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Health Information System in Primary Health Care: The Challenges and Barriers from Local Providers' Perspective of an Area in Iran

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ABSTRACT

Background: Health information system (HIS) has been utilized for collecting, processing, storing, and transferring the required information for planning and decision-making at different levels of health sector to provide quality services. In this study, in order to provide high-quality HIS, primary health care (PHC) providers' perspective on current challenges and barriers were investigated.

Methods: This study was carried out with a qualitative approach using semi-structured audiotaped focus group discussions (FGDs). One FGD was conducted with 13 Behvarz and health technicians as front-line workers and the other with 16 personnel including physicians, statisticians, and health professionals working in health centers of the PHC network in KUMS. The discussions were transcribed and then analyzed using the framework analysis method.

Results: The identified organizational challenges were categorized into two groups: HIS structure and the current model of PHC in urban areas. Furthermore, the structural challenges were classified into HIS management structure (information systems resources, including human, supplies, and organizational rules) and information process.

Conclusions: The HIS works effectively and efficiently when there are a consistency and integrity between the human, supplies, and process aspects. Hence, multifaceted interventions including strengthening the organizational culture to use the information in decisions, eliminating infrastructural obstacles, appointing qualified staff and more investment for service delivery at urban areas are the most fundamental requirements of high-quality HIS in PHC.

Keywords: Health information system, Health service provision, Primary health care

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INTRODUCTION

Developing countries are faced with a wide variety of health-related challenges including the limited resources and capabilities[1] and the health systems that address those challenges, have inevitably moved into maximizing the value of scarce resources and finding ways to make health systems functions as efficiently as possible.[2,3]

In order to ensure a more responsible use of the financial and human resource investments, public health professionals are increasingly expected to engage in evidence-informed decision making,[4] which is critically dependent on the timely availability of sound and accurate data and information.[5] This information not only is required for health policy makers to make more effective decisions,[6] but also it can be used by health front-line providers to improve the quality and efficiency of health initiatives.[7] Obviously, data and information provide knowledge and developing and managing the knowledge will provide power to construct effective interventions.[8]

Availability of accurate and timely information and understanding of how to use them effectively in the health system are critical components for evidence-informed decision making,[9] which are provided by the health information systems (HIS).[10]

Health information system is not a separate and independent component of the health system, and it should be designed according to the service delivery system.[11] HIS is utilized for collecting, processing, storing, retrieving, and transferring the required information.[12] HIS aims to improve the processes of data handling in order to extract useful information for health planning, decision-making, and resource allocation through different sources to provide quality services.[13,14] To this end, many attempts have been accomplished by the health sector and donors concerning the design, development and implementation of computerized HIS in countries.[3,15] The lure of this promise is magnified in developing countries given the existing conditions and inefficiencies.[3]

The HIS is a functional entity within the framework of the comprehensive health system to improve the health of the population. In this regard, the HIS structure should allow the generation of necessary information for use in decision-making at each level of the health system with a given amount of resources.[16] The HIS structure is grouped into two components of information process and HIS management structure. Information process involves the components of gathering, transferring, processing and analyzing the data, and presenting information for use in management decisions. The information management structure encompasses components like the information systems resources such as human (managers, statisticians, epidemiologists, etc.), supplies (telephones, computers, report forms and financial resources), which are utilized in a way that produce high-quality and timely information for decision-making, and a set of organizational rules, which are necessary to ensure the optimal use of HIS resources.[17]

One of the main strategies to achieve universal health coverage and reduce the gap between health outcomes in urban and rural areas is the implementation of primary health care (PHC),[18] which is known as the first level of service[19] delivery for past two decades.[20]

The public sector is main provider of PHC services across the country and services such as prenatal care and vaccination are provided free of charge in public facilities,[20] On the other hand, demographic and epidemiological transition that is underway in health sector have a significant impact on the pattern of morbidity and mortality in the near and distant future, especially as it affects the emergence of chronic non-communicable diseases. Hence, the kind and nature of the services to meet new needs have been changed.[21] For these reasons, it is necessary to pay more attention to HIS to suit new needs and evidence-based decisions.[22]

