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Access Priorities in Controlling Neonatal Mortality in Iran

Negin Madadzadeh [1,*], **Somayeh Hesam** [2], **Setareh Yousefi** [3]

[1] Midwifery Group, As.c. Branch, Islamic Azad University, Tehran, Iran

[2] PhD in Health Services Management, South Tehran Branch, Islamic Azad University, Tehran, Iran

[3] Midwifery, Astara Branch, Islamic Azad University, Astara, Iran

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*Corresponding author: Negin Madadzadeh, Midwifery Group, As.c. Branch, Islamic Azad University, Tehran, Iran. E-mail: neg4@iau.ac.ir

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Abstract

Introduction: Despite the success in reducing neonatal mortality in Iran, it is still far from developing countries and some Asian countries in this field. This study seeks to identify access priorities in controlling neonatal mortality for planning. Therefore, factors affecting access can be a predictive factor in controlling neonatal mortality in future macro-level management policies.

Methods: This applied cross-sectional research was done by the factor analysis method based on four patterns of reducing neonatal mortality. After reviewing different texts and patterns, the common and non-common dimensions of these patterns were set in a comparative table. The results of comparative studies were designed in the form of a questionnaire and sent to 20 experts for reliability and validity. Validity was confirmed by CVI and CVR methods and reliability by Cronbach's method. To validate the model, the final questionnaire was completed and collected by interviewing 311 people from seven provinces in a multi-stage interview with the multi-stage random sampling method. Data were analyzed using SPSS25 and AMOS-18 software.

Results: A total of six factors were identified as effective in controlling neonatal mortality, which include access to health services, policy-making, health care delivery, health information systems, family participation, and evaluation. Among these, access to health services and evaluation had the highest and the least effects with 23.19% and 1.19% of explained variances, respectively.

Conclusions: The availability of a skilled and trained person and the guarantee of the national budget for the availability of these people are the most important factors in access to controlling the mortality rate.

INTRODUCTION

The neonatal mortality rate is a suitable indicator for measuring the health of the community and can express the extent of community health services to women and children [1], which in fact expresses one of the pillars of social justice. The neonatal mortality index is an important health index that has a direct impact on neonatal mortality rates and children under 5 years old [2]. This index includes the death of all neonatal s who die from birth to the first 28 days of life, which is expressed as the number of deaths per 1000 live births during a year [3].

It is estimated that 78% of all neonatal deaths occur in middle- and low-income countries [4]. According to the UNICEF report, the neonatal t mortality rate in Iran was 8 per thousand in 2021 [5]. In the same year, however, this rate was much lower in developed countries, for example, 2 per thousand in Australia and 3 per thousand Germany in 2021 [6]. In fact, the neonatal mortality rate in Iran is still 3-4 times that of developed countries.

Most studies summarize the cause of neonatal mortality in three factors: prematurity, asphyxia, and infections [7-9]. These factors are the direct causes of death in developing countries, which can be easily prevented with low-cost interventions and technologies [10-12]. Alijani Renani (2018) studied the underlying causes of neonatal death in Abuzar Hospital in Ahvaz. According to this study, the five leading causes of death were generally prematurity, respiratory distress syndrome, septicemia, asphyxia, and intracranial hemorrhage. It was also found that the causes of death in low-birth-weight neonatal were similar to premature neonatal and included respiratory distress syndrome, septicemia, asphyxia, and intracranial hemorrhage [13].

Numerous studies have been conducted on factors affecting the mortality of children under one year of age in Iran and the world, most of which have studied a combination of health and social variables affecting mortality [14, 15]. Results and Conclusions: Overall, more than half of neonatal deaths in LMIC (Low and middle income countries) are avoidable through established and well-known cost-effective interventions, good quality antenatal and intrapartum care, neonatal resuscitation, thermal care, nasal CPAP, infection control and prevention, and antibiotic stewardship [16]. A comparison of neonatal mortality in the UK and Sweden shows that adverse birth-related accidents and socioeconomic factors lead to higher neonatal mortality in the UK [17]. Based on the finding of this study, ANC follow-up and neonatal normoglycemia will have significant impact to reduce neonatal mortality in NICU. Generally, in order to reduce NM rate encouraging mothers to visit health facility for ANC follow-up during the pregnancy period, monitoring labor with a partograph, and engaging in regular breastfeeding should be put into practice in order to lower the NM rate [18].

