A review of appropriate indicators for need-based financial resource allocation in health systems

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Abstract

Background

optimal need-based financial resource allocation is one of the most prominent concerns of health systems; various criteria are required to guarantee its fairness. The aim of the present study was to identify the indicators needed to allocate financial resources in the world's health systems through a comprehensive review of studies. In this systematic review, all articles and reports published about need-based financial resource allocation in health systems between 1990 to 2020 in the reputable English language databases including PubMed, Cochrane, Scopus, Persian language databases such as magiran, SID and Google and Google scholar search engines were searched and studied. Of 823 articles found, 29 articles met the inclusion criteria for this study and were analyzed by the content analysis method using MAXQDA (version 10) software.

result

Many need-based resource allocation formulas attempt to estimate health care needs using weighting methods for individuals. The most commonly used indicators were: age, gender, socio-economic status or deprivation, ethnicity, standardized mortality ratio (SMR), modified health indicators (disease consequences, self-assessed health and disability), geographical area / place of residence (geography) (rural versus urban), cross-boundary flows, cost of services and donations.

Conclusion

The indicators used in the allocation of the financial resources of the health system in each country must be simple and transparent and at the same time must be in accordance with the moral norms of that society, must be a good representative of the people's health needs in different geographical areas of that country and their information must be available (to an acceptable extent).

Introduction

Having access to health services with the aim of promoting, maintaining and ensuring the individuals' health is one of the important pillars in the development of any society (1). However, health systems are faced with the shortage of resources and are not able to provide all the services required for all society members on the one hand (2) and seek to increase justice in people's access to health care and services on the other hand. Are (3). Concerning limited financial resources, world health systems face various challenges in terms of service quality, efficiency, effectiveness and justice; equitable resource allocation is one of the major concerns of any health system and is also a key part of the decision-making process in this regard (4, 5). As a moral issue, it plays a critical role in creating justice in health care services and its health consequences (6). Resource allocation is fair when health care resources are distributed among

competing consumers (e.g. regions) based on the need for health care (7). Need-based resource allocation is one of the methods which has been considered for equitable allocation of resources in recent decades in most publicly financed health care systems (8) (9, 10). Need-based resource allocation is a process in which financial resources are distributed among individuals or populations based on the need for health care services (11, 12). This method is considered the most ethical and fair mechanism for allocating financial resources (13). In fact, need-based resource allocation tries to eliminate budget inequalities among the areas of a region or a country (14). It can ensure that government's public resources are distributed to different regions in accordance with the goals of the health system (15). Since it is difficult to measure health care needs directly in a society, indirect methods such as indicators are used to measure health needs (16). So far, no standard gold indicator has revealed the need for health care services in communities; this has caused challenges in selecting the indicators required to compile need-based resource allocation formulas (17). Therefore, the models and indicators used in this regard are significantly diverse (18).

According to the World Health Organization, health and treatment conditions have improved in most countries in recent decades; this improvement has been reflected in indicators such as "life expectancy at birth, life expectancy with balanced disability and decreased mortality resulted from health measures". However, these improvements have been accompanied by some concerns, the most important of which are inequalities in access to health care services and health consequences among different economic groups and individuals inside and outside countries (19, 20). Therefore, concerning numerous challenges that exist due to the shortage of resources to provide equitable health care services, the equitable allocation of available resources is of great importance; This requires changing the current resource allocation approaches to the need-based allocation method. Since creating a suitable indigenous model requires studying the models of other countries in order to identify the principles governing them and the type of indicators used by them, the present study aimed to identify the indicators used for need-based resource allocation in world's health systems through a comprehensive review of studies.

Materials And Methods

Search strategy

Authoritative English language databases such as "PubMed, Cochrane and Scopus", Persian language databases of "Magiran and SID" and Google scholar search engines were reviewed to find the studies published between 1990 and 2020. Studying the articles found in these databases and reviewing their references, other related articles were also identified and added to the previous ones.

Selection of articles: A total of 823 articles were extracted from the databases. Of them, 641 articles were excluded based on their titles and also due to duplication. The abstracts of the remaining articles (182) were reviewed, and 95 were excluded. The full text of the remaining 87 articles was studied; another 58 articles were excluded due to their non-compliance with the inclusion criteria. finally, 29 articles were entered into the final phase of the study (Figure 1).

Inclusion and exclusion criteria: English or Persian language articles which examined specific criteria and indicators in the need-based financial resource allocation were included in the study. Studies whose abstracts were not in English or Persian or whose full texts were not available were excluded.