Several studies have attempted to evaluate the HIS with various methods.[22,23] Some of these evaluations were more focused on technical issues and clinical processes and stakeholders' views on the state of the HIS have been less analyzed.[24-29] Furthermore, although some studies conducted in Iran have presented overall evidence regarding the functioning of the HIS in PHC, but have more focused on the successes and have less provided more detailed evidence about the challenges and inefficiencies.[30,31] Since changing environment such as growing developments in the technological, social, and cultural contexts lead any system toward organizational changes and achieving better future to survive and adapt to it,[32] this paper addressed the challenges and obstacles of high quality health management information systems (HMIS) at the PHC system in district levels in Kerman University of Medical Sciences (KUMS) to achieve a reliable evidence system for decisions.

METHODS

Context

Ministry of Health and Medical Education has designed a new health system since 1979 in Iran [Figure 1].

According to Figure 1, PHC in Iran is based on a District Health Network (DHN), one per district, that stand on a well-organized system consists of rural health center, urban health center, and health house. This network especially is well-established in rural areas emphasizing catchment focus area.[33] The DHN is accountable for managing, planning and monitoring of health services at the micro level. Moreover, this network is accountable to the provincial medical university (PMU). Each PMU encompasses at least more than one district and has the authority of supervising the provision of health care

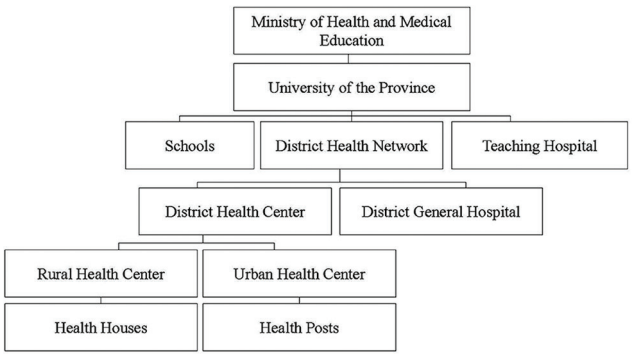

Figure 1: Health system structure in Iran
***Some provinces have more than one University of Medical Sciences**

in the entire province. Of course, some provinces have more than one medical university, and the districts are distributed among them for better stewardship.[20]

Kerman province is the second largest province in the Islamic Republic of Iran, located in the south-east of the country.[34] For this reason, access to appropriate infrastructure varies in different areas, and the significant difference was observed between the countries in terms of economic development.[35] According to Iran Statistical Center, its population was 2,938,988 in 2011.[36] KUMS is the main university among the four universities of medical sciences in the province with 10 counties covered.[37] In this study, only the view of service providers in KUMS has been studied.

The lowest and most essential parts of the DHN are the rural health houses and urban health posts, both of which are designed to deliver the variety of services envisaged by the PHC concept. The behvarzan in the rural health house, as well as in the urban health house, are an important component of the HIS that was developed to collect detailed information on the community and the population served by the PHC Network and to evaluate the effectiveness and impact of its interventions.[38]

The main instrument for data registration and collection in rural areas is vital horoscope. This instrument is a data source used by community health workers (Behvarz).[39,40] It provides the crude data related to population and health. It consists of four circles represent live births, deaths among infants, deaths among children aged 1–5 years and deaths of persons older than 5 years and seven tables contain the urban or rural identity of the health house, the number of households, a detailed summary of the age and sex structure of the population of the main and satellite villages, the number of births by outcome, the number of deaths associated with the pregnancy or delivery, specifying the four major causes of death and the age of the mother, information on the coverage of the family planning program, the number of deaths by sex and age, the number of deaths among children under 5 years by age and eight major causes of death.[38] Other data for PHC delivery are produced by household's health record and other files and notebooks.[39,40] Eventually, report of vital events prepared by the health centers is sent to the District Health Centre at the end of the year, where the data are entered into a computer program and are sent to the Tehran for consolidation. A recent evaluation of the structure and functionality of information system in PHC identified some limitations of it. For example, the data source including aggregate data and individual information is not presented in it. On the other hand, it should be ensured that the new set of data are collected in this system proportional to the demographic changes.[41]

Aims

The study addressed the challenges and obstacles of high-quality HMIS at the PHC system in district levels in KUMS.

