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Review Article

A Systematic Review on Clinical Indicators, Their Types and Codification Processes

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Abstract

Purpose: Valid and reliable clinical indicators are regarded as the most important necessities to promote and measure clinical services. Therefore, the present study aims at systematic summarizing and reviewing clinical indicators, their types and codification processes.

Methods: This systematic review study was conducted using keywords of “indicator” and “clinical” and their Persian equivalent from Medline, Google scholar, SID, PubMed, and Science Direct databases, Yahoo and Google motor searches, authentic journals, the related websites, and other references at the time interval of 1975-2012. After subject evaluation, abstract and full texts of the studies were found and the studies with weak relation with objectives of the study were eliminated. The selected studies were carefully considered and their results were extracted using Extraction Table.

Results: In this study, 2094 articles were found and 30 articles were finally studied. Exact evaluation of the articles resulted in 512 clinical indicators approximately covering all clinical fields. The selected indicators were classified in 6 categories, 19 types, and 10 methods and their selection and codification were divided into three general stages of data collection, indicators selection, and being assured of the indicators reliability.

Conclusion: To evaluate clinical governance performance in hospitals with clinical efficiency as one of its main elements, valid clinical indicators are required to measure and promote clinical services' quality. Summarizing valid indicators of studies conducted all over the world, the present study can be used to codify appropriate clinical indicators.

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Introduction

Nowadays, measuring health-therapeutic services function is one of the functional elements for quality promotion and is regarded as one of the ever-increasing expectancies of organizations offering health-therapeutic services [1- 3]. In this regard, clinical indicators have been codified from several medical aspects and used to promote standards of health services [4- 7]. Clinical indicators are systems measuring clinical activities in medicine and other medicine-related areas [8]. The indicators usually demonstrate small amounts of measurements and may serve as a standard and guideline for promotion of services' quality offered to the patients as well as

protective services [9]. Within recent years, codification, development, and report of clinical indicators have been accepted as a method to promote services' quality and widely enhance accountability in most countries [10, 11]. Indicators of Australia Health and Therapeutic Cares Standards Consultation Association are of the most important experiences of development and application of clinical indicators codified in 1993 to validate Australia hospitals. It was used to collect and codify 185 indicators from more than 500 health centers and hospitals [12, 13]. In 2000, national project was started to codify clinical indicators for six diseases in Denmark [14]. Aimed at improving health-care services quality, India took actions to codify clinical indicators for its second class cares, finally

resulted in codification of 21 indicators [15]. Clinical indicators have been widely used in health and therapeutic systems of most developed countries including America, England, Netherland, Taiwan, and other EU countries [16- 18]. Introducing clinical governance in England and its development and execution in other countries, the subject of clinical indicators have been widely attracted attentions to evaluate clinical governance function [19]. In this regard, each country has tried to design and use indicators corresponding with its own conditions. Evidently, use of indicators and experiences of other countries will be helpful in meeting this goal. Therefore, summarization of the published indicators may be really helpful in this regard. Thus, the present study aims at summarizing published clinical indicators, their types and codification processes to be used in codification of local indicators of every country.

Methods

This systematic review study was conducted using keywords of "indicator" and "clinical" and their Persian equivalent from Medline, Google scholar, Pub Med, Science Direct and SID databases (Table 1), Yahoo and Google motor searches (Table 2), and the related websites (Table 3) in time period of 1985 to 2012 both in English and Persian languages. While searching the databases, implemented search strategies resulted in exclusion of more than 1000 cases. According to database searches, 2094 articles gathered. After collecting of materials and articles, they were initially arranged based on publication date. Then, subjects of articles and reports were evaluated and those with weak relation with objectives of this study were excluded. During the next stage, abstract and full texts of the remaining articles were studied. Inclusion criteria were: Referring to clinical indicators, type of indicators, codification

processes of indicators and articles published in Persian and English. The exclusion criteria were: studies presented in seminars and conferences, studies that validate a clinical indicator, and letter to editor. After choosing the articles and reports, their references were studied and the qualified cases were selected. To completely cover the subject, finally, journals and other related references were manually searched. After exact evaluation of subjects, abstracts, and full texts of the organizational reports and articles, 2064 articles were excluded from the study and the study was finally conducted on 30 articles (Diagram 1). The required data was manually analyzed considering types and codification process of the indicators. Endnote X5 software was used for organizing, title and abstract reviewing, and also identifying duplicated studies.

