

**Preventive model of delays in
the care of pregnant women
with obstetric complications**

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Preventive model of delays in the care of pregnant women with obstetric complications

Modelo preventivo de demoras en la atención de embarazadas con complicación obstétrica

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Preventive model of delays in the care of pregnant women with obstetric complications

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Abstract

This study addresses a current problem in the State of Yucatan: the deaths of pregnant women who present an obstetric complication due to delays in care. Deaths that occur during pregnancy, childbirth, and the puerperium are a social and public health problem, mainly in low- and middle-income countries. Every year approximately 350,000 women die in the world from complications such as eclampsia, hemorrhage, sepsis, abortion, obstructed labor, among the main ones. It is known that complications are predictable in 95% of cases, which is why quality prenatal control is recommended, to teach women to identify alarm factors that warn that a complication may be starting, to make a decision timely. The genesis of maternal deaths is multifactorial; It is not only the clinical causes, but also a series of social, cultural, economic, geographical, gender and political factors that cause delays in the care of the pregnant woman and that, when linked, lead to death. Through a model called The Three Delays, it has been possible to study the sociocultural causes that cause delays in the care of obstetric complications. The model identifies three types of delays: the first is produced by deferring the search for help when the complication begins; the second is related to postponing the transfer of the pregnant woman to a clinic or hospital for her care; and the third with the lack of timely and quality care when it reaches the hospital.

In Mexico, there are communities where home birth care is performed by a midwife and, if it becomes complicated, access to an emergency obstetric service is limited. Existing programs for maternal health are focused on providing curative services, that is, to attend to the complication when it occurs, but preventive actions are not carried out, which are permanent and contribute to the reduction of maternal deaths due to complications. In this study, we reviewed the literature on the causes of delays in cases of maternal death, to build an analysis framework, with the intention of identifying a preventive model of delays in the care of obstetric complications. Articles in the Pubmed, EBSCO and Web of Science databases were reviewed using the keywords maternal mortality delays. Latin American articles were extracted from the Google Scholar database.

This thesis presents evidence of the medical and social processes that develop during the pregnant woman's search for help when she presents an obstetric complication and the barriers that cause delays in care, at the community-municipal and hospital levels. Likewise, following a qualitative methodology, the scheme of a delay prevention model was built, based on the accumulated knowledge and experience of the participants, which included key elements that must be addressed to prevent delays. To strengthen the preventive model, through a process of elicitation* of delay probabilities, a probabilistic model was built, which based the probability of dying due to the fact of having some of them, and the greater probability of dying due to the combination of the third and the first and the third and the second. A clinical decision tree was also constructed, in which the probabilities of dying or surviving whether or not there are delays in pregnant women with obstetric complications appear.

Finally, preventive actions are proposed at the community-municipal and hospital levels that respond to the needs identified in the model, to intervene in public health policy to prevent delays and thus contribute to the reduction of maternal death in Yucatan. This document intends that the model be a useful instrument to suggest interventions in the management process of health services and for the reordering of public policies that contribute to the reduction of maternal deaths, especially in Yucatan, and in other regions similar to this one as well.

Maternal Mortality, Prevention, Preventive model, Delays, Public Policy

*Unnecessary adaptation of the English verb to elicit, which sometimes appears in psychology texts with the meaning that corresponds to the Spanish verbs to cause, provoke or obtain (Prehispanic Dictionary of Doubts, 2005. Royal Spanish Academy). However, for the purposes of this study, the word elicitation used in Bayesian statistics is preserved in the text of the document.

Resumen

Este estudio atiende un problema vigente en el Estado de Yucatán: los fallecimientos de mujeres embarazadas que presentan una complicación obstétrica por demoras en la atención. Las defunciones que ocurren durante el embarazo, parto y puerperio son un problema social y de salud pública principalmente en los países de bajo y mediano ingreso. Cada año mueren aproximadamente 350,000 mujeres en el mundo por complicaciones como eclampsia, hemorragia, sepsis, aborto, parto obstruido, entre las principales. Se tiene conocimiento de que las complicaciones son previsibles en el 95% de los casos, por eso es recomendable el control prenatal de calidad, para enseñar a la mujer a identificar factores de alarma que avisan que una complicación puede estar iniciando, para tomar una decisión oportuna. La génesis de las defunciones maternas es multifactorial; no solamente son las causas clínicas, sino que se conjuntan una serie de factores sociales, culturales, económicos, geográficos, de género y políticos que ocasionan demoras en la atención de la embarazada y que al encadenarse conducen a la defunción. A través de un modelo denominado Las tres demoras, se han podido estudiar las causas socioculturales que causan retrasos en la atención de la complicación obstétrica. El modelo identifica tres tipos de demoras: la primera se produce al diferir la búsqueda de ayuda cuando inicia la complicación; la segunda se relaciona con aplazar el traslado de la embarazada a una clínica u hospital para su atención; y la tercera con la falta de atención oportuna y de calidad cuando alcanza el hospital.

En México, existen comunidades en donde la atención del parto intradomiciliario lo realiza una partera y, si éste se complica, el acceso a un servicio de emergencia obstétrica se encuentra limitado. Los programas existentes destinados a la salud materna están enfocados a brindar servicios curativos, es decir, a atender la complicación cuando ésta ocurre, pero no se realizan acciones preventivas, que sean permanentes y que contribuyan a la reducción de muertes maternas por complicaciones. En este estudio, se revisó la literatura de las causas de demoras en los casos de defunción materna, para construir un marco de análisis, con la intención de identificar un modelo preventivo de demoras en la atención de la complicación obstétrica. Se revisaron artículos en las bases de datos Pubmed, EBSCO y Web of Science utilizando las palabras claves maternal mortality delays. Los artículos latinoamericanos se extrajeron de la base Google Scholar.

Esta tesis presenta evidencias de los procesos médicos y sociales que se desarrollan durante la búsqueda de ayuda de la embarazada cuando presenta una complicación obstétrica y las barreras que son causa de demoras en la atención, a nivel comunitario-municipal y hospitalario. Asimismo, siguiendo una metodología de corte cualitativo, se construyó el esquema de un modelo preventivo de demoras, basado en el conocimiento acumulado y la experiencia de los participantes, que incluyó elementos claves que hay que atender para prevenir las demoras. Para fortalecer el modelo preventivo, mediante un proceso de elicitación* de probabilidades de demoras, se construyó un modelo probabilístico, que fundamentó la probabilidad de morir por el hecho de tener alguna ellas, y la probabilidad mayor de morir por la combinación de la tercera y la primera y la tercera y la segunda. También se construyó un árbol de decisión clínica, en el que aparecen las probabilidades de morir o sobrevivir si se tiene o no la demoras en la embarazada con complicación obstétrica.

Finalmente, se proponen acciones preventivas a nivel comunitario-municipal y hospitalario que dan respuesta a las necesidades identificadas en el modelo, para intervenir en política de salud pública para prevenir las demoras y de esta manera contribuir a la reducción de la muerte materna en Yucatán. Este documento pretende que el modelo sea un instrumento útil para sugerir intervenciones en el proceso de gestión de los servicios de salud y para el reordenamiento de políticas públicas que contribuyan a la reducción de las muertes maternas, especialmente en Yucatán, y en otras regiones similares a ésta también.

Mortalidad Materna, Prevención, Modelo Preventivo, Demoras, Política Pública.

*Adaptación innecesaria del verbo inglés to elicit, que aparece a veces en textos de psicología con el sentido que corresponde a los verbos españoles provocar, suscitar u obtener (Diccionario Prehispánico de Dudas, 2005. Real Academia Española). Sin embargo, para los fines de este estudio, se conserva en el texto del documento la palabra elicitación utilizada en estadística bayesiana.

1. Introduction

Eight hundred women die every day worldwide from causes related to pregnancy, childbirth or the postpartum period, despite efforts to reduce them. Maternal mortality occurs mainly in developing countries, where social determinants such as poverty, high marginalisation, low education and lack of opportunities for human development play an important role in the root causes.

The fifth Millennium Development Goal proposes the goal of improving maternal and child health; therefore, in the year 2000, the target was set that by 2015, maternal deaths should be reduced to 75%, taking the 1990 baseline as the time point (WHO, 2015). Mexico was one of the countries that did not achieve this goal, due to the slow rate of decline in maternal deaths; by 2014, which is the year for which official statistics on maternal mortality are available, it ended with a Maternal Mortality Ratio (MMR) of 38.9 deaths of women from maternal causes per 100,000 live births, while the Millennium target was 22.2 maternal deaths per 100,000 live births (NUM, 2023). In the 2030 Agenda for Sustainable Development, the new UN global target is to have fewer than 70 maternal deaths per 100,000 live births by 2030. Each country will have to adjust its targets and indicators to its reality and secure funding to achieve them. Mexico is in the process of planning the indicators and policies that will ensure compliance (UN, 2016).

In the State of Yucatan, the MMR for week 51 of 2014 was 59.07 deaths of women from maternal causes per 100,000 live births, it was found that most of the women who died in 2010 and 2012 from maternal causes were affiliated to Seguro Popular, had medical assistance and died in a clinic or hospital of the health sector (OMM, 2015).

The clinical causes of maternal deaths are well known, they are due to complications during pregnancy, childbirth or puerperium, such as pre-eclampsia, eclampsia, haemorrhage, sepsis and abortion, among the main ones; but the causes of these "causes of causes" are complex and multifactorial, such as for example inequity in access to health, lack of empowerment especially in rural women, their socio-cultural, socio-demographic characteristics and gender inequity, which condition or facilitate the clinical causes (Montero, 2012).

To study the non-medical causes of maternal deaths, a model has been used that analyses the factors that are present in the woman's pathway from the onset of the obstetric complication, when she seeks help, is transferred to another clinic and treated for the complication, until she leaves the clinic or dies. The "Three Delays Model" elaborates on the barriers that cause delays in the care of pregnant women with obstetric complications (Thaddeus and Maine, 1994).

This is why this study was based on the "Three Delays Model", from which specialists in health, other areas of knowledge and midwifery contributed key elements of the health-illness-care process for pregnant women, both in hospital life and in municipal and community processes. In other words, it was possible to analyse the path that a pregnant woman with an obstetric complication follows, from the moment she starts, seeks help, is transferred to another level of care and receives treatment. All of this analysis made it possible to identify barriers to care for the complication that cause delay.

Likewise, based on the "Three Delays Model", the population's perceptions of the causes of delays in the care of pregnant women with maternal complications have been studied, finding as the main ones the lack of recognition of warning signs for complications, the lack of decision by the woman to seek help, and the low quality of local health services, which include not only lack of human resources and equipment to treat the complication, but also fear of being transferred to another hospital and difficulties for good communication between pregnant women and health personnel because the women and their families only speak Mayan (Rodríguez, Montero, Andueza and Manrique, 2007; Rodríguez, Aguilar, Montero, Hoil and Andueza, 2012; Rodríguez, Andueza and Montero, 2012; Rodríguez et al, 2015). As a consequence of these findings, intercultural interventions have been initiated that address these causes and attempt to improve understanding between the population and health staff (Rodríguez, Andueza, Rosado, Ortíz and Hernández, 2012).

However, little is known about the perceptions of health personnel specialised in the care of women with obstetric complications about the barriers that cause delays in the care of the complication, especially when they are referred to a clinic or hospital for care. For this reason, knowing the perceptions of health care specialists will provide more comprehensive information on the barriers that cause delays in care, not only at the community (local) level, but also at the intermediate (municipal) and hospital levels, which is where the process of seeking help for pregnant women with obstetric complications ends.

The analysis of the critical path of care followed by the pregnant woman who dies is the procedure carried out in previous studies that was useful to describe the path followed by the woman when a complication occurred, from her home to the place of death, and which served to identify the responses related to delays in care (Rodríguez, Aguilar and Andueza, 2012). There are reports that propose to study the socio-cultural and clinical causes of maternal complications in women who survived maternal complications, allowing strategies to reduce maternal mortality to be proposed (Guilherme, Souza, Parpinelli, de Souza, & Amaral, 2007; Carvalho, Guilherme, Osis, & Souza, 2007).

From 2008 to 2010, the effect of a community intervention that improved knowledge of warning signs was tested (Rodríguez, Andueza, Rosado, Ortíz, & Hernández, 2012).

However, there have been no interventions that focus on reducing delays at the hospital level.

There are reports that conclude that increasing access to quality delivery care and emergency obstetric care are key elements in reducing maternal mortality (Hu, Bertozzi, Gakidou, Sweet, & Goldie, 2007). Even in resource-poor countries, accessible and reliable delivery care services with simple but hygienic infrastructure have been put in place and have lowered maternal mortality, such as in Bangladesh, where delivery care costs are minimal and consultations and medicines are free. Bangladesh had a maternal mortality ratio of 574 deaths per 100,000 live births in 1990-1991; by 2010 the ratio had fallen to 194 per 100,000 live births. Although it did not reach the target of 143 deaths by 2015, estimates indicate that at its average annual rate of decline of 3.3%, it is very close to achieving it (Naimul, 2012).

Studies have also concluded that the provision of good quality care and the extension of antenatal care, as well as improving the capacity of hospitals to handle emergencies and the management of all cases of eclampsia in intensive care units, are measures that could reduce this complication in teaching hospitals in Nigeria (Ade and Loto, 2008).

There are reports that a positive change in the attitude of health workers and the elimination of fee-for-service in emergency obstetric care could reduce the third delay in public health hospitals, and consequently maternal mortality (Igwegbe, Eleje, Ugboaja and Ofiaeli, 2010; Cardenas, 2007).

Although there is a vast literature that mentions that maternal mortality is very sensitive to emergency obstetric standards (Maine, 1991; Loudon, 1986; Paxton, Maine and Freedma, 2003; Paxton, Maine and Freedman, 2005), the differences in maternal mortality levels between low-income countries compared to high-income countries are usually due to the difference in the interval from the onset of the first symptom to its management or control. In other words, to prevent maternal death it is not enough to provide health centres, clinics and hospitals with specialised resources, but an attitude of change is also needed among women and their families as well as health workers to reduce those time intervals for care that prolong the wait, make the complication more serious and lead to death, even if the woman is referred to an intensive care unit with all the specialised resources for her care. In addition, it is necessary to promote the absence of obstacles or barriers to care, such as those caused by the fragmentation of the system or cultural aspects in certain communities (Carvalho, Guilherme, Osis, and Souza, 2007).

Traditionally, all information on the causes of maternal death is known through the methodology of verbal autopsies performed on relatives of the deceased, with in-depth reviews of a small number of selected cases up to the systematic review of all cases (Kalter, Salgado and Babille, 2011; Pattison and Hall, 2003).

Severe maternal morbidity (SMM) refers to complications in pregnant women, during labour or puerperium, that are related to or aggravated by the pregnancy itself or its management, but survive the complication. The MMS study has provided insight into the limitations of medical care and an understanding of the obstetric experience of women in terms of the care they receive.

They also give an indication of which factors of care are substandard and analyse barriers to primary and secondary prevention (Souza, Cecatti and Parpinelli, 2009). In short, the quality of the information they provide serves to evaluate maternal health programmes and the functioning of the health system.

