Trend of geographical disparities in child and maternal mortality indicators in Northwest Iran

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Abstract

Background: The present study was conducted to assess the trend of geographical disparities in child and maternal mortality rates in 20 districts of East Azerbaijan, in the Northwest of Iran, between 1999 and 2013.

Methods: Data on to health indicators between 1999 and 2013, extracted from population registry panels (ZIJ), was made available for the study by the East Azerbaijan Health Center. Disparities were measured by calculating the Index of Disparities (ID_{isp}) and the trend was assessed using the general linear model test.

Results: All the four indicators revealed decreasing trends between 1999 and 2013 ($P<0.001$), while there were no significant differences among the districts studied ($P>0.05$). The ranges of the ID_{isp} between 1999 and 2013 were 19-32% for Neonatal Mortality Rate (NMR), 16-22% for Infantile Morality Rate (IMR), 14-20% for Under 5 Mortality Rate (U5MR), and 120-143% for Maternal Mortality Rate (MMR), which revealed an increasing trend for all the indices. The trend of health indicators before and after implementation of the family physician program showed no significant difference for MMR ($P= 0.228$), while significant declining trends were observed for NMR, IMR, and U5MR ($P<0.001$).

Conclusion: The results showed that despite the downtrend in NMR, IMR, U5MR, and MMR indicators, there are still geographical disparities in these indicators among districts of the East Azerbaijan province, in the Northwest of Iran.

Introduction

The unnecessary, avoidable, and unfair differences in health are defined as inequity in health, which is synonymous with disparity, and it is a difference in which disadvantaged social groups –such as the poor, racial/ethnic minorities, women, or other groups who have persistently experienced social disadvantage or discrimination– systematically experience worse health than more advantaged social groups (1).

The aim of health policy makers was that the mortality rate of children under 5 years reach two-thirds of the rate between the years 1990 and 2015 (2).
According to the Millennium Development Goals (MDG) 2015 report, the death rate of children under 5 years in every region of the world has declined by more than half, with the exception of Oceania; however, the process is not sufficient to reach the MDG target and

about 10 years or more are needed to reach the global goal (3).

After the Global Strategy of Health for All meeting in Alma-Ata in 1978, the implementation of the primary care system in the form of health networks began for the first time in Iran rural areas in 1980. Currently, information on the health care system is updated and recorded regularly in the population registry panel or Vital Horoscope (ZIJ) (4).

Infant Mortality Rate (IMR) is related to a number of health indeces including maternal health, access to health care, socioeconomic conditions, and public health policies (5).

International evidence shows that the highest rate of child mortality is seen in populations with low socioeconomic situations, so IMR is used as a standard index to measure socioeconomic development and public health (4).

Maternal mortality and the mortality of children under 5 are considered to be important indicators of public health and socioeconomic development (6, 7) and require policy-makers to make appropriate decisions to decline the trend (7).

The maternal mortality rate in Iran reduced from 31 deaths per 100,000 live births in 2005 to 23 in 2013 (6) and the deaths of children under 5 years dropped from 26 deaths in 2005 to 17 in 2013 (8).

India, as the most populous country in South Asia, has the highest death rate of children under 5 years in this region and 20% of deaths under age 5 in the world. A study conducted in India to examine the death of children during the last two decades showed that, despite the decrease in mortality of children under 5 years in India, compared to countries with similar economic and social conditions, the rate was still at a high level. Epidemiologic and demographic studies show that low economic status, women's low level of education, poor maternal nutrition, low maternal marriage age, large family, women's lack of independence, and inadequate access to health services have negative impacts on maternal and child health (9).

A significant reduction was seen in the child mortality rate in Tanzania due to access to effective and new healthcare services, health education, and vaccination and malaria programs in the recent years. A recent analysis has shown a 24% reduction in child mortality between the years 2000 and 2004. If this trend continues, Tanzania will be among the African countries that will achieve the fourth MDG goal (10).