Table 2. Search Engines.

row	Key words	engine	year
1	"clinical indicator**"	Google	1990-2012
2	"clinical indicator**"	yahoo	1990-2012

Table 3. Website search.

row	website	country
1	Australian Council on Healthcare Standards (ACHS)	Australia
2	Australian Commission on Safety and Quality in Health Care (ACSQHC)	Australia
3	Agency for Healthcare Quality and Research Quality (AHQR)	US
4	Canadian Institute for Health Information	Canada
5	Organization for Economic Co-operation and Development (OECD)	Europa

Table 1. Databases search.

row	Key words	databases	field	Year	limits	results	Accept or Not Accept
1	clinical AND indicator*	Science Direct	title	1975- Present	-	221	A
2	"clinical Indicator**"	Science Direct	All field	1975- Present	-	5292	NA
3	clinical AND indicator*	Medline	title	1976-2012	H-E	574	A
4	"clinical Indicator**"	Medline	text	1975-2012	H-E	3689	NA
5	clinical AND indicator*	CINAHL	title	1975-2012	H-E	117	A
6	"clinical Indicator**"	CINAHL	All field	1975-2012	H-E	2704	NA
7	clinical AND indicator*	Google scholar	title	1975-2012	-	518	A
8	"clinical Indicator**"	Google scholar	text	1975-2012	-	7590	NA
9	clinical AND indicator*	PubMed	title	1975-2012	H- E	574	A
10	"clinical Indicator**"	PubMed	text	1975- 2012	H-E	55	A
11	clinical Indicator (in Persian)	SID	title	-	-	4	A

A= Accept NA= Not Accept H= limited to Human E= limited to English

Table 4. General process of selecting and codifying indicators.

Stage	Measures
Data collection	Literature review, collecting data from MIS, HIS systems, using questionnaires
Indicators selection	Holding experts' panel and using experts and specialists' comments, holding focused group discussions (FGD), interviewing with experts and specialists, using Delphi technique
Reliability and validity	Conducting pilot studies, using indicators and following them up, and collecting their application results

Results

After analyzing the found studies and excluding the studies which had weak relationship with the study objectives, 30 articles were finally entered to the study. Characteristics of the reviewed articles are brought in [Appendix 1](#). Results of 30 articles were 512 indicators, approximately 17 indicators per study. The results and characteristics of studies have been presented in [Appendix 1](#) (In this appendix due to very high volume of results only examples of indicators mentioned in the study have been presented). The highest rate of studies belonged to Australia, America, Denmark, New Zealand, Brazil, and Canada. There were also some studies from Asian countries including Hong Kong and India. The evaluated studies were conducted from 1997 to 2011 and the highest rate of studies was seen during 2003-2006. Data were collected and the indicators were selected mainly using Delphi technique, focused group discussion (FGD), interview, literature review, organizational data and hospital systems. In this study, there are indicators from almost all hospital wards and clinical practices. However, the most indicators belonged to cancers, cardiovascular disease, aesthetic and recovery, mental health, and general medicine. Evaluating selection and codification process of clinical indicators of the conducted studies led to specific process to be determined for selection and codification of the indicators. The offered process and model of this study have been presented in [Table 4](#).

According to this Table, there is a three-stage process to codify indicators, i.e. collecting indicators, selecting appropriate indicators, and being assured of indicators validity. The common measures taken in this regard include reviewing the texts, using experts and specialists' comments by different methods and, finally, conducting pilot studies and following up the indicators.

Considering codification objectives and several other factors, indicators are classified in different types. The present study summarizes the classifications and provides a definition and example for every class in order to provide a better understanding ([Table 5](#)).

Discussion

The study resulted in 512 indicators and there were indicators from almost all clinical fields. General processes of the indicators selection and codification include collecting, selecting, and being assured of their validity and reliability. The indicators were classified into 6 categories and 19 types.

In study of Harshad Thakur and colleagues [15] to codify clinical indicators for second level cares in Indian health-therapeutic systems, four stages including identification and codification of indicators, pilot implementation and correction and improvement of indicators' problems, final selection of indicators, and final implementation and training of indicators have been conducted in hospitals and finally 15 indicators for urban hospitals and 6 indicators for rural hospitals were selected.