Study participations

We selected a total of 29 participants on a basis of purposeful sampling method and maximum variation sampling. We considered two criteria for selection of the participants. First, the individuals who had at least 5 years of work experience in one of the health houses, rural, urban, and district health centers covered by the Deputy of Health and were well familiar with the information system and in fact, were the system users, that is, both produced the information and worked with the information system. Second, we employed the participants groups from different centers where they were not working together. It made the discussions more openly and minimized the boss and subordinate considerations effect on the participants to express of their opinions as well as it has been used all different job categories such as Behvarz, family physician, statistician, etc., who have been involved in this system.

After a brief explanation of the general aim and methods of the study by telephone, a verbal consent was acquired about willingness to participate in the study. Of course, it is necessary to explain that all the managers were assured that the results would be used to identify the challenges and improve the system and not to assess the individual. Finally, the mix of participants was included Behvarz (n = 7), health technicians (6), district health professionals (9), statistician (4) and family physicians (3).

Settings and design

The qualitative study was conducted in 2011 in counties covered by the KUMS. Focus group discussions (FGDs) were selected as a data gathering tool in order to understand the range of perspectives in a group on a given topic through group interaction.[42]

Data collection

We run two semi-structured FGDs with a diverse range of the personnel working in health centers of the PHC

network in KUMS. One FGD was held with frontline workers (Behvarz) and health technicians (FDG1.1 … FDG1.13) and the other with district health professional, statisticians, and family physicians (FDG2.1 … FDG2.16).

Focus group discussions were conducted in a quiet and comfortable place at the Deputy of Health. At the beginning of the session, a brief explanation of the study aim and gathering data process was given and then, challenges of the process were asked as the main question. A member of the research team acted as a facilitator during all of the discussions. Each FGD lasted on average between 4 h and 4.5 h. The meetings were audio-taped and then they were completely transcribed.

Statistical analysis

To analyze data, a framework analysis method (including 5 steps of Identifying, Identifying a Thematic Framework, Indexing, Charting and Mapping) was used. On this basis, a summary of the content of every meeting was prepared. Contents were coded separately, and a list of these codes was extracted. Holding several meetings and having discussions, these codes were reviewed and changed by the researchers. This process was repeated until a final agreement is reached.[43]

Ethical considerations

At the beginning of each FGD session, all participants were again informed about the study and of their right to refrain from participating. The participants were also informed that the discussions were going to be audio-taped, but that their complex to anonymity and confidentiality was guaranteed. All those present agreed to take part. Permission to undertake the study was obtained from the Deputy of Health, KUMS and also it was coordinated with the authorities of district health centers.

RESULTS

The identified organizational challenges were categorized into two groups: HIS structure and the current model of PHC at the local levels. The structural challenges were classified into HIS management structure (information systems resources (human, supplies and organizational rules) and information process [Table 1]. On the other hand, they were divided into 2 main themes and 20 sub-themes.

Table 1: HIS challenges in PHC based on the perspective of service providers at the local level

Main themes	Themes	Sub-themes
HIS structure	HIS management structure	Human
		Management level
		Governing bureaucracy principle on the local health systems
		Poor performance evaluation system among staff
		The poor performance of recruitment and staffing system
		Poor transparency of performance and duties of end-users
		Frontline level
		Cultural issues in expressing the functional facts and errors
		Shortage of continuous training
		Shortage of in-service training
		Supplies
		Deficiency of computerized facilities in recording data
		Deficiency of web-based technologies in transferring information
		Mismatch of health system with regional development
		Organizational rules
		The lack of guidelines in order to record data equally among areas
		Legal shortcomings in recruitment requirements
		Legal shortcomings in the integration of information systems
	Information process	Poor use of information in the local decision making
		Feedback lines defect in the information system
		Shortage of information and communications technology infrastructures between the various stages of the information production process
		Shortage of information and communications technology infrastructures in information transmission
		Poor communications between end-users in different stages of the process
Current model of PHC in urban areas		Inefficiency of the referral system in urban areas
		Poor intersectional collaboration and communication in urban areas

