Providing a framework for assessment of the access to medicine

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Abstract

Objective Improving access to effective and safe medicines is one of the major goals of all health systems. To achieve this goal, assessment is a fundamental phase of national medicine programs for access improvement. Collecting and compiling applicable indicators and impart a comprehensive framework for assessing access to medicine, are the aims of this study.

Methods To investigate the published materials on access to medicines framework or indicators, a literature review with a systematic search was conducted using PubMed/ Medline, Scopus, and Google Scholar databases. The results were completed with a general search of documents in Iran Food and Drug Administration (IRFDA). Two independent researchers reviewed all the articles and documents. Thereafter the related indicators were extracted. In focused group discussion of academics and IRFDA experts, duplicate entries or ineffectual concepts were cleaned from the preliminary indicators. In the next step, Delphi questionnaire was sent to the 17 experts that work in academia, Social Security Insurance, IRFDA, Ministry of Health and Iran Pharmacist Association. The results of Delphi technique were finalized in an expert panel.

Results One hundred and thirty one indicators were found in systematic search. After primary extraction of related indicators, 77 indicators were sent to the 17 experts in a Delphi form. The results of Delphi were finalized in a specialized-working group and 67 indicators were accepted in 5 categories including physical availability and geographical accessibility (19 indicators), affordability (23 indicators), human resources (4 indicators), quality and safety (5 indicators), information and rational use (16 indicators).

Conclusion The indicators that inclusively assess the full access to medicine in the concept of rational use have been categorized into five categories in this study. To determine the access to medicine status in each country further local surveys are necessary for all several indicators in each category.

Keywords Health services accessibility · Access to medicine · Accessibility · Availability · Pharmaceutical services · Health status indicators · “Health care quality · Access · and Evaluation” · Affordability · “Costs and cost analysis” · Health policy · National medicine program · Pharmaceutical policy

Introduction

Access to essential medicines is an irrefutable part of access to health and can influence the welfare of society. According to the World Health Organization (WHO), accessibility has three major objectives, including, physical accessibility, economic accessibility or affordability and information accessibility [1]. Physical accessibility refers to the availability and geographical accessibility of medicine for who need them for rational use. Affordability refers to the ability of people to pay for medicines without financial hardship and information accessibility includes the right to request, receive and impart information [1–4]. Most health systems have a mission to provide access to a sufficient quantity of safe, effective and high-quality medicines at an affordable price for the whole population [5]. Different countries follow different strategies in their

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National Medicine Policy (NMP) to achieve this mission. There is a need for systematic monitoring of the impact of country policies and activities on access and use of medicines. So, it is extremely important to have a consistent framework and comprehensive indices for assessing medicine accessibility at country. The World Health Organization has developed an Operational package for monitoring and assessing the pharmaceutical situation in countries in 2001 for the first time and has updated it in 2007 [6]. Afterward, some countries tried to assess their pharmaceutical sector using WHO or their own indicators. However, to our knowledge, there is no comprehensive framework for assessing access to medicine with a system approach. The authors believe that a system approach and attention to system component, including: input, output and outcome are very effective in monitoring and assessing. Therefore, the purpose of this study was to gather, evaluate and validation of the available indicators from scientific and governmental literature to provide an evidence-based framework for evaluating access to medicine in a system component level. The information gathered in this article can serve to guide researchers as well as policymakers to evaluate national medicine policy in a context of a country.

Methods

All study procedures were approved by the Iran National Institute of Health Research' and National Institute for Medical Research Development' Specialized Research Council.

Systematic search of literatures

The following electronic databases including PubMed/Medline, Scopus, and Google Scholar were searched. Additionally, a comprehensive search of government documents was done. Exclusive keywords were used to search for resources associated in five dimensions of access, including physical availability and geographical accessibility, affordability, human resources, quality and safety, and information and rational use. The search was conducted systematically in order to avoid losing any indicator of worldwide studies in this article. Electronic bibliographic databases have been searched for articles from First of January 2000 up to 17th November 2016. The keywords used were: access, assessment, analysis, measure, indicator, index, drug, medicine, medication, pharmaceutical, rational use, use, information, quality, safety, financial, cost, expenditure, geographic access, availability. Studies that used the governmental perspective and covered all five dimensions of access in their method were included. The restriction for language was Persian and English. All the articles and documents were reviewed by two researchers in terms of title, then abstract and eventually

full text. Any occurred controversial decision has been conducted to consensus by a third researcher as a supervisor. Duplicated studies, studies that did not have full text or full text in English and Persian, as well as studies that not mentioned any indexes or used non-governmental perspective, were excluded. The main objective was to collect all possible indicators for assessing the access to medicine, which was suggested or used, by different countries. Hence, there was no need for quality assessment.