The Ministry of Health in Iran initiated a series of health sector reforms, including the pilot of the family physician program in urban areas since 2001. The child mortality rate has rapidly declined in Iran in the recent years. The statistics show a decline from 28.6 deaths per thousand live births in 2006 to 21 in 2011 (4). Despite progressive reduction of child mortality in the country in the recent years, geographic disparities in child mortality continue to exist among different provinces; the geographical disparities are observed to be different even in cities of a province (5).

Therefore, the present study was conducted to examine the 15 year trend of maternal and child mortality indicators and geographical inequalities in maternal and child health in Northwest Iran and the impact of the family physician program on the process.

Methods

East Azerbaijan province, located in Northwest Iran, has a population of over 3,700,000, 20 districts, 59 cites, 142 villages and 69.2% urbanization. In the current observational study, secular trends of four health indicators, including the IMR, (Neonatal Mortality Rate) NMR, Under 5 Mortality Rate (U5MR) and Maternal Mortality Rate (MMR), were used to observe health inequality in 20 districts of East Azerbaijan. Data related to health indicators between 1999 and 2013 extracted from Vital Horoscope (ZIJ) was

made available for the study by the East Azerbaijan Health Center.

A paired t-test was used to determine whether or not there was a difference in secular trends of health indicators in the districts studied before and after implementation of the family physician program. Also, the general linear model test was run in Statistical Package for the Social Sciences (SPSS) software version 21 to assess the trend of health indicators among these districts.

The Index of Disparity (ID_{isp}), which is a quantitative index to evaluate inequities among population groups over time, was used to measure the 15-year trend of health inequalities. ID_{isp} summarizes the difference among specific group rates and the reference rate, expresses the summed differences as a proportion of the reference rate, and the obtained value is multiplied by 100. The total population rate of the East Azerbaijan province is considered the reference rate. The following formula was used to calculate ID_{isp}:

$$\text{Index of disparity} = \left(\sum \left| r_{(1-n)} - R \right| / n \right) / R^{*}$$

where r indicates the index rate in the target group, R refers to the index rate in the total population or reference population, J is the number of groups compared, and n shows the number of the groups.

A decreasing trend in ID_{isp} would indicate decline in health inequalities and also reflect an improvement in equality among the groups observed (11). Excel 2010 was used to calculate the index.

Results

The main effect of the secular trend of NMR with F=81.5 and *P*<0.001 was found to be significant. That is, the NMR trend had a significant decline over the 15-year period. But the differences among the districts related to the indicator were generally not significant during the same period (F=1.02 and *P*=0.40).

Also, comparison of the districts in pairs in terms of health indicators using the general linear model revealed that the obtained IMR in Bonab, Kalaybar, and Hashtrood districts was higher than those of Ajabsheer and Bostanabad, and the difference was statistically significant (*P*= 0.01).

The main effect of the IMR process with F=103.2 and *P*=0.001 was significant, meaning that it had a significant decline over 15 years. However, the difference was not statistically significant in this indicator among the towns studied (F=1.029 and *P*=0.40).

In paired comparison of the towns' IMR indicator, it was found that the indicator was higher in Kalaybar compared with those in Ajabsheer, Meyaneh, Varzeghan, Ahar, Bostanabad, Sarab, Shabestar, and Tabriz, and this difference was statically significant (*P*=0.02).

IMR index in the town of Charoymaq was also higher than that in Shabestar (*P*=0.01).

The main effect of the U5MR process with F=96.44 and *P*<0.001 was found to be significant, meaning that the U5MR process had a significant decline over the 15-year period studied. However, the difference was not statistically significant (F=1.028 and *P*=0.41).