In Australia after decision of country's authorities to design and use clinical indicators during accreditation of hospitals in this country, a database in national level was designed and implemented to collect and identify validity, reliability and responsibility of these indicators and it was one of the reasons for success in use of clinical indicators in Australian hospitals in years after its implementation in a way that after only some years after implementation of this database, hospitals who were sending and monitoring their information about clinical indicators through this database showed significant growth [20]. So it seems that taking advantages of this experience of Australia could be so beneficial for countries that tend to design and use system of clinical indicators and it is very bold in countries with Middle and Low Income Country (MLIC) due to the weaknesses in their informational infrastructures.

In the study of Michel and colleagues [21] in Australia, 5 indicators of unexpected patient telephone calls, unplanned staff call-outs, unplanned return to hospital, medication administration errors, and patient refusal to consent to HIH care were provided to evaluate quality of hospital services for home care. According to the role and importance of home cares and increasing demand for these services in one hand and due to naïve role of home cares provided by hospitals in Iran and other countries with low and average income on the other hand, it seems that considering these indicators and trying to localize and improve indicators related and appropriate to home cares could have an effective role in developing and increasing the quality of home cares.

Table 5. Categorization of types of indicators.

Indicator	Definition	Types	Example
Rate-based/sentinel indicators	Rate-based indicators are used to measure events occurred for several times, weak functions and ratio calculation, rate and mean of activities for samples of patients	-Rate-based indicators - Sentinel indicators	- Disinfection of infectious ulcers - Mortality rate during surgery
Related to structure/process/outcome indicators	Indicators measuring inputs (human resources, equipments, space, etc.), processes (measures of physicians, laboratories, radiology, etc.), and outputs (effects and results of process)	-Structural indicators -Process indicators -Outcome indicators -End-result indicators	- Availability of special techniques (MRI, ...) -Ratio of diabetic patients with regular diet - HbA1c results for diabetic patients - Mortality rate & satisfaction rate of patients
Generic/disease-specific indicators	Indicators used to measure how cares are provided at general or specific conditions of a specific group	-Generic indicators -Disease-specific indicators	- Specialists to other physicians ratio, mortality rate of hospitalized patients - Number of cardiologists to other physicians caring patients with cardiac insufficiency at cardiac ward
Type of care indicators	Indicators measuring quality and safety of cares based on their type	-Preventive indicators -Chronic indicators -Acute indicators	-Appropriate children care, children weight should be measured at four time intervals - Children with positive sickle cells - Children with urinary tract diagnosis
Functional indicators	Indicators measuring quality and safety of health and therapeutic cares based on their function	-Treatment indicators -Diagnosis indicators -Follow-up indicators -Screening indicators	--
Modality indicators	--	-History taking indicators -Physical examination indicators -Laboratory/radiology study indicators -Provision of medications indicators	--

The present study classifies indicators selection and codification process to three stages of collecting indicators, selecting indicators, and being assured of the indicators validity and reliability. Each of these three stages includes different measures and practices. The classification varies in different studies with special similarities and differences. According to Patrice Lindsay and colleagues [22], the classification is of five stages which are almost similar to classification of the present study considering different measures for three stages of the study. There are same measures such as reviewing systematic texts, holding experts' panel, selecting indicators, and etc., for these two stages. The present study as well as the study conducted by Georgina Skews and colleagues [23] referred to holding focused group discussion, using Delphi technique, systematic review of texts, pilot studies, and completing the questionnaire as measures to select and codify the indicators. The study divides indicators selection and codification steps into three stages and 10 measures. Jan Mainz's study conducted at Aarhus University of Denmark introduced 2 stages of planning and codifying and six measures for the classification. According to Jan Mainz [14], clinical indicators were divided into 6 categories and 15 types. In comparison with the present study, there are only four different indicators. Additionally, the classifications are very similar considering their content. Contrary to Jan Mainz's study, the present study provides definitions for the indicators. In their study in Clinical Governance Research Center of New South Wales University of Australia in 2009, Travagila & Debono [24] classified the indicators and obtained similar results. They classified the

indicators in 13 groups and, similar to the present study, they provided a definition for each indicator. Contrary to this study, however, they did not offer any example for the indicators. Unavailability of some valid databases such as Embase and the related authentic journals is regarded as the main weak point of the present study.