Indicators localization

In order to categorize and localize the indicators, a specialist-working group was established from the experts of Medical universities (Pharmacoeconomics and Pharmaceutical Administration Departments) and Iran Food and Drug Administration (IrFDA). Within 6 hours of teamwork, all the extracted indicators were reviewed and unnecessary or contradictory concepts were removed, modified or localized according to the country context.

Delphi procedure

A Delphi study has been run with all consideration for a comprehensive study [7]. Initially, 20 participants were invited to join the Delphi, which 17 of them have contributed to the study. Among them, one had not responded the questionnaire and thus response rate was 94.11%. The follow-up was carried out for someone who did not respond, but quitted Delphi. The experts comprised of specialists from the fields of health insurance, public health, rational use of medicine, pharmaceutical administration, and pharmacoeconomics with academic and executive backgrounds in the country's pharmaceutical system. The characteristic information of the invited experts to participate has been shown in Table 1. Experts were deliberately chosen from among those who had national and international experience in insurance, regulatory organization, the health ministry, or academics, and had experience of working on the

Table 1 Main characteristics of participants

Gender	M	6.50%
Mean Age		52
Education	PhD	100%
Employment	Academic with Executive experiences in IFDA	44%
	IFDA	18.8%
	Ministry of Health	12.5%
	Insurance	25%

M Male, *PhD* Doctor of philosophy, *IFDA* Iran food and drug administration

concepts of access to medicine and the health system. The geographic scope of the Delphi procedure was national. In the first unstructured round, a core group of authors drafted a set of revised indicators in the five dimensions of access to medicine and participated experts evaluated the indicators and recommendations via email or face-to-face interview. A questionnaire sent to experts, including elementary explanations for the study, cases to be considered and a table. Each indicator was specified in the table with the name and description in each row, and experts were asked to record their points. The face-to-face interview was conducted for 2 participants whom working with email was not convenient for them. The experts evaluated the importance of the indicators in dimension of a 10-point scale where 1 represented “lowest importance” and 10 represented “highest importance”. The median score equal or higher than 7 was considered as consensus threshold, where the median score between 5 and 7 was reviewed in the next round, and the median score equal or lower than 5 was eliminated. The Delphi was open for approximately 3 months and repeated two times to reach consensus. Despite the first round, the second run was directed at meeting. The decision was to change the form of Delphi due to problems that researchers had faced. The follow up by email and interview were time-consuming that might threaten the result of the study. The aim of the second run was to rescore first round median scores and reaching to a consensus.

Specialist-working group

With the purpose of systemic approach, several expert panels were conducted in the form of specialist working group. The panel was composed of academicians, monitoring and evaluation specialist, and IrFDA managers. Over three expert panels, the indicators were categorized into three fields of input, outputs, and outcomes. Then index, ancillary, a source of data, collection frequency and collection level were determined and confirmed by the experts.

Results

Primary indicator extraction and localization

A total of 9209 reports and articles were obtained from databases, WHO documents, and Food and Drug Administration of the Islamic Republic of Iran. Finally, a set of indicators of access to medicine was obtained. Figure 1 shows the summary of search results and Table 2 shows a total of primary 131 indicators in

different dimensions. According to the specialist-working group, 76 indicators remained that replaced in five dimensions, including physical availability, geographical accessibility, financing, human resources, quality and safety, and information and rational use.

Expert consensus on indicators determination

At the end of round one of the Delphi exercise, 38 items achieved consensus using the average value. It means that 37 items were accepted and 1 item was rejected (from information and rational use field) in the first round. The distribution of accepted items was 16 items in physical availability and geographical accessibility, 16 items in affordability, 1 item in human resource, 3 items in safety and quality and 1 item in information and rational use. Remained 38 items were advanced to round two. After receiving feedback, the panel achieved consensus on accepting 30 items. Overall, 67 items determined as access indicators by completion of Delphi exercise.