UNICEF and the WHO have developed a variety of models to reduce neonatal mortality as a result of their research. To reduce neonatal t mortality, UNICEF (2015) has proposed strategic measures, including ensuring the provision of essential neonatal primary care, promoting social and political support to ensure a capable environment for providing essential neonatal care, ensuring access and the use of specialists skilled in the field of mother and child in a safe environment, participation of families and communities in increasing demand, and improving the quality and access to perinatal information. The study also paid special attention to the referral system and midwifery emergency of human resources [2]. The WHO Action Plan (2015) summarizes its research and identifies four important areas for neonatal activities: leadership and trusteeship (national programs and policies), health information system, implementation of health services, and provision, respectively. Health Financial [19].

The EWEC (Every women every child) Working Group, reviewing and summarizing studies conducted by UNICEF and the WHO, has proposed seven strategic measures to reduce neonatal mortality: using national data to investigate the causes of neonatal mortality, care during pregnancy, and labor, and childbirth, improving the quality of services, strengthening health information systems, innovations, and goods, access to every woman and baby, interacting with the community, and improving the quality of data [20]. Nineveh (2015) compared the management system of health services in Iran with several countries and finally presented a model for the maternal and child health system. He has proposed changes in his model in seven areas: support system, provision of services and equipment of government support policies, human resource management, systematic midwifery care system, a system of registration, referral and joint operation, and management of financial and physical resources [17].

According to the mentioned materials, the infant mortality rate in Iran is still far from developing countries, on the other hand, the models presented for other countries are presented and there is still no model to control infant mortality. The measures taken in Iran are not enough to control the reduction of infant mortality. At the same time, access to health care services plays an important role in reducing infant mortality. According to the mentioned introduction, this study aimed to summarize the measures taken and the proposed solutions of the mentioned models to investigate factors affecting access to health services.

METHODS

The present cross-sectional study in terms of the applied purpose was conducted quantitatively and comparatively. In the first stage, the literature 23 scientific articles and models presented by UNICEF and the WHO, EENC (every essential newborn care), and ENAP (every newborns action plan) were reviewed by the summarizing method. By summarizing, the articles were read and the important points of each article were extracted. Articles of 2018 were searched using Google Scholar, PubMed, Elsevier, and Scopus search engines by keywords of neonatal mortality, neonatal mortality control, and interventions affecting neonatal mortality. Studies on neonatal mortality and neonatal mortality rates were not included in the study. Then, the data of this phase were classified using an adaptive matrix (Table 1). The output of this activity was the extraction of 83 components questionnaire as well as operational and theoretical variables affecting the control of neonatal mortality. The data collected through the questionnaire was used in the second stage to confirm the design model to control infant mortality in Iran. Based on these components, a preliminary questionnaire was developed to examine the relevant items and the calculation of CVI (0.82) and CVR (0.7) and to eliminate unnecessary or irrelevant options. The questionnaire was then given to 30 experts in the field of neonatal mortality, consisting of those with managerial positions, more than 8 years of experience in neonatal mortality, and working in the Ministry of Health and Medical Education, as faculty members at universities, and hospitals. At the completion of this step, the final questionnaire was designed with 48 items, its reliability was determined using the Cronbach's alpha coefficient method, and distributed among 30 experts. The reliability was assessed by the internal consistency method, and the calculated Cronbach's alpha coefficient

(0.94) indicated the acceptable internal consistency of the questionnaire.