In terms of interventions to reduce delays in maternal deaths, the following have been documented: payment for transport to hospital (Essendi, Mills, & Fotso, 2011; De Costa, Patil, & Kushwah, 2009), training of non-medical staff to deal with obstetric emergencies (Maine, 2007; Gessesew, Barnabas, & Prata, 2011), the use of radio telephones and radio communication systems that allow intercommunication between midwives, women and the health system (Noordam, Kuepper, & Stekelenburg, 2011), geographic information systems for referencing distressed areas (Chen, Wang, & Yu, 2011) and improving the patient referral system (Murray & Pearson, 2006; Baskett & O'Connell, 2009; Fournier, Dumont and Tourigny, 2009), health education has also been proposed to improve knowledge of warning signs for major maternal complications (Rodríguez, Rosado, Andueza, Ortiz and Hernandez, 2012; Ganatra, Coyaji and Rao, 1998; Killewo, Anwar, Bashir, Yunus and Chakraborty, 2006) and the recognition of these by health workers, who often do not identify the onset of a complication in time; for both community-family and health workers, new tools are being developed to assess signs and symptoms of severe maternal morbidity for early detection. (Souza, Cecatti and Haddad, 2012).

It is now recommended that, for monitoring the quality of obstetric emergency care, both its referral system and its emergency services, two frameworks should be used: the three delays model and severe maternal morbidity, which can improve the monitoring of health system performance and find gaps in obstetric care (Id. *ibid* ; Guilherme, Souza and Amaral, 2007; Carvalho, Guilherme and Souza, 2007).

In Yucatan, studies have been carried out using the "Three Delays Model", but no studies have been developed on severe maternal morbidity. Institutional reproductive health programmes developed at the central level contain norms and policies that dictate the activities that must be carried out to ensure the health of the pregnant woman and to achieve the best pregnancy outcomes (Secretaría de Salud, Mexico, 2013). In recent years, guidelines for the care of pregnant women have been developed and disseminated to medical units in the state for follow-up (Secretaría de Salud México, 2001). However, there is no model that prevents delays in the care of women who present with an obstetric complication, that is sensitive to the local context, and that incorporates and integrates expert knowledge of obstetric care at each of the levels: community, municipal and hospital to reduce maternal deaths in Yucatan.

The purpose of this study is to present a preventive model of delays in the care of pregnant women with obstetric complications in Yucatan, which will allow the health sector to initiate relevant interventions aimed at addressing the main barriers that cause delays and limitations in the care of pregnant women that prevent the reduction of maternal mortality. Likewise, through a process of elicitation with a panel of experts, the probabilities of death due to obstetric complications under the model of the three delays and the impact of their prevention on the Maternal Mortality Ratio were determined.

1.1. Research problem

Maternal mortality is a global public health problem, with approximately 350,000 women dying each year from complications during pregnancy, childbirth and the postpartum period, even though 95 per cent of these deaths are preventable. The clinical causes of death are mainly complications, which, combined with a range of individual, family and health service factors, cause delays or delays in care leading to women's deaths. There is evidence that maternal death is related to three types of delays: the first is linked to the pregnant woman's lack of awareness of the warning signs of complications and the need to seek help; in the second delay, the woman seeks help, but has difficulty in getting transport to another clinic; and in the third, she seeks help from the health services, but they do not respond in a timely manner or respond erroneously in providing care.

In Yucatán, delays related to pregnant women's care and their association with maternal deaths have been explored, but there is no preventive model of delays that would contribute to reducing maternal deaths. This raises the following questions:

- Can we use the knowledge accumulated by experts in the field to build a preventive model to reduce the risk of delays in the care of pregnant women with obstetric complications?
- What interventions are relevant to avoid delays in the care of pregnant women with obstetric complications?

1.2. Hypothesis

The experience gained by the members of a panel of experts in obstetric care has enabled them to accumulate technical and scientific knowledge through the analysis of which it is possible to propose specific interventions that can be translated into a preventive model of care for pregnant women.

1.2.1 It is possible to construct a preventive model of care for pregnant women, taking into account the available literature and the experience gathered over a long period of time regarding delays, and to suggest relevant interventions that will contribute to the reduction of maternal mortality.

1.2.2 A probabilistic model can be constructed to estimate the risk of maternal death due to delays.

1.2.3 The probability of death of pregnant women with obstetric complications increases as the number of delays increases.

1.3. Rationale for research

A maternal death is not just another death, but the problem extends beyond the nuclear family and in most cases the death of the product of pregnancy also occurs, either before birth or after birth. If the foetus manages to be born alive, it will probably survive until the age of one year, the other children, if there are any, are left in the care of relatives or strangers; and if they are small, they may also die early.

This study addressed a preventable public health problem in Yucatan: maternal mortality. Maternal deaths still represent a public health and social problem in Yucatan. Despite the efforts made by the health sector to prevent maternal deaths, every year there are deaths due to maternal complications occur every year at home and in second and third level hospitals. The three main clinical causes of deaths have been well studied and are pre-eclampsia-eclampsia, obstetric haemorrhage and puerperal sepsis; with an increase in recent years of deaths due to illnesses that the woman had or that appeared during pregnancy and that complicated it, such as hypertension, diabetes or being a cancer survivor.

To this last group belong the so-called indirect maternal deaths, which are those that derive from previously existing illnesses or illnesses that appeared during pregnancy and that were not due to direct obstetric causes, but that were aggravated by the physiological effects of pregnancy (PAHO, ICD-10, 1995). Although the causes are not predictable, some are identifiable early and, in all cases, the course of the causes can be modified with timely attention. In this sense, the level of maternal mortality recorded in Mexico can be reduced by.

Even in countries without a growing development economy, maternal deaths have been reduced, as demonstrated by successful experiences where the political will of governments, non-governmental organisations and the United Nations Population Fund have played a key role in providing resources. This is why it is feasible to carry out studies that seek strategies to reduce maternal deaths. One strategy used in the investigation of maternal deaths is the application of the "Three Delays Model" reported in 1994 (Apud) by Thaddeus and Main, who point out that a maternal death is due to delays or delays in the care of the complication (Thaddeus and Maine, 1994).

Similarly, exploratory studies conducted in 2010 in the eastern part of the state demonstrated associations of delays with maternal deaths (OR 7.5, 95% CI 1.38-45.18), where the likelihood of dying was associated with failure to recognise the warning signs of a complication (OR 6.57, 95% CI 1.04-46.57). However, deaths also occur in other areas of the state where the model has not been applied (Rodriguez, Montero, Andueza and Manrique, 2007; Rodriguez, Aguilar, Montero, Hoil and Andueza, 2012; Rodriguez, Andueza and Montero, 2012). Currently, with funds from the Kellogg's foundation, the transfer of educational methodology to prevent delays to other communities in the state has begun.

Another frequent delay encountered in Yucatan is related to the care of the complication at the hospital level. Women with maternal complications arrive at tertiary hospitals in the city of Mérida, not only from the city itself but also from municipalities in the interior of the state, from where they are referred for emergency obstetric care resources that are only available at these hospitals.

The Comprehensive Strategy to Accelerate the Reduction of Maternal Mortality in Mexico proposes activities that should be improved in hospitals to prevent maternal deaths, but these have not been evaluated, nor is there a preventive model of delays in pregnant women with obstetric complications that would allow us to suggest pertinent interventions to reduce delays. This is why the proposal of a preventive model of delays could be of benefit to safeguard the lives of women with obstetric complications.

In addition, the methodology of elicitation with a panel of experts allows the use of their knowledge about the care of pregnant women. Elicitation is the process of extracting a priori knowledge from experts to find out the probability that events are likely to be a certain way according to their experience and which they judge to be valid. Thus expert experience helped to extract the probabilities of delays and their relationship to maternal mortality.

The present study aims to transcend to the societal level. To this end, specialists from the health jurisdictions in charge of the pregnancy care network, a midwife from the community, specialists from various disciplines, hospital specialists and nursing staff, assessment staff and hospital orderlies were involved.

The purpose of the model is to be a management tool for the Ministry of Health that contributes to reducing the level of maternal mortality in Yucatan, because it takes into account indispensable elements in the care of pregnant women with obstetric complications that must be addressed in order to reduce delays. This is intended to benefit pregnant women who present an obstetric complication, because by reducing delays in care, the probability of death due to delay is also reduced.

1.4. Overall objective

1.4.1 To construct a preventive model of care for pregnant women, taking into account the available literature and long experience of delays, in order to suggest relevant interventions to help reduce maternal deaths.

1.4.2 To construct a probabilistic model to estimate the risk of delays on the probability of maternal death.

1.5. Specific

1.5.1 To identify care needs for the main delays and suggest interventions to help reduce the risk of delays in care in the event of maternal complication.

1.5.2 To quantify the risk of delays on the likelihood of maternal death.

1.6. Methodology

This study had a mixed approach and approached the problem of delays in obstetric complication care from both qualitative and quantitative paradigms, with a cross-sectional design.

1.6.1. Qualitative

In order to fulfil the first objective: to construct a preventive model of care for pregnant women, taking into account the available literature and the experience collected over a long period of time on delays, which allowed us to suggest relevant interventions that contribute to reducing maternal deaths, interviews were conducted with focus groups and individuals, both with specialists in the area of health and other disciplines, as well as with a community midwife. An inductive procedure was used to analyse the information.

1.6.2. Quantitative

The methodology followed to achieve the second objective: to construct a probabilistic model to estimate the risk of delays on the probability of maternal death, was through a process of elicitation with a panel of experts. Elicitation allowed the experts' a priori knowledge to be extracted and transformed into quantities to quantify the risk of death, with the support of Bayesian statistics.

1.7. Definitions

The following definitions were included for clarity of the terminology used in sections 2 and 3, which corresponds to the literature review and the preventive model. It is worth mentioning that the terms do not correspond to the study variables, but are concepts that require clarity for reading comprehension.

Obstetric complication. Clinical cause of death related to pregnancy, reported in the International Classification of Diseases, which can lead to the woman's death (PAHO, ICD-10, 1995).

Delay. A delay in the time between one action and another, from the onset of the obstetric complication until the woman is attended and discharged or dies. For the purposes of this study, times longer than one hour were considered delays (Thaddeus and Maine, 1994; Hirose, Borchert, Niksear, Alkozai, Cox and Gardiner, 2011).

Health economics. A field of research whose object of study is the optimal use of resources for disease care and health promotion. Its task is to estimate the organisational efficiency of health services and to suggest ways of improving this organisation. In this case, economics is adapted to cultural customs, habits and practices.

Elicitation. The process of extracting a priori knowledge from experts, to find out the probability that events will be a certain way given the data that the experts judge to be valid for those events. (Oakley and O'Hagan, 2010).

Interculturality. Relationship of respect and understanding of the way of interpreting reality and the world, in a process of communication, education and training.

Model. Representation of a fact or phenomenon, proposed as an ideal to be followed. It aims to show the general characteristics of the structure of this phenomenon, explain its elements, mechanisms and processes, how they interrelate and the theoretical aspects that support it, in order to facilitate its understanding (Cordera and Bobenrieth, 1983).

Delay prevention model. A system of relationships between selected, abstract and simplified properties consciously constructed for the purpose of reducing the time to care for obstetric complications (Cordera and Bobenrieth, 1983).

Probabilistic model. An abstraction in which the relationships between variables and the target are expressed in terms of probabilities (Dawson and Trapp, 2005).

Maternal death. Death of a woman during pregnancy, childbirth or puerperium, occurring up to 42 days after delivery, as a result of an obstetric complication, from any cause related to or aggravated by the pregnancy itself, but not from accidental or incidental causes. (PAHO, ICD-10, 1995).

Direct obstetric deaths. Result from obstetric complications of the gravida (pregnancy, labour and puerperium), interventions, omissions, incorrect treatment, or the chain of events leading to any of the above (Id. Ibid).

Indirect obstetric deaths. These arise from previously existing disease or disease that appeared during pregnancy and was not due to direct obstetric causes, but was aggravated by the physiological effects of pregnancy itself. (Id. Ibid.).

Perceptions. Ordering, classification and elaboration of systems of categories with which the stimuli that the subject receives are compared, as they form the perceptual preceptual referents through which new sensory experiences are identified, transforming them into recognisable and comprehensible events within the collective conception of reality (Vargas, 1994).

Prevention. Measures aimed not only at preventing the onset of the disease, such as the reduction of risk factors, but also at halting its progression and mitigating its consequences once established (Id. Ibid).

First delay. Delay in the decision to seek care by the pregnant woman, and includes delay in recognizing an obstetric complication (Thaddeus and Maine, 1994; SSA, Mexico, 2013).

Probability. Probability is a method by which the frequency of a given event is obtained by performing a random experiment, for which all possible outcomes are known, under sufficiently stable conditions. (Id. Ibid).

Second delay. Delayed arrival at the point of care, i.e. the woman knows she is sick and wants to consult, but cannot because of difficulty in accessing services, or because it takes too long to get to the place where care is provided. (Id. Ibid; SSA, Mexico, 2013).

Near-miss. A woman who presented with a severe obstetric complication that brought her to the brink of death and survived (Guilherme, Souza and Amaral, 2007).

Third delay. Delay in obtaining care, once the woman has reached a medical service with the capacity to respond, i.e. the woman consults, but is not attended correctly, receives poor monitoring, or administrative procedures hinder her care (Thaddeus and Maine, 1994; SSA, Mexico, 2013).

Obstetric violence. A type of institutional violence expressed in power relations that legitimise and naturalise a series of procedures that include the appropriation of women's bodies and the physiological processes present during pregnancy, childbirth and the postpartum period. It is at the same time a dehumanising treatment (it violates human rights) and considers the physiological processes of pregnancy as a disease ("pathologisation", "medicalisation"), which leads to a loss of autonomy and women's capacity to make decisions. These are malpractices, aggressions, omissions, poor access to information, and improper procedures by health personnel caring for women during pregnancy, childbirth and the postpartum period (WHO, 2015).

1.8. Delimitations of the scope of the study

This study advanced knowledge about the process of care for pregnant women with obstetric complications and the delays in care that lead to survival or death. It also suggests interventions to reduce barriers to care that cause delays.

Although the scope of the conclusions of this study can only be applied to the population of the State of Yucatan, studies carried out in other Mexican states in conditions similar to those in Yucatan could have similar results.

During the development of this thesis, the current document that served as a framework for analysis in the discussion with the specialists was the Official Mexican Standard NOM-007-SSA2-1993, Care of women during pregnancy, childbirth and puerperium and of the newborn. Criteria and procedures for service provision. On 5 November 2012, the draft Mexican Official Standard PROY-NOM-007-SSA2-2010, For the care of women during pregnancy, childbirth and puerperium, and of the newborn, was published in the Official Journal of the Federation, so that during the sixty calendar days following its publication, comments could be submitted to the National Consultative Committee for Standardisation for its revision. On 7 April 2016, the update of NOM-007-SSA2-2016, For the care of women during pregnancy, childbirth and puerperium, and of the newborn, was published. Due to inconveniences in the timing of its publication, it was not possible to analyse it in discussions with specialists, so comments on it are made in the conclusions of this paper.