Indicators systemic categorization

According to the results of the specialist-working group, the determined indicators were categorized into three categories of input (6 indicators), output (24 indicators) and outcome (37 indicators). The Food and Drug Administration, the National Health Institute, the Iranian Medical Association and the Association of Iranian Pharmacists will have the largest share in the data collection of indicators. In addition, 39 indicators require specialized periodic surveys. Other characteristics specified for each indicator, such as the frequency of the collection and levels of collection are interpreted in Tables 2, 3, 4 and 5.

Discussion

To ensure a continuous access to medicine, good evaluation tools are crucial. This report is an effort to develop a comprehensive list of quantitative indicators for assessing all aspects of access to medicine –as a system- for the first time. This study suggests four dimensions of access, including 1- physical availability and geographical accessibility, 2- affordability, 3- human resources, 4- quality and safety, and 5- information and rational use. Another categorization is based on the system components. Where, facilities and human resources are assumed as inputs, developed criteria, regulations and access infrastructures are assumed as outputs and the effect on people accessibility are assumed as outcomes. Since the impact is the long-term effect of the

Fig. 1 PRISMA flowchart of access to medicine indicators systematic search

outcomes, it is so hard to measure particular in a health system that multiple variables –beyond the access to medicines– are involved. On the other hand, the impact is what the health system hopes their efforts will accomplish. It is the principal goal of a health system that will happen in the future and often is uncertain and immeasurable at this time. Therefore, assessing a system according to inputs, outputs and outcomes are more tangible and common in countries.

Countries all around the world have been carried out several surveys to appraise their pharmaceutical system that were included in systematic search as valuable experiences. Most studies employed standardized methodology developed by WHO [1, 10–12, 16, 20, 26, 31, 35, 36]. Also, none of them has presented system approach. Some countries have used some more important indicators to map their pharmaceutical situation [9, 13–15, 21, 25, 27, 32, 34]. Some surveys have adapted for assessing the accessibility in a special disease situation [15, 16, 20, 26]. Cummings et al. mentioned the racial and socioeconomic variables [14]. Lin and Taira focused on

elderly population [17, 29]. In contrary Wang et al. reported the accessibility to pediatric essential medicine [27]. In that report, authors confine to physical availability in selected facilities as an availability indicator and measuring the price of medicines and compare it with patient wage as an affordability indicator. Lee et al. examined the effect of some reimbursement methods on societal affordability [23]. According to our result, the payment for medicines and proximity to community pharmacies are more frequent variables for most of the countries [17–19], and weightiest indicators in Delphi rounds. This result is a reflection of the importance of geographical accessibility and affordability in providing access. It is confirmed that the most significant barrier to access to medicine is fiscal [22]. There are some non-monetary determinants, which influence affordability. These determinants include patient income, employee status, and insurance or social security coverage [25]. Generic substitution could lead to significant improvement in affordability. According to a cost minimization study, the cost saving of using generics instead