In the third stage, this questionnaire was provided to employees with a background in neonatal mortality (including physicians, faculty, midwives, nurses, and family health experts) throughout Iran. Data were collected after the completion of the questionnaire. The sampling method was simple random. Considering the size of the sample and the limitation of collecting questionnaires from 31 provinces of the country, a quarter of them, 7 provinces, were selected. Within each province, 2 hospitals and 3 health centers were selected. Questionnaires were distributed among the following people; obstetrics, neonatal and supervisors' wards, community health centers, and managers and deputies of the health network. Inclusion criteria were midwives, nurses, physicians, and health care providers with at least 2 years of work experience related to neonatal mortality, assistants and managers of neonatal departments, obstetrics, supervisors, and health centers, and managers and deputies of health care networks. The midwives and nurses were working in the maternity neonatal wards. In this study, the number of samples for collecting quantitative data on sample size based on a review of texts that are 5 to 15 [13] times. The variables has been proposed, according to 48 items at least 240 samples, which in practice researchers 311 questionnaires they collected.

The adequacy of sample size (0.924) was measured using the Kaiser-Meyer-Olkin (KMO) index. The collected data were analyzed by the exploratory factor analysis using SPSS software version 25, and then rotation was done by the Varimax method to identify six factors with a specific value (Eigenvalue) higher than 1. In the next step, the data model was validated using the confirmatory factor analysis (CFA) by the AMOS software version 18 using df, X^2, X^2, GFI, AGFI‘, CFI, and RMSEA indices. A summary of the research method process is provided in Figure 1.

Table 1. Models provided to control or reduce neonatal mortality

Model name	Year	Dimensions
UNICEF EENC Operational Program	2017	Accepting EENC, improving social support, ensuring access, family participation, improving the quality of health information
UNICEF Healthy newborn neonatal **action plan (Western pacific Asia)**	2014	Ensuring the implementation of Early Essential Newborn Care, political and social support to ensure an enabling environment for Early Essential Newborn Care, access and use of skilled birth attendants and essential maternal and newborn commodities in a safe environment, Engage and mobilize families and communities to increase demand, Improve the quality and availability of perinatal information
Ending Preventable Maternal and Newborn Mortality and Stillbirths Effective interventions and strategies (EWEC Group)	2015	Engage in data-driven country analysis, Strengthen and invest in care during pregnancy, labor, birth, and the first day and week of life, Focus on improving quality of care, strengthen health systems — health workforce, commodities, innovation, reach every woman and every newborn, Harness power of parents, families, and communities, strengthen measurement capacity and improve data quality
WHO action Plan (2015)	2015	Leadership and policy-making, health information system, health services delivery, financing of health services, health workforce, essential medical products and technologies, Community, ownership, and partnership

In this study, data collection tools included a receipt, a comparative table, and a questionnaire. The results of this study can be generalized to women from pregnancy to postpartum and neonatal s from birth to 28 days after birth. The scope of this research also refers to the data of UNICEF and the WHO in the last 10 years (2010 onwards, collected in 2019). The time span of this research goes back to the models presented in the last 10 years (2010-2021).

To collect the required information in the study, a questionnaire was developed in three parts. The first part included the characteristics of the interviewees, the second part was about a brief description of the research and the initial conceptual model, and the third part consisted of 48 questions affecting the components extracted from the review study and measured in the eyes of experts. In this section, the questions were scored on a five-point Likert scale. SPSS software was used for data analysis, and then AMOS 25 software was used for the CFA of dimensions and effective components.

Table 2. Research steps

Step 1	Conducting a library study to extract the dimensions of the model: qualitative
Step 2	Forming an adaptive matrix to identify variables: qualitative
Step3	Expert survey on important variables taken from comparative study, questionnaire design and determination of validity and reliability of questionnaire: Quantitative
Step 4	Field study and survey of employees
Step5	Exploratory factor analysis and mathematical pattern extraction: Quantitative
Step 6	Field study and survey of users: Quantitative
Step 7	Confirmatory factor analysis
Step 8	Presentation of the final model

RESULTS

To extract the underlying factors of the neonatal mortality control model, the data were analyzed using a principal component analysis approach. KMO is a test conducted to examine the strength of the partial correlation (how the factors explain each other) between the variables. KMO values closer to 1.0 are

consider ideal while values less than 0.5 are unacceptable. The Bartlett's test of Sphericity is used to test the null hypothesis that the correlation matrix is an identity matrix. An identity correlation matrix means your variables are unrelated and not ideal for factor analysis. The results of the analysis showed that the KMO (Kaiser-Meyer-Olkin) index was equal to 0.924, and the Bartlett spherical index was statistically significant at the level of 0.01.