The experience of the key informants who participated, not only from the hospital area but also from the municipal and community areas, as well as specialists from other disciplines, provided a broad view of the care process, through the analysis of the care route followed by the pregnant woman from the onset of the complication until she is attended and leaves the hospital or dies. Likewise, the medical and non-medical view of the process interweaved disciplinary elements that made it possible to integrate a model that links education with health services.

On the other hand, with the process of elicitation with a panel of experts, the quantitative element of risk of death or survival was incorporated, which in addition to reinforcing the evidence from the literature, allowed us to understand the overall risk of death due to delays in the State.

1.9. Chapter Summary

Maternal deaths occur due to delays in the management of obstetric complications. Delays begin at the community level, but continue during the transfer of the pregnant woman and when she arrives at the hospital for care. In Yucatan, little has been studied about delays and the risk of death or survival of pregnant women from delays in care is not known. Through specialists in the care of pregnant women, who are involved at all levels of the process, experiences were gathered that identified the main barriers that cause delays and were able to propose interventions to reduce them. Likewise, the problem of maternal mortality is approached from the point of view of various disciplines, with the aim of having more integrative elements that can provide a more complete frame of reference that incorporates not only medical causes but also social, cultural, economic and those that, although included in the maternal health programme, had not been taken into account for its operationalisation in favour of the prevention of delays in the care of pregnant women in Yucatan.

2. Review of the literature on maternal mortality

2.1. Introduction

Maternal mortality is a global development indicator. The fifth Millennium Development Goal is to reduce maternal mortality by three quarters by 2015, compared to 1990 figures (WHO, 2015).

In Mexico, the rate of decline in deaths has been slow and the target of 22.2 deaths x 100,000 live births committed to for 2015 was not achieved (NUM, 2023).

Globally, in 2008, an estimated 342 900 women died from maternal complications; more than 50% occurred in Asian and African countries (Hogan, Foreman, Naghavi, Ahn, Wang, Makela et al., 2010). The most frequent complications of pregnancy, delivery and puerperium are pre-eclampsia-eclampsia, haemorrhage and sepsis; their frequency varies from country to country (WHO, 2005).

In 2012, standardised rates were calculated for maternal mortality per 100,000 women aged 15-44 years in Mexico compared to some Latin American countries, the United States and Europe, where it is observed that Mexico has between two and ten times higher risk of maternal death compared to Latin American countries such as Chile, Costa Rica and Puerto Rico; and between five and twenty times more compared to developed countries such as the United States, Germany, Holland, United Kingdom, Sweden and Japan (Table 1) (Cárdenas, 2012) (Cárdenas, 2012).

Table 1 Standardised maternal mortality ratios per 100,000 women aged 15-44 years, by type of Obstetric Causes, in Mexico and nine selected countries

Obstetric causes					
Country	Total population	Totales	direct*	hints**	Other direct***
Mexico	26,024,032	4.8	3.9	0.9	1.1
Chile	3,825,134	1.2	0.8	0.2	0.4
Costa Rica	1,048,780	2.2	1.4	0.3	0.9
Puerto Rico	862,662	0.6	0.6	0.3	0.0
United States	62,073,767	1.2	0.9	0.5	0.2
Germany	16,449,179	0.1	0.1	0.0	0.0
Netherlands	3,325,161	0.5	0.5	0.2	0.0
United Kingdom	12,503,098	0.4	0.3	0.1	0.1
Sweden	1,732,486	0.3	0.3	0.2	0.0
Japan	23,572,014	0.2	0.1	0.1	0.0
CIE-10: *O00-O97; **O98-O99; ***O10-O12; Oc22-O75; O95-O97, excepto O46, O67 and O72.					

Source: ID. *Mortality of women of childbearing age: maternal causes, cancers, violence and more. D.R. Demographic Conjuncture*

A maternal death is not just another death, but the problem goes beyond the family nucleus and in most cases the death of the product of pregnancy also occurs, either before birth or after birth. If the foetus manages to be born alive, it will probably survive until the age of one year, the siblings, if there are any, are left in the care of other people, who may be relatives or strangers, the father often remarries and forms another family, and in some cases the deceased woman was the main provider in the household (Karam, Bustamante, Campuzano and Camarena, 2007). All of this means that maternal death transcends numbers to the lack of family development and care that will result in family disintegration.

Due to the availability of resources, it has been feasible, even in poor countries, to carry out studies aimed at designing strategies for the reduction of maternal mortality (Naimul, 2012). One strategy used in the investigation of maternal deaths is the application of the three delays model reported in 1994 (Apud) by Thaddeus and Main, who point out that a maternal death is due to delays or delays in attending to the complication (Thaddeus and Maine, 1994).

In Mexico, there are disparities between women and men that lead to unequal opportunities to enjoy better living conditions and health services. In marginalised areas, this gender inequity in health is more evident, where the lack of opportunities for women to acquire goods and services and to make decisions for the self-care of their health is prevalent, leading them to social backwardness.

Studies have also analysed delays in the care process for pregnant women and, according to their results, recommend interventions aimed at the early stages of complications and at reducing the various forms of gender inequality in health and socioeconomic inequality (Castro, Campero, Hernández and Langer, 2000).

Likewise, in 2009 the National Centre for Gender Equity and Reproductive Health (CNEGySR) postulated that maternal mortality can be reduced by 40% if the factors that condition the three delays defined in Deborah Maine's study are overcome (Estrategia Integral para Acelerar la Reducción de la Mortalidad Materna, 2010; Id. Ibid).

In the latest reports from the General Directorate of Epidemiology in Mexico, 971 maternal deaths occurred in the country during 2011 (SS,2012). A report from a hospital of the Mexican Social Security Institute (IMSS) mentions that although maternal deaths have been reduced, they still occur in populations without adequate prenatal care; this hospital, considered to have low maternal mortality, had 30 maternal deaths over the course of 10 years (1998-2007) (González, Ayala, Cerda and Cerón, 2010). Similarly, another IMSS hospital reports eclampsia, haemorrhage and an increase in heart disease as the main causes of maternal death between 1991 and 2005 (Veloz, Martínez, Ahumada, Puello, Amezcua and Hernández, 2010).

In the case of the state of Yucatan, studies from 2003 to 2006 showed 24% underreporting of maternal deaths between 1997 and 2001 in Merida and 19% in various municipalities in the state (Rodríguez, Andueza, Montero and Hoil, 2005; Rodríguez, 2010). On the other hand, research has been done on the clinical causes that lead to women's deaths, and recent evidence shows that in very marginalised areas, haemorrhage is the main cause of maternal death (Rodríguez, Montero, Andueza and Manrique, 2007; Rodríguez, Aguilar, Montero, Hoil and Andueza, 2012), 590 2012). In the period from 2005 to 2009, 87 maternal deaths were reported for women residing in various municipalities in the state of Yucatan, but there is a possibility that some deaths may have gone unreported and that mortality trends may not reflect the reality of the problem.

In 2011, 14 maternal deaths were reported in Yucatan, among which the predominant underlying diseases in pregnant women, such as diabetes and obesity, further complicated the obstetric cause and contributed to the fatal outcome. The number of deaths in the following years was 19 and 21 in 2012 and 2013, respectively; and in 2014 there were 17 deaths that have not yet been made official because the reports are still under review. In 2015, 14 women in Yucatán died from obstetric complications (Ministry of Health, Mexico, 2015).

Deaths caused by obstetric complications are related to the way women respond to the warning signs that indicate a complication and the response of health services to timely care and treatment (Elú and Santos, 2004). In other words, maternal deaths are not accidental, but are due to a set of factors that, when linked together, form a fatal chain of delays that prevent the prevention of risks during pregnancies, limit access to quality health services and result in the lack of timely care for the complication and, consequently, death (Carvalho, Guilherme, Osis and Souza, 2007).

2.2. Multifactorial approach to maternal mortality

It has been identified that maternal death is a multifactorial chain of events that begins with health education in the female population, technical assistance through prenatal care, the fundamental performance of the doctor during the obstetric event, contemplating an indispensable hospital technological infrastructure and under the approach of healthy health policies aimed at "linking this chain of events" with the purpose of reducing maternal death (Ministerio del Poder Popular para la Salud, Caracas, 2008).

Maternal deaths cannot be attributed only to obstetric complications that are mentioned in the death certificate and are interpreted as direct or indirect causes of death; it is necessary to look beyond what happens in the context of the clinical care of the pregnant woman. Research that addresses this issue shows that a maternal death is due to a series of socio-cultural, economic, political, demographic, nutritional, gender and access to health services factors that influence the integral development of women (Montero, 2012).

Likewise, the determinants of maternal mortality are linked to risk conditions and vulnerability. Risk conditions refer to endogenous factors of the mother and the product of gestation, such as biological factors, habits and lifestyles of mothers and their families that determine dangers for the natural evolution of pregnancy, including nutritional status (anaemia, malnutrition and obesity), multiparity, short inter-gestational interval, extreme ages, adolescence, underlying diseases such as diabetes, hypertension, heart disease, tuberculosis, human immunodeficiency syndrome (AIDS); as well as smoking, alcohol and drug dependence (UNICEF, 2015).

Vulnerability is an expression of the lack or limitation of a protective condition or set of conditions, the object of social rights, that weaken the capacities of the mother and her family to anticipate the risks of pregnancy, childbirth, growth and development and includes geographical, socio-economic, cultural, educational and protective health factors.

Geographic factors include residence in remote areas, with transport difficulties and poor road conditions, which constitute a major barrier to timely access to health services. Socio-economic, cultural and educational factors are related not only to lack of money, but also to unemployment, lack of or low level of education, lack of adequate housing, overcrowding and poor sanitary conditions, lack of a partner to provide support and protection, and lack of a family member. Health factors refer to weaknesses in the health organisation that determine limitations in access, availability, timeliness and quality of care. Protective health factors are represented by the set of social rights, housing, healthy spaces, recreation, transport, health, education, food, employment, social security within the framework of justice and equity (UNICEF, 2015).

The identification of the underlying causes (maternal risk conditions) and basic causes (social vulnerability) shows the need for cross-cutting axes and intersectoral actions to reduce maternal death, with a vision of sustainability (Ministry of Health, Chile, 2015).

In addressing maternal mortality, it is essential to consider certain common characteristics in the developing world, in which most of these deaths are the result of direct obstetric causes, linked to the insufficient education of the population for the timely use of medical services in the face of alarm data of complications that are ultimately aggravated by insufficient accessibility to outpatient and inpatient obstetric care, as well as the limited quality of the latter (Ministry of People's Power for Health, Caracas, 2008).

Most health problems can be attributed to people's socio-economic conditions. In the case of maternal health policies, solutions focused on the treatment of illnesses have predominated, without adequately incorporating interventions on the "causes of the causes", such as, for example, actions on the social environment. As a result, maternal deaths continue to occur, due to increasing inequities in health and health care, and the results obtained with curative-focused maternal health interventions have been insufficient and did not allow the goal of reducing the maternal mortality ratio for Mexico to be achieved. Although not all health targets were missed, the target set for maternal mortality was not met. According to the latest official reports up to 2014 on progress towards the Millennium Development Goal targets in Mexico, the reduction in maternal mortality was insufficient, reaching 38.9 maternal deaths per 100,000 live births in 2014, and the target set for 2015 was 22.2 maternal deaths (MDG Mexico, 2016). Due to the slow rate of decline, it was estimated that the target was not met by 2015, although this data has not been officially reported.

There is now evidence that maternal deaths are the result of a set of problems, including those derived from social determinants (the social conditions in which people live and work, which impact on health) and risk factors inherent to the patients (diabetes, hypertension, overweight, etc.). This multiplicity of situations not only makes health sector actions aimed at ending maternal deaths more complex, but also hinders the expected results. (Id. Ibid.).

A frequent observation in the analysis of maternal deaths is directly related to the multiple reasons for which medical attention to pregnant women is deferred, and not only the criteria of being entitled to medical services; sometimes it is also a function of the lack of physical infrastructure and/or qualified personnel 24 hours a day, and delays in this sense can condition an imminent risk to life at any moment. (Briones, 2011).

Women die in hospitals due to insufficient emergency medical and surgical obstetric care, so one of the main hospital strategies that contribute to reducing morbidity and mortality is to structure a multidisciplinary team of health professionals (obstetrician, nurse, intensivist-internist, paediatrician, anaesthesiologist, social worker, laboratory and ultrasound) whose function is to optimise the care system and hospital resources trained in obstetric emergencies, 24 hours a day, 365 days a year. (PAHO/WHO, 2002).

According to the National Centre for Gender Equity and Reproductive Health, in relation to obstetric care, there are multiple delays between contact with the health service and the evaluation that decides on definitive admission; in addition to this, there are the procedures that must be overcome for the emergency to be definitively resolved, which means that a significant percentage (80%) of women who die have reached a care service, which did not prevent the fatal outcome. (CNEGySR, 2010).

On the other hand, in a study conducted in the State of Morelos in 2013, saturation of care services in second level clinics was reported, and although they had sufficient infrastructure and basic resources, the demand for delivery care services was excessive (Walker, Fritz, Olvera, Montoya and Flores, 2013).

Therefore, the problem of maternal mortality is associated with multifactorial characteristics, such as social and/or economic inequality of the population, making it complex to address and resolve (Barkat, Rahman, Bose, Com and Akther, 1997).

2.3. The three delays model

Since the first evidence of delays described by Tahddeus and Main in 1994, work has been done to analyse them through a model based on how the woman, her family and the health services respond to the complication, called the "three delays model". (Binder, Johnsdotter and Essén, 2012; Cham, Sundby and Vangen, 2005; Lori and Starke, 2012; Kloos, 1987). The first delay relates to the lack of recognition by women and their families of the onset of a complication and the delay in deciding to seek help; the second delay relates to difficulties, as they decide to seek help, in getting transport so that they can be referred to a hospital for care; and the third delay is because once they reach the hospital, they are not seen in a timely manner due to errors in diagnosis or lack of adequate treatment.

Also, recognition of a condition may be influenced by factors such as the prevalence of the condition (Kloos, 1987). In a study of pregnant women in Senegal, 13% reported fever, pallor and dizziness as normal signs of pregnancy because these conditions were common in pregnant women in the area (Thonneau, Matsudai, Alihonou, de Souza, Faye et al., 2004). In Argentina, 79% of maternal deaths studied had delays in recognising the warning signs for complications; and they also reported that they have found delays in referring women for fear of being insulted by doctors; because women request delivery care from midwives and midwives cannot persuade them that they should be attended in a hospital by skilled personnel; this leads them to attend deliveries at home and be referred to hospital in case of complications. (Rosestein, Romero and Ramos, 2008).

For women living in areas far from health services, such as those in rural areas, or in the poverty belts of the cities themselves, the opportunities to decide on and access health services are difficult. Most of these women's partners are working outside the home for the whole week or for weeks or months at a time (Shah, Hossain, Shoaib, Hussain, Gillani and Khan, 2009; Okour, Khader, Amarin, Jaddou and Gharaibeh, 2012; Hynes, Sakani, Spiegel and Cornier 2012). This situation further complicates women's opportunity to seek help. In a study of Afghan women in 2011, delay of first delay was 5.6 times higher, and tripled in those who did not have antenatal care. (Hirose, Borchert, Niksear, Alkozai, Cox and Gardiner, 2011).

