Application of geographic information systems in maternal health: a scoping review

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Abstract

Background: Improving maternal health is a global health priority and requires accurate evaluation of factors affecting maternal health. Geographic information systems have been used to explore maternal health problems.

Aims: The aim of this study was to identify studies that used geographic information systems in the field of maternal health care and to determine maternal health and mortality variables visualized on these systems.

Methods: This was a scoping review in which we systematically searched PubMed and Science Direct for studies that used geographic information systems to evaluate maternal health care. We included all relevant cross-sectional studies published in English between December 1995 and December 2017. We extracted the following information from each study included: study year, region, objectives, type of geographic information system used, variables visualized by the geographic information system, and all other variables examined that related to maternal health.

Results: Of 5240 articles initially retrieved, 40 were included for detailed review. Most of the studies (n = 32) were done in developing countries in Africa, Asia, and Latin America and the Caribbean. Most of the studies (n = 33) visualized mothers' distance to health facilities and travel time to health care centres on geographic information systems. Other factors examined included antenatal care capacity (n = 4) and capacity of maternal health services (n = 3).

Conclusions: Comprehensive research on the application of geographic information systems in maternal care is lacking. Most studies applied simple descriptive mapping of spatial distribution patterns with a few relevant variables.

Keywords: geographic information system; maternal health; maternal health services; health services research

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Introduction

Maternal health is a globally important health challenge. Maternal health refers to the health of women during pregnancy, childbirth and the postpartum period *(1)*. According to the World Health Organization (WHO) the global maternal mortality rate is unacceptably high and about 810 maternal deaths occur daily around the world with 94% of all maternal deaths occurring in developing countries *(2)*. In 2015, 295 000 women died following pregnancy related complications – most of these deaths were in low-resource settings and most could have been prevented *(2)*.The Sustainable Development Goals (SDGs) now call for an acceleration in progress in order to achieve a global maternal mortality rate of 70 maternal deaths per 100 000 live births, or less, by 2030 *(3)*. Achieving this global goal will require countries to reduce their maternal mortality rate by at least 7.5% each year between 2016 and 2030 *(3)*. Reducing maternal mortality was introduced globally as an important health priority in the United Nations Millennium Development Goals *(4)*. Precise evaluation of the maternal mortality rate is the first step to reducing this rate.

Extensive implementation of various software and information technology services in recent years has helped health experts to improve health care. These improvements have helped health care professionals work more efficiently and effectively *(5,6)*. Recently, researchers have started to apply geographic information systems (GIS) to explore maternal and newborn health problems *(7–9)*. GIS help to show regional variations and abnormal patterns of health characteristics. Through the use of GIS, researchers can gain insight into the use of health services and expose health problems and environmental risks. This technology can be easily used by non-geographers with basic computer literacy and map-reading skills *(10)*. The use of GIS is a means to effectively link and analyse the range of data necessary to address complex questions in health promotion, public health, community medicine, epidemiology, and other fields *(11)*.

Despite a number of reviews on the use of GIS in maternal health *(12–16)*, to the best of our knowledge, no review has collectively analysed the results of studies to determine maternal health and mortality factors visualized through GIS. Some studies have shown that the application of GIS in maternal health can help decision-making on policies to reduce maternal problems and improve maternal care outcomes *(17,18)*. Therefore,

we did a scoping review to identify GIS studies related to maternal health care to determine maternal health and mortality factors (variables) visualized through GIS. We also summarized other variables investigated, but not visualized through GIS, to get a general overview of all evaluated variables in the included studies. The results of our review can be used to help in planning to reduce preventable causes of maternal health problems. Our results can also help determine gaps in the use of these types of data and provide a road map to guide more precise studies on various aspects of maternal health.

Methods

Search terms

We searched for relevant articles in English from 1995 to 2017 using PubMed and Science Direct databases. We used two groups of key search terms. Group A included GIS-related terms: GIS; geographic information system; risk mapping; spatial analysis; spatial data; GPS; and health mapping. Group B included terms related to maternal health: maternal mortality; maternal health; maternal care; pregnancy; delivery; and maternal death. Our search strategy was as follows: first we used "OR" to combine the terms within each group A and B separately. Then, we combined keywords from the two groups using the "AND" operator to find all the studies that used GIS in the field of maternal care. We then limited the search in both databases to humans and studies published in English.