Table 2 Total access to medicine indicators extracted from literatures review

Dimension	Indicator	Source of indicator
Physical availability & geographical accessibility	Existence and year of last update of a published national list of essential medicines [3, 8]	Gray literature
	The availability of certain tracer drugs [9]	Systematic search
	Medicines not found in any outlets [8]	
	Medicines found in less than 25% of outlets [8]	Systematic search
	Medicines found in 25 to 50% of outlets [8]	
	Medicines found in 50 to 75% of outlets [8]	Systematic search
	Medicines found in over 75% of outlets [10]	
	Mean percentages of availability of selected medicines by condition of morbidity and version of medicine, according to sector [11, 12]	Systematic search
	Drugs included in the WHO Model List	Gray literature (governmental document)
	Availability of vaccines (EPI)	Gray literature (governmental document)
	Availability of vaccines (none EPI)	Gray literature (governmental document)
	Availability of key medicines in public health facility dispensaries, private drug outlets and warehouses supplying the public sector.(availability of essential medicines) [4]	Gray literature
	Essential medicines production as percentage of licenses held by manufacturers [13]	Systematic search
	Stock out duration at public health facility dispensaries and warehouses supplying the public sector [4]	Gray literature
	% of adequate record keeping at public health facility dispensaries and warehouses supplying the public sector [4]	Gray literature
	Number of medicines shortage in public hospitals	Gray literature (governmental document)
	Number of facilities [14]	Systematic search
	Proportion of each pharmaceutical cadre by facility type and sector [8]	Gray literature
	Travel time to access healthcare [15]	Systematic search
	Distance to access healthcare [15–19]	Systematic search
	% medicines obtained in the public sector [20]	Systematic search
	% medicines obtained in the private sector [20]	Systematic search
	Percentage of municipalities covered [21]	Systematic search
	Pharmacy Facilities Density (number of pharmacies affiliated with the subsidized medicines-essential medicines- per 100,000 inhabitants) [21]	Systematic search
	%All prescribed medicines are available in any pharmacy	Gray literature (governmental document)
	%Patient is forced to change his/her drug, but the alternative drug is available in any pharmacy	Gray literature (governmental document)
	%Patient has to go to a specific public pharmacy to obtain his/her medicine/s	Gray literature (governmental document)
	%The prescribed medicines are obtained with several visits to pharmacies	Gray literature (governmental document)
	%Patient has to trip to a bigger city to obtain his/her medicine/s	Gray literature (governmental document)
	%patient has to trip to a bigger city and to a specific public pharmacy to obtain his/her medicine/s	Gray literature (governmental document)
	%Patient must trip to the capital city to take his/her medicine/s	Gray literature (governmental document)
	%Patient has to take his/her medicine from black market	Gray literature (governmental document)
	%The prescribed medicine is not available at all	Gray literature (governmental document)
Financing	Total pharmaceutical out-of-pocket expenditure [22]	Systematic search
	Pharmaceutical out-of-pocket expenditure as % of total pharmaceutical expenditure (inpatients/-outpatients)	Gray literature (governmental document)
	Medicines' inflation rate	Gray literature (governmental document)
	% Obtained medicines for free [20]	Systematic search

Table 2 (continued)

Dimension	Indicator	Source of indicator
	per patient drug expenditure (monthly drug costs divided by the number of patients dispensed drugs, i.e. costs per patient) [23]	Systematic search
	unit prices (monthly drug costs divided by the number of units dispensed, i.e. costs per unit) [23]	Systematic search
	co-payment for medicines per patient	
	Average spent on medicines in the last 4 weeks [24]	Systematic search
	% of people have to refuse dispensation of medicines due to co-payment [24]	Systematic search
	Were there any medicines prescribed or recommended for you in the last 30 days that you were not able to find or buy? [25]	Systematic search
	Affordability was measured as the number of days' wages required for the lowest-paid unskilled government worker to purchase standard treatments for common conditions. [10, 26–28]	Systematic search
	Affordability (GDP per capita) [22]	Systematic search
	Dollars per generic, preferred or non-preferred equivalents (coverage) In questionnaire:	
	1.receiving free samples from the doctor [28]	Systematic search
	2.skip filling prescription because of high cost [28]	
	3.taking less medication than prescribed by doctor to save money [28]	
	4.being talked about the use of brand vs. generic drugs [29]	
	Real expenditure per capita [30]	Systematic search
	Effective co-payment rate (Cost-sharing expenditure divided by total expenditure) [30]	Systematic search
	Median MPR (median price ratio) of Innovator brand, most sold generic and low price generic drugs in Public Procurement Sector, Private Sector Retail Pharmacies, and Dispensing Doctors' Sector [31]	Systematic search
	During the past 12 months, was there any time you needed prescription medicines but didn't get them because you couldn't afford it [32]	Systematic search
	% Households whose monthly medicine expenditures represent at least >20% of total expenditures [3]	Systematic search
	Average household medicine expenditures as % of total expenditures [3]	Gray literature
	Average household medicine expenditures as % of non-food expenditures [3]	Gray literature
	Average household medicine expenditures as % of total health expenditures [3]	Gray literature
	Average annualized health expenditures per person [3]	Gray literature
	Average HH medicine expenditures for a reported illness as a % of total expenditures [3]	Gray literature
	% HH with at least partial insurance coverage for at least one medicine [3]	Gray literature
	% respondents who say that prescribed medicines were not taken "because HH cannot afford medicines" [3]	Gray literature
	% respondents who can get free medicines at public health care facility [3]	Gray literature
	% respondents who agree medicines are more expensive at private pharmacies [3]	Gray literature
	% respondents who say they can get credit from the private pharmacy [3]	Gray literature
	% respondents who can usually afford to buy medicines they need [3]	Gray literature
	% respondents who agree that better insurance coverage would increase their use of medicines [3]	Gray literature
	% respondents who have had to borrow money or sell things to pay for medicines [3]	Gray literature
	Measuring Price Components [28]	Gray literature
	Types of free medicines [33]	Gray literature
	Types of fees charged [33]	Gray literature
	Type of insurance coverage [33]	Gray literature
	Percentage of cost covered [33]	Gray literature
	Public medicines budget and per capita drug expenditures [33]	Gray literature
	Affordability of treatment for adults and children under 5 years of age at public health facility dispensaries and private drug outlets [4]	Gray literature
	Price variation of key medicines in public health facility dispensaries and private drug outlets [4]	Gray literature
	Average cost of medicines at public health facilities and private drug outlets (by patient) [4]	Gray literature
	Price of key medicines [4]	Gray literature
	Price of pediatric medicines [4]	Gray literature
	Pharmaceutical spending per person and growth rate [34]	Systematic search
	Percent of population reporting not filling a prescription or skipping a dose because of costs during the previous 12 months [34]	Systematic search
Human resources	Number of pharmacists (per 1000 pop) [35]	Systematic search
	Density of pharmacists and pharmaceutical technicians per region [35]	Systematic search
	Number of pharmacists employed in the public and private sector or NGO [35]	Systematic search
	Density of pharmaceutical human resources per 10,000 population by cadre [8]	Gray literature
	Density of each pharmaceutical cadre per 10,000 population by facility type [8]	Gray literature
	Proportion of the workforce by cadre [8]	Gray literature
Quality & safety	Proportion of facilities with non-pharmaceutical cadres providing pharmaceutical services [8]	Gray literature
	% of facilities that comply with the law (presence of a pharmacist) [4]	Gray literature
	% facilities with pharmacist, nurse, pharmacy aide/health assistant or untrained staff	
	Dispensing [4]	Gray literature
	% facilities with doctor, nurse, trained health worker/health aide prescribing [4]	Gray literature
	% facilities with prescriber trained in RDU [4]	Gray literature
	Number of Quality Control samples taken for testing annually	Gray literature (governmental document)
	Number of annual tested samples failed to meet quality standards	Gray literature (governmental document)
	% of SSFFC medicines per Total medicines	