Other causes reported by several studies that correspond to the first delay are failure to recognise the warning signs or severity of the condition, such as the study of 50 maternal deaths in Odisha, India in 2011, which reported as many as 58.1% of women who failed to recognise the severity of the clinical picture; and the study in Malawi conducted in the same year, where a case of first delay was exemplified, when the woman became complicated and stayed at home with abdominal pain for 45 days and experienced headache for over a month (Hynes, Sakani, Spiegel, & Cornier, 2012; Combs, Sundby, & Malata, 2012).

Another case was that of Venezuelan women, among whom 38.5% did not recognise the warning signs; (Mazza, Vallejo and González, 2012); and in 28 maternal deaths of Colombian women 82.1% did not recognise the warning signs of the complication (Amaya, Bolaños, Cuevas and Díaz, 2010). It has also been described that the local definition of complicated pregnancy may not be included in a prolonged labour, as was the case in African women who, when it was recognised, it was considered a natural occurrence (Wachuku and Stanley, 1994). Delay also occurred when the husband or family members perceived it unnecessary to transfer the woman when the complication occurred, (Okour, Khader, Amarin, Jaddou and Gharaibeh, 2012; Umeora and Egwuatu, 2010). Due to the ease of seeking help from the local midwife, which was also a cause of delay (Cham, Sundby and Vangen, 2005; Id. *ibid*; Santos, Luna and Gonzalez, 2010).

The low quality of emergency care, its cost and the deteriorating health status of mothers all contribute to delays in referral (Id. *Ibid*.). Likewise, the strong association between transfer from one hospital to another and maternal death suggests delays in diagnosis, management and referral. (Id. *Ibid*.). In another study, substandard care was reported in 52.6% of deaths, delay in seeking help in 55.3%, delay in transport in 15.8% and delay in hospital care in 17.1%. Women who did not recognise warning signs (OR 6.32), those over 37 weeks gestation and those with a higher average family number were delayed in reaching help. (Id. *Ibid*.).

The second delay is related to the delay in reaching help once the complication is recognised by the woman and her relatives. The main causes reported to give rise to this delay are lack of transport to the hospital, lack of financial resources to pay for it, fear of seeking health services due to bad experiences. The frequency of second delay has been found to be between 35% and 74% of women with obstetric complications in countries such as India and Africa (Combs, Sundby and Malata, 2012; Okour, Khader, Amarin, Jaddou and Gharaibeh, 2012; Mullick and Serle, 2011). In some cases, the lack of monitoring of the ambulance from the hospital to another hospital is reported, with delays of 2 hours to reach the place of origin, and 3 hours to reach the referral hospital; in addition to transfer in the worst conditions and without availability of blood (Mazza, Vallejo and Gonzalez, 2012).

Another study conducted in Jordan in 2012 found a delay of 15% in obtaining transport, (Id. *Ibid*); but in Nigeria this same problem occurred in up to 92.3% of 750 women who were referred (Umeora and Egwuatu, 2010). Similar situations of delay are observed in Latin American countries, as in the case of women in La Libertad, Venezuela, where the probability of dying due to problems with the transfer was 3.66 times more among those who were delayed more than an hour compared to those who were transferred in less than an hour (Santos, Luna and González, 2010).

Communication between community members and health staff has been another cause of second delay. In communities, language can be a powerful weapon of communication between inhabitants, but also a barrier and limitation to understanding between health care providers and families. A growing problem seen in recent years is the migration of ethnic groups to developed countries. In a 2012 UK study of 54 African migrants, the discordant language barrier between women and health care providers in understanding the complication was noted (Hynes, Sakani, Spiegel, & Cornier, 2012). Lack of transport, long distances and bad roads as well as financial problems to pay for transportation have been reported by relatives of Indian and Argentinian women (Walker, Ashley, McCaw and Bernard, 1986; Nahar, Banu and Nasreen, 2011; Rosestein, Romero and Ramos, 2008; Id. *Ibidem*; Killewo, Anwar and Chakraborty, 2006).

In some communities there are social support networks for pregnant women and social participation to expedite their care when complications arise, as is the case in Bangladesh, where despite being a poor country, the conditions of care have improved due to better organisation of the community, and the participation of non-governmental organisations and public and private health services, which help pregnant women and their families financially and clinically when they request help (Id. *Ibid*). However, there are still countries with many limitations in the functioning of these support networks that are the cause of the second delay, and where there is remote access to the vehicle, health personnel and clinic for pregnant women's care (Hirose, Borchert, Niksear, Alkozai, Cox, & Gardiner, 2011).

The lack of sufficient resources and infrastructure in the communities to provide quality obstetric care makes it necessary for the woman to be transferred to another hospital outside her community. Although there is a protocol for referral, there are still failures in the referral system, as in the case of 10 Colombian women between the ages of 22 and 37 who died due to delays in the logistics of referral to a specialist (Rodriguez and Ruiz, 2011). Delays also occur due to fear of caesarean section, as was reported in 5 maternal deaths in Kinshasa, whose relatives waited more than 10 hours to accept the transfer for surgery (Kabali, Gourbin, and De Brouwere, 2011).

Areas where there is a war environment due to civil war make it difficult for women to access health services. In such places, in addition to lack of money and transport, 15% of people do not want to travel at night because of dangers (Lori and Starke, 2012). In addition, if an emergency arises, political conditions are adverse and care is delayed or limited, as seen in clinical case reviews in Burma, when maternal health workers were unable to reach the home of a woman in need of services because they were located in an inhospitable area. (Teela, Mullany and Masenior, 2009).

Once they reached the health service, women experienced delays in receiving care, which corresponds to the third delay in the process. The rate of occurrence of the third delay ranges from 18% in Burkina Faso to 63% in Asian and African countries (Hynes, Sakani, Spiegel and Cornier, 2012; D'Ambruso, Byass and Ouedraogo, 2010). By the time a woman arrives at a health facility, the waiting time for care can be extended to over an hour. This was the case in 32 deaths in Malawi, where factors such as waiting 90 minutes before being seen by the doctor predominated; In addition, there was poor management of treatment, delays in referral, no antibiotics, very early postpartum discharge, no emergency surgery, no x-rays, early discharge on first admission, lack of adherence to antiretroviral treatment, family request for referral letter which they were slow to provide, uncertainty about whether to refer to another clinical service. (Combs, Sundby and Malata, 2012).

Something similar was reported in the study from Newi, Nigeria, where 54 women who died eventually waited more than 1 h. to be seen (Igwegbe, Eleje, Ugboaja, & Ofiaeli, 2010); and in a cohort of 673 Brazilian women with complications, there were delays in receiving care during ambulance transfer, as well as in correct diagnosis and treatment, in 35% of them (Oliveira, Papinelli, & Souza, 2009).

Despite investment in emergency obstetric care infrastructure and equipment in some countries, such as Bangladesh, there are still limitations in hospital-level care that cause delays. The consequences are felt in maternal deaths from preventable causes such as pre-eclampsia-eclampsia. A study conducted in Brazil reported delays in preventing seizures and implementing appropriate obstetric care in cases of haemorrhage in 25% of 158 women with severe maternal morbidity; (Lotufo, Parpinelli and Cecatti, 2012); in India, poor management of obstetric haemorrhage is also an unresolved problem, with a reported 46.5% delays in receiving treatment or being treated adequately, delay in referral, poor service, unavailable health team, incompetent team and lack of obstetric management guideline (Iyer, Sen and Sreevathsa, 2013). A study conducted in France in 2011 reported that delay in blood administration was linked to 34 maternal deaths (Bonnet and Deneux, 2011).

The low quality of obstetric care was perceived by the relatives of 14 deaths in Lao PDR, (Alvesson, Lindelow and Laflamme, 2012); as well as the lack of skills of the health team for the correct management of childbirth, as clearly described in three case studies in India, (Mullick and Serle, 2011); where health units were poorly equipped for emergency obstetric care and staff were not properly trained to deal with it.

In some Latin American countries, the lack of adequacy and understanding of health services with customs during pregnancy, childbirth and the puerperium has been perceived as contributing to the third delay (Mayca, Palacios and Castañeda, 2009). In Argentina, 25% of the cases of 20 maternal deaths presented the third delay due to substandard medical care, lack of doctors and good diagnosis and treatment, lack of equipment and resources (Rosestein, Romero and Ramos, 2008).

In Yucatan, Mexico, 53% of the delays in 9 cases of death were due to inadequate and untimely medical treatment, increased waiting time for care, lack of risk identification in prenatal consultation, and deficient medical resources and medicines (Rodriguez, Aguilar and Andueza, 2012). In the study conducted by (Apud) Kabali, Gourbin and De Brouwere in hospitals in Kinshasa in 2011, some attitudes taken by the health staff at the time of attending the complication were perceived by the relatives as signs of delay in care; some of them mentioned that the pregnant woman had inadequate hospital care, poor attitude of the health team and incompetence and negligence were perceived. (Kabali, Gourbin and De Brouwere, 2011).

Deficiencies in clinical testing of pregnant women in their own communities for abnormalities or diseases during antenatal care continues to be another problem causing delays. In Tanzania, 63 observations and records of women with antenatal care showed a lack of supplies and reagents for urine and glucose tests and a lack of information to women about test results (Sarker, Schmid, and Neuhann, 2010). The WHO recommends that six major structures must be addressed to strengthen the health system: delivery service, health workers, information, medicines, financing and governance; (WHO, 2007); and although the growing field of research has generated evidence that has improved gaps between these and practice, systematic studies on the causes of delays of the third delay, once a woman reaches the health service, are lacking. (Knight, Self and Kennedy, 2013).

In Yucatan, the first study of the three delays using the model's methodology was conducted on maternal deaths in an urban area (Rosado, Rodriguez and Andueza, 2008). When asked about what warnings in their body might indicate something wrong during pregnancy, most women did not recognise warning signs for maternal complications, such as headache and lower limb oedema. In another study conducted in 6 communities in the southern part of the state, the third and first delay were the most frequent delays found in maternal deaths from 2006 to 2009 (Rodriguez, Aguilar, Montero, Hoil, & Andueza, 2012). In this study, the third delay could be deduced from what was referred to in the records of the deceased women, where initial diagnoses were found that did not agree with the final ones; and the comments of the relatives, who mentioned the lack of medication and the number of times the woman was returned home after being attended to at the health centre, despite the fact that the symptoms continued.

2.4. Current model of care for pregnant women

The procedures carried out in Mexico for the care of pregnant women must follow the guidelines of the Technical Standard NOM-007-SSA2- 2016, Care of women during pregnancy, childbirth and puerperium and of the newborn, which was published on 7 April 2016 (SEGOB, 2016). For the elaboration of NOM-007 and the promotion of its compliance, experts intervened in the National Consultative Committee for Standardisation, which is composed of technical staff from twenty-five health sector agencies, scientific and technological research centres, professional associations, civil associations, medical associations, institutes, hospitals and sanatoriums in Mexico City. This committee reviews the NOM every five years and updates it according to changes in the developing world (SEGOB, 1993).

Before making the updated NOM-007-SSA2-2016 document official, a draft of the Mexican Official Standard PROY- NOM-007-SSA2-2010 was prepared and published in November 2012, which incorporated key points for women that should begin three months before pregnancy with preconception counselling, including the care that both doctors and the pregnant woman should take to achieve a healthy pregnancy and delivery, as well as preventive care actions during the 42 days following delivery.

It also incorporates actions that involve the participation of the family and the husband in the care and attention of the pregnant woman, and shows sensitivity towards the permissibility of giving birth in a clinic or hospital vertically or in any other way that the pregnant woman demands, as long as the conditions are right for it to be carried out in this way. It also includes epidemiological surveillance of all cases of maternal deaths and their immediate notification.

However, PROY-NOM-007-SSA2-2010 derived from the Official Mexican Standard NOM-007-SSA2-1993,100 which was in force in Mexico until 2015 and which served as the framework for this thesis.

In 2001, the Ministry of Health developed the Manual of Care for Healthy Pregnancy, Safe Childbirth, Safe Postpartum and the Healthy Newborn as a technical instrument that reinforced the provisions of NOM-007-SSA2-1993, including the importance of strengthening support networks for pregnant women, especially in communities far from emergency obstetric services (Secretaría de Salud, México, 2001).

In the last century, the health system in Mexico began a process of "medicalization" of childbirth, which consisted of promoting in the community that all childbirth should be attended by medical personnel and not by midwives. This process displaced traditional midwives, who provide emotional support and are recognized by the community as people they trust to attend births and perform "massages", so that going to midwives regularly is part of their reproductive customs. Although there is no scientific evidence of the presence or absence of risk or benefit of their practices, some of them have been trained by the health sector to attend normal births.

The "medicalization" of childbirth could be one of the reasons why pregnant women delay their care. On the other hand, when the community medical intern has to attend births, he/she lacks personnel, equipment and material for quality care. The Medical Arbitration Commission reports rates of medical complaints for poor quality maternal care (CONAMED, 2003). Due to the volume of births that occur annually in the country (more than 2 million), it is natural that there is a higher frequency of complaints about this type of service, compared to some of which may occur a few thousand per year. Nevertheless, there are studies that show the detrimental role of the physician's actions at the time of delivery (Infante, 2006).

Other findings are those reported in two hospitals in the State of Morelos, in 512 women who requested delivery care during the period from May to June 2012.

Of these women, 29% experienced some type of abuse during childbirth: 19% experienced verbal abuse and 8% physical abuse; 2% did not report what type of abuse, although they responded that they had suffered it (Instituto Nacional de Salud Pública, México, 2013).

Likewise, in Yucatan there is also evidence of medical mistreatment of 108 pregnant women during childbirth (Cervera and Méndez, 1997); and also of 21 midwives distributed in the municipalities of Valladolid, Temozón, Ticul and Halachó; the former were verbally assaulted for their attitudes towards childbirth; and with the latter the communication link between the midwives and the medical intern was broken, which resulted in misinformation of the health system about the number of births attended in the homes. (Méndez and Cervera, 2022).

Since 2002, studies in Yucatan on maternal deaths financed by the Latin American and Caribbean Women's Health Network (RSMLAC), the National Council of Science and Technology (CONACyT) and the Ministry of Social Development (SEDESOL) have identified that not only verbal aggressions by health personnel continue, but also the lack of information to family members, creating mistrust towards health services (Project: Mortalidad materna en Yucatán: perfil del proceso salud-enfermedad- atención y estimación del subregistro. Technical Report, CONACyT, 2006) (Rodríguez, Andueza, Oliva, Manrique and Ortega, 2006).

In recent years, the Observatory of Maternal Mortality in Mexico has reported several cases of women who received poor care at the time of requesting delivery services, such as the case of the Oaxacan woman who came with labor pains and was not attended in time, giving birth in the hospital garden; and another case of maternal death occurred in Yucatan, where the woman came alive to the hospital and the ultrasound showed fetal death, but the delay in the care of the pregnant woman caused her death. (OMM, 2015).

In the Maternal and Perinatal Health Specific Action Program 2013-2018, new objectives are incorporated to strengthen the actions carried out in the institutions to improve maternal health, such as the implementation of modules for the care of pregnant women at risk (MATER) and the training and integration of immediate response teams in hospitals to deal with obstetric emergency (Secretaría de Salud, México, 2014).

