Causes of Maternal Mortality in Iran: A Systematic Review

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Abstract

Background: Maternal death is a key qualitative reliable index of a nation's economic development. The present research aims to investigate causes of maternal mortality in Iran.

Materials and Methods: A systematic review of the following databases led us to find the target articles: Medline (via PubMed), Science Direct, CINAHL, CINAHL (EBSCO), Scopus, Web of Science, SID, ISC, Magiran, and Google Scholar. The key terms searched for were: pregnancy, childbirth, mother's mortality, pregnancy side effects, Iran. The search was done in two languages, English and Persian. The operators used were AND, NOT, OR which led us to find related articles.

Results: A review of the 19 articles indicated that the main direct causes of mortality were respectively bleeding, eclampsia, sepsis and embolism. Among the indirect causes of mortality, background diseases ranked first and heart diseases ranked next. Overall, the foremost rate of mortality was induced by direct causes.

Conclusion: According to the present findings, a number of suggestions are made to help to significantly reduce the rate of pregnant women's mortality in Iran: recognition of mothers at risk by the healthcare staff, preventive measures such as educating efficient and experienced forces, more equipment and facilities including blood products, monitoring care provision during pregnancy, during and after the childbirth, development of local healthcare centers and educating more midwives especially in rural areas, improvement of nursing hospitals in counties and timely referral of mothers to specialized centers.

Key Words: Iran, Maternal mortality, Pregnancy, Systematic review.

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1- INTRODUCTION

Maternal death during pregnancy or in 42 days of pregnancy termination for any reason except for accidents is considered as induced by the side effects of pregnancy and childbirth (1). Mother's mortality is a key qualitative and reliable index of national economic development and a function of women's literacy, means of communication, access to healthcare services and midwifery emergencies, medical costs and availability, family income and quite many other factors (2). According to the United Nations Millennium Development Goals, mother's mortality was expected to reduce for 75% in 2015 as compared to the base in 1990 (3). As maintained in the latest report by World Health Organization (WHO), the total mortality rate of pregnant women in 2015 was 303,000 cases worldwide (4). About 830 women die from pregnancy- or childbirth-related complications around the world every day. It was estimated that in 2015, roughly 303,000 women died during and following pregnancy and childbirth. Almost all of these deaths occurred in low-resource settings. Every day, approximately 830 women die from preventable causes related to pregnancy and childbirth. Ninety-nine percent of all maternal deaths occur in developing countries. Maternal mortality is higher in women living in rural areas and among poorer communities. Young adolescents face a higher risk of complications and death as a result of pregnancy than other women. Between 1990 and 2015, maternal mortality worldwide dropped by about 44%. Between 2016 and 2030, as part of the Sustainable Development Goals, the target is to reduce the global maternal mortality ratio to less than 70 per 100,000 live births (5-8). National and international body of related literature showed the key factors involved in mother's mortality to be: bleeding, mother's level of literacy, experience of prior pregnancy for more than four times, rural residence, unavailability of intensive care during pregnancy and unavailability of midwifery emergency care services (9-14). Despite the fact that a pregnant woman's death is a pitiful, avoidable and preventable event, no systematic review has yet been conducted to explore the underlying factors in the Iranian context. To fill the existing gap, the present research aimed to investigate Causes of Maternal Mortality in Iran.

2- MATERIALS AND METHODS

2-1. Study design and search strategy

The present systematic review aimed to investigate causes of maternal mortality in Iran. In the beginning of the study, search strategy was designed. By consulting a librarian who was familiar with databases, a decision was made to perform the search in electronic databases. The following national and international databases as follows Medline (via PubMed), Science Direct, CINAHL, CINAHL (EBSCO), Scopus Web of Science, SID, ISC, Magiran, and Google Scholar were searched in two languages, English and Persian to find the related body of literature. A manual search was done in Journals and Organizational Reports. In order to access organizational reports, the official websites of the Ministry of Health and Medical Education in Iran (http://www.behdasht.gov.ir), and WHO (www.who.int) were visited. The primary search was based on the following key terms: "pregnant women", "childbirth", "mortality", "pregnancy side effects", "Iran", "maternal death", "maternal mortality rate", and "pregnancy", were searched for in two languages, English and Persian. The operators used in the search were OR, AND, NOT. Further key terms and relevant operators specific to each database were used to change the strategy. The researchers repeated the search twice.

2-2. Inclusion criteria

In this study**,** cross-sectional research, study doing in Iranian context and research published in English or Persian from Jan 1990 to the end of 2016 were included. The study population was selected to include maternal to mortality cause of pregnancy.

2-3. Data collection, analysis and extraction

The search procedure was conducted by two of the present authors and a body of related literature which dealt with pregnant women's mortality in Iran was selected. The first phase was a search in the titles and abstracts. The second phase was marked by a thorough checking upon the articles in full-text by both authors individually. Any cases of disagreement were consulted with a third researcher and finally those articles which were fully agreed-upon were included.