Inclusion and exclusion criteria

The inclusion criteria were: cross-sectional study related to the use of GIS in maternal health care; published between December 1995 and December 2017; in English; and on a human population. The exclusion criteria were: review studies, editorials, commentaries and letters; studies that had not visualized data on GIS; and articles not in English.

Review strategy

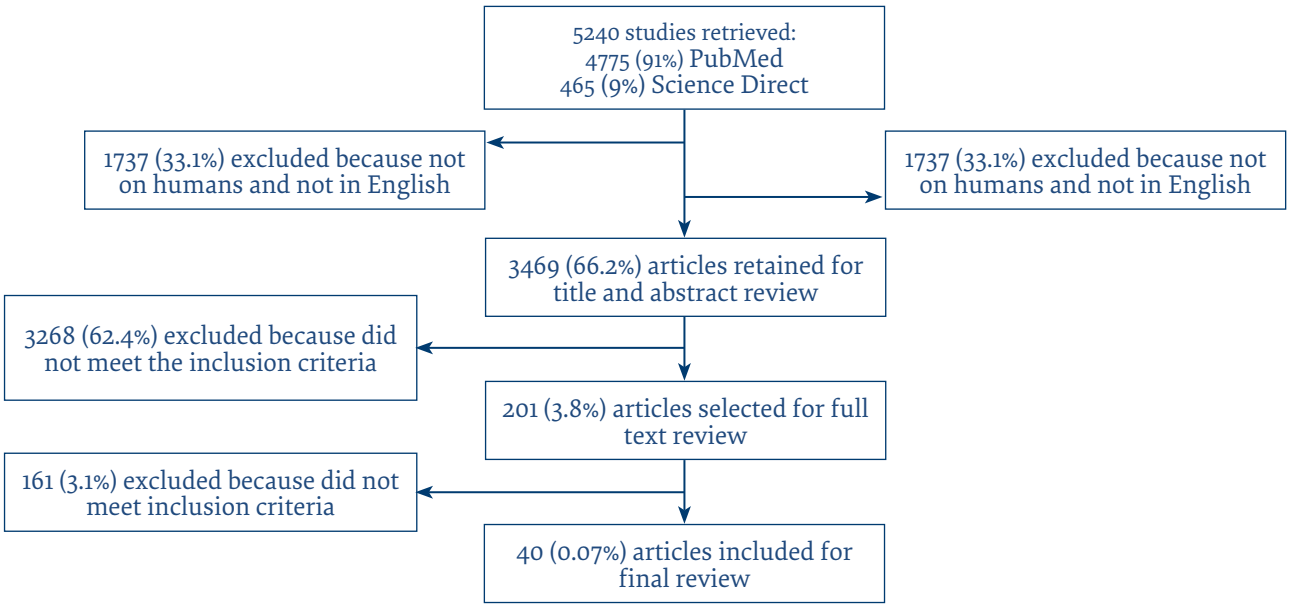
Two reviewers independently screened and assessed the titles and abstracts of the retrieved articles. The reviewers met and reached consensus at the end of the screening process. In cases of disagreement, a third independent reviewer was consulted to resolve the disagreement. We compared the results of the independent screenings using the kappa statistic (kappa = 8.6). The reviewers were blinded to each other's decisions to control for assessment bias. We also checked the reference lists of the articles retrieved for other relevant studies. We developed a data collection form and extracted the following information from each paper: study year, region, objectives, GIS application type, variables visualized by GIS, and all other variables examined that related to maternal health. We examined the extraction forms for coverage, clarity and content validity in several meetings. We divided the extracted variables from the studies into two groups: subvariables and variables directly visualized on GIS. Based on expert consensuses and in order to better report on the variables, we classified the subvariables into six categories: (1) maternal factors, (2) socioeconomic factors, (3) health care service factors, (4) ecological determinant factors, (5) environmental factors, and (6) health related factors.