Table 5 shows that six eigenvalues greater than one were extracted following the analysis, which explained approximately 72% of the total variance. The shares of the first (access to health care services) and the last factors (health information systems) in explaining the total variance were 23. 190% and 1.199%, respectively.

Table 3. Bartlett and K.M.O. indices

Kaiser-Meyer-Olkin for sample adequacy	0.942
Batrlet test	
Chi-square	15407.933
Degree of freedom	1128
Significance level	0.000

Table 5. Number of components, total explained variance, Eigenvalues, and variances explained by each factor

Factors	Total (special value) Eigen value	Percentage of variance (unique contribution to the explanation of total variance)	Cumulative percentage (cumulatively explained variance)	Total	The cumulative percentage
Access to health care services	23.190	48.313	48.313	23.190	48.313
Health policy	3.076	6.408	54.720	3.076	54.720
Technology innovation	2.885	6.011	60.731	2.885	60.731
Participation of families	2.610	5.437	66.168	2.610	66.168
Health information systems	1.746	3.639	69.807	1.746	69.807
6	1.199	2.498	72.305	1.199	72.305

The analysis was repeated for the second time in which the Varimax cycle was used to extract the components. Items 17, 18, 19, 20, 21, 22, 23, 24, 26, 27, 28, 29, 30, and 38 are the first factor, items 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10 are the second factor, items 25, 31, 32, 33, 34, 35, 36, 37, 39, and 40 the third factor, items 11, 12, 13, 14, 15, and 16 the fourth factor, items 41, 42, 44, 45, 46, and 48 are the fifth factor, and items 43 and 47 are the sixth factor of the questionnaire. After extracting the factors, each factor was named in proportion to the common meanings of the items and by re-polling the experts. Thus, the named factors were the first factor of access, the second factor of policy, the third factor of health services, the fourth factor of social participation, the fifth factor of health information system, and the sixth factor of evaluation.

In the next step, to determine the fit of the six-component model, the control model was designed with the data collected from the second-order CFA using AMOS 24.0 software and the maximum likelihood (ML) estimate. The analysis covered all items, each item was limited to the underlying factor and allowed first-order underlying factors (policy, social participation, access, health care delivery, information system, and evaluation) on the underlying factor. The model designed to control neonatal mortality creates a factor load. Table 6 shows the fitting indices of the assumed model.

Based on this, it was concluded that the model designed to control neonatal mortality had an acceptable fit with the collected data. Table 6 shows the parameters of the model designed to control neonatal mortality in the second-order CFA.

Table 6. The research model fitness indicators

Model fit index	The value obtained	Cutting point [1]
χ^2	295.388	
Model degree of freedom	1028	-
χ^2/df	2.071	
GFI [2]	0.907	0.90 <
AGFI [3]	0.896	0.850 <
CFI [4]	0.924	0.90 <
RMSEA [5]	0.078	0.08 >

[1] Cutting points based on Klein's perspective; [2] Cutting points based on Klein's view; [3] Relative Chi-square; [4] Fit goodness index; [5] Modified fit goodness index

Table 7. Fitting indices of factors affecting accessibility in controlling neonatal mortality

Fitness indicators	Initial model	Cutting point
χ^2	240.39	-
Model degree of freedom	89	-
df'/χ	2.70	<3
GFI	0.917	>0.9
AGFI	0.874	>0.85
CFI	0.966	>0.90
RMSEA	0.081	<0.08

The results of the analysis in the second order also showed a strong relationship between each of the components and the model designed to control neonatal mortality. The factors of policy components (β = 0.825), participation (β= 0.789), access (β = 0.853),

health services (β = 0.926), health information system (β = 0.783), and evaluation (β = 0.678) were higher than 0.6. The finding indicates a significant and acceptable role of each component in the model designed to control neonatal mortality. The fit of the factors affecting accessibility in controlling neonatal mortality was investigated using the CFA. Table 7 shows the fitness indicators related to the factors affecting access in controlling neonatal mortality.