HIS=Health information system, PHC=Primary health care

Concept one: Health information system structure

Human

Many participants had a critical view around the way that higher levels (provincial and district managers) exercise the power of supervision, controlling and managing on lower levels. They had a common sense that managers does not value to their work according to the value-added which they produce. Rather, the managers support and guide them along with working mission; mainly they highlight the drawback points regardless of their causes. In addition, some participants stated that supervisory approach is in a way in which service quantity has higher priority than to the quality of service delivery. This may cause the individuals go around the incorrect reports or records potentially.

One participant declared: "…If there is something wrong with the improving trend in performance based on giving information and indicators, there is an improper culture in which we are blamed for it. Thus, it causes the system does not follow the root causes of the issue and make a decision to conceal it" (FDG1.12).

A prevalent issue was indicated that the system does not compete between the individuals for improving the performance. It could not distinguish between the individuals who perform their tasks truly and those that have bad performance whether or not deliberately. It was found that the current evaluation system has some deficits and it might not to take competitive advantage.

Moreover, because the data are not transferred through the information hierarchy, the reports almost either do not arrive into a targeted point or are incomplete.

One of the participants declared that: "We must report some data monthly such as… it also is asked us report them quarterly again. This causes we spend more redundancy time for data gathering and could not correspond to other tasks correctly" (FDG2.3).

Other disadvantage is that most participants believed that it was viewed to the functions of statistician as limited practice as workers for merely data registration and production, not anything more. This has influenced two approaches made by the managers. Firstly, it is affected by the process of workers' staffing. As, the decisions related to provide workforces for these units are considered a position lower than other work fields. Secondly, this issue also might result in the low priority to plan required in-service training courses in align with the health information system for community health workers, biostatisticians, and analysts.

Another key factor is a deficiency in continuing education around statistics, indicators and analytical approach to analyze the root causes of issues and identify potential solutions to improve. Often participants indicated that the proportion of the analytical education and training (as can hold in seminars, FGD, workshops and expert panel etc.) rather than other topics is inadequate that we cannot utilize for improvement in knowledge of the arena in question.

Supplies

One main drawback declared by most participants was manual data registration at frontline service delivery level. This issue has caused that data registration to be consuming time and cost.

Various mechanisms for data transfer are used by unskilled vehicles and support workers especially at rural areas. On other hand, some disadvantaged districts have not been equipped to proper information and communications technology infrastructure for establishing the web-based technologies.

One participant who was working in district health center stated: "…It happens that completed statistical forms at the first level of service delivery are transferred to higher levels by drivers. In this case, it can either postpone the data transfer, or the data is lost. So, these highly intensify the rework in processes…" (FDG1.10).

Most participants except for community health workers (Behvarz) stated that the health resources including staff, facilities, and generally investments are not balanced with urban development. They also expressed the urban family medicine plan might help the establishing referral system in these areas and improving information systems for more efficient decision-making.

Organizational rules

Based on service delivery system requirements and information needs of decision-making, there are no data collection forms and related rules and guidelines and are not updated.

One participant stated: "Some of the data items are collected and recorded in different forms repeatedly. Besides these, there are some other data collected from the past and seems to be usually reported and are unnecessary" (FDG2.15).

Legally, qualification requirements of personnel for collecting and analyzing data are undefined and manpower does not have the necessary eligibility.

One participant stated that "gathering data are considered as a normal and routine task that can be undertaken by anyone and statistics unit is the first place where Transitional employees from other departments and disciplines and fields are employed in it" (FDG2.5).

Interviewees stated that the legal supports do not exist for the integration of technology in collecting, recording, processing, analyzing and transferring the data.