Results

Study selection

In our initial search of the online databases we found 5240 articles (Figure 1). After our first screening of titles and abstracts based on out inclusion and exclusion crite-

Figure 1 Flow diagram of the selection of papers



ria, we retained 201 eligible articles for further full-text review. Based on this review of full texts, we excluded 161 articles as they did not meet the inclusion criteria, and retained 40 articles for detailed analysis.

Included studies

Of the 40 articles we retained, all were journal papers. Table 1 gives a description of the 40 studies – publication year, objectives, region and data sources. The oldest articles were published in 2004 *(57,58)*. The number of studies investigating the application of GIS for maternal care has increased since 2010. Most of the studies (*n* = 29) were conducted in developing countries in Africa, Asia, and Latin America and the Caribbean *(19–23,26–31,33,34,36,37,39–43,45–50,53,55,58)* and 11 were conducted in developed countries in Europe, North America, Australia, New Zealand, and Japan *(24,25,32,35,38,44,51,52,54,56,57)*. Nearly half of the studies (*n* = 16) were done in Africa because of its high maternal and infant mortality rates *(21,23,26,28,31,36,39–42,46–50,58)*, nine were done in Asia *(19,20,22,27,34,37,43,53,55)*, 11 in the Americas and the Caribbean *(24,25,29,30,32,33,44,45,51,52,54)*, three in Europe *(35,57,56)* and one in Oceania *(38)*.

Each study presented data on one country/region, except one study which provided data on four countries *(27)*. Multiple data resources were used to conduct the studies. The source of data in 15 of the studies was national statistics and censuses (Table 1). Other sources of data included, among others, results of other previous surveys (*n* = 11), interviews with women and health staff (*n* = 5) health registries (*n* = 6).

Geographic access to health services was the most common factor examined (*n* = 22) in the included studies *(20,22,25,26,28,30,35,37,39,40,41,43,44–47,49,51,52,56–58)*. Other common factors examined included antenatal care capacity *(19,25,42,55)* and capacity of maternal health services *(21,48,53)*.

Most studies (*n* = 28) used the spatial analysis of the GIS software such as network analysis, buffer, hot spots and Moran techniques *(19,22,23,26–29,31–35,37–45,48–50,52,53,55,56)*. Other studies (*n* = 10) used spatial mapping *(20,21,24,25,30,36,51,54,57,58)* and two used spatial modelling techniques *(46,47)*.

Many of the studies that used GIS in maternal health focused on potential geographic access to care on the basis of the spatial distribution of health facilities *(27,35–37,44,46,47,51,52,56)*. Some investigated the effect of geographic access on mortality and care utilization *(24,33,49,55)*. Other studies modelled the availability of and access to emergency obstetric care *(22,28,43,50)*.

The geospatial unit of analysis in 16 studies was the national level *(27,28,29,31,35,36,39,40,44,46,48–50,52,56,58)*. Most of the studies (*n* = 24) used ArcGIS (Esri, Redlands, California, United States of America) *(19–21,24,25,27,31,32,34,36–39,42–47,50,51,53–55)* to analyse the data, 10 studies used other types of GIS software – ArcView, QGIS, ArcInfo – *(22,26,28–30,35,41,49,56,58)*, and six did not state which software was used to analyse the data *(27,33,40,47,52,57)*.

Variables extracted from the studies are shown in Table 2. Many studies visualized the variables: distance to health facilities (*n* = 16) and travel time to health care centres (*n* = 17). Other frequently mapped variables were spatial distribution of health services and emergency obstetric care (*n* = 11). Socioeconomic and sociocultural variables, such as women's educational level (*n* = 10) and household wealth (*n* = 9), were often investigated.

Discussion

The findings of our study show that special attention has been paid to geographic access and travel time to health services in published literature on maternal health. Other important reported variables included: maternal age, maternal educational level, household wealth, residential area, distribution of health services, and availability of emergency obstetric care facilities per population.