Table 2 (continued)

Dimension	Indicator	Source of indicator
Information and rational use	medication error in prescribing and administration	Gray literature (governmental document)
	abuse of selected medicines (according to DID)	Gray literature (governmental document)
	Average number of medicine prescribed per patient encounter [1, 36, 37]	Gray literature (governmental document)
	Encounters with only one drug prescribed [36]	Gray literature & systematic search
	Encounters with five or more drugs prescribed [36]	Systematic search
	Percentage of medicines prescribed by generic name [1, 36–38]	Systematic search
	Percentage of medicines prescribed by generic name [1, 36–38]	Gray literature & systematic search
	Percentage of medicine prescribed from an EML or formulary [1, 37]	Gray literature & systematic search
	Percentage encounters with an antibiotic prescribed [1, 36–38]	Gray literature & systematic search
	Percentage encounters with an injection prescribed [1, 36–38]	Gray literature & systematic search
	Prescriptions contain corticosteroids medicine as % of total prescription	Gray literature (governmental document)
	Annual consumption of selected narcotic pain killers (mg/capita)	Gray literature (governmental document)
	% HH medicines taken for acute illness by category of providers who recommended or prescribed them [3]	Gray literature
	% HH medicines by source [3]	Gray literature
	% acute illnesses for which the class of medicines taken does not reasonably match recalled symptoms [3]	Gray literature
	% of acute illnesses treated with injections [3]	Gray literature
	% HH medicines with adequate label [3]	Gray literature
	% HH medicines with adequate primary packaging [3]	Gray literature
	% respondents who said prescribed medicines were not taken for a reason related to acceptability [3]	Gray literature
	% respondents who said prescribed medicines were not taken because of previous side effects [3]	Gray literature
	% HH classes of medicines kept for future use [3]	Gray literature
	% HH reporting a serious acute illness who did not seek care outside and did not take medicines [3]	Gray literature
	% HH reporting a serious acute illness who sought care outside but did not take all prescribed medicines [3]	Gray literature
	% HH with a chronically ill person who was never told to take medicines [3]	Gray literature
	% HH with a chronically ill person who does not take recommended medicines regularly [3]	Gray literature
	Drugs included in the WHO Model List [36]	Systematic search
	Drugs included in the National List of Essential Medicines [36]	Systematic search
	Drugs included in the local List of Essential Medicines [36]	Systematic search
	Drugs available in the same facility of the consultation [36]	Systematic search
	% of facilities that comply with the law (presence of a pharmacist) [4]	Gray literature
	Dispensing [4]	Gray literature
	% facilities with pharmacist, nurse, pharmacy aide/health assistant or untrained staff	Gray literature
	% facilities with doctor, nurse, trained health worker/health aide prescribing [4]	Gray literature
	% facilities with prescriber trained in RDU [4]	Gray literature