2-4. Quality measure

The quality of included studies was assessed using the National Institutes of Health Quality Assessment tool for Observational Cohort and Cross Sectional Studies (http://www.nhlbi.nih.gov/health-pro/guidelines/indevelop/cardiovascular-risk-reduction/tools/cohort). Reporting of studies was assessed using an adapted version of the STROBE statement, which is a checklist of items that should be addressed in articles reporting on three main study designs: cohort, case–control and cross-sectional. This is included in the online supplementary material (15).The articles were categorized in terms of the significance and relevance to the topic and then each part of the article which could be used later on was determined. The strengths and weaknesses of each article were jotted down and an overall evaluation was done accordingly. The data were extracted based on a data collection form specific to observational studies. The collected data included author's name,

publication year, year of conduction, and frequency of the direct and indirect causes. Then, the existing data in articles entered Excel software 2010 in accordance with the above-mentioned categories. To make up for inconsistencies, all the articles were analyzed from the participants' perspective as well.

3-RESULTS

3-1. Summary of included studies

In the primary search once the redundancies were done away with, 209 related articles were found. Those not meeting the inclusion criteria were omitted. The data extracted from 19 local and national articles which involved all provinces in Iran entered the study. Details on the selection procedure are indicated below (**Figure.1**). The causes of maternal mortality in each article have been reported based on different criteria. The 19 original articles and their characteristics are summarized in **Table.1**. The study participant size ranged from 6 to 307. In total, 3 studies in English, and 16 Persian studies were selected (*Please see the table in the end of paper*).

3-2. Quality of included studies

Table-2 describes the quality of included studies. All studies were of cross-sectional design and of moderate quality. Since this study was conducted to evaluate the maternal mortality, no justification for the sample size , blinding, follow-up after baseline 20% or less and measure and adjust key potential confounding variables statistically for their impact on the relationship between exposure (s) and outcome (s) were included in the study. In other, criteria from the checklist, almost all studies were at an acceptable level (*Please see the table in the end of paper*).

The results of this systematic review are summarized in **Table.3** and the frequencies of direct and indirect causes of maternal mortality are also included. Of

the 1,231 deaths that occurred during the study period, 909 cases were related to direct causes (429 cases Bleeding, 209 cases Eclampsia, 113 cases Sepsis, 96 Sepsis and 62 cases other direct causes), and 322 cases were related to indirect causes (*Please see the table in the end of paper*). After analyzing the studies, the main direct causes of maternal mortality were: Bleeding (34.89%), Eclampsia (16.97%), Sepsis (9.17%), and Embolism (7.79%), respectively. Overall, direct causes outnumbered the indirect (**Figure.2**). Among the indirect causes of