Information processes

The main goal for HIS is establishing a basis for applying the information in decision making as it is named

"evidence-informed decision-making". Participants in both FGDs clearly stated that only little information is used for decision-making process at local and regional levels and mainly produced information aimed to be sent higher level to national.

Legal feedback is not consistent with the reports that it has led to diminish the role of information in decision making.

"I think that the forms are not used, because if it was used, the feedback was given to me" (FDG2.12). "Many times, there is no feedback or low speed in feedback on the information sent, therefore, we cannot perceive our performance and it may cause the exhaustion in motivation of health staff and local managers for using the information" (FDG1.9). "The feedback cycle of the produced data is so long time that it causes to exhaust the work force" (FDG2.4).

Most interviewees stated in some cases although some software for speed to data registration and analysis exist, These information databases have not been organized into an integrated technology that could be facilitated the communication among all levels of data collection, registration, transfer and processing.

Low density and high geographical interval between the capital and districts of the Kerman province are considered as the limitations for transferring data in non-automation manner.

One of the participants said that: "Sometimes it occurs that the data due to limited sources on one hand and no enough time to report to higher level on the other hand, we have and prefer to send by telephone. This undoubtedly reduces the data accuracy" (FDG1.5).

Sharing and sending the data in horizontal communication is poorer than vertical ones. As mentioned earlier, there are various units within the Deputy of Health which those have defined responsibilities related to health and undoubtedly, it is required to plan and share their information for making the given interventions. However, an issue was the providers' opinion that this collaborative relationship within and between organizational units is relatively poor, and each handles their affairs more in isolation. This can be especially seen between diverse units and statistics unit. It means the workers and service providers spend the much more time for additional and repetitive data collection. Additionally, this cannot be used in an integrated and systematic manner to apply for decision-making.

Concept two: Current model of primary health care in urban areas

Primary health care in urban areas is different than rural ones, as the manner of service delivery in urban areas is passive and there is a deficit in referral system of health care levels. Moreover, urban areas exposure with many issues such as population mobility, increasingly immigrations, and potentially high burden of non-communicable diseases that makes it more difficult for universal coverage. Currently, the proportion of urban population is about two third of the total population, While more than two past decade, this proportion was for rural areas. Hence, the pattern of urbanization is prevailed, and urban development has caused a problem called marginalized areas that this requires facilities, manpower, and proper and high-quality information sources in order to plan and decide. This indicates more necessary for a reliable, comprehensive, and accurate information system. Although similarly with rural areas, the basis for information registration and collection is household record, inefficient referral system and lack of logical relationship between provider sectors in urban areas are main causes of poor access to PHC services in urban areas and deficit information.

One participant stated: "The routine data system in rural areas is adequately comprehensive and complete so that other sectors at the local level mainly request as they needed demographic information, however it is poor at urban areas since current PHC model is passive and not respond to needs of these areas" (FDG2.8).

DISCUSSION

This study has addressed the ongoing barriers of HIS as an inseparable part of the health system at the PHC level of KUMS. One of the main conclusions can be drawn is that the functions and effects of HIS in health issues were suboptimal and needed to be improved. We found out many challenges related to the systematic failures in the current model of PHC, particularly urban areas, and organizational conditions affecting quality of HIS such as human, supplies, organizational rules and process [Figure 2], and felt that most of these challenges were beyond the front-line provider's control.

Rules provide HIS structure that is associated with three key components namely, the rules related to human, supplies and process. The structure is formed in a context which is the PHC model, and the structure is developed with regard to it. Of course, the ultimate goal of HIS is in relation to the decisions system. For this reason, it is recommended that rules relating to the structure are adjusted to suit the hierarchy of decision-making. Thus, Based on the model, if the weaknesses of the PHC current model and failure in responding to the needs of the population in urban areas that studies of Moghadam *et al.*[30] and Eskandari *et al.*[44] also refer to it and the challenges related to components of human, supplies, rules and process which are basis of HIS structure are resolved, the comprehensive and timely information, knowledge and power to decisions will be provided and the state of the