Conclusion

Seven-pillar clinical governance model was initially designed and used in England. Clinical effectiveness is one of the main pillars of the model [25]. It seems necessary to evaluate clinical governance function of countries using indicators corresponding with their health system status as well as social, cultural, and economic conditions considering development of clinical governance application in different countries especially western Mediterranean ones. Evidently, all countries need indicators and experiences of successful countries to codify indicators corresponding with their own indicators. Therefore, it will be very helpful to access a reference to become familiar with experiences and indicators of other countries. It is of high importance in clinical effectiveness considering different conditions of diseases pattern, demographic properties, applied medical technologies, specialized fields and etc. Summarizing clinical indicators published by different studies, types of indicators, applications of clinical indicators, preparation and codification processes and stages for every indicator can be used to codify local indicators in any country.

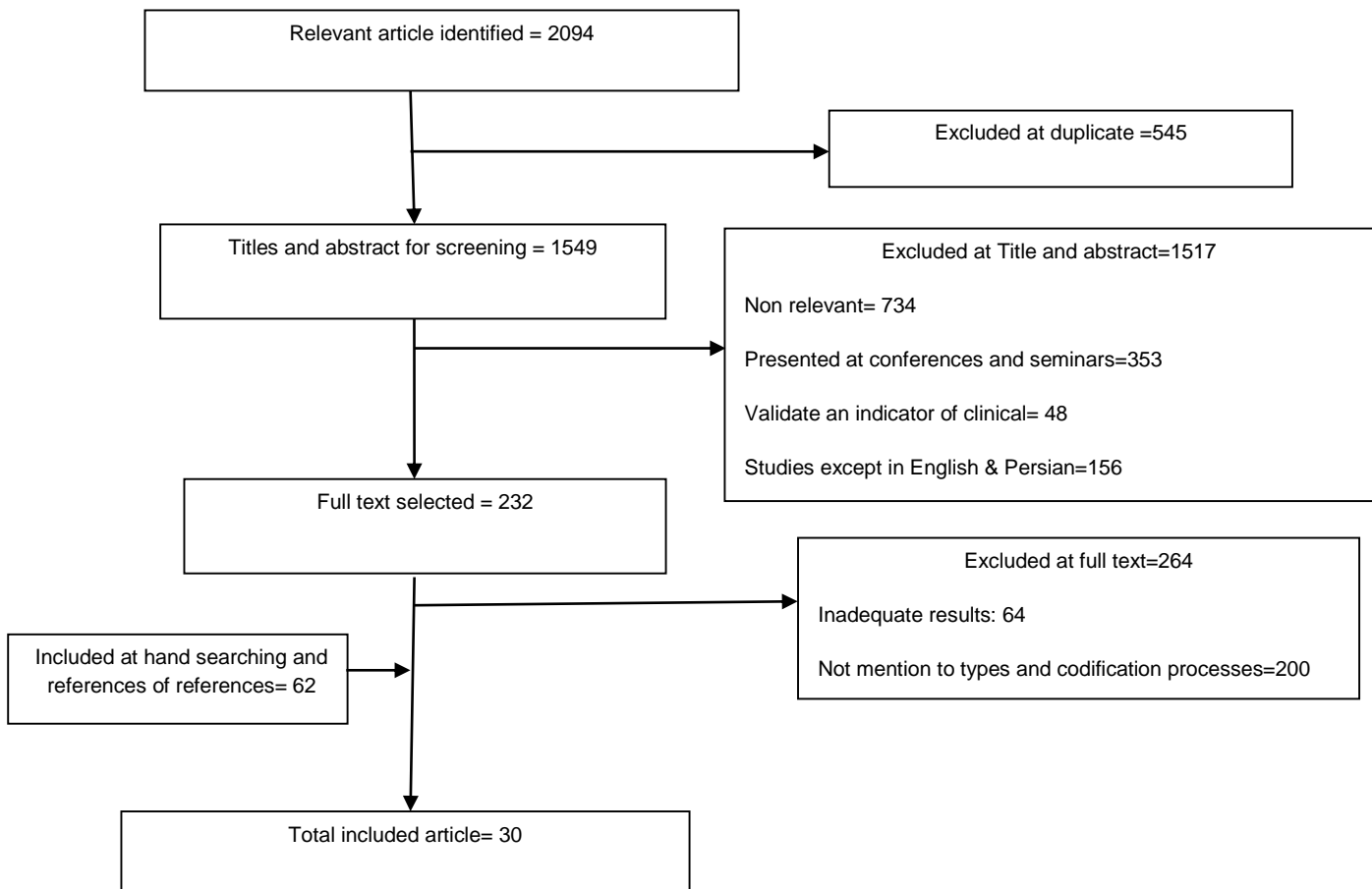


Diagram 1. Literature review and retrieval flow diagram.