mortality, background diseases ranked first, and heart diseases stood next. In **Figure.3**, the prevalence of maternal mortality from 1990 to 2015 has been reported. This figure shows that maternal mortality rates in Iran have declined from birth to 1990 through 2015. In the past 25 years, the percentage of mothers who lost their lives during pregnancy dropped by 7.5%. This reduction can be deduced from the death rate per 100 live births. In 1990, this ratio was 123 mothers per 1,000 births, down from 25 mothers per 1000 live births in 2015 (8).
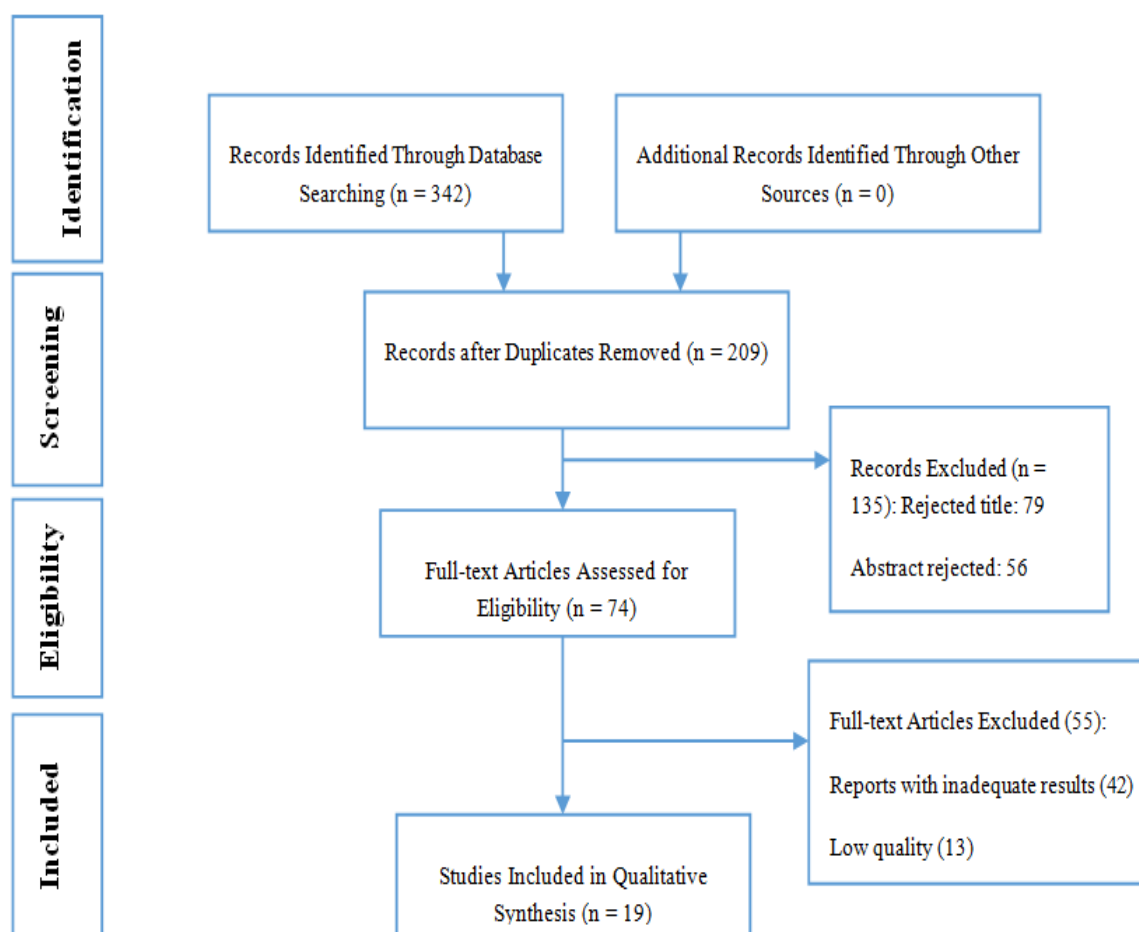
Fig.1: The flowchart of present study.
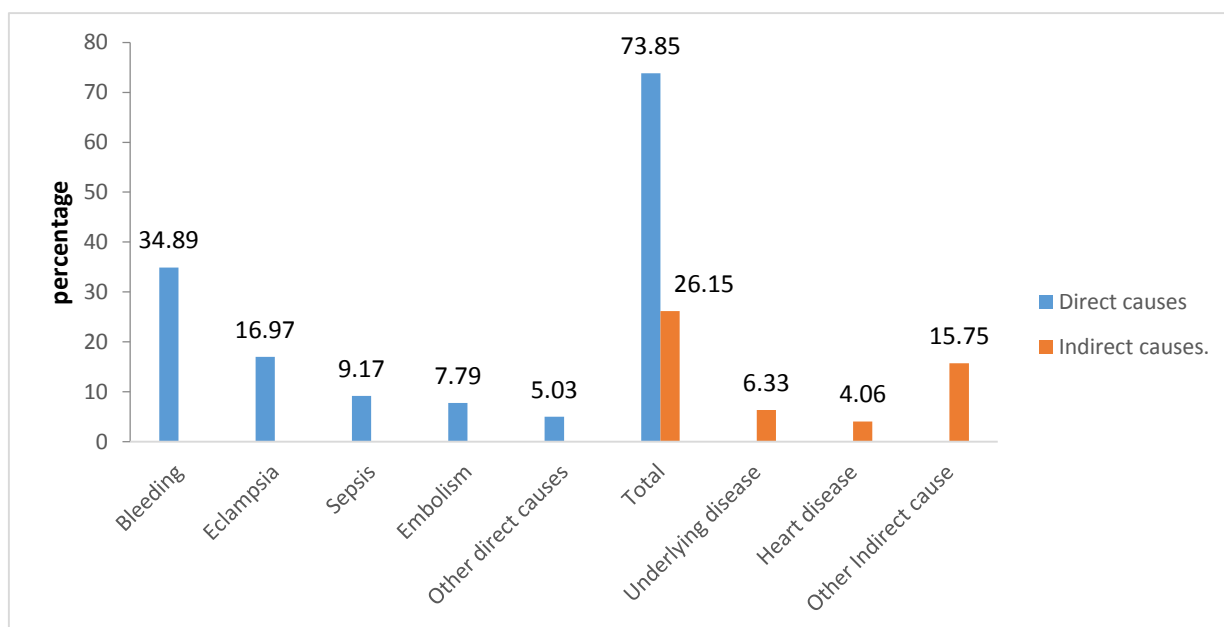
Fig.2: Direct and indirect causes of maternal mortality in Iran durring 1990-2016.
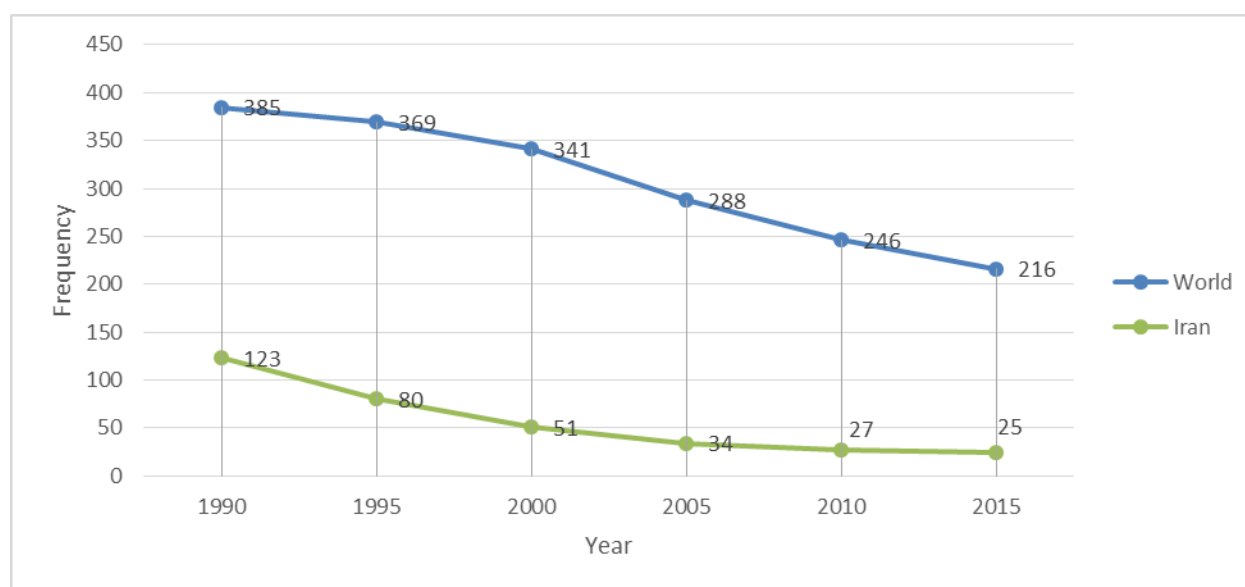
Fig.3: Prevalence of maternal mortality in the world and Iran during 1990 to 2015(30).