Data Extraction and Analysis: the information in the selected articles was extracted using MAXQDA software (version 10) and a pre-designed form. Data related to each study was extracted independently by two people; some minor disagreements were resolved by the third person, and the extraction was finalized if all three people agreed (Table 1).

Findings

Examining the results of studies conducted on the need-based allocation of financial resources in the health system of different countries has revealed that different indicators and methods have been used to allocate financial resources according to the specific conditions of each country, and that the main purpose of all methods is to promote justice in having access to health services, make use of these services and thus increase the efficiency of services. Table 1 shows the common indicators used in the distribution of financial resources in the health system of countries.

As the data in the above table shows, different countries use one or a combination of two general "individual-level data and area-level data" methods to allocate resources. The most commonly used indicators are age, gender, socio-economic status or deprivation, ethnicity, standardized mortality ratio (SMR), modified health indicators (disease consequences, self-assessed health and disability), geographical area / place of residence (geography) (rural versus urban), cross-boundary flows, cost of services and donations.

Reviewing the existing formulas has also shown that all models based on per capita initially take advantage of the indexes "population size and the age-sex distribution of the population of the mentioned areas". In fact, this index forms the basis for all further calculations.

Discussion

In this study, common indicators used in compiling the formula of allocating financial resources were examined. Need-based formulas, as a more equitable allocation of health budgets to geographical areas of a health system, are increasingly being used as an alternative to the historical methods (8, 23, 42, 43). To develop a need-based formula, it is important to have a practical definition of justice (13). In other words, defining a need-based approach is the first essential step in selecting the indicators "necessity and need to compile a formula for allocating need-based resources" (44). According to Starfield, justice is defined as "No difference in access to health services for equal health needs or greater access for the population defined in terms of social, demographic or geographical status with greater health needs" (45). The theoretical basis of the need-based allocation formula is that the need for health care in populations of equal size is not necessarily equal, and that the population characteristics are the basis for inferring the population's relative needs (48-46).

As mentioned in the findings section, the most common need indicators used to measure the relative need for health care services are: age, gender, socio-economic status or deprivation, ethnicity, standardized mortality ratio (SMR), modified health indicators (disease consequences, self-assessed health and disability), geographical area / place of residence (geography) (rural versus urban) and cross-boundary flows. However, although indicators such as the cost of services and donations are not considered a need indicator, they are used in the resource allocation formula in some countries.

Population size

Personal characteristics of individuals determine their needs for health care services. Owing to the wide variation of the population size in provinces, the population size in a geographical area is the first important indicator of the need for health services in the resource allocation formula (16, 34, 43, 49).

Demographic indicators

Population composition in a region or country (especially age and gender) is a key demographic factor in estimating the relative need for health care services in a geographical area; this is because there is a close relationship between age / gender and the need for health care services (16, 23, 43, 50-52).

Therefore, demographic composition can have more weights in the resource allocation model compared to other factors (53). Three main age / gender groups of children, women of reproductive age (childbearing) and the elderly people are considered the most vulnerable population groups to diseases and thus need more health care services (34, 54-56). Thus, the population size in these groups is an important factor affecting the need for health care services and, consequently, health resources in different regions and areas. For example, the Resource Allocation Working Party (RAWP) claims that demographic features affect the need for health care services and weigh the population of each region according to the national use of health services by age and gender groups (57). In the British formula, 18 age groups within health trusts were adjusted through the national use of health services in the trusts (58). In South Africa (8), the age / sex ratio adjusted based on the national use of health services in each group is used as a need factor in the health resource allocation formula. Children under 5 are selected as a demand criterion for child care services; women aged 15-49 are chosen as an indicator of the increased need for health care services experienced by women who are mainly in childbearing age; and people aged 65 and more are recognized as the criterion of the need for the elderly care. According to the data written in table 1, it can be seen that the age/ gender factor has been used in all the studied countries (except for Israel and France which have only used the age factor).

Ethnicity

Ethnicity is often used in terms of race, citizenship and country of birth in both matrix and ecological models (11). In some countries, some ethnic groups do not use health services (e.g. the Maori people in New Zealand and non-Nordic immigrants in Sweden). In New Zealand, it is estimated how much Maori does not use health care services and thus weighting is adjusted accordingly, while ethnicity is not

considered in the Swedish model. It is clear that this index can be used in a country where there are ethnic differences between different regions.