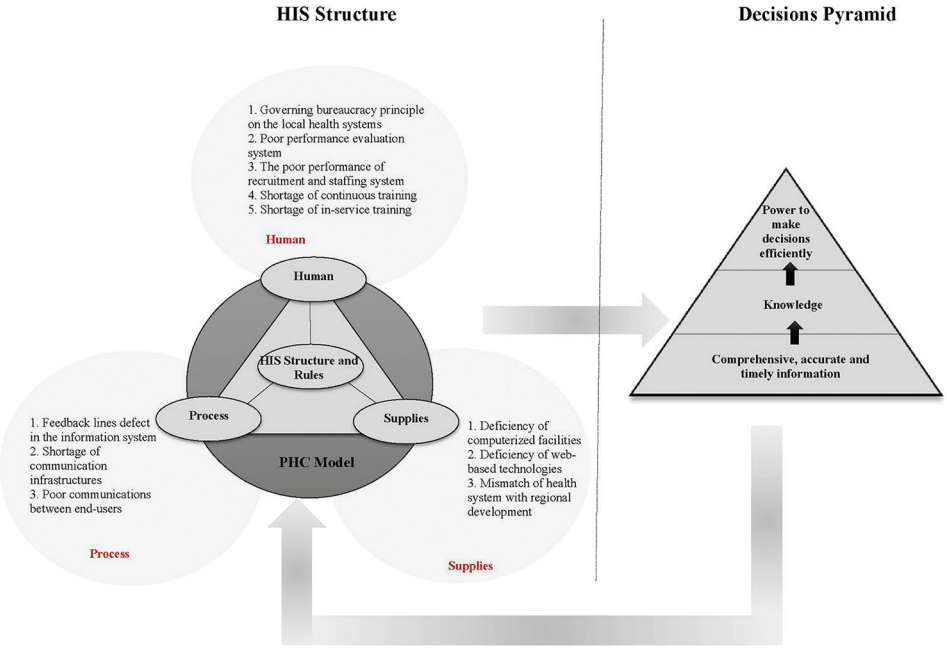

Figure 2: HIS structure in decisions system in PHC

PHC system and HIS system will improve and this cycle will dynamically repeat.

In human component, one main constraint emphasized by participants was limited human capacity in HIS area to apply the analytical tools and methods to synthesize information for decision-making. This was caused by poor training and not having adequately courses in in-service training for community health workers. This result is consistent with results of Spyrou's study at Karlovassi Health Center[45] and study of Yusof *et al*. in primary care organization in the UK.[46] They emphasized that learning and training must continue throughout the implementation cycle and the needs of the information system and the unfamiliar users are removed.[45,46]

Based on the participants' perspective, we concluded that way of evaluation is so improper at two-dimensions. First, it could not provide underlying causes of the problems and the free-error sphere. Secondly, the evaluation system is more single-dimension and does not include other manners to ensure the quality of delivered services such as contact with customer or patient. Also, in another qualitative study from Iran, family health providers revealed that supervision and management system is suboptimal and does not give support and guidance for improving quality at tasks contributed to PHC.[47]

With respect to the process component of HIS, it was observed that disaggregated data are often not available in the form required by program managers for day-to-day decision-making at the point of delivery of health services and required data is less available in a reliable and timely manner and often, it is incomplete and thus useless for evidence-informed action; Weak feedback mechanisms and products of HIS, and organizational culture which values and encourages analytical thinking[48] is less supported. Actually, often, HIS are not adequately equipped with tools and techniques of data analysis and has not the capacity for analysis in order to assess the equity and disparities among diverse areas. Because it is based on aggregated data rather than individualized data and Nolen *et al*. imply that in macro level, there is a need to provide strategic opportunities to improve the contribution of HIS in effective planning and monitoring of progress in response to interventions and moving toward the equity.[49]

Another of current issues is that appropriate tools for transforming the information for decision-making are not always applied properly. Based on the study of Efe in 2013, order to effectively manage PHC services and bring it closer to the grassroots, intense re-invigoration and dissemination of comprehensive information between rural and urban areas is required.[50]