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Appendix 1. Result of articles evaluation.

Row	Author-year- country	Category	NO	Example
1	Stephen:2000:uk [26]	general practice	12	Generic prescribing rate (%) - Potential generic savings as % of total drug expenditure - Antibiotic generic prescribing rate (%)
2	Neil J. MacKinnon, 2008: Canadian [27]	type 2 diabetes	21	Persistent hypoglycemic event - Nocturnal hypoglycemia- Hypoglycemic event to ED - Poor glycolic control(HbA1C > 7%)- Hypoglycemic or hyperglycemic event- Patient is suffering from erectile dysfunction
3	Patrice Lindsay:2002 [28]	Emergency Departments	30	Time from interred to ED to first documented intervention for an acute exacerbation- Unplanned return visit to an ED within 24 h of index visit for same/ related asthma exacerbation - Time from interred in the ED to first dose of antibiotics for admitted patients- Oxygenation assessment done during ED visit
4	Carvalho:2008: brazil [29]	child development	31	When the child cries, the mother knows what child wants- The mother talks to the child in a style especially targeted at mummy language- The child reacts to mother- The mother proposes something to the child and awaits for child reaction.
5	Alex:2001: Australia [30]	consultation–liaison	6	Timeliness of evaluation in the ED and for doctors C–L) - timeliness of evaluation in general C–L)-oral communication with the referrer.
6	Gary D:1979:US [31]	left main Coronary Artery Disease	1	patients with left main coronary artery and clinical finding/ patients with clinical finding
7	Paul:2011:US [32]	Immunization	1	Add-immunization was defined conservatively based on the year-specific guideline of the Committee on Immunization Practices before 18 months.
8	Stanley:2010: Australia [33]	early psychosis intervention	7	The early psychosis flagging indicator- The duration of untreated psychosis indicator- The drug abuse indicator- The self-suicide risk (SR) indicator- The global evaluation of relational functioning indicator- The program drop-out indicator
9	Brand: 2009: Australia [34]	General medicine.	14	If at risk, then prescribed LMWH within 24 h (Level I)- in condition admitted to GMU, then cognitive status is documented
10	Marielle: 2006: Netherland [35]	head and neck cancer	23	Number of patients who know who to talk to for information - Number of patients who were informed on all information items applicable to their situation – Number of patients who said they were offered emotional support - Number of patients who were informed about the possibilities to contact companions in distress
11	Anthony: 2004: Australia [36]	mental health	25	Tangatawhaiora are given a choice of whether they want their cultural issues addressed - The nurse has sought informed consent of tangatawhaiora - Consultation about treatment has taken place with whanau and/or significant others
12	Alex:2000: Australia [37]	consultation–liaison service	6	Recorded 'yes' if there was oral communication of management recommendations from a member of the service to the parent unit. Includes a recommendation for no further management - Recorded 'yes' if there was communication between a member of the service and the service continuing the patients care after involvement with the C–L service is complete. If the patient as an inpatient, then oral or written communication with the parent continued would be recorded as 'yes'. Includes a recommendation unit for no further management
13	Georgina Skews,2000: New South Wales [38]	mental health	14	No. non-English speaking background patient/client files with at least one reference to the nursing use of an interpreter in the 3 months of the survey period./Total number of NESB patient/client files surveyed, the number being a representative sample of files.- No. patient/client files with adequate nursing