Regarding the Mexican Institute of Social Security and the Institute of Security and Social Services of State Workers, the procedures for the care of pregnant women are based on clinical guidelines developed for each of the obstetric complications (IMSS, 2015).

In the document entitled Comprehensive strategy to accelerate the reduction of maternal mortality in Mexico, published in 2010, it is based on the model of the three delays to propose opportunities for improvement in the care of pregnant women, considering as a fundamental strategy and in order of priority attention, If this is not addressed, it will be useless to educate and promote in the communities that they should go to the health services if the quality of care does not improve and if there is no well-organized communication and transportation system for the transfer of pregnant women. (National Center for Gender Equity and Reproductive Health CNEGySR, Mexico, 2010).

The processes of care for pregnant women vary between urban and rural areas. In the former, there are hospitals that provide emergency obstetric care; therefore, access to care is not as problematic as in rural areas. In the latter, the pregnant woman follows a path from her home, the midwife, the private doctor, the health center, the municipal police station, the means of transportation, the referral clinic, until her arrival at the hospital. During pregnancy, she goes to the health center in her community or the closest one to her community for prenatal care, but she also goes to the midwife (in communities where they still exist) to be "soben", and some of them still request her services at the time of delivery.

When the pregnant woman has an obstetric complication, she is referred to a second level clinic, where the emergency must be resolved. However, in most cases, she is transferred to another hospital located in the urban area because of the seriousness of her condition. In any case, the hospitals in the urban area are the ones that receive women in serious condition from all parts of the state.

2.5. Analytical Models

Most of the evidence provides qualitative information from samples of pregnant women who died or survived, mainly from developing countries.

There are also quantitative studies describing the prevalence of the causes of delay, as well as some analytical studies and a minimum of experimental studies. In other words, there is a lot of descriptive evidence from various countries, such as the prevalence of the causes of delays, but there are no local studies that analyze the magnitude of the impact of delays in the care of obstetric complications. By strengthening the evidence with studies of this type, it will be possible to scale up to the design of effective interventions that prevent delays.

2.6. Concept of elicitation

When the information we need to study is difficult to obtain with traditional statistical techniques and methods, there are alternatives to achieve it, such as the elicitation technique with experts using Bayesian statistics. Such is the case of information on specialists' judgments on the knowledge of the probability of death due to delays in care, acquired a priori and through their experience in the care of severe cases with obstetric complications at the hospital level and their implications for maternal mortality. Through Bayesian methods, external information on delays in obstetric complication care can be incorporated to estimate the magnitude of the effect under investigation. In our case, data on percentages of delays were available, especially for the first and second delays.

Regarding the analysis processes of the studies carried out on the clinical and sociocultural causes of women's deaths due to obstetric complications, most of them have been cross-sectional and qualitative case studies. In a systematic review conducted from 1972 to 2013, on delays in the care of obstetric complications it was found that 85% were descriptive studies; (Rodriguez, Palma, & Zapata, 2014). In the literature search, no studies of elicitation of delays in obstetric complications care with expert panel using Bayesian statistics were identified.

The scope of application of Bayesian statistics is the same as that of classical statistics, but there are situations where the use of the former presents advantages. Some important situations for its application in the health area are in equivalence studies, in the monitoring of clinical trials, in meta-analysis, in the evaluation of local data, in the adaptation of models to a new environment and in the elaboration of clinical guidelines (Molinero, 2002). To achieve this, a panel of experts and elicitation are used, i.e., people who have accumulated valuable experience on a given topic (experts) participate, which is interpreted probabilistically through Bayesian statistics (elicitation); a facilitator (a specialist in probability and group management) guides the entire elicitation process.

Elicitation as a technique of Bayesian statistics has been used for several years to extract experience from experts and translate it into numbers (Meyer and Booker, 1991). This statistical method, unlike the traditional one, takes into account the experience of experts in the area, because in practice, we need knowledge that is not found in the literature to make decisions. Thus, it is a matter of knowing the probability of some event that experts judge to be valid.

Elicitation is a dialogue between experts and facilitator to obtain expert opinions about an unknown quantity or quantities and their possible variation. That is, elicitation is the process of experts formulating knowledge in the form of a probability distribution (Gartawaite, Kadane, & O'Hagan, 2005).

Researchers in applied psychology and cognitive psychology have contributed significantly to knowledge elicitation (KE) methodology, which is growing in importance with the increasing use of information technology for complex forms of sociotechnical work systems and the involvement of experts in knowledge-based organizations (Hoffman, 2008).

Graphical elicitation and participatory diagrams have also been used to obtain data that are difficult to acquire through traditional verbal exchange (Umoquit, Dobrow, Lemieux, Ritvo, Urbach, & Wodchis, 2008).

Expert opinion is considered a legitimate source of information for modelling decision analyses where the required data is not available. In 2007, a pilot study was conducted in England to develop a computer-based tool for eliciting expert opinion on the shape of the distribution of various parameters. The study compared theoretical elicitation with technical elicitation and found that the very complex elicitation techniques referred to in the literature were difficult to use in practice. In contrast, the study approach achieved a reasonable response rate (50%), provided logical answers and was rated as easy to use. The software used allowed for graphical feedback on the elicitation process (Leal, Wordsworth, Legood and Blair, 2007).

In health care, the elicitation methodology has been applied to studies aimed at health system improvement, environmental and cost-effectiveness studies to decide on the best treatment (Davies, Vardeva, Loze, L'italien, Seenfalt and Baardewijk, 2008; Saunders, Magnanti, Correia, Yang, Alamo, Bartonova et al. 2012; Karnon, Czosk, Smith and Brand, 2009).

A cost-effectiveness analysis of atypical antipsychotic treatment sequences for the management of stable schizophrenia was conducted in 2008 in the UK using Bayesian analysis. The analysis found that different treatment sequences for stable schizophrenia are appropriate (Davies, Vardeva, Loze, L'italien, Seenfalt and Baardewijk, 2008).

In 2009, a study was conducted in Dresden, bringing together experts to discuss the toxic effects of the pesticide chlorpyrifos on neurodevelopment. A literature review was conducted and causal chain diagrams and an online questionnaire were sent to those who had published in relevant areas of research. They were asked to assess probability ranges that chlorpyrifos contributes to neurodevelopmental disorders and the likelihood of confidence in the scientific evidence.

In another questionnaire they were asked to respond on justifiable policy actions based on scientific knowledge. The conclusions were that there is a debate among experts on the toxic effects of chlorpyrifos that requires further research. Further dissemination of the harmful effects to consumers is also needed (Saunders, Magnanti, Correia, Yang, Alamo, Bartonova et al. 2012).

In Australia in 2009, a study was conducted to develop a natural history model of age-related macular degeneration to estimate the cost-effectiveness of screening tests. The method used was a decision analytic model with expert elicitation and literature data to develop the model. To incorporate the parameter of interest and unobserved data parameters, an innovative form of probabilistic calibration was designed to obtain the outcome parameters. The results identified priority actions to address before implementing screening, such as reducing the degree of uncertainty around the obtained mean, as well as resource requisitioning and reorganisation of services (Karnon, Czoski, Smith, & Brand, 2009).

In a 2010 study conducted for decision support in the health system of Barcelona, Spain, it was concluded that expert panel elicitation with Bayesian statistics is an appropriate measure for extracting relevant knowledge in complex areas of health. Both explicit and implicit knowledge are critical to guide the scientific analysis of highly complex decision problems, such as those encountered in health systems research. (Brett, Fairchild and Reed, 2013).

There are several elicitation methods that can be used to carry out the process: direct elicitation methods and group analysis. Among the former are rating scales, threshold techniques and the standard game. Conjoint or group analysis studies are categorised according to the question format used and include ranking, graded pairs and discrete choice (Molinero, 2002).

Researchers in England have in recent years developed a method of elicitation that can be individual or group-based, using software that facilitates analysis of the results (Oakley and O'Hagan, 2010).

The Bayesian method has been tested in several environmental studies and cost-effectiveness analyses and has facilitated the processes because of its practical and objective way of obtaining the results.

A cost-effectiveness analysis was conducted in England and Wales to test the effect of bisphosphonate treatment over five years for fracture prevention. This study used an elicitation technique and Bayesian analysis to aid decision-making to extend treatment (Stevenson, Oakley, Lloyd, Brennan, Compston and McCloskey, 2009).

Recently in Ohio, a Bayesian model analysed associations of manganese exposures and motor function impairments in exposed residents (Bowler, Beseler, Gocheva, Colledge, Kornblith, Julian et al., 2016).

Another study used a Bayesian model to quantify the change in mortality associated with future ozone exposures in the face of climate change (Alexeeff, Pfister and Nychka, 2015).

2.6.1. Elicitation technique

One of the purposes of the present study was to develop an expert panel knowledge elicitation process on probabilities of delays in pregnancy care using Bayesian statistics. Thus, the data obtained from the experts provided information that strengthened the quantitative evidence that existed to date at the level of the state of Yucatan.

It has been said that an expert has made all the mistakes that can be made in a very specific field (Nils Bohr), but it is also someone who makes three correct guesses in a row (Laurence J. Peter) (Gartawaite, Kadane and O'Hagan, 2005). Experts are specialists in their area or field of knowledge, who based on their theoretical learning and their experience over many years, can process information that combines both knowledge to make a final judgement that they consider to be valid (Molinero, 2002).

The facilitator is the person with knowledge of probability and statistics who conducts the dialogue to elicit the expert's knowledge as reliably as possible. (Id. Ibid).

2.6.2. Description of the method

In this study, the stages described by (Gartawaite, Kadane and O'Hagan, 2005) were followed to elicit expert knowledge, because their method is simple and reliable and has been applied in other research to elicit probabilities. The elicitation process consists of ten stages:

– 1st Recording the elicitation

In the first stage, the reason for the elicitation process is explained to the expert. The record of the information is kept and the data obtained in the session with the expert is reviewed. The record of the information is also useful to demonstrate to the expert the seriousness with which the process is carried out. The recording of the process starts with the date and purpose of the interview. All stages of the procedure are recorded and are visible to the expert, who can correct any mistakes. It is important that at this stage the expert agrees with the recording. The recording is done by means of questionnaires and the comments of the participants are recorded.

– 2nd The expert

It is recorded who the expert is and what his or her expertise lies in. The expert is also asked at this stage about any conflict of interest in the outcome as a result of their involvement in the elicitation process, to minimise errors in the estimation of effect. This reduces the bias that might be caused by persuasion of opinions and objectivity.

– 3rd Simulation

At this stage, a practice exercise is carried out with the expert before the final probability elicitation. The parameter by means of which their opinion is sought is similar to the one to be elicited in the study. For example, the quantity about which his or her opinion is elicited should be something like the population of a country other than the expert's home country; the expert probably does not know it exactly, but is unlikely to be totally unaware of it. The expert will then know how big that country is and will be able to compare it with what the expert knows about the population of his or her own country. The exercise serves as training for the expert through practice in assessing probabilities. The simulation exercise can take several hours and should serve to clarify doubts about concepts such as probability and confidence intervals. In this way, a mock elicitation is designed to familiarise them with the process.

– 4th Definition

Define what you want to know and the units of measurement to be elicited. The expert is located in time, place and person, i.e. the contexts are provided according to the probability to be elicited.

– 5th Evidence

The expert is asked to specify the evidence on which he/she relies to evaluate the probable values of the quantity. This allows the source of the written evidence to be recorded in the elicitation and makes the expert think explicitly about the evidence; this makes it easier for the expert to focus on the recalled elements.

– 6th Ranking

At this stage the expert is asked for a plausible range of values for the quantity, how large or how small the range could realistically be, based on the available evidence and the expert's judgement. The plausibility of the range is primarily intended to encourage the expert to recognise the complete inaccuracy of the quantity.

– 7th Median

At this point the expert is asked to think of a central value for the quantity. The central value asked will be the median, and it will be explained that the chance of the true value being above the median is 0.5, exactly the same as the chance of the value being below the median. The purpose of asking for "high" and "low" limits is so that the expert does not feel that one is better than the other. The reason why this comes after the range stage is to avoid the phenomenon that psychologists call anchoring. The expert will be asked to think first about the rank and then about the median, because otherwise, there is a tendency to think about how far away from the median it is plausible for the ranks to lie. Experiments have shown that people do not move far enough: being anchored at the median allows uncertainty to be elicited with bias.

– 8th. Probabilities

At this stage, probabilities are asked for in percentages. To elicit each probability, a question is asked. For example: What would be the probability of having the three delays in the care of the pregnant woman with obstetric complication? As all probabilities are imprecise, if the expert mentions a probability of a certain amount, it is interpreted as an approximation to that amount, rather than an exact probability to the amount.

For each question, the range and median are obtained. Each probability and its ranks are recorded in a database. For each probability, its specific probability is calculated, to obtain the best and the largest of the median, representing its most probable variability. The formulas $X1=(2M+S)/3$ $X2=(2M+I)/3$ are used, where:

$X1$ =Specific probability of the upper bound of the interval $X2$ =Specific probability of the lower bound of the interval M =Median.

S =Specific probability of the upper bound of the interval I =Probability of the lower bound of the interval

This operation is performed for each expert. Finally, the probabilities are averaged to obtain a single probability value for each question.

– 9th. Feedback

Tables with the elicited probabilities are presented and the results are discussed; the results are the averaged probabilities of the group of experts. If the expert feels that the averaged quantities do not adequately represent what he/she thinks is happening in reality, then some of the previous steps are revised, and if necessary additional probabilities are requested.

– 10th. Concluding remarks

Finally, the elicitation confirming the agreed probabilities; and any observations or comments that the expert wishes to express about the process are recorded.

2.6.3. Other considerations

Each of the experts is first elicited separately and then a consensus is reached to give them an opportunity to discuss their beliefs with each other. Finally, the consensus of the group is reached and the final stages of the process continue. A final consideration is the questionnaire. The individual face-to-face interview is done with each expert, giving the previous explanations and example of simulation to facilitate the understanding of the process. In case of incomplete answers due to the unwillingness of the expert to participate during the process and he/she declines to participate, another expert is selected.

2.6.4. Limitations of the process

It is obvious that there are imperfections in the process of obtaining the probabilities representing the experts' statements. First, because by choosing a particular probability, the facilitator is inferring for the expert a huge number of unspecified probabilities. Second, the selected probability will rarely be able to exactly reproduce the expert's statement. However, it is reasonable to accept these imperfections on pragmatic grounds.

2.7. Decision models in health

Decision models are used in public health to assist in problem-solving decisions; they seek to maximise the benefit to the population by correctly diagnosing the problem and establishing the appropriate alternative solution.

Mathematical decision-making models came to prominence during World War II to support military operations, when it became necessary to apply another form of research supported by quantitative techniques known as operational research (OR). IO originated in Great Britain and has since spread in the analysis of decision making in all fields of activity, systems, products or services, in which it can be applied. IoT is currently considered one of the most innovative decision-making processes of the 21st century (García, García, Galvez and Rodríguez, 2012).