However, in paired comparison of the towns' U5MR index, it was found that the index was higher in Kalaybar than those in Julfa, Meyaneh, Marand, Bostanabad, Sarab, Shabestar, and Tabriz, and it was higher in Charoymaq than those in Bostanabad, Julfa, and Shabestar (*P*=0.01).
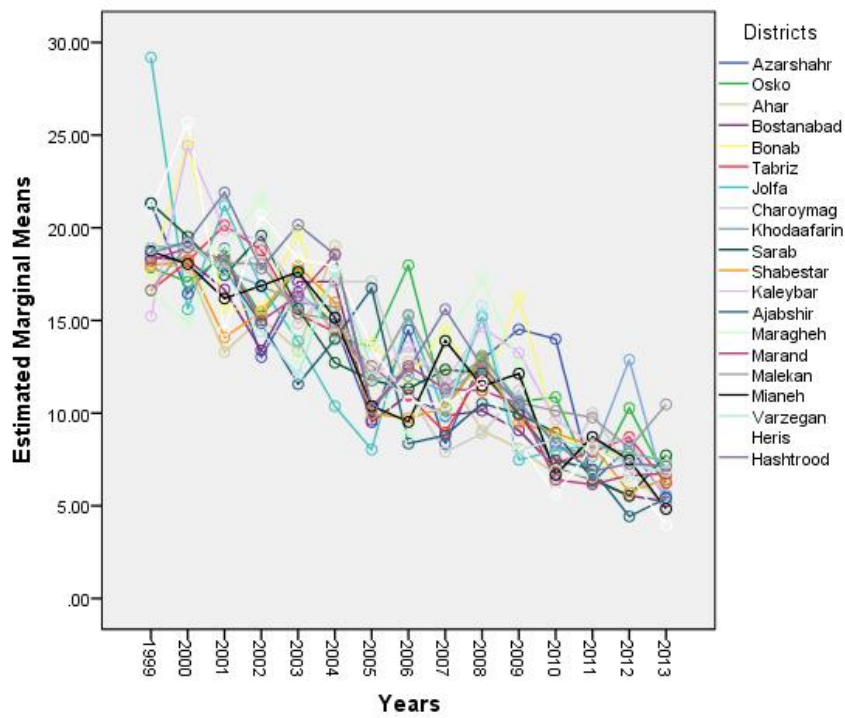
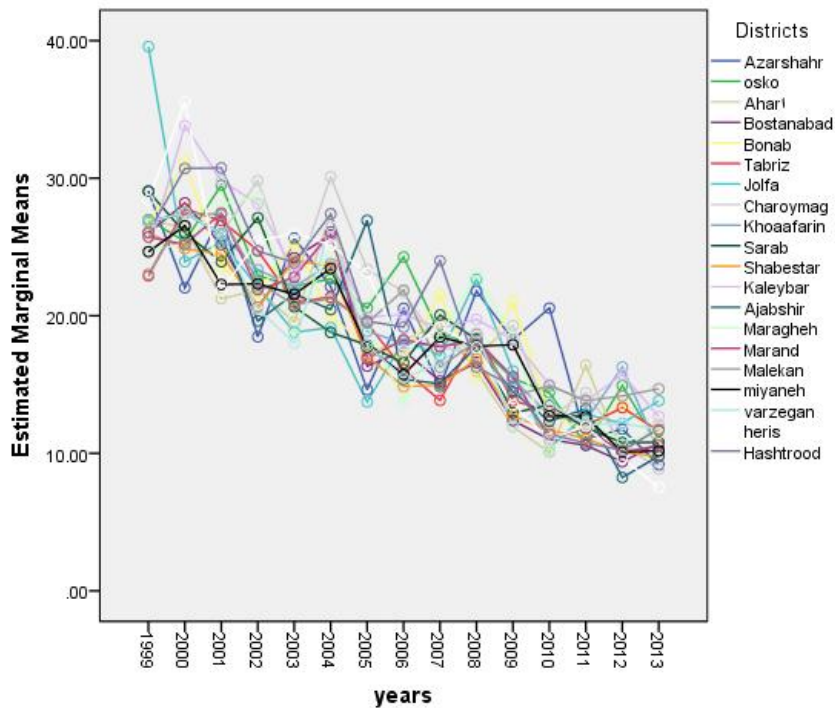Figure 1. A 15-year trend of neonatal mortality rate among districts of the East Azerbaijan province