Table 5 shows that the model related to the factors affecting access in controlling neonatal mortality has an acceptable fit with the collected data (df / 2 = 2.70, CFI = 0.966, GFI = 0.966, 0.874 = AGFI, and 0.081 = RMSEA). Table 8 shows the factor loadings of all variables affecting access to neonatal mortality control.

Table 8. Parameters related to variables affecting access to neonatal mortality control in the confirmatory factor analysis

Item	b (non-standardized factor loading)	β (Standardized factor load)	SE (standard error)	t (Critical ratio)
Availability and equal distribution of a skilled and trained person	1.000	0.909		
Guarantee the national budget for the provision of a skilled and trained person	0.997	0.896	0.039	**25.505**
Geographical access to all mother and baby	0.919	0.868	0.039	**23.560**
Complete care of mother and baby and mothers during pregnancy	0.980	0.866	0.042	**23.455**
Extensive access to specialized centers at all times	0.830	0.830	0.039	**21.251**
Full family planning coverage	0.879	0.875	0.037	**24.066**
Increase the length of hospital stay after delivery	0.806	0.782	0.043	**18.836**
Free treatment facilities for low-birth-weight babies	0.498	0.626	0.038	**13.046**
Training of first line health workers	0.914	0.891	0.036	**25.197**
Use practical training methods to learn the essential care of mother and baby	0.521	0.648	0.038	**13.735**
Newborn Care Guidelines	0.983	0.877	0.041	**24.193**
Develop standards for providing high-priority topics	0.598	0.769	0.033	**18.225**
Ranking of primary care implementation centers	0.803	0.821	0.039	**20.766**
Immediate treatment of suspected infections	0.450	**0.580**	**0.038**	**11.742**