Determining the distribution of human resources (obstetricians/gynaecologists, maternity nurses and midwives) can show imbalances in the distribution of health personnel. The findings of some research has shown that the educational level of women was strongly correlated with the maternal mortality rate *(59–63)*. The results of our study also showed that mothers' educational level was frequently reported in the included studies. Educational level has a positive influence on autonomy, awareness of health services, the health-seeking behaviour, responsibility and knowledge of self-care and healthy lifestyles *(64)* and can directly and indirectly contribute to a reduction in maternal mortality. Some believe that education may have a more important role compared to economic indicators, such as income, clean water supply and sanitary sewer access *(65)*. Maternal age was examined as the underlying variable in many of the studies we reviewed, and is a key variable because older women are at a higher risk of death and complications during pregnancy or delivery *(66,67)*. The risk of pregnancy-related death for mothers over 40 years between 1998 and 2005 has been reported to be six times higher compared with teenagers *(68,69)*. Others research has found that young adolescents (< 15 years old) face a higher risk of complications and death as a result of pregnancy *(70,71)*. The residential area of pregnant woman is also an important factor. Higher maternal mortality rates have been reported in women living in rural areas and poorer communities *(2)*. The fact that most of the studies included in our review were conducted in developing countries, especially in Africa, is understandable as, according to WHO, 94% of all maternal deaths occur in developing countries *(2)* and factors that threaten the health of mothers are more common in these countries.

Some research has provided evidence that comorbid conditions such as high blood pressure, diabetes and cardiac diseases contribute to maternal deaths *(72)*. Others showed that direct pregnancy complications are

Table 1 Description of the included studies

Author	Publication year	Objectives of the study	Country[a]	Data sources
Ansariade and Manderson, *(19)*	2015	Determine the influence of urban and rural settings on antenatal care and birthing decisions and investigate if women's decision on antenatal care and birth assistance are geographically clustered	Indonesia, Sulawesi	Structured interview with women who delivered
Jain, et al. *(20)*	2015	Assess the influence of economic and geo- graphic access to health facilities on institutional deliveries	Pakistan	Health facilities; and household surveys
Tabatabai, et al. *(21)*	2014	Map and analyse the capacities of public and private hospitals to provide maternal health care	United Republic of Tanzania, Ruvuma	Hospital questionnaire; population census dataset
Sabde, et al. *(22)*	2014	Identify potential areas for further interventions to increase the effectiveness of the emergency obstetric transport system	India, Madhya Pradesh	Interviews with parturient women
Mwaliko, et al. *(23)*	2014	Determine the association between the place of delivery and the distance of a household from the nearest health facility, and assess the demographic characteristics of households with a delivery within a demographic surveillance system	Kenya, western	Database of Webuye health and demographic surveillance system; structured interviews with trained field assistants
Detres, et al. *(24)*	2014	Examine how GIS maps can be used by local organizations to engage the community in the discussion of maternal and child health data to modify service delivery	USA, Florida	Florida vital statistics birth and infant death records
Brown, et al. *(25)*	2014	Determine maternal ground transport times from community hospitals to the nearest hospital offering comprehensive (level III) neonatal care	USA	US census tract data; American hospital association annual survey
Nesbitt, et al. *(26)*	2014	Compare methods to measure potential spatial access to delivery care in low- and middle-income countries	Ghana	Kintampo Health Research Centre surveillance data; health facility assessment; Ghana registered midwives association
Tatem, et al. *(27)*	2014	Present methods to estimate women of childbearing age, and pregnancies and live births in relation to current health infrastructure	Afghanistan Bangladesh, Ethiopia, United Republic of Tanzania	Household survey data; United Nations statistics; new estimates of stillbirths, miscarriages and abortions from the Guttmacher Institute
McKinnon, et al. *(28)*	2014	Assess the effect of distance to emergency obstetric and newborn care services on early neonatal mortality and examine whether proximity to services contributes to socioeconomic inequalities in early neonatal mortality	Ethiopia	Ethiopian Demographic and Health Survey; Ethiopian national emergency obstetric and newborn care needs assessment (Ethiopian Ministry of Health); questionnaire filled by women
Wang, et al. *(29)*	2014	Estimate the influence of service readiness at health facilities on women's use of facility delivery care for delivery	Haiti	Haiti Demographic and Health Survey; Haiti service provision assessment survey
Gaspar, et al. *(30)*	2014	Evaluate the spatial distribution of public sector obstetric care	Brazil, Belo Horizonte	A system of obstetric information Municipal (SISMater®), Department of Health of Belo Horizonte (SMSA-BH);, cohort of 2956 newborns
Benedict, et al. *(31)*	2014	Explore geographical patterns in the risk of not utilizing using a skilled birth attendant during childbirth in women of different socioeconomic backgrounds	Ghana	Ghana Demographic and Health Survey; interviews with women
Blake, et al. *(32)*	2014	Explore the geographic relationships among between dairy farms, nitrate levels in drinking water, low birth weight and socioeconomic data at the Zip code level	USA, California	Zip codes, US census