4- DISCUSSION

The present research aimed to investigate the causes of mortality among pregnant women in Iran. A review of the related literature indicated that the main causes of maternal mortality were respectively bleeding, preeclampsia-eclampsia, infection, and lung embolism. In was indicated in some research that bleeding, blood pressure disorders and infection were the key causes of maternal mortality worldwide (31). The present systematic review revealed that bleeding proved to be a key factor involved in maternal mortality on a global scale (32-34). It is estimated that one mother dies per 7 minutes due to bleeding (35). In their research, Hasegawa et al. (2017) found bleeding as the main cause of maternal mortality (36). Another investigation by Marshal et al. indicated that mothers with postnatal bleeding died significantly more than those without bleeding (36). Three factors that lead to bleeding and then mortality are doctor's delayed decision-making, delayed transfer to primary care center and delayed emergency care provision (38). The last cause showed to be more important than the other two. Such factors as delayed diagnosis, lack of drugs and facilities, lack of blood products are also involved (39). Therefore, it seems that better childbirth facilities such as educated specialists, blood resources, and emergency drugs in urban and rural areas can prevent maternal mortality to a significant degree.

Moreover, mother's bleeding can result from demographic and social characteristics. In her research, Tort observed the effect of women's demographic characteristics on postnatal bleeding (40). Recently, such features as one's age >35 years, background diseases (e.g. anemia, high birth weight, genital disorders) showed to affect postnatal bleeding (41-44). Among the probable factors involved in maternal bleeding after vaginal delivery are hard childbirth, specialists unavailable in deserted rural areas, delay in referring mothers to specialized centers due to the inaccessibility of areas, low quality of care provided at pregnancy, lack of facilities and equipment required for childbirth, emergency drugs and blood products. A number of measures could be taken so as to reduce the rate of maternal mortality at least partly: identification of the mothers at risk by healthcare staff and preventive measures such as educating efficient and experienced staff, better and more equipment and facilities such as blood products, enhanced monitoring system of prenatal, natal and postnatal care, further education of local healthcare staff such as rural midwives, enhanced condition of nursing hospitals in counties and timely referral of mothers to specialized centers.

Pre-eclampsia/eclampsia was found as another cause of maternal mortality especially in developing countries (45) and the most frequent cause of maternal mortality among those with hypertension in South Africa and worldwide (46). Blood pressure disorders during pregnancy account for 185 of maternal mortality on a global scale. It actually accounts for 62,000-77,000 mortalities a year (47). In an investigation by Hasegawa et al., 30% of maternal mortality was induced by pre-eclampsia which explained 14% of the total rate of mortalities (35). Brain stroke showed to be significantly correlated with maternal mortality among those with hypertension at pregnancy (48). At present, due to a lack of valid, reliable and affordable screening programs for pre-eclampsia, the primary step to prevent the emergence of the disease is a timely identification and treatment of those at risk with appropriate prenatal care. Unfortunately, in developing countries, due to insufficient prenatal care, most patients visit doctors at the advanced level of the disease which increases the rate of

mortality and postnatal side effects (49). In the present research, the second main cause of maternal mortality was Preeclampsia and Eclampsia, which is the delayed diagnosis of the disease by the medical staff and is related to therapeutic measures. As for delayed medical decision-making, the cure lies mostly in enculturation and awareness raising of pregnant women and their families of the natal and postnatal symptoms of the disease. Similarly, the staff working at hospital reception and emergency unit should be made aware of the risks. On the other hand, Keshavarz et al. indicated that the occurrence of eclampsia was significantly higher at a higher age which, in turn, can result from an increased overall age of marriage in Iran in particular geographic areas. Authorities are, therefore, expected to remove the barriers to marriage among the youths (50).

In the existing body of obstetric research, sepsis has been mentioned as the next cause of maternal mortality in the target population. Despite vast global developments in reducing the rate of maternal mortality, sepsis is still considered as a key factor involved in avoiding maternal mortality (50). Sepsis accounts for 11% of maternal mortality. It also mediates the effect of other factors involved in mortality. One reason for women's infection is infectious abortion. Controlled birth and legitimization of abortion managed to prevent infectious abortion and mother's infection (51). Considering the fact that the present review found infection as a main cause of maternal mortality, it seems that specialists have not managed to diagnose and treat the disease on time. Besides, unintended pregnancies and illegal abortions have increased the risk of infection in pregnant women. Unhygienic abortions are carried out illegally by non-specialists ignorant of the risks threatening mother's health. Therefore, certain steps need to be taken

effectively and thoughtfully to legitimize abortion to reduce the rate of maternal mortality (512). Embolism showed to be another cause of maternal mortality in the present systematic review. Lung embolism was stated as a main factor accounting for maternal mortality in England (53), Norway (54) and the U.S. (55). C-section, hypertension at pregnancy, age above 40, more than 3 pregnancies, preterm birth, transfusion of blood clots, lupus, still born delivery at present showed to be significantly correlated with the risk of lung embolism in pregnant women (56).