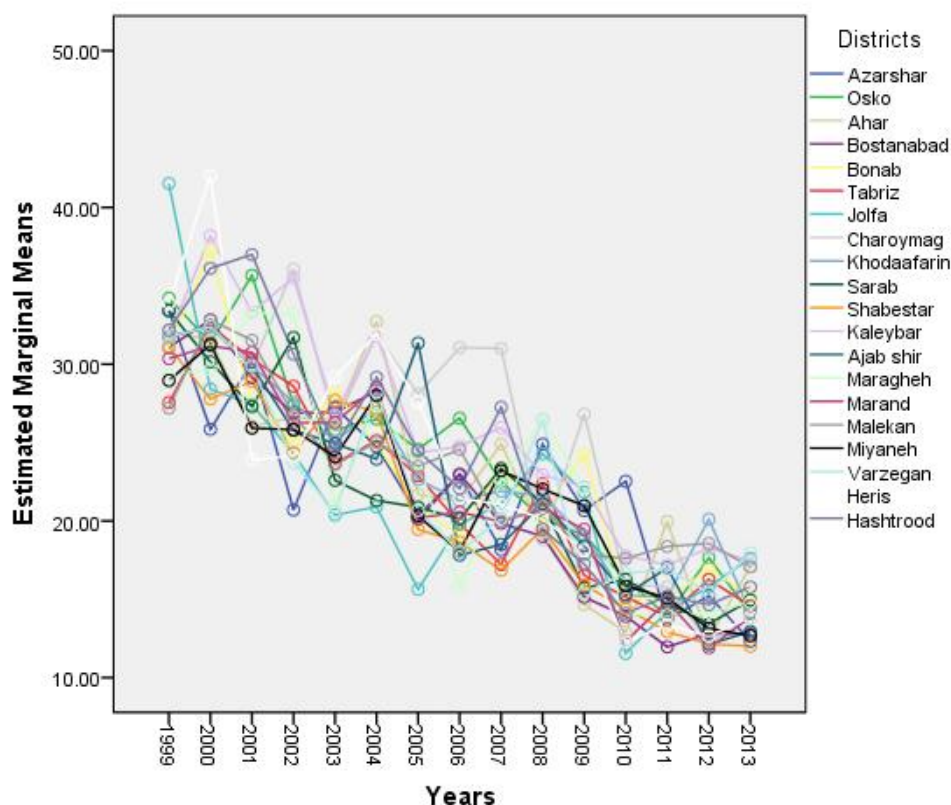Figure 2. A 15-year trend of IMR among districts of the East Azerbaijan province

Figure 3. A 15-year trend of U5MR among districts of the East Azerbaijan province

The secular trend of MMR with F=3.44 and *P*<0.001 was found to be significant, as well. That is, the MMR index over the 15 years studied had a significant declining trend. However, the difference among the towns in terms of MMR over this period was not generally significant (F=1.021 and *P*=0.43).

In paired comparison of this index among districts, the index rates in Charoymag and Harris counties were higher than those in Azarshar, Uskoo, Bonab, Tabriz, Shabestar, and Kalaybar (*P*<0.05).

A paired t-test was used to see if there were differences for health indicators before and after implementation of the family physician program, that was started in 2006. The results showed no significant difference for MMR (*P*=0.22), while there were significant differences for NMR, IMR, and U5MR (*P*=0.001). Figure 5

displays the ID_{isp} trends of mortality rate indicators between 1999 and 2013, and Figure 6 displays this trend without the MMR.

The ranges of the ID_{isp} between 1999 and 2013 were 19-32% for NMR, 16-22% for IMR, 14-20% for U5MR, and 120-143% for MMR. Before the family physician program (1999-2005), the ID_{isp} for NMR, IMR, and U5MR showed an increasing steep, then the slope decreased while the ID_{isp} for MMR showed considerable fluctuations.