Table 1 Description of the included studies *(Continued)*

Author	Publication year	Objectives of the study	Country[a]	Data sources
Almeida, et al. *(33)*	2014	Identify spatial patterns of in distribution of overall, early, and late neonatal mortality rates	Brazil, São Paulo	Department of information systems and information technology of the Brazilian national healthcare system
Arslan, et al. *(34)*	2013	Determine the spatial patterns of perinatal mortality, examine whether regional differences exist and whether these differences are linked to regional risk factors	Turkey, Kocaeli	Registry of births and deaths
Engjom, et al. *(35)*	2013	Assess the availability of obstetric institutions, the risk of unplanned delivery outside an institution and maternal morbidity in a national setting in which the number of institutions declined from 95 to 51 during over 30 years	Norway	Census data; Statistics Norway; medical birth registry
Sudhof, et al. *(36)*	2013	Identify potential gaps in access to emergency obstetric care	Rwanda, Kayonza	Birth registries at in eight health centres and the district hospital
Song, et al. *(37)*	2013	Assess spatial accessibility to maternity units	China, Shenzhen	Website of Shenzhen Health and Population and Family Planning Commission
Chong, et al. *(38)*	2013	Assess the usefulness of geospatial methods in identifying communities at high risk of smoking during pregnancy and timing of the first antenatal visit	Australia, New South Wales	New South Wales health ministry
Bowie C, et al. *(39)*	2013	Evaluate geographical access to health care facilities	Malawi	Malawi census; Ministry of Health facility surveys
Masters, et al. *(40)*	2013	Estimate travel times between populations and health facilities using geospatial techniques	Ghana	Ghanaian Ministry of Health
Yao, et al. *(41)*	2013	Present a geographical perspective on access to sexual and reproductive health care for rural women	Mozambique, Gaza province	Population survey data
O'Meara, et al. *(42)*	2013	Assess spatial autocorrelation in uptake of antenatal care and relationship to individual, household and village-level factors	Kenya, western	Survey data
Monyet al. *(43)*	2013	Investigate the availability and distribution of emergency obstetric care services in eight northern districts of Karnataka State in south India	India, Karnataka	Combination of self-reporting, record review and direct observation
Brown, et al.*(44)*	2012	Determine the percentage of women of reproductive age living within a 30- and 60- minute drive time of the nearest tertiary care perinatal centre	USA	US census tract data
Friedman, et al. *(45)*	2012	Evaluate the effect of an inverse relationship between health care use and distance to care related to emergency and essential surgical care	Haiti, central district	Retrospective review of operative logbooks; Haiti earthquake data portal
Gething, et al. *(46)*	2012	Develop a uniquely detailed set of spatially-linked data and a calibrated geospatial model to undertake a national audit of geographical access to maternity care at birth	Ghana	Ghana Ministry of Health; University of Ghana; project by the Ghana Ministry of Health and Ghana Health Service Core; Welfare Indicator Questionnaire survey
Blanford, et al. *(47)*	2012	Analyse the physical access of populations to health facilities with an emphasis on the effect of seasonal conditions and the implications of these conditions for availability of adequate health services, and provision of drugs and vaccinations	Niger	FAO Geo Network Portal; Niger Ministry of Health