These all can be due to mothers' low level of awareness and inadequate education by the health authorities. Identification of mothers at risk by the health staff and taking the right preventive measures such as a timely diagnosis of the disease and referral of patients to hospitals can play a key role in reducing the rate of maternal mortality. With this respect, Alves (2007) maintained that an improved condition of natal healthcare provision helps to reduce 94% of maternal mortality only if this care is accompanied by high quality medical attention and timely referral to hospitals (57). In another study, Kuklina mentioned surgeries as a main risk factor of embolism. In the U.S.A, the rate of embolism showed to be increased along with a rising trend of C-section (58). Maternal mortality due to embolism in the present systematic review can be induced by insufficient attention to the mothers at risk, lack of timely diagnosis and referral of patients to specialists. Moreover, the risk of embolism is higher in mothers who have a C-section than those with a vaginal delivery. It is, therefore, recommended to raise mothers' awareness of the adverse effects of unnecessary surgical childbirth.

4-1. Limitation

One of the limitations of this research is to only select a cross-sectional study. However, cohorts studies may well exist.

5- CONCLUSIONS

Bleeding was found to be the most prevalent cause of maternal mortality in the present systematic review. A number of recommendations are made to reduce the rate of maternal mortality: identification of mothers at risk by the medical staff, preventive measures such as educating efficient and experienced staff, more equipment and facilities such as blood products, enhanced monitoring system of prenatal, natal and postnatal health care provision, training more local healthcare forces such as efficient midwives in rural areas, improved condition of nursing hospitals in county capitals and timely referral of mothers to specialized healthcare centers.

6- CONFLICT OF INTEREST

All the authors declare that they have no conflict of interest.

7- ACKNOWLEDGMENTS

8- REFERENCES

1. Sarani M, Shahraki Z, Shirazi M, Saravani S. Risk factors of maternal mortality in Sistan region: 10-year report. Tehran University Medical Journal TUMS Publications. 2014;72(9):623-9.

2. Azemikhah A, Amirkhani M, Jalilvand P, Emami Afshar N, Radpooyan L, Changizi N. National maternal mortality surveillance system in Iran. Iran J Public Health. 2009;38:90-2.

3. Dadipoor S, Rajaei M, Naderi S, Ghanbarnejad A, Safari Moradabadi A. Investigating causes of infant mortality in hospital of children during 2010-2011 in Bandar Abbas. Iranian Journal of Neonatology IJN. 2014;5(1):12-8.

4. Haseli A, ghiasian M, Seififard F, Ebrahimzadeh M, basami k. The Study of Frequency and Effective Factors on Maternal Mortality in Ilam Province during 2002-2010. www sjimu medilam ac ir. 2015;22(7):39-46.

5. Safari Moradabadi A, Hassani L, Ghanbarnejad A, Madani A, Rajaei I, Dadipoor S. The effect of education on knowledge and preferred method of delivery in nulliparous women. J Health Care. 2014;16(1):74-83.

6. Zolala F, Haghdoost AA. A gap between policy and practice: A case study on maternal mortality reports, Kerman, Iran. International journal of preventive medicine. 2011;2(2): 88-93.

7. Dadipoor S, Alavi A, Safari-Moradabadi A. A survey of the growing trend of caesarian section in Iran and the world: a review article. Iranian Journal of Obstetrics, Gynecology and Infertility. 2016;19(27):8-17.

8. Alkema L, Chou D, Hogan D, Zhang S, Moller A-B, Gemmill A, et al. Global, regional, and national levels and trends in maternal mortality between 1990 and 2015, with scenario-based projections to 2030: a systematic analysis by the UN Maternal Mortality Estimation Inter-Agency Group. The Lancet. 2016;387(10017):462-74.

9. Mohammadinia N, Rezaei M, Sameizadehtoosi T, Rostaei F. Investigating the frequency and effective factors on maternal mortality in Sistan and Baluchistan Province, Iran, 2002-2009. The Iranian Journal of Obstetrics, Gynecology and Infertility. 2013;16(44):28-34.

10. Golyan Tehrani S, Holakoei K, Zarei M. Survey study of effective factors on maternal mortality in Kurdestan province from 1998 to 2002. Journal of hayat. 2004;10(2):47-54.

11. Aghajanian A, Mehryar AH. The pace of fertility decline in Iran: Finding from the demographic and Health Survey. Journal of Comparative Family Studies. 2007:255-64.

12. Yavangi M, Sohrabi M-R, Alishahi Tabriz A. Effect of Iranian ministry of health protocols on cesarean section rate: a quasi-experimental study. Journal of research in health sciences. 2013;13(1):48-52.

13. Daneshbod K, Borazjani GR, Sajadi H, Hamidzadeh MM. Survey of Maternal Deaths in South Iran Analysis of 96 Autopsies. BJOG: An International Journal of Obstetrics and Gynaecology. 1970;77(12):1103-8.

14. GHolami-Taramsari M. Ten-Year Evaluation of maternal mortalities in Kohgiluyeh and Boyerahmad province. Journal of Knowledge & Health. 2008;3(2):33-8.

15. Mangin D, Stephen G, Bismah V, Risdon C. Making patient values visible in healthcare: a systematic review of tools to assess patient treatment priorities and preferences in the context of multimorbidity. BMJ open. 2016;6(6):e010903.