14	Peskett: 1999: New Zealand [39]	recovery room	8	treatment (care) plans (may be integrated in patient care plan)/Total number of patient/client files surveyed, the number being a representative sample of files. - No. patient/client files with progress notes that do not reflect a timely, signed and dated nursing clinical review process.
15	Eugene sherry:1999: Australia [40]	Orthopedic Surgery	6	Intervention by anaesthetist to relieve respiratory distress – Any respiratory or cardiac arrest – Core temperature < 35°C- review by an anaesthetist to manage severe pain
16	Christine:1994 :US [41]	anesthesia	14	Postoperative pulmonary embolus- Unplanned hospital readmission- Prosthetic joint dislocation- Heel pressure
17	Wollersheim: 2007: Netherlands [42]	head or neck - diabetes mellitus - pneumonia	15	Death of patients during or within 48 hours following the administration of general anesthesia- Failure of patient to emerge from general anesthesia within 1 hour of termination of anesthesia - Patients diagnosed with central nervous system complications occurring during or within 1 day following the administration of general anesthesia
18	Jan mainz:2003: Denmark [26]	Stroke- lung cancer - Blood glucose control	5	Provision of information (12 items)- Swallowing and voice rehabilitation- Admission time (<24 hours) 24- Time to treatment (<30 days)- Annual foot inspection carried out- Exercise advice given - Smoking pattern discussed- Weighted annually- Achieved an HbA1c of <7% - Antibiotic recommended by guideline is prescribed- Sputum sample taken before start of antibiotic- Blood sample taken before start of antibiotic
19	Annabel hickey,2004. Australia [43]	cardiac care	27	Proportion of patients treated/rehabilitated in stroke units - Proportion of patients treated - Proportion of patients resected - Proportion of diabetics with HbA1c<7.0 mmol/l - 30-day and 3-, 6- and 12-month mortality(stroke)
20	Jan mainz:2004: Denmark [14]	stroke	8	ECG: proportion of patients receiving ECG within 10 minutes of hospital removal- proportion of highly eligible patients receiving thrombolysis - Time to lyses: proportion of highly eligible patients receiving thrombolytic within 60 and 30 minutes of hospital arrival - Cardiac counselling: proportion of highly eligible patients receiving in-hospital cardiac counselling-
21	Collopy, 2000: Australia [44]	surgery	6	Proportion of patients treated/rehabilitated in stroke units - Proportion of patients treated with platelet inhibitors - Proportion of patients treated with anticoagulants
22	Beatriz AmorimBeltrão, 2011Brazil : [44]	Breathing Pattern in Children	7	Bile duct injury in laparoscopic cholecystectomy - Mortality rate for abdominal aortic aneurysm - Post-tonsillectomy haemorrhage - Negative histology rate for appendectomy in children - Complete excision of skin tumours - Coronary artery graft surgery mortality
23	Michel ,1999: Australia [21]	Hospital in home care	5	depth of inspiration – respiratory rhythm-respiratory rate - impaired expiration
24	Lau,2001, Hong Kong [45]	Anaesthetic	6	Unexpected patient telephone calls- unplanned staff call-outs- unplanned return to hospital- medication administration errors- patient refusal to consent to HIH care
25	Brian; 2000, Australia [12]	Day procedure indicator	5	Elective surgery with a preoperative visit - Emergency surgery with a preoperative visit - Failure to be discharged from the recovery room due to clinical causes
26	Harshad, India, 2008 [15]	secondary health system	15	Failure of patient to arrive – Cancellation of procedure after arrival- Unplanned return to the operating room – unplanned overnight transfer- Delay in discharge from day patient unit
				Time interval between demand and supply of Blood - Call book response time - Perinatal mortality - Deaths in low birth weight babies - Perineal tears during delivery - Post caesarean section vaginal births

27	Joanne,1997, Australian [20]	Hospital Wide Medical Indicator	6	Pulmonary embolism - Unplanned readmission - Unplanned return to operating room - Clean wound infection - Contaminated wound infection - Hospital-acquired bacteraemia
28	david, 2003,US [46]	Patient safety	84	Total patient occurrences/1000 patient days (per quarter) - Total patient falls with injuries (per quarter) - Total reported medication errors/10 000 doses - Total reported medication errors with harm/10 000 doses - Evidence-based hospital referral volumes (LeapFrog) - Evidence-based hospital referral mortality: (LeapFrog) -Surgical infection rate (abdominal hysterectomy) - Surgical infection rate (inguinal hernia)
29	Jan mainz:2003: Denmark)[27]	quality improvement	19	Proportion of specialists to other doctors- Access to specific technologies (e.g. MRI scan)- Access of specific units (e.g. stroke units)- Clinical guidelines revised every 2nd year- Physiotherapists assigned to speciWc units- Proportion of patients with diabetes given regular foot care- Proportion of patients with myocardial infarction who received thrombolyses
30	Travaglia:2009- New South Wales [24]	All health care services	99	Unplanned admission before index admission - Unplanned readmission after - discharge from index admission - Hospital incurred patient injury - Adverse drug reaction Unplanned transfer from general care to intensive care - Unplanned transfer to another acute care hospital Unplanned return to the - operating theatre - adverse drug reactions