Discussion

Health disparity refers to the index of population groups who can benefit from health care based on race/ethnicity, gender, age, socioeconomic status, and geographical location.
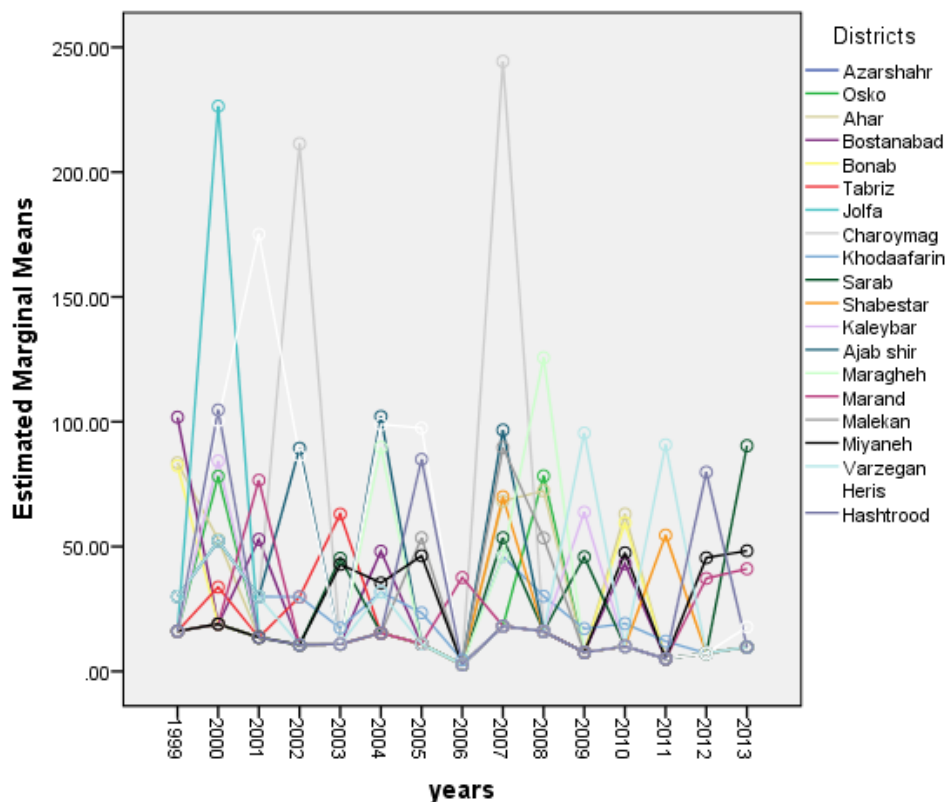
Figure 4. A 15-year trend of MMR among districts of the East Azerbaijan province

Many attempts have been made at the national and international level to decline inequalities in health that are unfair, unnecessary, and avoidable (12). In so doing, the health system in Iran has made great efforts to reduce inequities in the health sector, and these efforts have placed Iran among the countries that are active in the fourth (reducing child mortality) and fifth (reducing maternal mortality) millennium development goals (13). They observed that the decline in U5MR between 2000 and 2013 has been even sharper than expected (14). However, compared to some countries with similar socioeconomic statuses, including Cuba, Costa Rica, Sri Lanka, and Thailand, lots of work must be done in Iran regarding IMR and U5MR (15).