Some applications in medicine of IoT are reflected in predictive and diagnostic studies and treatment planning or prediction of clinical manifestations particularly in the field of neuroscience (Pardalos and Principe, 2002; Sainfort, Brandeau and Pierskalla, 2004; Pardalos, Sackellares, Carney and Iasemidis, 2004; Ferris, Lim and Shepard, 2003).

IO incorporates analytical tools such as decision tree models (Mar, Antoñanza and Arrospide, 2010). as a proposal for a solution that integrates existing knowledge and introduces the expected value and probabilities of occurrence of different events as inputs to obtain projections about the future consequences of adopting health decisions in the present (Pradas, Antoñanza and Mar, 2009).

Probability analysis using a probability tree allows for the analysis of the frequency with which an event occurs, taking into account the elicited knowledge of the experts. The results of the probabilistic model provide quantitative tools that strengthen the health system for decision-making. Based on the results of the probabilistic model, decision-making models can be constructed that consider alternative pathways to act in the best interests of the population; the medical alternatives present and the options available in the management of patient care can be clearly specified and demonstrated to physicians, students and, with caveats, the patient (Greemberg, Daniels, Flanders, Eley, & Boring, 2005).

The elements in a probability tree or diagram include:

1. Constructing a diagram called a probability "tree" with all the branches that combine the different events as the problem presents itself.
2. Incorporating probabilities for uncertain events into the tree.
3. Performing mathematical calculations that combine all the probabilities.
4. Incorporate results into a decision model of the alternative options to be made.

The problem should be clearly stated. The diagram flows from left to right, options (probability nodes) are highlighted with rectangles; outcomes (terminal nodes) are inserted in the right corner of the appropriate branches. The tree should contain all appropriate probabilities and all uncertainties and options. The measurements should be on the probabilities of survival or death (Sanchez and Echeverri, 2001).

The probability tree consists of the following components:

- Starting point: is the presentation of the problem in a nutshell.
- Decision node: Represents a point where a behaviour is taken, such as the different alternative solutions to the problem. It is represented by a square at the top left of the tree.
- Probabilistic node: Shows the point where the different consequences of a decision are generated, which are not under the control of the decision maker. The consequences have a component of uncertainty that can be quantified by means of probabilities. It is represented by a rectangle.
- Terminal node: Represents the final outcomes. It is represented by a triangle.
- Connectors: These are lines that link the different elements described. The way the different structures are connected follows a sequence in which what is on the left has temporarily occurred before what is on the right. The extent to which the tree develops corresponds to the horizon of analysis.
- Definitions and values: The connectors leaving a probability node have at the top the description of the outcome and at the bottom the quantification of the uncertainty (probability values). At the end of the terminal nodes are the values assigned to the outcomes (utilities) (Evans and Olson, 1998; Fineberg, 1980; Sandoval, 2002).

In constructing the probability tree, a sufficient number of combinations representing the key events and probabilities are incorporated, but it must be simple to be understood. The probabilities elicited through the expert panel are fed into the top branch of the tree, from left to right, to give the probabilities of the first, second and third delay. On the terminal branches at the right end of the whole branch arm, the elicited probabilities of death per delay are assigned for each delay, alone and combined; the survival probability of each branch will be the difference between the unit and the probability of death.

At each probability node, the probabilities and numerical outcomes of each branch of the path are multiplied and the values of the separate branches are summed. This process is called averaging (Greemberg, Daniels, Flanders, Eley and Boring, 2005).

With the support of a computer program, calculations are made from right to left (roll back), with all possible combinations of branches, obtaining at the end an overall value of death due to the fact of being exposed to delays, which is placed at the beginning of the tree, at the left end of the tree.

To decide which pathway is the right one for the health services to follow and which will bring the greatest benefit to the population, a final probabilistic diagram of two or more pathways is constructed, which are considered to be alternative ways of addressing the problem, seeking the best preventive benefit to the population with the relevant interventions to reduce it.

2.8. Summary

Deaths of women during pregnancy, childbirth and puerperium are still a public health but also a social problem in the State of Yucatan. According to trends reported by official agencies, the decline in deaths has been slow, with ups and downs from one year to the next, with an annual average of 18 deaths in the State of Yucatan from 2002 to 2013. Likewise, the MMR in 2012 and 2013 exceeded the national average. The clinical causes of women's deaths are well known and are related to access to and quality of health care. However, there are non-medical but social factors that influence women's lack of access to services. The three delays model allows us to enter the community level to understand the social, cultural, economic, demographic and gender barriers that women face when a maternal complication occurs. Many studies, most of them descriptive, report on the frequency of delays among women and their families.

When it is necessary to know information that is difficult to obtain through classical statistics, the technique of eliciting experts with Bayesian statistics is used, which allows the knowledge of specialists who, with their experience in a given situation, make reasoned judgements that are translated into numbers. With the support of mathematical models, parameters can be measured to provide answers to complex public health situations that require a decision. The probability tree and the decision tree are mathematical tools that help the health system in decision making when it is necessary to make decisions about the best benefit for the population.

That is why in this study, having information from experts involved in the health-disease-pregnancy care process allowed the construction of a conceptual framework with a tendency to integrate elements present in the context in which pregnant women with obstetric complications develop at the community, municipal and hospital levels, from the experience and perspective of those who care for pregnant women on a daily basis.

3. Preventive model of care for pregnant women

3.1. Introduction

In order to fulfil the first objective of the research, to construct the preventive model of delays in the care of pregnant women with obstetric complications, the study was based on the qualitative, interpretative paradigms (Sandoval, 2002), in which reality is constructed from the point of view of intra- and inter-individual subjectivities, as well as their interrelations and knowledge of empirical reality, which is influenced by culture and their particular social relations.

Using Thaddeus and Maine's model of the three delays⁶ as a guide, a critical reflection was made on the reality of what is happening around the care of pregnant women with obstetric complications, at the community, municipal and hospital levels; and through the individual perceptions of the experts on the causes of the first, second and third delays, a knowledge constructed on a shared basis emerged, which allowed, through "entering into reality", recognising it in a logical, internal and specific way.

The construction of the preventive model was based on the analysis of the participants' discourse on their perceptions of delays in the care of pregnant women with obstetric complications. From this perspective, the methodological framework originated from the need to describe the reality of the care process for pregnant women, using two basic tools: the discussion group and the individual interview. This description of the reality was given through the information provided by key informants, who knew the cultural, socio-demographic, gynaecological-obstetric and gender characteristics of the women in their area of work and daily influence, as well as the processes that are carried out for the care of pregnant women. Thus, this study was based on the concept of culture as "everything that has been learned or produced by a group of people" (Spradley, 1979); or in a narrower sense, "(...) the knowledge that people use to generate and interpret social behaviour (...)", which is learned and gradually shared (Vargas, 1994).

3.2. Ethical considerations

Each participant was asked to sign an informed consent form, which guaranteed the confidentiality of the identity of the recordings and the freedom to withdraw from the study voluntarily if they chose to do so (principle of autonomy). The study had a social benefit (principle of beneficence), by contributing to the fulfilment of the demand established by the WHO in Millennium Development Goal 5 to improve maternal health; and it sets a precedent for future evidence-based actions to be taken to contribute to the reduction of maternal mortality in Yucatan. Furthermore, the risk to the participants was minimal (principle of non-maleficence), as no interventions were carried out that endangered their physical and moral integrity. It also aims to propose to the health services a fairer and more humanised distribution of resources, based on human rights, with respect for culture, dignified treatment and quality care, highlighting the need to attend to the vulnerable group of pregnant women, mainly in rural areas (principle of justice).

This study complied with the guidelines established in the Declaration of Helsinki of the World Medical Association of 1964, with the modifications made in Tokyo 1975, Venice 1983, Hong Kong 1989, South Africa 1996 and Edinburgh 2000, as well as with the provisions of Article 7 of the International Covenant on Civil and Political Rights of the United Nations General Assembly of 1986 and the Regulations of the General Health Law on Health Research published in the Official Journal of the Federation on 6 January 1987. The study protocol was reviewed by the Ethics Committee of the Centro de Investigaciones Regionales "Dr. Hideyo Noguchi" of the Universidad Autónoma de Yucatán, Mexico, which gave its approval to carry out the study.

3.3. Methodology

The qualitative methodology carried out for the elaboration of the preventive model of delays in the care of pregnant women with obstetric complications was based on a transversal design, for which a flexible and emergent plan was prepared, oriented towards the construction of the process of care for pregnant women with obstetric complications. This plan made it possible to reconstruct the reality through the perception of the process at each of the levels of the context (community, municipal, hospital), where the pregnant woman goes for help when the complication occurs, as well as the way in which emerging elements at each of these levels are interrelated and interwoven.

This plan answered the questions of how could the outline of the preventive model be constructed, and under what circumstances of mode, time and place could the preventive model be developed? The first question was answered by the selection of key participants, who were chosen as specialists in the care of pregnant women with obstetric complications in Yucatan, taking care to select those who were considered the best representatives and informants of the reality to be explored. Likewise, to answer the second question, the design contemplated the planning of the ways of approaching these people, the means of inviting them to participate, the place where we would have the meetings with them, the level of context of the participants and the most appropriate data collection techniques with which we would be able to rescue information for the reconstruction of knowledge (Table 2).

Table 2 Summary of participants and procedures carried out in the study to arrive at key points

Participant	Number	Contact	Technique	Context level	Questions	Key points for intervention
Obstetricians and Gynaecologists	4	Institutional Charter	Discussion group	Hospital	On the care of pregnant women with obstetric complications. 1) What are the procedures? 2) What are the procedures based on? 3) What are the barriers that cause delay in procedures? 4) What needs to be improved? 5) What strategies do you propose?	Universal standards and procedures
Physicians in Public Health	3	Institutional Charter	Discussion group	Municipal		
General Practitioners	1	Institutional Charter	Discussion group	Municipal		Training at all levels in EmOC
Doctor in Anthropology Social	1	e-mail	Video call	Community		
PhD in Social and Educational Psychology	1	e-mail	Individual interview	Community		Positive attitude Infrastructure and resources
PhD in Economics	1	e-mail	Individual interview	Community		
Population Health Physician	1	e-mail	Individual interview	community - Hospital		Budgeting Communit model
Doctor of Health and Social Behaviour social	1	e-mail	Video call	community		
Nutritionist	1	e-mail	Individual interview	community		Demand-driven demand
Orderlies	2	Institutional Charter	Group interview	Hospital		
Administrative Assistant	4	Institutional Charter	Individual interview	Hospital		
Nurse	1	Institutional Charter	Group interview	Hospital		
General Practitioner	1	Institutional Charter	Group interview	Hospital		
Midwife	1	Staff	Individual interview	community		

Source: Own Elaboration

This stage also defined the times and moments between one session and another, or between one interview and another, to allow time to sort the information obtained, organise the digital files, transcribe them, do the detailed reading of the transcript, review it, write memos, and identify some general categories of the detailed line-by-line analysis of each interview.

Two qualitative interview techniques were used to construct the preventive model of delay in pregnancy care: focus groups and individual key informant interviews.

3.3.1. Focus groups

For the purposes of this study, we call a focus group a socialised conversation project, in which the production of a group communication situation serves to capture and analyse the ideological discourses and symbolic representations associated with any social phenomenon (Alonso, 1998).

Didactic techniques used in qualitative research, such as brainstorming, flow charts and diagrams, were used to collect information from the participants in the focus groups. The focus group interview technique was selected because it is indicated in qualitative research when it is necessary to listen and talk, to know both the equivalence between the group (micro level) and the totality or social context (macro level) where the process that gives rise to the problem studied takes place; also because during the conversations, the participants maintain a face-to-face interrelationship that guarantees the internal cohesion of the group.

The dialogue that takes place in the discussion group is always between more than two people, with the right to speak alternating between one person and the other. All comments emanating from the focus group should ultimately lead to consensus, (Diccionario de la Real Academia Española, 2001); that is, to common elements that lead to a conclusion.

To form the discussion group, criteria were taken into account regarding the number of participants (maximum five per group), profile of the participants (specialists in the care of pregnant women with obstetric complications), interaction between group members (experience in information exchange sessions and workshops), that responded to an objective created by the researcher (perceptions of the care process for pregnant women with obstetric complications, the barriers that cause delays and proposals to reduce them), that responded to a context (community, municipal, hospital) and predefined spaces (home, health centre, hospital). Based on these criteria and identifying specialists in the care of pregnant women in Yucatan, at the community, municipal and hospital levels, they were invited to the study first by telephone and then by letter indicating the objective of the meetings, as well as the duration of the meetings (Annex 1).

To ensure that participants met the criteria for inclusion in this study, a form was developed asking for personal information about their speciality, years of service, scientific material reviewed and conference attendance (Appendix 2). Likewise, an informed consent form was given to each participant, which mentioned the confidentiality of the interviews and that they would be recorded and transcribed, to be subsequently analysed and interpreted for the construction of the Preventive Model; the form was read and signed voluntarily (Appendix 3).

Once the participants had been selected, two discussion groups were formed: one made up of five participants from the first and second level (community-municipal) and the other of four participants from the third level of care (hospital). In the first group, two public health physicians (community-municipal level, experience of more than 20 years) and three general practitioners (community-municipal level, experience of more than ten years) participated.

Although general practitioners are not considered specialists, they were included in the group of participants because there are not enough specialists in the communities to care for pregnant women and it is the general practitioners who know and have experience in the process of pregnancy care. In the second group, all four were specialists in obstetrics and gynaecology, of whom two were women (hospital level, experience of more than ten years) and two men (hospital level, experience of more than twenty years).

Thus, the members of the discussion groups were professionals who were knowledgeable about the subject of care for pregnant women with obstetric complications; they gave their perceptions of what has happened and is happening in the process of care for pregnant women with maternal complications, that is, health professionals who know the different situations and conditions that pregnant women face on their journey from the community to the hospital when they seek help when they present a complication; and who receive cases of obstetric complications in hospitals for their care and resolution.

Once the focus groups were formed, sessions were scheduled for interviews with each group, so that the preventive model was constructed through dialogue, reflection and experiences as the research progressed, and it emerged little by little through ideas and perceptions about the process of care for pregnant women until consensus was reached. According to the Royal Spanish Academy, consensus is an agreement produced by consent between the majority of the members of a group or between two groups (Diccionario de la Real Academia Española, 2001).

During the sessions with the participants, the objective of the study was made known: to construct a preventive model of delays in the care of pregnant women with obstetric complications; and they were invited to respond verbally and in writing to a guide of pre-designed questions related to the Current Pregnancy Health Programme in Mexico, the current Official Mexican Norm NOM-007 on the care of pregnant women, existing and applied models of care for pregnant women, as well as the main perceived barriers and proposed strategies to improve the care of pregnant women (Annex 4).

The discussion was evaluative in nature, going beyond a simple description of the reality of care for pregnant women, and was based on the actions to be taken in accordance with the Technical Standard on Care for Pregnant Women, on what and how is being done and what is not being done, as well as why what should be done in terms of prevention, prior to pregnancy, during pregnancy, delivery and the postpartum period, is not being done.