Table 1 Description of the included studies *(Concluded)*

Author	Publication year	Objectives of the study	Country[a]	Data sources
Massey, et al. *(48)*	2011	Identify priority regions for the expansion of human resources for health	Senegal	National agency for demography and statistics; WHO
Gabrysch, et al. *(49)*	2011	Quantify the effects of distance to care and level of care on women's use of health facilities for delivery	Zambia	National household data from the Zambian Demographic and Health Survey; national facility data from the Zambian health facility census
Bailey, et al. *(50)*	2011	Provide a set of multicriteria decision analyses to help health planners make informed decisions about interventions to increase access to emergency services	Ethiopia	Ethiopian national survey on baseline assessment of emergency obstetric and newborn care; spatial population data from Land Scan™ population data
Gjesfjeld & Jung. *(51)*	2011	Examine maternity care access for expectant mothers	USA, Dakota	North Dakota department of vital records
Grzybowski, et al. *(52)*	2011	Systematically document newborn and maternal outcomes in terms of travel distance to access the nearest maternity services with caesarean section capability	Canada, British Columbia	British Columbia Perinatal Health Program
Fisher and Myers *(53)*	2011	Test the appropriateness of new, inexpensive and simple GIS tools in poorly resourced areas of a developing country	Indonesia, Nusa Tenggara Timur	Cybertracker; health data collected by district and subdistrict health officer departments and clinics
Bloch, et al. *(54)*	2011	Examine spatial patterns of neighbourhood contextual factors of stress with preterm birth and country of birth (USA or elsewhere)	USA, Philadelphia	Census data; de-identified geocoded Philadelphia birth records; publicly available Philadelphia police department crime statistics.
Målqvist, et al. *(55)*	2010	Examine the association between distance from the mother's home to the closest health facility and neonatal mortality, and investigating investigate the influence of distance on patterns of perinatal health care use	Viet Nam, Quang Ninh	Interviews with mothers and staff; medical records; VidaGIS database
Pilkington, et al. *(56)*	2008	Describe the effect of maternity unit closures on distance and mean travel time between pregnant women's homes and maternity units	France	French national perinatal surveys; vital statistics registries
Dummer, et al. *(57)*	2004	Investigate whether geographical accessibility to hospitals affected the risk of infant mortality	England, Cumbria	Cumbrian births database
Heard, et al. *(58)*	2004	Identify whether access to reproductive health services partly explains the use of modern contraception	Malawi	Malawi health facilities inventory; Malawi demographic and health survey

WHO=World Health Organization; GIS=geographical information system; USA=United States of America; FAO=Food and Agriculture Organization.
[a]*Where the region is not specified, the study done at the national level.*

the leading causes of maternal deaths *(73)*. Little attention was paid to these health factors in the studies in our review, which may be because the data sources used in these studies did not include these kind of health-related factors.

The articles included in our study used and combined various data sources, which provides better results and allows greater understanding. Our review showed that the effects variables such as environmental factors, political policies, exposure to infectious diseases during pregnancy and nutritional status on maternal mortality are largely ignored. Evidence indicates important linkages between the water and sanitation environment and maternal and perinatal mortality *(34,74)*. Although we believe there is a relation between the above-mentioned groups of variables and maternal mortality, it is difficult to know which variable is the strongest determinant. In addition, the strength of the association of these variables with maternal mortality may differ by region. However, proposing a dataset for research in this field would direct researchers to a unique guideline and standard data set *(75)*. Despite the rapid growth of technologies and health information systems, most of health information systems do not merge patients' records with external datasets. This fact can explain why isolated data systems cannot be used to recognize how the physical and environmental context of each patient influences his/her health choices