The results of the present study have shown a decline in the maternal and child mortality rates trend, which is consistent with the reduction of maternal and child mortality in the country and indicate adequate coverage of health care in East Azerbaijan. The results also showed a significant difference among the NMR, IMR, and U5MR indicators before and after the implementation of the family physician program in 2001, indicating the positive impact of this program. However, no difference was observed in the MMR indicator. The reason for the lack of difference could be due to the fact that Iran has achieved the fifth millennium development target to reduce maternal mortality by as much as 75% between 1990 and 2015 (13). Also, following family planning coverage in Iran during the past three decades, fertility has significantly decreased, so has maternal mortality (16).
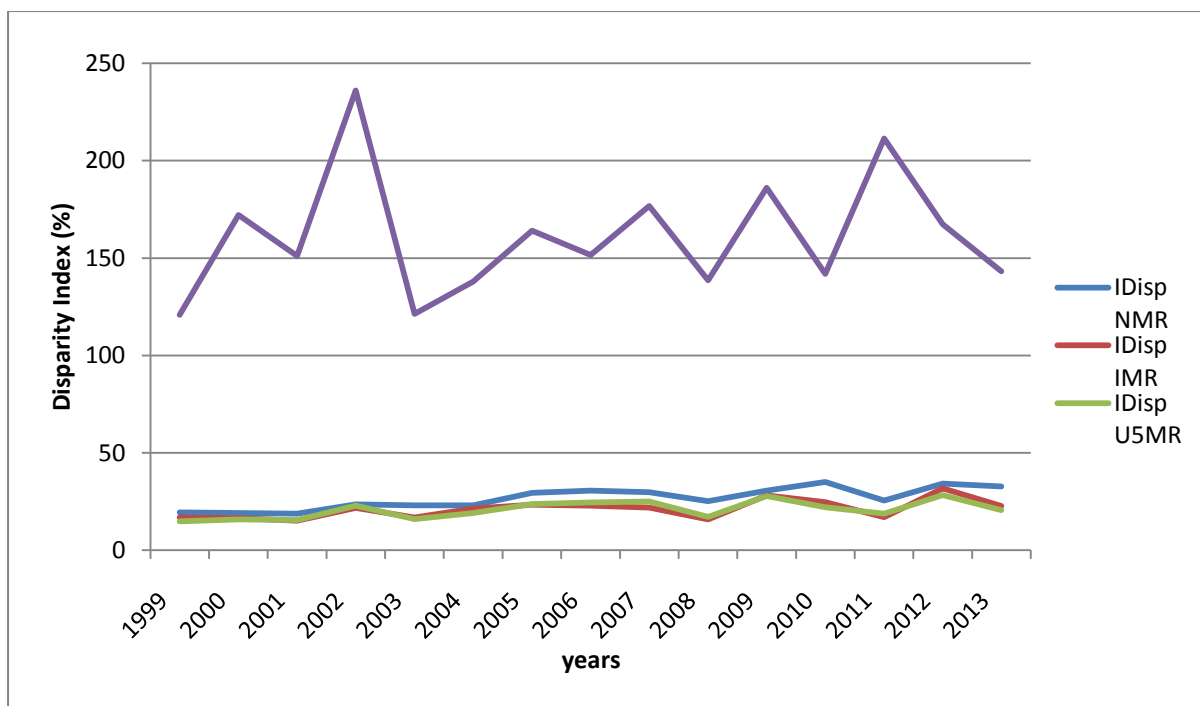
Figure 5. The ID$_{isp}$ trend of NMR, IMR, U2MR, and MMR in the districts of East Azerbaijan, 1999 to 2013
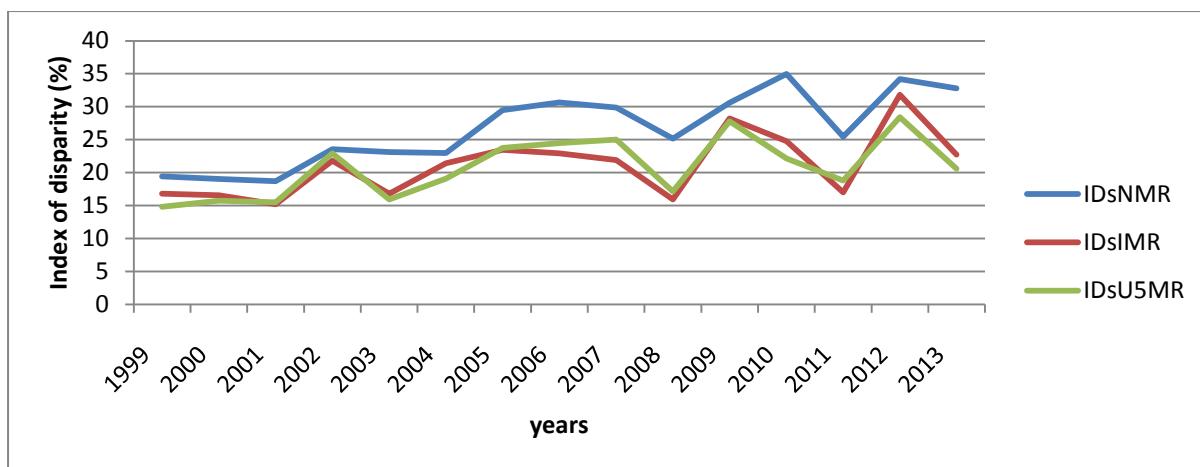