of originator brands in low and middle-income countries is estimated about 8 to 89% [39]. Mass generic production of new anticancer medicines can reduce treatment costs by up to 30 times [40]. The advantage of generic prescribing is making patient enable to select between available substitutes and not to be limited to the brand medicines. To enhance substitution without concerns, the quality assessment of generics is essential. Results of generic formulations assessment showed it is required to improve the registration process for generic products based on international

standards of Common Technical Documents (CTDs) in Pakistan. [41] In Nigeria, physician's greatest concern over the prescription of generic medicines has been reported the worry of failure in treatment because of quality [42]. Sufficient regulations to assuring generic medicine quality are crucial to protecting society from potentially unsafe effects or inefficient medicines that might lead to a waste of resources. Availability of qualified pharmaceutical human resources is effective on public education and health [43]. Globally, there is critical human resource

Table 3 Input indicators of access to medicine

Main index	Sub-index	Collecting Frequency	Collecting Level	Source of Data
Physical availability and geographical accessibility	Number of centers providing medicine	Annually	Provincial / National	IrFDA
	Number of urban pharmacies per every 100,000 population	Annually	Provincial / National	IrFDA
	Number of 24 h urban pharmacies per every 100,000 population	Annually	Provincial / National	IrFDA
Human resources	Number of pharmacists per every 1000 population	Annually	Provincial / National	Iran Medical Council / Iran Pharmacists Association
	Concentration of pharmacists and Pharmaceutical technicians per district	Annually	Provincial	Iran Medical Council / Iran Pharmacists Association
	Concentration of Pharmaceutical human resources based on sort of work group per every 10,000 population	Annually	Provincial / National	Iran Medical Council / Iran Pharmacists Association

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deficiency for health, most of which are inefficient. However, it is more serious in developing countries. Sometimes the main problem is the distribution of health workers, in particular, specialist health workers that could have a significant impact on quality, safety, information and rational use of medicine. Although WHO has emphasized on quality of medicines superior to other dimensions of accessibility [44, 45] it was neglected in previous studies. This study attempts to accumulate quality and safety indicators in all aspects of pharmaceutical products and services. WHO defined the rational use of medicine as “*Patients receive medications appropriate to their clinical needs, in doses that meet their own individual requirements, for an adequate period of time, and at the lowest cost to them and their community*” [46]. Nonetheless, the size of prescribing medicines, antibiotics, injections and corticosteroids are current indicators for assessing the rational use of medicines in most of the countries [1, 36–38]. Generally, the use of antibiotics and injectable formulations is high in many developing countries. Nowadays, microbial resistance is a global challenge. Selling antibiotics in the form of over the counter (OTC) is illegal, but in developing countries, most patients buy antibiotics in pharmacies without any prescription [47–49]. Even if there are strict laws to prevent this from happening and the pharmacy does not dispense the medication, the patient will go to another pharmacy and take the requested medication. The results of a systematic review showed the supply of antibiotics without prescription following a patient request, was 78% [49].

One of the major concerns about the irrational use of misplaced and unsafe injections is associated with the potential risk of transmission of hepatitis B and C, HIV/AIDS and other life-threatening problems [50].

According to systematic search results in this study, the number of medicines included in the National List of Essential Medicines is one of the selected indicators for assessing rational use of medicines. On the contrary, in some studies, it has been shown that the availability of a larger list of formulary does not always reflect a better quality of care. In the review of essential medicines in Stockholm for over 15 years, it has been shown that the number of items in the list has remained roughly constant during these years [51]. However, contrary to the assumption, prescribers’ adherence in the core list has increased from 75% to 84% [51]. The Stockholm model for the wise use of medicine has been introduced as a multidimensional approach to improving the quality of rational use of medicine in primary care and in the hospital [52]. This approach recommends that to improve the trust of physicians to the wise-list (essential medicine list) and increased adherence, use the comprehensive communication strategy and recommendations that have also electronic access, continuous medical education and involvement of professional networks and patients may be helpful [53].