With this plan, six focus group sessions were held. In the first session, the thematic questions were asked according to the pre-designed guide, and when a comment was not well understood, it was asked again for clarification. The discussion developed freely and according to the question guide. In order to give back to the participants the information gathered in the first session, they were invited again to participate in a second session, where they were presented with a synthesis of the discourses and the most relevant categories pointed out, as a first approach to the descriptive analysis of the discourse. This same procedure was followed in four more sessions in the focus group dynamics. When the information collected with focus groups was reduced because the responses and comments on a theme were repeated, it was considered that there was saturation of information. Validation of the findings was established by confirmation of the information (feedback), through diagrams that summarised the process to the participants.

During the sessions, two researchers (PhD student and thesis director) were also present, who coordinated the participants' responses, as well as two editors, who took note of the relevant aspects mentioned. In order to facilitate the work of recording the information, without creating interferences, the focus group sessions were carried out in closed, spacious, comfortable places with adequate environmental conditions to maintain the three hours of work that each session lasted on average. In order to protect the confidentiality of the information, as well as the identity of the participants in the focus groups, the recordings of the meetings were kept by the author of this thesis.

With the information provided by the participants up to that point, a first outline of the Model was constructed, with the first approximations to the reality of the processes of care for pregnant women with maternal complications and which would be the main characteristics to be addressed according to the level of the pregnant woman's context, which are influencing her health and leading to delays in her care.

3.3.2. Individual interviews

The individual interviews were conducted with four key informants from the assessment area of the hospital, a nurse and a doctor from the assessment area, two orderlies and a midwife. The information provided by each of the interviewees served to complement the information from the focus groups, because these people are part of the staff who care for pregnant women with obstetric complications in the hospital and in the community.

Also in this study, specialists from other disciplines in health, social sciences and humanities, as well as political science and economics, were interviewed individually. These specialists were not involved in the care of pregnant women with obstetric complications, but they were familiar with the institutional, socio-cultural, political and economic context of pregnant women, as well as their nutritional and psychological conditions; they were also familiar with how communities and municipalities are organised to respond to pregnant women's requests for help and the determinants that are influencing the health of pregnant women in these contexts.

Thus, through their contributions to the construction of the preventive model, it was possible to have a broader view of the reality of the care process for pregnant women, resulting from their theoretical and practical knowledge from the point of view of their discipline.

All of their contributions provided feedback for the construction of the model and made it possible to propose interventions that, from their perspective, contribute to reducing delays in the care of pregnant women with obstetric complications.

Before conducting the complementary individual interviews and those of other disciplines, as in the case of the focus groups, participants were asked for their informed consent, which was signed voluntarily. Seven individual interviews were conducted with key informants in anthropology, nutrition, economics, psychology, demography and population health; and an interview with a traditional midwife from a community in the east of the state was also included. The interview was face-to-face in their work areas in the case of the participants in economics, psychology, nutrition and in the home of the midwife; and three were via internet: two by video call (specialists in gynaecology-obstetrics and social anthropology); and another was with a doctor in health and social behaviour, who asked for the questions to be sent to him by email so that they could be answered in writing. The video calls were recorded and transcribed for later analysis.

The question guide for the individual interviews was similar to that of the focus groups (Annex 4); the approach was through their perceptions of the programme established for the care of pregnant women with obstetric complications, the main barriers that could cause delays in care and proposals for strategies to prevent delays. In this way, an attempt was made to establish a relational aspect between the questions asked to the focus groups and the interviewees from various disciplines. The question guide ensured that the researcher covered the entire topic area of care for pregnant women with obstetric complications in the same order for each interviewee, while consistently preserving the conversational context of each interview.

With the information from the individual interviews from various disciplines, it was possible to construct the second outline of the delay prevention model, which incorporated new but also non-new elements (obtained from the focus groups) on the barriers that cause delays in the process of care for the pregnant woman. In this way, the first proposals for strategies to reduce delays in care emerged from the findings of both the focus groups and the individual interviews.

Care was also taken when listening to the recording to listen carefully, pausing and rewinding to listen again to the arguments related by the participants; and for the transcription of the information, its reading and the elaboration of questions on aspects that were not clear.

3.3.3. Ordering of information

In order to organise the information collected from the focus groups and individual interviews and prepare it for analysis, the answers to the questions in each session and interview were transcribed. Special care was taken not to use signs or markings in the transcription that could confuse the structure of the writing, in order to avoid confusion with the categories and codes that emerged from the analysis for interpretation. Each interview was read line by line, on several occasions, to begin the descriptive analysis, through the assignment of codes and the selection of general categories. Through direct contact with the participants, and their narratives through reflective dialogue, it was possible to reconstruct the scenarios in which the production of social, cultural and personal meanings about the process of care for pregnant women at the community-municipal and hospital levels takes place.

In this way, it was possible to discover and recognise the different ways of seeing reality that characterise the underlying dynamics in the construction of the care process for pregnant women. This is why, with this logic, we had a dynamic and plural view of this human reality, and different possibilities of understanding this reality from the point of view of the participants. The understanding that the problem of pregnancy care is a multidimensional reality brought us closer to the provisional character of knowledge, because it allowed us to construct a first outline of the preventive model.

Pregnancy is a physiological process, but during this process the pregnant woman can become ill, either due to a previous illness or one that begins during the process. Following this order of ideas, this study conceives that the human reality in the health-illness-pregnancy care process develops simultaneously on three levels: physical-material (infrastructure, equipment, human resources), social (opportunities and difficulties of access to care for pregnant women in rural and urban areas) and personal-living (experiences in the care of pregnant women in health centres and hospitals).

Although the pregnant woman is not ill, since pregnancy is a physiological process, this does not prevent her from having a previous illness or developing a disease during the process.

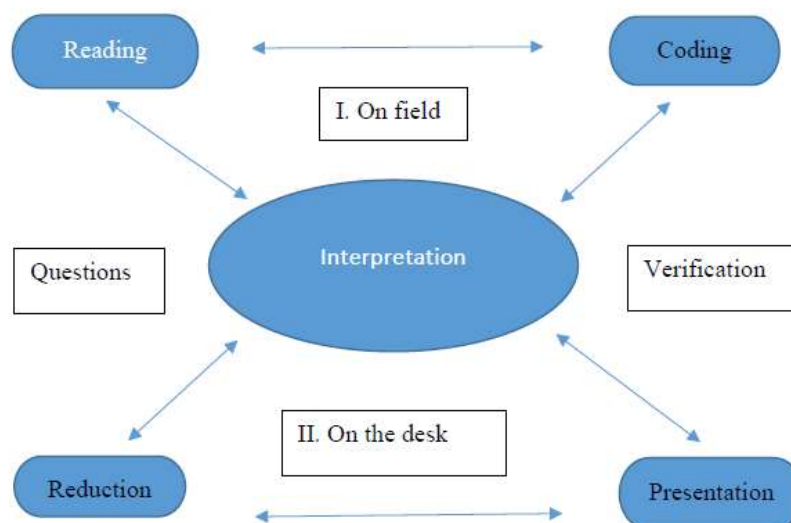
This is why the information that was analysed from the narratives made it possible to construct a space of knowledge, not only of the physical-material world, but also of the significance of the social plane and of the ethical, political and cultural approach of the personal-living plane of the participants on the barriers that cause delays in the care process of pregnant women with obstetric complications; it is on these planes where the subjective and intersubjective were constructed as objects and vehicles of knowledge of the human in the care process of pregnant women with obstetric complications. All of this acquired meaning in the "sciences of discussion" (Hoyos and Vargas, 1997), and through the analysis of the themes, codes and categories, it was possible to give meaning to what occurs in the different contextual levels of care: community, municipal and institutional hospital.

3.3.4. Analysis and interpretation

The methodology used to interpret the information provided by the participants was narrative or discourse analysis. Two conditions were taken into account to construct knowledge: a) the recovery of the social and institutional reality of the health-care process of pregnant women with obstetric complications, through the discourse of the participants, and b) the intersubjectivities to access the consensus of the reality of the health-disease-care process of pregnant women with obstetric complications.

The basic steps in the analysis of the qualitative data followed an inductive method (Ulin, Robinson and Tolley, 2006), following a sequence of interrelated steps: reading, coding, presentation, reduction and interpretation (Figure 1).

Figure 1 Qualitative data analysis process



3.3.4.1. Reading

The process began with the reading and re-reading of the texts and the review of notes, trying to have an immersion in the data that would lead to a first interpretation of the data. Through the reading, the perceived barriers that cause delays in attention and some strategies that could prevent delays emerged. The process of reading and re-reading opened the door to identifying important themes related to the research question.

3.3.4.2. Coding

From the readings and "being steeped" in the information provided from the participants, both from focus groups and individual interviews resulted in the identification of themes to which codes were assigned to the text fragments that represented those themes. Each theme was classified into a thematic area. Subsequently, each of the thematic areas was explored, sorting the codes into general categories, and then reducing the information to essential points (Table 3).

Table 3 Sample question and assignment of codes to responses

Question: What are the hospital barriers to timely care for pregnant women (decisions, time, human resources, material resources, equipment, blood bank, infrastructure, etc.)?	
Answers	Codes
Participant 1: (...). In the labour areas we don't have catheters, (...), sometimes not even cautery. The problem is personnel resources, it is basic, the attitude towards care, the loss of confidence, the structures in the north of the country and the horrendous culture of demand and the union. Nowadays, everyone does it in a defensive way, that lack of decision, there is no defence from an institution, if you have a problem you see how you manage, we all prefer to take our hands off, now it is because they are. we all prefer to keep our hands to ourselves, now it's because they are targeting you.	<ul style="list-style-type: none"> - Equipment - Lack of staff - Attitude - Trust - Demand culture - Union - Decision and advocacy - Advocacy - Problem - Attitude
Participante 2: El área de evaluación es la barrera, no hay un diseño que agilice la evaluación, la comunicación, no todo el personal está preparado para resolver una emergencia. Hay que formar al personal de enfermería, porque no están formados, no podrían hacerlo. Creo que hay que insistir en eso y en el tema administrativo tema administrativo, ese ha sido el problema.	<ul style="list-style-type: none"> - Physical area - Physical area - Communication - Training - Training - Training - Training - Administration - Issues

Source: Own Elaboration

3.3.4.3. Verification

After reading and coding and before moving on to the presentation of the data, data verification was carried out, i.e. a means of data verification was created by recording the recordings of each of the interview participants, both from the focus group sessions and individual interviews, as well as the transcripts of the interviews on computer in Word files. This allowed the participating specialists to review the decisions of the analysis and to conclude for themselves whether the interpretations were supported by the data.

3.3.4.4. Presentation

Once all the information on a topic had been extracted and combined into a coding group, the topic could be examined more closely. The presentation sought to capture the variation or richness of each theme, noting differences or similarities between participants in the focus groups and individual interviews. The main sub-themes that emerged from the data provided by the participants were identified and as the analysis progressed sub-themes were identified that reflected more subtle distinctions between the barriers that cause delay in the process of caring for the pregnant woman with obstetric complication and the strategies that would need to be put in place to prevent the barriers that cause delay. Once the main sub-themes of a code were identified, the narratives were returned to again, paying attention to the specific vocabulary used by the participants during the discussion. The text was examined to identify the different contexts in which pregnancy care takes place: community, municipal, hospital.

3.3.4.5. Reduction

Once the transcripts had been read, the important themes identified, the coding system for selecting these themes established, and the variation in each thematic file and the participants' perspectives explored, the data were reduced to distinguish between central and secondary themes, i.e. to separate the essential from the non-essential. Schemes and diagrams were constructed in which the most important themes were reduced.

At this stage, related text fragments were brought together in one place and the comments of the coding categories were abbreviated, in order to reduce a complicated data set to a more manageable but comprehensible size. In this way, boundaries of important themes could be established.

3.3.4.6. Interpretation

In this section we focused on getting to the essential meaning of the qualitative data and ensuring that the interpretation was reliable. The purpose of the interpretation was to identify how the many different parts of the emerging themes and sub-themes, connections and contradictions that emanated from the focus group participants and individual interviews were spliced together to arrive at the meaning of the whole. With the meaning obtained from the analysis, we tried to reflect the intention of the participants' responses, to make sense also to a wider population and to provide answers to socially and theoretically significant questions about the process of care for the pregnant woman with obstetric complication, the barriers that cause delays in care and the strategies proposed to reduce these barriers.

In each described step of the qualitative analysis and interpretation of the data, an attempt was made to find the basic meaning of the thoughts, feelings and behaviours described in the texts, i.e. an initial interpretation of the data was made and finally, an overall interpretation of the results of the study was made, showing how the thematic areas are related to each other, explaining how the network of concepts answered the original question of the study, i.e. whether it is possible to build a preventive model of delays with the expertise of specialists, in this case health professionals and various disciplines.

In the last stage of the research, we moved on to the progressive systematisation of the process and results of the research work. An initial preliminary closure was made with the findings of the narratives of the first focus group sessions. From this preliminary closure, intermediate closures of analysis were carried out, using a logic analogous to that used in the preliminary closure. Once the entire research experience had been collected in a complete and orderly manner, the last stage of the process, the final closure, began, that is, the global interpretation of the results for the construction of the preventive model of delays.

The preventive model was constructed taking as a frame of reference the norms established in Mexico for maternal health care (Diccionario de la Real Academia Española, 2001). This model included particularities of the State of Yucatan and proposals for action to intervene in the care process of pregnant women with obstetric complications. The barriers that the participants perceived as causes of delays in care emerged, resulting in proposals for intervention to reduce them.

In addition, to complement the information provided by the hospital specialists, interviews were conducted with staff in the assessment area who receive pregnant women when they arrive at the emergency department. In total there were four administrative assistants from different shifts in the emergency department; and a nursing graduate, the doctor and two orderlies in the assessment area (Table 2). The questions focused on the description of the procedures carried out in this area, the limitations and barriers perceived during their work and the proposals they would make to improve care. The time spent on obstetric complication care was also explored.

The procedure followed to identify the main barriers and proposals for intervention was as follows:

1. List of barriers and proposals
2. Selection of first categories of barriers and proposals.
3. Grouping of categories of barriers and proposals by first, second and third delays.
4. Condensation of sub-themes of barriers and proposals for each delay.
5. Networking of themes and sub-themes of barriers and proposals for each delay.