16. Abdolahpour P, Babaei M, Gasemi YM. Causes of Maternal Mortality in Pregnant Women in Urban and Rural Areas of Ilam, Iran. health system research. 2011;7(6):1278-87.

17. Rajaie M, Zare S, Dadipour S. Determining the frequency and causes of maternal mortality in hormozgan province, Iran during 2005-2011. The Iranian Journal of Obstetrics, Gynecology and Infertility. 2014;16(87):9-14.

18. Mansouri A, Hejazi A, Badieian Mn. A Survey on Mortality among Pregnant Women and its Causes in Cases Referred to Khorasan Legal Medicine Center between 1999-2005. Forensic Medicine. 2005;11(37);28-32.

19. Sedghieyani M, Golmohammadlu S, Ayatollahi H, Ibrahimi I, Salary S. Rate and causes of maternal mortality induced by direct complications of pregnancy and delivery in West Azerbaijan province in 1997-1999. Uraemia university of medical sciences journal 2002;13(4):275-82.

20. Maharlouei N, Zakeri Z, Mazloomi E, Lankarani KB. Maternal mortality rate in Fars Province: trends and associated factors in a community-based survey. Archives of Iranian medicine. 2012;15(1):14.

21. Karimi-Zarchi M, Ghane-Ezabadi M, Vafaienasab M, Dehghan A, Ghasemi F, Zaidabadi M, et al. Maternal mortality in Yazd Province, Iran. Electronic physician. 2016;8(2):1949.

22. Karimzaei T, Zareban I, Jamalzae A-Q, Darban F, Bakhshani KD, Balouchi A. Frequency of Maternal Mortality in Urban and Rural Areas of Iranshahr County (Southeast of Iran) in 2009-2013: A Retrospective Study. Journal of Clinical and Diagnostic Research: JCDR. 2016;10(8):QC14.

23. Khajeian A, Anaraki A, Ghaed Hamoudy Z. Factors associated with maternal mortality in the province from 2000 to 2007 years. Maternal and infant health periodicals. 2009;11:18.

24. Zokaei M, Homayonpoor G, Ghaderi E, Zandvakili F, Salahian B, Mafakheri F. Investigation and comparison of the factors associated with maternal death between verbal autopsy and forensic autopsy from 2001 to 2013 in Kurdistan province. Scientific Journal of Kurdistan University of Medical Sciences. 2015;20(1): 18-29.

25. Akhlaghi F, Hamedi A, Lotfi N. Study of the maternal mortality rate in the last decade in Mashad Emamreza Hospital. Journal Of Sabzevar University Of Medical Sciences. 2003;9(4):74-9.

26. Mobasheri M, Khalafian P, Alidosti M, Salehifard A. Study of pregnant women's mortality in Chaharmahal va Bakhtiari province in a 10-year period (2002-2012). Journal of Clinical Nursing and Midwifery. 2014;3(2):21-9.

27. Moradan S, Forouzesh Far M. Prevalence and Causes of Maternal Mortality in a 10-year period in a University Hospital in Semnan. The Iranian Journal of Obstetrics, Gynecology and Infertility. 2012;15(3):1-7.

28. Jamshidpour M, Izadi N, Najafi F, Khamoshi F, Shirdel AR, Jalili K. Maternal mortality rate and causes in Kermanshah province (2001-2012). Journal of Kermanshah University of Medical Sciences. 2014;18(7):409-15.

29. Zarean E, Bina R. Investigate the causes of maternal morbidity during 2006-2011 in Isfahan. J Health Syst Res. 2014;Health Education supplement: 2056-2063.

30. WHO. Statistics. Maternal mortality. Available at:

www.who.int/gho/maternal_health/countries/ir
n.pdf

31. Say L, Chou D, Gemmill A, Tunçalp Ö, Moller A-B, Daniels J, et al. Global causes of maternal death: a WHO systematic analysis. The Lancet Global Health. 2014;2(6):e323-e33.

32. Callaghan WM, Kuklina EV, Berg CJ. Trends in postpartum hemorrhage: United States, 1994–2006. American journal of obstetrics and gynecology. 2010;202(4):353. e1-. e6.

33. Haeri S, Dildy GA, editors. Maternal mortality from hemorrhage. Elsevier:Seminars in perinatology; 2012.

34. John M. Eisenberg Center for Clinical decisions and Communications Science. M agement of postpartum hemorrhage: current state of the evidence. Comparative effectiveness review summary guides for clinicians. Rockville (MD): Agency for Healthcare Research and Quality. 2016.

35. Potts M, Prata N, Sahin-Hodoglugil NN. Maternal mortality: one death every 7 min. The Lancet. 2010;375(9728):1762-3.

36. Hasegawa J, Sekizawa A, Tanaka H, Katsuragi S, Osato K, Murakoshi T, et al. Current status of pregnancy-related maternal mortality in Japan: a report from the Maternal Death Exploratory Committee in Japan. BMJ open. 2016;6(3):e010304.

37. Marshall AL, Durani U, Bartley A, Hagen CE, Ashrani A, Rose C, et al. The Impact of Postpartum Hemorrhage on Hospital Length of Stay and Inpatient Mortality: A National Inpatient Sample (NIS)-based Analysis. American Journal of Obstetrics and Gynecology. 2017;217(3):344.e1-344.e6.

38. Safari Moradabadi A, Rajaei M, Naderi S. Investigating the underlying causes of mortality among less than one year old infants in pediatric hospital of Bandar Abbas, Iran. Bimonthly Journal of Hormozgan University of Medical Sciences. 2014;18(3):180-6.