The association between the number of medicines prescribed for patients and the quality of care is a major concern in countries with both high rates of infectious diseases such as HIV and non-communicable diseases such as diabetes and hypertension [54, 55]. However, the question raised is whether the size of prescribing selected medicines could reflect the rationality of prescription. Recent research in Namibia has shown that WHO/INRUD indicators have poor accuracy in assessing prescribing practices and using national guidelines better reflects the quality of care [56]. The availability of the guidelines is an important factor that influences the use of them

Table 4 Output indicators of access to medicine

Main index	Sub-index	Collecting Frequency	Collecting Level	Source of Data
Physical availability and geographical accessibility	Availability of national essential medicine list for the country and its last revised date	Annually	National	IrFDA
	Percentage of rarely medicine that are available in the formal list of the country	Annually	National	IrFDA
	Average time spent travelling to the daily and 24 h pharmacy	every 3 years	Provincial / National	Survey
	Median distance from daily and 24 h pharmacy	every 3 years	Provincial / National	Survey
Financial access	Median/average price of essential medicines	Annually	National	IrFDA
	Median/average price of medicines for pediatric diseases	Annually	National	Survey
	Percentage of free medicines available for patients	Annually	National	IrFDA
	Providing information for patients on benefit and side effects of using Brand and Generic medicines when they buying them	every 3 years	Provincial / National	Survey
	Relative median from the brand price, the best-selling generic medicine and popular generic medicines in pharmacies	Annually	National	IrFDA
	Median/average expenditure of patients for essential medicines	Annually	National	Survey
	Median/average expenditure of patients for pediatric medicines	Annually	National	Survey
	Number of workday wages of a general laborer to pay for medicine in normal circumstances (a normal illness)	Annually	National	Survey
Human resource	Percentage of pharmacies that work under the supervision of a pharmacist	every 3 years	Provincial / National	Survey
Safety and quality	Percentage of SSFFC medicines from the total medicine	Annually	Provincial / National	IrFDA
	Number of expired medicines available on the shelves of pharmacies	every 3 years	Provincial / National	Survey
Information and rational use	Percentage of health centers that have been trained to prescribe medicine rationally	Annually	Provincial / National	IrFDA
	Percentage of available medicines in the pharmacy that contain written instruction in the box	every 3 years	National	Survey
	Percentage of people who have not used the prescribed medicines due to not being admitted	every 3 years	National	Survey
	Percentage of people who have not used the prescribed medicines due to previous side effects	every 3 years	National	Survey
	Percentage of families that keep non-OTC or expired medicines at home for future use	every 3 years	National	Survey
	Percentage of people who have chronic disease but do not regularly use prescribed medicine	every 3 years	National	Survey
Outcome indicators per medicine	Percentage of medicine in a household that do not have appropriate label	every 3 years	National	Survey
	Percentage of medicine in a household that have appropriate initial boxing	every 3 years	National	Survey
	Percentage of medicine that contain instruction from entire medicines given to a patient	every 3 years	National	Survey

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and also enhances adherence and performance of practitioners [57]. In this study, according to the collected indicators, it has been shown that the WHO guidelines for financial and geographic accessibility, as well as human resources, are not complete without systematic searches [8, 24, 28, 30, 33].

Specialist working groups in this study tried to extend the indicators to cover prescribing medication errors. Even so, the authors believe that further studies are necessary to improve the rational use of medicines indicators.

Conclusion

In conclusion, to comprehend the extent to which the health system has achieved its goals of providing access to medicines for its society and contributed to better health status, it is important to evaluate the whole pharmacotherapy chain from availability of qualified medicines for rational use of them. Accessibility at a national level is a system that needs assessment in all components, including inputs, outputs, and outcomes.