Figure 6. The ID$_{isp}$ of NMR, IMR, and U5MR in the districts of East Azerbaijan, 1999 to 2013

As for child mortality, since Iran is on the track for the fourth millennium development goal, it seems that the family physician program has increased the provision of health services to children. Moreover, since midwives, who play a key role in increasing mothers' awareness during pregnancy, were involved in the family physician program, too, their role seems to be effective in reducing NMR, as well.

In our study, the general trend of the indicators was not significant in separate towns within the 15-year period studied. Also, in paired comparison, IMR, U5MR, and MMR indicators were not in satisfactory condition in Charavimaq, Harris, and Kalaybar, which could be due

to their deprivation of and low access to health facilities.

Ajabshir and Bostanabad districts differed from Kalaybar, Bonab, and Hashtrood in terms of the NMR indicator. Of course, the status of this indicator was better in Ajabshir and Bostanabad than in the three other districts. The probable reason for this in Bostanabad could be due its proximity to Tabriz, which makes the immediate referral of newborns possible in case there is an urgent need for special care. Another study carried out in the country showed lack of access to Neonatal Intensive Care Unit (NICU) in addition to primary care in most parts of Iran as a reason why decline in NMR indicator was slower than that for other indicators (15).

Based on the 2015 Millennium Development Goals Report, the NMR in the world in years 1990-2015 declined from 33 deaths to 19 per 1,000 live births. However, since the decline in NMR is slower than the mortality rate decline in 1-5 year-old children, the highest U5MR has been allocated to the neonatal mortality for the time being (3).

One study conducted on disparities in health indicators among Iranian villages showed that, despite improvement and promotion of health indicators in the country, it seems that this promotion has not been homogeneous and balanced. In fact, not only has the improvement been observed to be unequal in all indicators of the country, but there was heterogeneous inequality in indicators' improvement among the provinces of the country, too (17). The results of disparity indicators in the present study showed that disparity in health indicators over the past 15 years had an increasing trend. Of course, this upward trend is slow, which implies that health facilities are not equally distributed among districts of the province and the facilities are more concentrated in the centers of districts, especially in Tabriz. A study by Lakeh et al. showed that the disparity indicator was rising for NMR. In addition to primary health care, access to NICU

was recommended to reduce this disparity (15). In the present study, this indicator showed a decreasing trend in East Azerbaijan. Yet, the health sector cannot be the only entity responsible for this disparity. Studies have shown that other factors, including family income, maternal education, adequate housing, water and sanitation systems, etc., are involved in leading to the disparity in maternal and child mortality indicators (18, 19).

Limitations of the study

In the present study, there was no possibility to evaluate other factors affecting the trend of disparities. Other advanced statistical methods to observe the trend of inequality could be implemented, as well.

The results showed that, despite the downtrend in NMR, IMR, U5MR, and MMR indicators, there are still geographical disparities in these indicators among districts of the East Azerbaijan province. This shows that health facilities have not been distributed evenly among East Azerbaijan districts.

Conflict of Interest

Authors declare no conflict of interest.

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