**P < 0.01

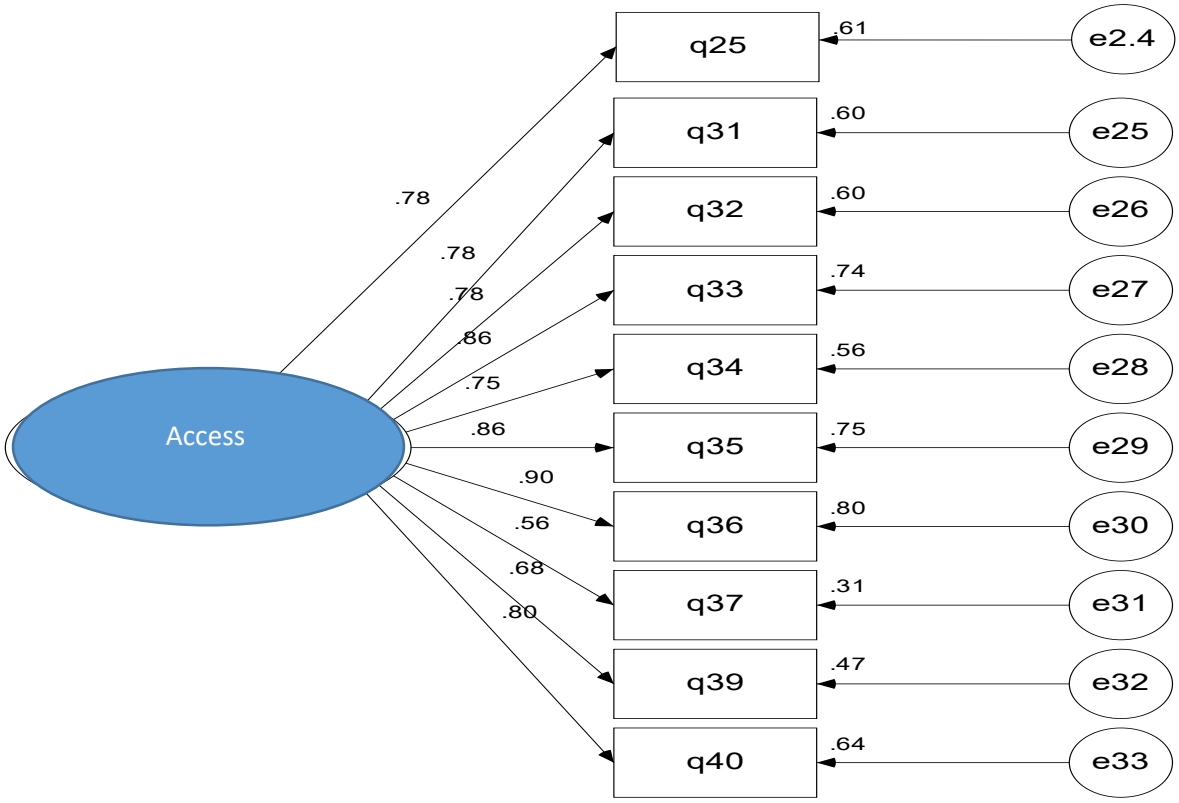

Figure 1. Confirmatory factor analysis of the access factor in the neonatal mortality control model based on standard coefficients

According to the results of Table 5, the highest factor load belongs to item 17 (β = 0.909) "availability and equal distribution of skilled and trained person" and the lowest factor load belongs to item 38 (β = 0.580) "immediate treatment "suspected infections." Therefore, all components can be considered as factors affecting access in controlling neonatal mortality. Figure 1 shows an accessibility model for controlling neonatal mortality.

DISCUSSION

According to the findings, a total of 6 factors were found to be effective in controlling infant mortality, which include: access to health care services, policies, technologies and innovations, health information systems, family participation, and evaluation. Meanwhile, access to healthcare services with the largest share in the explained variance [19, 21] and evaluation with the lowest share in the explained variance (1.19) have had the least impact.

Based on the results of the present study, access to health services and policy-making was among the most effective factor, and access to the health information system and the evaluation was the least effective factor in controlling neonatal mortality in Iran.

In the present study, the access factor of the neonatal mortality control model consists of 14 components, in which the highest factor load belongs to the component "availability and equal distribution of a skilled and trained person" and the lowest factor load belongs to the component "treatment". "Immediate treatment of suspected infections." Therefore, it can be argued that access to all geographical areas is not desirable in Iran from the respondents' viewpoints, and there are problems in the optimal performance of employees and, in fact, the quality of service. In its research, UNICEF has also emphasized the importance of the presence of a skilled person in childbirth [22].

In the study of Nineveh, the role of the mother-child guidebook is very prominent in the developed countries, especially Japan. This booklet is provided free of charge to mothers and includes coupons for pregnancy visits and family education in simple language and in different languages, as well as care registration, which is designed for the whole country and public and private centers alike [23]. In the results of this research, the existence of this booklet has been necessary for the guidance of essential mothers, which is in line with the present study and the study of Bakhshi et al. [21].

One of the important components in accessing health services is wide access to medical centers at all times. The importance of the diversity of service centers for mothers and children is seen in the countries studied by Nineveh [20]. The existence of various birth centers in homes, hospitals, clinics, midwifery units attached to hospitals, etc. has increased the right of choice for mothers in childbirth in accordance with the risk and needs of their tastes and a sense of comfort and better access to enable services, which are consistent with the findings of Malqvist et al. [24]. Facilities should be considered to encourage professionals and midwives to provide services in rural and deprived areas, which is consistent with the study of Sambo et al. [25].

According to the findings of the present study, access to health services in Iran is an important factor in controlling neonatal mortality. Access itself is divided into physical, geographical, cultural, financial access, and so on. Evans also points out that the training of midwives and health workers, the availability of medicines, the presence and access of skilled people at birth, and the emergency transportation system are effective in reducing neonatal and maternal mortality [6].

Geographical access is of little importance from experts' views in this study. According to the respondents, there are health centers in Iran in different places, but the main problem seems to be in the training and ability of staff to provide health and care services, as well as raising the awareness of families in receiving services. The findings of this study are not consistent with those of Homay Rad, [26] who state that despite the increased access to maternity services, the quality-of-service delivery has not improved considerably, which is consistent with Mbowele [7]. According to his study in Iran, rural-urban injustice in receiving services has a greater impact on child mortality and is one of the reasons for the importance of access to control mortality in Iran. Perhaps the situation of injustice has improved slightly over the years after the study of Homay Rad [26].