In supplies component, the participants identified that paperwork in data registration and transmission spends much time, and this makes the system inefficiently. Tomasi *et al*. in 2004 expressed that the computerized systems are more useful and efficient than paperwork because of the further improvement of the efficiency in management processes, saving more time in locating information, more economical use of financial resources and greater ease and speed of data recovery.[51]

Moreover, information and communications technology infrastructure especially online service in rural areas is limited and according to Séror's research, it firmly restricts to the development of computerized initiatives.[52] Also, Martínez *et al*. study stated that lack of information and communications technology infrastructure is one of the common limits for the introduction of new technologies at PHC of Peru and Nicaragua.[53]

Hence, strengthening information and communications technology infrastructure and developing the computerized process on recording, collecting and producing the health system data and information can play a significant role in PHC services, especially to increase efficiency in the management of HIS. On the other hand, the prediction of electronic household record plan in rural and urban areas requires the development of computerized processes and infrastructural facilities in more deprived areas.[54] In general, although few studies have been done in the field of the direct impact of information technologies on quality improvement of service delivery and health indicators, but there is an overall consensus on improving the efficiency in processes and its positive impact through monitoring these systems.[55]

Eventually, given the rapid growth of urbanization in Iran and increasing expectations and changing health problems in these areas,[56,57] reorganization of health care delivery system and thus strengthening routine HIS in urban areas, particularly measuring the health inequalities is unavoidable. Because health data that are routinely collected are usually expressed in the form of aggregated data in counties and as a result, differences between society groups and individuals are not reported. In the research of Moghadam *et al*. which was done in a review systematic way to determine weaknesses and challenges of current PHC system in 2012, was found that the HIS in PHC requires a set of the data for efficiency and effectiveness of the provider's decisions. HIS should have a suitable design and technical infrastructure to share information on the various tiers of the organization.[30]

All of the above challenges may lead to delays in access to comprehensive and transparent information and thus, the inefficiency of the information system will cause difficulties in decisions.

Limitations and strengths

This study is a case of assessing the HIS at PHC from the local provider's perspective in an area of Iran as end users. Although some results had similarities to other studies in Iran, it has no aim to generalize the results to other settings. Furthermore, this Study only extracted the perspective of local providers but it did not focused on other aspects of system evaluation. So, it requires other studies which encompass multi-facet methods for assessing HIS.

This study also had a main strength. This study tried to explore more in-depth the PHC providers' perspective than the barriers of HIS. For this reason, it employed the maximum variation for participants groups.

CONCLUSIONS

The HIS works effectively and efficiently when there are a consistency and integrity between the human, supplies and process aspects. Hence, this study indicated the current challenges for an example of local HIS at the PHC level in Iran. It also concluded that due to Lack of logic chain between all levels and adequate and up to date information structure which is compatible with the changing demands in PHC organizations, it is fewer utilizable in decision making system at local level than the national level. Furthermore, it also was shown the importance of redesign and rearrange functions of HIS with regard to changing needs and reforms.

Hence, based on the study findings, it seems that multifaceted interventions, including strengthening the organizational culture in order to use the information to improve the health system performance, eliminating infrastructural obstacles related to information and communications technology at remote areas for developing the computerized health information especially implementing electronic health record plan, changing from single-view to multilateral evaluation system in service delivery, appointing qualified staff in statistics units at all levels and more investment for service delivery at urban areas are the most fundamental requirements of high-quality HIS in PHC; It should be noted that due to urbanization and its subsequent changes in demographic and epidemiological features,[58] re-frame of the PHC model is required; and information structure will change in proportion to change the service delivery system.[59] This reframe has increasingly importance to improve the health care coverage. In Iran, the implementation of family physician program has been considered as a pivotal to strengthen the referral system especially in urban areas.[60] This requires providing and designing an infrastructure to collect the trusty, timely and dynamic data and information for decision-making. Therefore, the new initiatives for developing health equity indicators and electronics household records on health can improve the functions and capabilities of the HIS.

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