Table 2 Frequency of variables examined in the studies

Background variables	No. (%) (*n* = 40)
Maternal factors	
Maternal age	11 (27.5)
Antepartum haemorrhage	1 (25.0)
Antenatal care visits	5 (12.5)
Use of contraception (family planning)	2 (5.0)
Number of children	1 (25.0)
Parity	5 (12.5)
Newborn outcomes	1 (25.0)
Complications during last pregnancy	1 (25.0)
Gestational age	2 (5.0)
Birth weight	4 (10.0)
Multiple births	2 (5.0)
Type of delivery (normal or caesarean section, emergency or elective)	3 (7.5)
Birth order and interval	3 (7.5)
Socioeconomic factors	
Educational level of pregnant woman	10 (25.0)
Parents' educational level	3 (7.5)
Household wealth	9 (22.5)
Mother's ethnicity	3 (7.5)
Mother's occupation	2 (5.0)
Women's autonomy within society	3 (7.5)
Marital status	4 (10.0)
Employment of head of household (employed/unemployed)	1 (25.0)
Sex of head of household	1 (25.0)
Sex of the newborn	2 (5.0)
Sex of infants who have died	1 (25.0)
Religion	1 (25.0)
Exposure to media	2 (5.0)
Exposure to family planning messages	1 (25.0)
Residential area(urban, rural)	9 (22.5)
Year of birth of mother	1 (25.0)
Health care service factors	
Human resources	3 (7.5)
Maternity and delivery beds	2 (5.0)
Type of facility	4 (10.0)
Level of delivery care (basic or comprehensive)	3 (7.5)
Readiness of facilities to provide good delivery care	1 (25.0)
Type of birth attendant (skilled or traditional)	2 (5.0)
Place of delivery	3 (7.5)
Ecological determinant factors	
Level of social vulnerability in catchment area	1 (25.0)
Proportion of indigenous people in catchment area	1 (25.0)
Environmental factors	
Drinking-water quality	1 (25.0)
Health-related factors	
Chronic diseases (high blood pressure, diabetes, heart disease)	2 (5.0)
Smoking and tobacco use during pregnancy	2 (5.0)
Alcohol use during pregnancy	1 (25.0)
HIV	1 (25.0)

Table 2 **Frequency of variables examined in the studies** *(Concluded)*

Background variables	No. (%) (*n* = 40)
Geographic factors visualized on GIS	
Season of birth	3 (7.5)
Distance to facility	16 (40.0)
Travel time to facility and emergency obstetric care	17 (42.5)
Type of transport taken to facility (on foot, vehicle, ambulance)	4 (10.0)
Distribution health services and emergency obstetric care facilities per population	11 (27.5)
Distribution of human resources	1 (25.0)
Childbirths per region at health facilities, at home, or outside home or health facility (e.g. in car/ambulance)	5 (12.5)
Distribution of childbirths occurring unassisted by health professionals	1 (25.0)
Distribution of early neonatal, early fetal and late fetal deaths	4 (10.0)
Distribution of woman receiving antenatal care	2 (5.0)
Distribution of women who had caesarean sections	2 (5.0)
Distribution of women of reproductive age	2 (5.0)
Distribution of private and public maternity units	1 (25.0)
Distribution of maternity beds	1 (25.0)
Distribution of women with high-risk pregnancies	1 (25.0)
Distribution of births with poor neonatal outcomes (national)	1 (25.0)
Distribution of facility-based peripartum fetal care	1 (25.0)

and health outcomes. Therefore, the use of tools such as GIS is needed to evaluate these associations. Pregnant women's access to health care centres and improvement in their health status are basic rights of women and can be thought of as an index of development in any country.

Our study had some limitations. First, the variables examined in some of the studies were not clearly reported and may have been missing. Second, we classified the extracted variables based on expert consensus for a better reporting. As such, we may have misclassified some variables. Third, although we reported the effect of these variables on maternal care, we could not undertake a precise analysis because of the large number of descriptive studies and the many different objectives of the studies. We only included articles in English and searched only two databases which is another limitation as there might have been some relevant articles published in other languages and included in other databases.

Conclusion

Our review highlights the various applications of GIS in examining important variables in maternal care, and the need for programmes to improve the accessibility, use and quality of care for pregnancy and childbirth. Health care planners can use GIS to determine the best location and capacity of new health care facilities, and assess the costs. Furthermore, electronic health technologies, such as telemedicine, may be a way to overcome barriers of geographic access.

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Application des systèmes d'information géographique à la santé maternelle : étude exploratoire

Résumé

Contexte : L'amélioration de la santé maternelle est une priorité sanitaire à l'échelle mondiale et nécessite une évaluation précise des facteurs qui influent sur la santé des mères. Des systèmes d'information géographique ont été utilisés pour étudier les problèmes de santé maternelle.

Objectifs : La présente étude avait pour objectif d'identifier les travaux de recherche faisant appel aux systèmes d'information géographique dans le domaine des soins de santé maternelle et de déterminer les variables en matière de santé et de mortalité maternelles que ces systèmes permettent de faire apparaître.