Socio-economic status

Socioeconomic status or deprivation is often used as an indirect indicator of the relative need for health care services (13, 23, 42, 46). Since the relationship between socioeconomic status and the need for health care services is not simple and straightforward (59), weights less than one are assigned to socio-economic factors in a need-based formula. In different countries, various socio-economic indicators are used as indicators of the need to adjust the models for allocating health care resources (for example: income / assets (Netherlands, South Africa, Malawi), homelessness and education (New South Wales), unemployment (Belgium and Stockholm), welfare status (Alberta, Netherlands, New Zealand, Northern Ireland and USA), marital status (Norway, Stockholm), family structure (Norway), quality of housing (Belgium), housing ownership and social class (Stockholm) and cohabitation (Stockholm, Northern Ireland). In South Africa, unemployment, people living in poor housing conditions, lack of access to tap water, poor toilet facilities, lack of access to clean energy sources, illiteracy of the household head and female-headed households have been used in the resource allocation formula in order to compile socio-economic indicators (42) Namibia has used a deprivation index using household assets including electricity, radio, television, refrigerator and motorcycle, as well as drinking water and toilet type for equitable health resource allocation among the provinces (13).

Population mortality rate

Owing to some features such as having a familiar concept, reliability and ease of data collection, mortality indicator is considered one of the most common indicators selected to indicate the need for health (49, 60). Standardized mortality ratio (SMR) and age / sex specific mortality indicator have been used as indicators of need to know the health resource allocation (17). For example, raw and standardized mortality ratios have also been used as indicators of need in Per capita schemes in Belgium, Italy, Namibia, Northern Ireland, Norway, Scotland Wales and Zimbabwe. Making use of mortality indicators may have some disadvantages because the health system provides health services for the living not for the dead, so resource allocation indicators should be directed to the living as much as possible. Moreover, using mortality statistics such as SMR to allocate resources may not be appropriate in some cases because a significant portion of health care services is provided for people whose treatment does not lead to death. Finally, the geographical distribution of health needs may not be in line with the geographical distribution of death in different parts of a country. For example, some people who die in one area may die from diseases they contracted in another area some years ago (61). Since the relationship between mortality and need is not straightforward, the mortality rate cannot be mechanically considered in the resource allocation formula, as it may lead to unreasonable and unrealistic allocation patterns (62). Hence, weights less than one are applied to this index in the resource allocation formulas (53).

Disease complications in the population

Disease complications directly indicate poor health (ill-health) conditions in the population (12). The prevalence of some chronic diseases such as diabetes, cardiovascular problems and osteoarthritis as well as the occurrence of acute complications such as the gastrointestinal and respiratory injury or infection are examples of appropriate indicators of disease complications to assess the need for health care services (17). Disease complication data have been used, in combination with socioeconomic factors, to allocate health financial resources in Stockholm, Sweden (38) and the NHS (60). Self-reported health which is people's perception of their health compared to the peers' health is considered an appropriate indicator of disease complications because it is closely related to many other health indicators and is independent of the indicator "health services use" (15, 63). However, making use of disease complications is not popular as a need indicator due to its technical problems. For example, data on disease complications may be biased owing to differences in records of institutions and regions (64). In addition, disease complication indicators may not cover all the health conditions people need to enjoy health care services (16). This may underestimate the need for health care resources in areas which need these resources more. Moreover, there are always limitations in the frequency, timing or availability of disease complication data for the entire populations and regions; in turn, they impose some restrictions on assessing the need for health through disease complications (65).

Geographical factors

Geographical area is usually an indicator used to decide on the allocation of resources in most health systems. Reasons have been given to justify the allocation of resources based on geographical areas. For example, making use of the geographical area-based resource allocation approach, differences in the cost of providing health services in different regions can be offset by appropriate reimbursements (64). The United Kingdom, Scotland or Ontario Canada have considered these differences in their formulas. The resource allocation based on the geographical area has the potential to include both the justice goals and the goals of the efficiency of health systems (66). Allocating a larger share of the health budget to geographical areas that need more health care services can increase the efficiency in the use of health services (11). Fair distribution of health credits among geographical areas can also improve the previous inappropriate distribution of health facilities and trusts in the regions (67, 68).

Place of residence

Place of residence (province, cities, towns, urban-rural areas and slums) can affect health and the chance of improving living conditions (69, 70). Geographical differences are regarded as an ethical concern in terms of having access to health care services and health outcomes (10). Therefore, geographical classification is considered an important tool for health promotion and proper distribution of health resources among regions (71). Living in urban or rural areas affects the people's health in different ways (72). Urban life provides citizens with many opportunities and excellent and better living standards. However, urban environments can increase health risks and reshape population health issues from infectious diseases and malnutrition to non-communicable diseases, violence and injuries and deaths from accidents and the effects of environmental disasters (73).

