenced by how the health care system is financed and the economic situation.

The set of indicators produced by this research is by no means complete, because much of the information used in the decision-making process has not been published and it was not possible to access all the available information. To arrive at a comprehensive set of clinical indicators for assessing clinical performance, an in-depth systematic review is needed. Research on the quality of dental care should focus on evaluating the properties of indicators, including validity, reliability, precision and risk adjustment among others.

Conclusion

In this paper, we listed the performance indicators used to assess the quality of primary dental care at different levels (patients, professionals and the health care system), their usefulness and relevance from a managerial perspective, the sources for data collection and finally, the dimensions used to evaluate the quality of dental care.

We consider it essential to increase the awareness of policymakers at different levels of the health care system on the importance of oral health so they can provide their support for quality improvement in dental care services. In addition, comprehensive analysis of the indicators obtained from different sources of information can be combined in a balanced way to increase the efficient use of information for decision-making with regard to quality improvement.

This set of performance indicators can benefit by including measurements on emergency room activities, continuity and safety of dental care.

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