Table 5 Outcome indicators of the access to medicine

Main index	Sub-index	Collecting Frequency	Collecting Level	Source of Data
Physical availability and geographical accessibility	Percentage of medicines available in the national list that are not found in any pharmacy	Monthly	National	IrFDA
	Percentage of medicines available in the national list that are found in less than 25% of pharmacies	Annually	Provincial / National	Survey
	Percentage of medicines available in the national list that are found in 25% to 50% of pharmacies	Annually	Provincial / National	Survey
	Percentage of medicines that have been prescribed with generic name	Every 6 month	Provincial / National	IrFDA
	Percentage of medicines that have been prescribed from the national medicine list	Every 6 month	National	IrFDA
	Percentage of medicines available in the national list that are found in 50% to 75% of pharmacies	Annually	Provincial / National	Survey
	Percentage of medicines available in the national list that are found in the more than 75% of pharmacies	Annually	Provincial / National	Survey
	Percentage of outpatient medicines that are found in the access level one	Annually	National	Survey
	Percentage of outpatient medicines that are found in urban pharmacies	Every 6 month	National	IrFDA
	Percentage of patients that had to go to pharmacy several time to get their prescribed medicine	Annually	Provincial / National	Survey
	Percentage of patients that had to go to the another city to get their prescribed medicine	Annually	Provincial / National	Survey
	Percentage of rarely used medicines are not found in any pharmacy	Monthly	National	IrFDA
	Percentage of patients who had to get their medicine from black market	Annually	Provincial / National	Survey
Financial access	Total pharmaceutical expenditure of patient	Annually	National	Survey
	Sum of pharmaceutical expenditure of patient as a percentage of total pharmaceutical expenditure	Annually	National	Survey
	Pharmaceutical inflation rate	Annually	National	IrFDA
	Sum of pharmaceutical expenditure per patient	Annually	Provincial / National	Survey
	Average copayment/ coinsurance per patient for medicine during the last 4 weeks in pharmacies (patient's expenditure)	Annually	Provincial / National	Survey
	Household pharmaceutical expenditure as percentage of total expenditure	Annually	Provincial / National	Survey
	Percentage of households that have at least one insurance coverage for a medicine	Annually	Provincial / National	Ministry of Cooperatives, Labor, and Social Welfare
	Average pharmaceutical expenditure of household as a percentage of total non-nutritional expenditure	Annually	Provincial / National	Survey
	Average pharmaceutical expenditure of household as a percentage of healthcare expenditure	Annually	Provincial / National	Survey
	Percentage of people who have not obtained their medicine due to pharmaceutical copayment/coinsurance	Every 2 years	Provincial / National	Survey
	Percentage of people who take less amount of medicine than prescribed to cut the cost	Every 2 years	Provincial / National	Survey
	Percentage of patient who do not take medicine as they cannot pay for it	Every 2 years	Provincial / National	Survey
	Percentage of increase in the use of medicine after obtaining insurance coverage	Annually	National	Ministry of Cooperatives, Labor, and Social Welfare
	Percentage of people who had to borrow money or sell their home furniture to pay for medicine	Every 2 years	Provincial / National	Survey
	Percentage of households whose pharmaceutical expenditure accounts for more than 20% of their total healthcare expenditure	Annually	Provincial / National	Survey
Safety and Quality	Duration of pharmaceutical counseling per every prescription or patient	Annually	National	Survey
	Pharmaceutical error during perception and use	Every 6 month	Provincial / National	IrFDA
	Percentage of medicine misuse (per DDD)	Annually	Provincial / National	Survey
Information, prescription and use	Average number of medicines prescribed for a patient	Annually	Provincial / National	IrFDA
	Percentage of people that attend pharmacy with at least one prescribed antibiotic	Annually	Provincial / National	IrFDA
	Percentage of people that attend pharmacy with at least one injectable medicine	Annually	Provincial / National	IrFDA
	Percentage of people that attend pharmacy with at least one corticosteroid medicine	Annually	Provincial / National	IrFDA
	Average annual use of selected narcotic analgesia (mg/capital)	Annually	Provincial / National	IrFDA
	Percentage of acute diseases that have been cured by injectable medicines	Annually	Provincial / National	Survey

IrFDA Iran food and drug administration

Several indicators were identified at each stage that the weightiest being geographical accessibility and affordability and then after human resources indicators. Further studies are needed to improve access to medicine assessment from quality and rational use perspectives.

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Compliance with ethical standards

Conflict of interest All the authors listed in this article have scientifically contributed significantly to do this research and they declare no conflict of interests.

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