Health care costs can be a major barrier for families seeking care during pregnancy, childbirth, and after childbirth. In some countries, up to 11% of the population is pressured to pay for health care, and 5% of the population is impoverished by paying for health care, including essential maternal and neonatal care [27]. Global health coverage for maternal and neonatal care faces two major obstacles: access to essential services for all people in the country and protection from financial constraints related to the cost of these services. Performance-based financial incentives can potentially increase the quality of services, but payment has been shown to increase demand as well. To achieve universal coverage, political leaders, financial decision-makers in countries, and community-level development partners must prioritize adequate and sustainable resources for maternal and neonatal health [20, 28].

Although the proportion of women giving birth in the presence of a skilled person (physician, nurse, or midwife) has risen to 70% worldwide, there are large differences in the quality-of-care coverage between countries and within countries. The group of each

woman, each child in its study among countries with higher neonatal mortality, encountered 38 cases of severe imbalance and fundamental shortages in access to health services. Evidence also shows that 87% of essential maternal and neonatal services can be provided by midwives [2]. Similarly, the availability of life-saving facilities can be a bottleneck in the provision of quality care rather than investment strategies in supply and demand.

In a study on the quality of services, Mousavi shows that there is a large gap between the benefits of health indicators between West and East Azerbaijan provinces [29]. Okeke studied obstetric care and its effects on neonatal mortality in Nigeria and found that high levels of organizational care in obstetrics reduced neonatal mortality. In fact, he studied home delivery and its relationship with neonatal mortality. His findings show that knowing the date of delivery and its timing is directly related to the use of health services. Furthermore, night delivery is associated with a high rate of home delivery, a high rate of neonatal mortality, and the need for 24-h coverage and the use of health services. This study highlights the importance of policy for 24-h coverage of health services [30], which is consistent with the findings of the present study. In the present study, various dimensions of access to health care services were comprehensively investigated. One of the strengths of the current study is that it has comprehensively gathered the dimensions of access to health care services, which have been mentioned in various studies, each of them referring to several dimensions.

Based on the results of the present study and the important role of access in controlling neonatal mortality, it is suggested to implement the necessary measures for women and neonatal to have access to a trained and skilled person at birth in all parts of Iran Planners and stakeholders in neonatal mortality control. The results can be used in hospitals and all neonatal health centers. Also, it is suggested to look into strategies for more access to healthcare services in the next studies. According to the findings of the research, it can be said that there are various barriers to access health care services to control infant mortality, including legal, financial, gender, and cultural barriers to appropriate health care services for infants, and it is necessary to take measures to provide the same services to be adopted in the whole country through a single instruction. Also, life-saving facilities should be provided for every mother and every baby, and measures should be taken to provide high quality services to every mother and every baby.

Research Limitations

Every study has its limitations. In this study, we encountered the following issues: the existence of the opinion of the lack of practicality of the research among the people participating in the study, the high workload of the experts to answer and delay in returning the questionnaire.

CONCLUSION

The availability of a skilled and trained person and the guarantee of the national budget for the availability of these people are the most important factors in access to controlling the mortality rate.

CONFLICT OF INTEREST

The authors hereby declare that this work is the result of an independent study and has no conflict of interest with other organizations and individuals.

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ETHICAL CONSIDERATION

The informed consent form for the participants in the study was presented and completed, and signed by the researcher and the participant in the study. At the beginning of each interview, explanations were given about the objectives of the study, and the interviewees were assured that their details would remain completely confidential and that they could withdraw if they did not wish to continue the interview. Conducting this research would not cause any damage to the image of their organization. A written consent form for conducting the interview was presented and obtained. Necessary permits were obtained, and the code of ethics for this research was obtained with the code ir.iau.tmu.rec.1398.078.

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AUTHORS' CONTRIBUTIONS

All authors participated in conducting the research, analyzing the data, and writing the article. Ms. Negin Madadzadeh is the corresponding author.

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