Cross-boundary flow

Cross-boundary flow is where patients may cross health care boundaries to access neighboring health services because the required services are not available at their place of residence or there is an unreasonable delay in obtaining care services (32 , 74, 75). Cross-border use of health services is often enjoyed by temporary guests who include people who use the facilities provided in the border regions, people who seek treatment in other cities or abroad, and people who are sent to other cities or abroad by their health sponsors. (74, 76). Cross-boundary flows are considered an element in some resource allocation formulas (including Alberta, Canada, New South Wales and Spain). However, in many cases there is a lack of information about cross-boundary flows, especially in developing countries. This places limitations on the inclusion of "cross-border use of health services" in need-based resource allocation formulas (77).

Costs of providing health services

Costs of providing similar services can vary greatly from region to region (77). For example, costs can be much higher in remote rural areas due to higher transportation costs and perks given to employees in order to encourage them to travel to these regions. Moreover, owing to a tiny number of people in a region or country with very low population density, the cost may be wasted (78). In addition, due to different input costs, service costs may vary among buyers. (79). These factors implicitly indicate the need to adjust a need-based resource allocation formula based on differences in service provision costs resulted from the impact of geographical factors. However, appropriate data must be provided to include various costs in the formula. Additionally, decisions made about adjusting different service costs are often a political issue (11). Alberta, the United Kingdom, Ontario, Scotland, the United States and Wales are examples of countries which have used this indicator in their formulas.

Donations by donors

Alternative financial resources provided by donors and NGOs especially for low-income countries is another indicator used in compiling a need-based allocation formula. The challenge this indicator poses for health policymakers and planners is whether the government should allocate fewer resources in areas with higher donations (41) or not. Uganda is an example of countries that uses this index to allocate health care budgets according to the following weighting: 60% based on the population size index in different age groups, 20% based on human development index (per capita income, life expectancy and school enrollment rates) and 20% based on donations and NGO expenditures in each region (11).

As mentioned above, the geographical area is usually the most common decision-making factor for resource allocation in most health systems; thus, it is the basis of the need-based allocation formula because geographical conditions can affect health and therefore the use of health care services (10, 63). In most of these formulas, the weighted capitation is used to estimate the relative need for health care services in each geographical area. Concerning the main indicators of population composition (age, gender) and especially age (because the gender distribution is usually very similar in different regions)

(11), socio-economic factors (education or occupation, income, wealth, marital status and employment status,...) and geographical factors, this approach ensures more equitable distribution of resources among geographical areas in accordance with the principle "equal access to health care services for all people with the equal need" (10, 11, 63, 80) (8, 11, 43). Age, with higher weight for newborns and population over 75, is the most prominent factor used to pay per capita in high-income countries, while socioeconomic factors as well as factors associated with disease complications are considered a less important criterion except for psychiatric and society-based care services. In low- and middle-income countries, however, the population under 5, poverty indicators and rural population have the highest frequency and are of great importance in the development of need-based financing formulas (11). The essential point about the possibility of using these indicators is that they must meet the requirements so that they can be used as indicators of need in developing resource allocation models. Seven main criteria which the "need indicators" must meet are: universally recorded, verifiable, consistent, no incentive for gaming, no vulnerability to manipulation, confidentiality respected and plausible (10, 16, 64).

In general, as described in the findings section, there are a variety of indicators of the need for health care services. However, there are serious limitations and disagreements about the selection of indicators owing to the emphasized criteria and assumptions, absence of research evidence on the appropriate factors, lack of dependence and legitimacy of the need factors and lack of proper and relevant information about potential need indicators (64, 81).

Conclusion

There are various methods for need-based resource allocation; they can vary from simple indicators such as population size and composition mainly used in developing countries to complex models used in developed countries. Each of these methods is designed according to the conditions of those countries. Access to data and the possibility of calculating the index for the given region, values and ethical criteria and cultural, economic and social conditions are among the most important factors which are considered in the allocation of resources. According to the findings of the present study, an appropriate combination of demographic indicators, mortality indicators, socio-economic indicators and geographical location seems to be effective in developing a need-based allocation formula and thus improving justice in the distribution of financial resources. Although the allocation of financial resources in health systems seems economic in nature, ethical standards of society must be taken into consideration for fair allocation of resources. Therefore, the most appropriate method of need-based resource allocation in the health system in each country is to design and choose a method which both is simple and transparent and uses indicators that meet the moral norms of that community and be a good representative for people's health needs in different geographical areas of that country. Moreover, the information about the characteristics of that model must also be available to a great extent.