Méthodes : Il s'agissait d'une étude exploratoire dans laquelle nous avons systématiquement recherché dans PubMed et Science Direct des études qui utilisaient des systèmes d'information géographique pour évaluer les soins de santé maternelle. Nous avons inclus toutes les études transversales pertinentes publiées en anglais entre décembre 1995 et décembre 2017. Nous avons extrait de chaque étude les informations suivantes : année d'étude, région, objectifs, type de système d'information géographique utilisé, variables mises en évidence par le système d'information géographique, et toutes les autres variables examinées concernant la santé maternelle.

Résultats : Sur 5240 articles initialement récupérés, 40 ont fait l'objet d'une analyse détaillée. La plupart des études (n = 32) ont été réalisées dans des pays en développement en Afrique, en Asie, en Amérique latine et dans les Caraïbes. Grâce aux systèmes d'information géographique, la plupart des études (n = 33) ont permis de faire ressortir la distance entre le lieu d'habitation des mères et les établissements de santé ainsi que le temps de trajet pour se rendre dans les centres de soins. Les autres facteurs examinés portaient sur les capacités en matière de soins prénatals (n = 4) et de santé maternelle (n = 3).

Conclusions : Il n'existe pas de recherche exhaustive sur l'application des systèmes d'information géographique aux soins maternels. La plupart des études ont appliqué une cartographie descriptive simple des schémas de répartition spatiale, complétée par l'ajout de quelques variables pertinentes.

تطبيق نُظُم المعلومات الجغرافية في مجال صحة الأم: استعراض استكشافي

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الخلاصة

الخلفية: يُعد تحسين صحة الأم أولوية صحية على الصعيد العالمي، ويتطلب تقييماً دقيقاً للعوامل التي تؤثر على صحة الأم. وقد استُخدِمت نُظم المعلومات الجغرافية لاستكشاف المشاكل المتعلقة بصحة الأم.

الأهداف: هدفت هذه الدراسة إلى تحديد الدراسات التي تستخدم نُظم المعلومات الجغرافية في مجال الرعاية الصحية للأمهات، وتحديد متغيرات صحة الأم ووَفَيَات الأمهات التي تُظهرها هذه النُظم.

طرق البحث: كان هذا استعراضاً استكشافياً بحثنا فيه بأسلوب منهجي في قواعد بيانات PubMed وScience Direct عن الدراسات التي تستخدم نُظم المعلومات الجغرافية لتقييم الرعاية الصحية للأمهات. وأدرجنا جميع الدراسات المقطعية وثيقة الصلة المنشورة باللغة الإنجليزية في الفترة بين ديسمبر/ كانون الأول 1995 وديسمبر/ كانون الأول 2017. واستخلصنا المعلومات التالية من جميع الدراسات المُدرَجة: سنة الدراسة، والإقليم، والأهداف، ونوع نظام المعلومات الجغرافية المستخدَم، والمتغيرات التي يُظهرها نظام المعلومات الجغرافية، وجميع المتغيرات الأخرى التي درسناها والمتعلقة بصحة الأم.

النتائج: أُدرجت 40 مقالة للاستعراض التفصيلي من أصل 5240 مقالة استُرجعت في البداية. وأُجريت معظم الدراسات (العدد = 32) في بلدان نامية في أفريقيا وآسيا وأمريكا اللاتينية ومنطقة البحر الكاريبي. وأظهرت معظم الدراسات (العدد = 33) بُعد الأمهات عن المرافق الصحية ووقت السفر إلى مراكز الرعاية الصحية في نُظُم المعلومات الجغرافية. وشملت العوامل الأخرى التي خضعت للدراسة القدرة على تقديم الرعاية السابقة للولادة (العدد = 4)، والقدرة على تقديم الخدمات الصحية للأمهات (العدد = 3).

الاستنتاجات: لا توجد بحوث شاملة بشأن تطبيق نُظم المعلومات الجغرافية في مجال رعاية الأمهات. وطبَّقت معظم الدراسات رسم خرائط وصفية بسيطة لأنماط التوزيع المكاني مع عددٍ قليلٍ من المتغيرات.

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