39. Thorsen VC, Meguid T, Sundby J, Malata A. Components of maternal healthcare delivery system contributing to maternal deaths in Malawi: a descriptive cross-sectional study. African journal of reproductive health. 2014;18(1):16-26.

40. Tort J, Rozenberg P, Traoré M, Fournier P, Dumont A. Factors associated with postpartum hemorrhage maternal death in referral hospitals in Senegal and Mali: a cross-sectional epidemiological survey. BMC pregnancy and childbirth. 2015;15(1):235.

41. Al-Zirqi I, Vangen S, Forsen L, Stray-Pedersen B. Prevalence and risk factors of severe obstetric haemorrhage. BJOG: An International Journal of Obstetrics & Gynaecology. 2008;115(10):1265-72.

42. Driessen M, Bouvier-Colle M-H, Dupont C, Khoshnood B, Rudigoz R-C, Deneux-Tharaux C. Postpartum hemorrhage resulting from uterine atony after vaginal delivery: factors associated with severity. Obstetrics and gynecology. 2011;117(1):21.

43. Sheldon W, Blum J, Vogel J, Souza J, Gülmezoglu A, Winikoff B. Postpartum haemorrhage management, risks, and maternal outcomes: findings from the World Health Organization Multicountry Survey on Maternal and Newborn Health. BJOG: An International Journal of Obstetrics & Gynaecology. 2014;121(s1):5-13.

44. Kramer MS, Berg C, Abenhaim H, Dahhou M, Rouleau J, Mehrabadi A, et al. Incidence, risk factors, and temporal trends in severe postpartum hemorrhage. American journal of obstetrics and gynecology. 2013;209(5):449. e1-. e7.

45. Herrera JA, Herrera-Medina R, Herrera-Escobar JP, Nieto-Díaz A. Reduction of maternal mortality due to preeclampsia in Colombia-an interrupted time-series analysis. Colombia Médica. 2014;45(1):25-31.

46. Moradabadi AS, Alavi A, Eftekhaari TE, Dadipoor S. The reproductive behavior of families with Thalassemic children in Hormozgan. Journal of reproduction & infertility. 2015;16(3):167.

47. Abalos E, Cuesta C, Carroli G, Qureshi Z, Widmer M, Vogel J, et al. Pre-eclampsia, eclampsia and adverse maternal and perinatal outcomes: a secondary analysis of the World Health Organization Multicountry Survey on Maternal and Newborn Health. BJOG: An

International Journal of Obstetrics and Gynaecology. 2014;121(s1):14-24.

48. Dadipoor S, Alavi A, Pormehr-Yabandeh A, Golnam M, Safari-Moradabadi A. Investigation on some maternal factors affecting the birth of preterm infants: a case-control study. Feyz Journal of Kashan University of Medical Sciences. 2017;20.

49. Ehdaivand F, Rostamnejad M, Iranijam E. A Study of Epidemiological Factors and Complications of Preeclampsia in Alavi Hospital, Ardabil, 2001. Journal of Ardabil University of Medical Sciences. 2004; 4(4): 25-9.

50. Keshavarzi F, Rezaei M, Iranfar S, Fakheri T, Nankali A, Imani A. Advanced maternal age relationship with pregnancy complications. Journal of Kermanshah University of Medical Sciences (J Kermanshah Univ Med Sci). 2011;15(3): 193-9.

51. Guinn DA, Abel DE, Tomlinson MW. Early goal directed therapy for sepsis during pregnancy. Obstetrics and gynecology clinics of North America. 2007;34(3):459-79.

52. Sakineh D, Ali Safari M. Prevalence of legal abortions and correlated causes in a central women's hospital in south of Iran (2009-2012). Life Science Journal. 2013;10(12s):91-4.

53. Dadipoor S, Aghamolaei T, Ramezankhani A, Safari-Moradabadi A. Comparison of Health Belief Model Constructs According to Birth Type by Nulliparous Pregnant Women in Bandar Abbas. J Educ Community Health. 2017;4(1):65-71.

54. Nazari B, Bakhshi S, Kaboudi M, Dehghan F, Ziapour A, Montazeri N. A Comparison of Quality of Life, Anxiety and Depression in Children with Cancer and Healthy Children, Kermanshah-Iran. International Journal of Pediatrics. 2017;5(7):5305-14 .

55. Berg CJ, Chang J, Callaghan WM, Whitehead SJ. Pregnancy-related mortality in the United States, 1991–1997. Obstetrics & Gynecology. 2003;101(2):289-96.

56. Morris J, Algert C, Roberts C. Incidence and risk factors for pulmonary embolism in the postpartum period. Journal of Thrombosis and Haemostasis. 2010;8(5):998-1003.

57. Alves SV. Maternal mortality in Pernambuco, Brazil: what has changed in ten years? Reproductive Health Matters. 2007;15(30):134-44.

58. Dadipoor S, Alavi A, Ziapour A, Safari-Moradabadi A. Factors involved in the mortality of infants below the age of one in Bandar Abbas a document-based study. International Journal of Pediatrics.2018. [In Press].

Table-1: Characteristics of studies according to the variables Studied.