Declarations

Ethics approval and consent to participate: Not applicable

Consent for publication: Not applicable

Availability of data and materials: The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests: The authors declare that they have no competing interests.

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Authors' contributions: MR, FE and RM conceived the study and designed its method. MR performed the computations and applied the model, with help from AA for revision of the analytical method. All authors discussed the results and contributed to the final manuscript. MR BN and AA carried out the analytical experiment. MR and BN wrote the manuscript All authors contributed to the development and approved the final manuscript. MR is the guarantor.

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Table

Table 1- Indicators of need-based financial resource allocation in the world health systems

Country	Micro indicators of financial resource allocation	Macro indicators of financial resource allocation
Alberta, Canada ^(9, 10, 21-23)	Age; Sex; Ethnicity; Welfare status	Remoteness; Cross-boundary flows; Funding loss protection; Cost variations
Belgium ^(21, 23)	Age; Sex; Disability; Unemployment	Urbanization; Mortality
England ^(9, 11, 21, 23-28)	Age (Sex); Additional Need	Market Forces Factor(staff, land & building costs); Unmet Need; Growth Area Adjustment (rurality, scale economies & case-mix factors)
Finland ^(21, 23)	Age; Disability	Archipelago; Remoteness; Tax base
France ^(21, 23)	Age	Phased implementation
Germany ^(21, 23, 29)	Age; Sex; Invalidity; Morbidity; Sick pay	Income base
Israel ^(21, 23)	Age	–
Italy ^(21, 23)	Age; Sex	Mortality; Damping mechanism
Kenya ^(30, 31)	–	Infrastructure; Under-5 population; Poverty rate; AIDS cases; Females of reproductive age (15 to 49); Area of district (sq. km.)
Malawi ⁽³²⁾	population size; asset indices	
Mozambique ⁽³³⁾	population size; demographic composition; infant mortality	population density
Namibia ^(13, 33-35)	population size (weighted by the demographic composition); deprivation index	mortality levels
Netherlands ^(21, 23, 25, 29)	Age-Sex; Source of Income; Region; Welfare/Disability status; Pharmacy Cost Groups; Diagnosis Cost Groups	Urbanization; Retrospective Adjustments; Income base
New South Wales, Australia ^(9, 21-23, 25, 28)	Age; Sex; Health Needs Index (HNI); Unavoidable Costs; Unmet need; Indigenous Weight; Homelessness	Teaching and Research; Geographical Adjustment; State-wide Services; Cross-boundary flows; Substitution
New Zealand ^(9, 21-23, 25, 28)	Age; Sex; Deprivation (Welfare status); Ethnicity	Rurality; Unmet Need; Overseas Visitors; Phased implementation
Northern	Age; Sex	Mortality; Elderly living alone; Welfare status;

Ireland ^(23, 28)		Low birth weight; Rural costs adjustment
Norway ^(21, 23)	Age; Sex; Marital status	Mortality; Elderly living alone; Tax base
Ontario, Canada ^(25, 36)	Age; Refined Clinical Group; Socioeconomic Status; Rurality	Market Share; Unit Costs; Population Growth
Scotland ^(9, 21, 23, 25, 28, 37)	Age- Sex; Morbidity and Life Circumstances; Unmet Need	Excess Costs (Remoteness/Rural Cost...)
South Africa ^(11, 31, 34)	population size; deprivation index	–
Spain ^(21, 23)	–	Cross-boundary flows; Declining population adjustment
Stockholm, Sweden ^(9, 11, 21-23, 25, 28, 29, 38, 39)	Age; Cohabitation and marital status; Housing Tenure; Educational Level; Employment Status; Urbanization;	Costly Diagnosis Groups; Phased implementation
Switzerland ^(21, 23)	Age; Sex; Region	Income base
Tanzania ^(31, 33, 40)	population size (Age/Sex); under 5 mortality rate; Rurality	poverty level
Uganda ^(11, 41)	population (age-sex); Human Development Index; per capita donor and NGO spending	security situation
USA ⁽²¹⁻²³⁾ (Veterans)	Dependency (x2)	Labor costs; Phased implementation
USA ⁽²¹⁻²³⁾ (Medicare + choice)	Age; Sex; Disability; Welfare status; Previous in-patient diagnosis; county of residence	–
Wales ^(21, 23, 28)	Age/Sex; Standardized mortality ratio; Additional Need	Extra Costs (Road length, Mean travel Distance...)
Zambia ^(33, 34)	population size; deprivation index	burden of disease
Zimbabwe ^(8, 33, 34)	population size; socio-economic status	morbidity and mortality rates; service coverage

Figures

Figure 1

Flow of articles included in the study