Authors	Impelementation	Sample size	Number delivery >3	Age < 18	Age >35	Number of delivery < 2 Year	Cesarean	Language	Mean of age
Mohammadinia et al.(9)	2002-2009	307	70.7	41		68.8	39.5	Persian	28
Golyan Tehrani et al. (10)	1998-2002	55	36.4	9.1	9.1		41.5	Persian	29.3
Abdolahpour et al. (16)	2001-2010	25						Persian	
Rajaie et al. (17)	2005-2011	91	40.7	22	26.4	52.9	37.4	Persian	30
Mansouri et al. (18)	1999-2005	17	41.2	5.9	47.2		64.9	Persian	31.2
Sedghieyani et al. (19)	1997-1999	66	53	1.5	28.8		14.5	Persian	
Maharlouei et al. (20)	2003-2010	101	34.65	3	27.72	21.78	64.36	English	29.93
Karimi-Zarchi et al. (21)	2002-2011	40					55	English	29.17
Karimzaei et al. (22)	2009-2013	34					18.2	English	30
Gholami-Taramsari et al. (14)	1997-2007	66	59	10.6	16.7			Persian	
Khajeian et al. (23)	2000-2007	40	7.5	0	10	7.5	60	Persian	
Zokaei et al. (24)	2001-2013	79	17.72	0	22.8	88.6	51.9	Persian	35.1
Akhlaghi et al. (25)	1991-2000	31	81		35.5			Persian	
Mobasheri et al. (26)	2002-2012	28	46.4	0	28.6		46.4	Persian	31.1
Moradan and Forouzesh Far (27)	2002-2009	6					100	Persian	35.17
Haseli et al. (4)	2002-2010	22	18.1	0	31.8		55	Persian	31.14
Sarani et al. (1)	2002-2014	57	21.1	9	26	46.9	51	Persian	33.5
Jamshidpour et al. (28)	2001-2011	99	29.3	3	32.4		45.3	Persian	31.3
Zarean and Bina (29)	2006-2011	67						Persian	

Table-2: Quality of included studies (NIH Quality Assessment Tool) (15).

Criteria / Author	Was the research question or objective in this paper clearly stated?	Was the study population clearly specified and defined?	Was the participation rate of eligible persons at least 50%?	Were all the subjects selected or recruited from the same or similar populations?	Was a sample size justification, power description, or variance and effect estimates provided?	For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?	Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?	For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome?	Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	Was the exposure(s) assessed more than once over time?	Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	Were the outcome assessors blinded to the exposure status of participants?	Was loss to follow-up after baseline 20% or less?	Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?
Mohammadinia et al.(9)	🙂	🙂	🙂	🙂	😐	🙂	🙂	😐	🙂	☹️	🙂	😐	😐	😐
Golyan Tehrani et al. (10)	🙂	🙂	🙂	🙂	😐	🙂	🙂	😐	🙂	☹️	🙂	😐	😐	😐
Abdolahpour et al. (16)	🙂	🙂	🙂	🙂	😐	🙂	🙂	😐	🙂	☹️	🙂	😐	😐	😐
Rajaie et al. (17)	🙂	🙂	🙂	🙂	😐	🙂	🙂	😐	🙂	☹️	🙂	😐	😐	😐
Mansouri et al. (18)	🙂	🙂	🙂	🙂	😐	🙂	🙂	😐	🙂	🙂	🙂	😐	😐	😐
Sedghieyani et al. (19)	🙂	🙂	🙂	🙂	😐	🙂	☹️	😐	🙂	🙂	🙂	😐	😐	😐
Maharlouei et al. (20)	🙂	🙂	🙂	🙂	😐	🙂	☹️	😐	🙂	🙂	🙂	😐	😐	😐
Karimi-Zarchi et al. (21)	🙂	🙂	🙂	🙂	😐	🙂	☹️	😐	🙂	🙂	🙂	😐	😐	😐
Karimzaei et al. (22)	🙂	🙂	🙂	🙂	😐	🙂	🙂	😐	🙂	☹️	🙂	😐	😐	😐

Study	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Gholami-Taramsari. (14)	Yes	Yes	Yes	Yes	NA	Yes	Yes	NA	Yes	No	Yes	NA	NA	NA
Khajeian et al. (23)	Yes	Yes	Yes	Yes	NA	Yes	Yes	NA	Yes	No	Yes	NA	NA	NA
Zokaei et al. (24)	Yes	Yes	Yes	Yes	NA	Yes	Yes	NA	Yes	No	Yes	NA	NA	NA
Akhlaghi et al. (25)	Yes	Yes	Yes	Yes	NA	Yes	Yes	NA	Yes	No	Yes	NA	NA	NA
Mobasheri et al. (26)	Yes	Yes	Yes	Yes	NA	Yes	Yes	NA	Yes	No	Yes	NA	NA	NA
Moradan and Forouzesh Far. (27)	Yes	Yes	Yes	Yes	NA	Yes	No	NA	Yes	No	Yes	NA	NA	NA
Haseli et al. (4)	Yes	Yes	Yes	Yes	NA	Yes	Yes	NA	Yes	No	Yes	NA	NA	NA
Sarani et al. (1)	Yes	Yes	Yes	Yes	NA	Yes	Yes	NA	Yes	No	Yes	NA	NA	NA
Jamshidpour et al. (28)	Yes	Yes	Yes	Yes	NA	Yes	Yes	NA	Yes	No	Yes	NA	NA	NA
Zarean and Bina (29)	Yes	Yes	Yes	Yes	NA	Yes	Yes	NA	Yes	No	Yes	NA	NA	NA

Yes: 🙂, No= 🙁, NA: 😐.