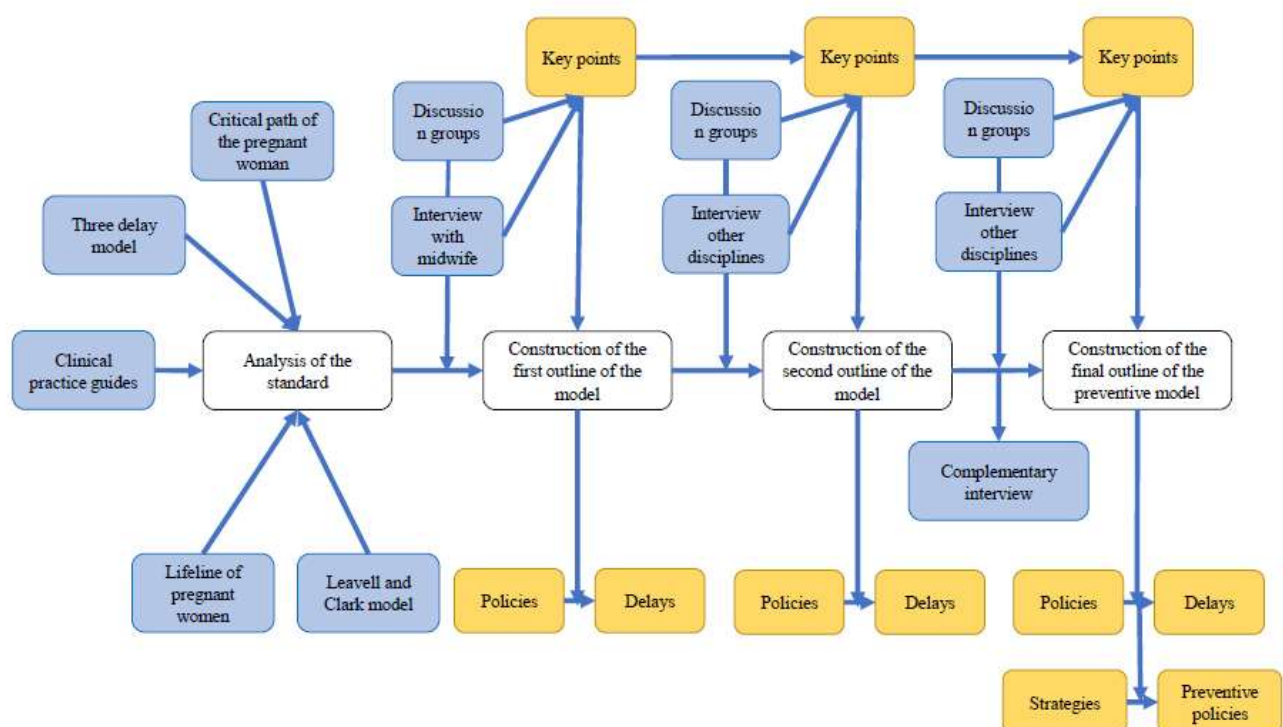
In this way, after selecting the essential elements, the preventive model of delays in the care of pregnant women with obstetric complications was constructed, which interweaves the interrelationships between the clinical, socio-demographic, gynaecological-obstetric and gender determinants that cause delays in the care of pregnant women with obstetric complications; and where interventions identified as relevant to reduce delays are indicated.

The entire process developed for the construction of the Model outline, from the analysis of the Technical Standard 100 to the construction of the Model itself, is summarised in Figure 2.

The process began with the analysis of elements established in the NOM-007 on care for pregnant women, on the critical route from the onset of the complication, its transfer to another clinic or hospital, the delays in care during this route, the clinical practice guidelines used in hospitals on the procedures of health personnel in the event of an obstetric complication, the care times for pregnant women during prenatal care and the health-illness-care process for obstetric complications based on the Leavell and Clark scheme (Leavell and Clark, 1965).

At this stage, the groups of community, municipal and hospital specialists participated, as well as a community midwife, from whom the first key points (general themes) could be extracted for the construction of the first outline of the model and the proposal of the first policies on delays. As the process progressed with the groups of specialists at the community, municipal and hospital levels, and with the integration of specialists from other disciplines at this stage, new elements of analysis were incorporated, which gave rise to new key points (barriers that cause delays and strategies to prevent them) that served to construct a second outline of the model, with proposals for preventive policies for delays. In the final stage, with the participation of the previous groups, complementary interviews were also conducted with first contact hospital staff in emergency care, such as staff in the maternity assessment area, from which new key points emerged that provided feedback on the information obtained up to that point and gave rise to the final outline of the model with proposals for preventive strategies and policies for delay care.

Figure 2 Development process of building the Preventive Model



Source: Adapted from Huberman and Miles, 1994, p. 429

To begin the construction of the model scheme, a review was made of the technical guidelines established for the care of pregnant women in Yucatan and derived from the Technical Standard NOM-007.100. Based on the Leavell and Clark model scheme to describe the natural history of disease (HNE) in our species (Leavell and Clark, 1965), elements of the Mexican Official Standard (NOM) were identified for the care of pregnant women that should be carried out before pregnancy, where primary prevention, health promotion and specific protection activities are mentioned. By definition, the NOM is a technical document whose content establishes guidelines for care and the content of services. In this sense, it is not responsible for taking into account cultural, social, etc. elements, except, where appropriate, as a context for the standard or its changes.

For this reason, the Three Delays Model was incorporated into the framework of analysis, as well as the critical routes followed by pregnant women with obstetric complications, clinical practice guidelines and the pregnant woman's life line, which made it possible to identify not only unaddressed elements of the Standard, but also those that by definition the Standard does not include, even though they are part of the socio-cultural context of the pregnant woman.

In the evaluation of what NOM-007 says, with what is currently done in the Pregnancy Care Programme, the participants of the community-municipal group mentioned that there are neglected areas that correspond to the pre-pathogenic period, that is, before the onset of the obstetric complication and even before pregnancy, such as health promotion activities. It should be clarified with regard to the use of the Leavell and Clark model that the disease to which it refers is not pregnancy, but a complication arising during and associated with pregnancy (Table 4).

Table 4 Health promotion and specific protection activities contained in NOM-007 that are neglected in the pre-pathogenic period of care for pregnant women.

Before the complication	
Pre-pathogenic period	
Health promotion	Specific protection
Healthy lifestyles	Family planning
Exercise	Weight management
Counselling	Pregnancy diet
Risk prevention	Sexual health
Violence prevention	Warning signs
	Vaccination
Primary prevention	

Source: Own Elaboration

3.4. Identification of key points in the medical field

In this section, we mention the general categories that emerged from the discourses of the specialists in the medical area, both at the community-municipal and hospital levels; in the general categories we found individual characteristics of each context that influence women's health and cause delays in care. With this information, it was possible to construct the preliminary outline of the Preventive Model of Delays in Obstetric Complication Care.

3.4.1. Community-municipal group

Participants at the community-municipal level mentioned that NOM-007 describes the programmes and actions to be carried out even before pregnancy, but there are not enough personnel assigned to carry out the activities in each medical unit and Health Centre in the municipalities of Yucatan. Likewise, the maternal care programmes do not provide information to other family members and to all those involved in the health-illness-care process of the pregnant woman, about the risks of pregnancy and its complications; instead, it is only the woman who is responsible for knowing and asking for help. They mentioned that this is an area of opportunity for action that would allow balancing the burdens that have been imposed on pregnant women mainly in rural areas.

Therefore, they mentioned that primary prevention should be reinforced so that critical states of complication that put the life of the pregnant woman and her product at risk can be prevented at this level. Some of the actions mentioned by the participants were the greater commitment that municipal authorities should have in the prevention of maternal risks, including violence, negative environmental factors and addictions (Table 5).

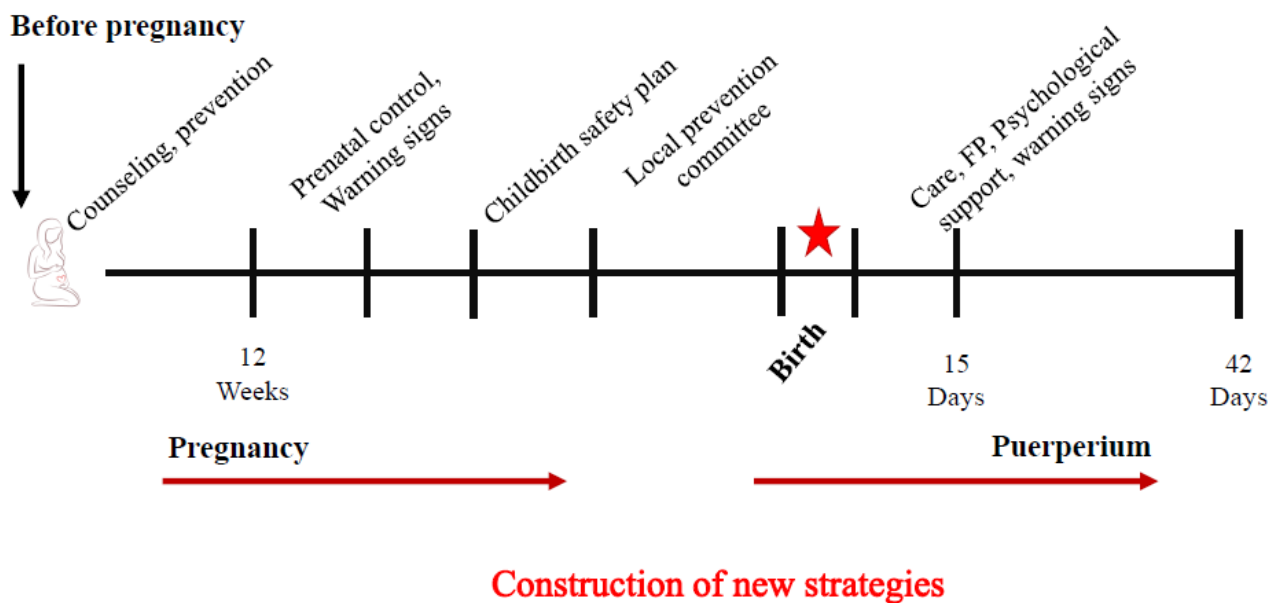
Table 5 Health promotion and specific protection at the first level of prevention for pregnant women according to NOM-007

Health promotion	Specific protection
<ul style="list-style-type: none"> – Participation of municipal authorities in the construction of preventive strategies for maternal and perinatal risks, including violence and negative environmental factors. – Care during pregnancy and monitoring of the physiological postpartum period and warning signs, healthy lifestyles, control of obstetric risk factors, addictive substances. – Pre-pregnancy counselling on family planning for the couple and consequent consultation. – Safety plan for childbirth care. – Integration of a committee for the prevention, study and follow-up of morbidity and mortality. 	<ul style="list-style-type: none"> – Folic acid and iron, three months before pregnancy. – Anthropometric measurements, vital signs. – Comprehensive dental assessment. – Psychological support. – Medical history, laboratory tests and ultrasonography. – Pregnancy support network and birth savings plan. – Vaccination with tetanus toxoid, anti-rubella.

Source: Own Elaboration

Also, on the lifeline of the pregnant woman according to NOM-007, the participants mentioned that there is no information on the warning signs of pregnancy complications, as well as the lack of a birth safety plan, including the pregnant woman's knowledge of the community support network for delivery care and how to save for funds to pay for the expenses that are generated when an emergency arises. Figure 3 summarises the topics that should be discussed during antenatal and postpartum consultations. They also mentioned that there is no known ongoing training plan in Yucatan for health personnel focused on improving the quality of obstetric emergency care.

Figure 3 Pregnancy lifeline and proposals for actions to strengthen care for pregnant women



Source: Own Elaboration

They also mentioned that it is necessary to consider the reevaluation of humanism in medical care, which would restore the user's confidence in requesting the service and facilitate communication between the community and specialists, in order to allow the link between the pregnant woman-family and the health personnel (interculturality). This would also be applicable in urban areas, especially in conurbations where low-income women from the interior of the state have difficulty accessing care.

They also commented that studies are needed to analyse the situation of obstetric violence, because their authorities told them that they should allow a family member to accompany the pregnant woman while she is hospitalised, but they perceive that this creates an atmosphere of tension with the health personnel who attend her.

Other comments were that women, especially those in rural areas, need to be empowered to make decisions when the situation requires it in order to avoid delays in care that could lead to fatalities. Pregnant women should be closely monitored by specific personnel dedicated to ensuring that they attend prenatal care and that they share cultural and technical knowledge for a better understanding (Table 6).

Table 6 Intervention proposals for inclusion in the Model

Pre-patogenic period	
Health promotion	Specific protection
<ul style="list-style-type: none"> – Awareness of warning signs – Interculturality – Decision-making for self-care – Studies on violence in pregnancy – Responsibility of the local support network 	<ul style="list-style-type: none"> – Specific personnel for the follow-up and monitoring of pregnant women
Primary prevention	

Source: Own Elaboration

In this way, the first reconstructions of the scenarios of care for pregnant women were obtained, which originated from the analysis of NOM-007 and which provided a frame of reference for making progress in the construction of the Preventive Model.

For the construction of the preliminary outline of the Preventive Model, the focus group sessions and individual interviews continued.

3.4.1.2. Community procedures in the care of pregnant women

Through reflective dialogue, for 90 minutes, participants discussed what maternal care is like in rural areas, what barriers cause delays, and made proposals for removing these barriers to reduce delays in receiving care. The participants commented that in rural areas there is a community model of care for pregnant women that is operated by the health assistants and the midwife. In addition, the recognition of warning signs is promoted and when the case cannot be resolved, there is a link with other sectors of the community so that the pregnant woman can be transferred to the health centre:

"The community care model we have. The objective is to guarantee promotion and motivate for prevention; it is not a medical model but a community model, it is operated by the health assistants and the midwife. The linkage implies that there are promoters and committees in communities where there are no health services, where only the (health) caravan arrives.

Regarding the barriers when there is a complicated pregnancy, they mentioned that there is a lack of human resources and infrastructure in the Health Centres to deal with obstetric emergencies:

"In terms of haemorrhage, pre-eclampsia, all Health Centres should know how to handle these and have basic indispensable equipment; the proposal for red trolleys is already starting, the methodology in handling, the midwife has her equipment and in the Health Centre there is none, also (they need) a gynaecological table, vaginal mirrors, Hartman, gloves, swabs".

They also mentioned that they have a community model that has been organised but should be supervised by a multidisciplinary team:

"The supervision team made up of the doctor, promoter, nurse and driver, are in charge of seeing that the NOM-007 guidelines are met, they monitor promotion and dissemination and how they are organising themselves with the midwife and the community."

"The weakness that exists is that the community model has emerged, but it should be comprehensive, but there is no multidisciplinary supervision team. We have statistics on the number of talks given to the population. There is an inconsistency in meeting a number of talks. There should be access to literature and medical information in the Health Centres on obstetric emergencies, but first there should be supervised training and monitoring of the care model; what medicines there should be, we are trying to get it organised so that the first level can respond to emergencies.

The midwife's comments were related to the care of the pregnant woman when labour pains begin and the attitudes and practices they carry out when they request her services. She commented that there are women who insist that she attend them at home because they do not want to go to the doctor, and although she explains to them that they should go to the doctor, they are reluctant to do so:

"That's if she wants to go to the hospital, I can't tell her to go if she doesn't want to, I tell her to go to the doctor, that I don't have medicine, but she doesn't want to leave her home; because the doctor has medicine, he has to put saline for the pain, he has the ampoule to put in the saline, so that the pain is strong."

Regarding the attitudes that some young women in labour have, she says that they do not want to feel pain, and that they ask to be taken to the doctor soon so that they can be operated on, and she thinks that this is the reason why there are so many caesarean sections:

"Young women don't want to do their part (they don't want to walk or endure the pain of childbirth) because they want to be cut; some do their part and others don't; better to take me to the doctor they say, better to cut me. That's why these women get cut a lot.

The midwife also talks about why women do not seek help soon when labour pains begin, and mentions that they are ashamed to tell their husbands or relatives, so when they arrive with her, several hours have passed and the pains are already severe:

"When the pains start they don't tell, they are ashamed, until they can't stand it they tell their husband or mother-in-law".

On the procedures she carries out during labour, she describes the instructions she gives to the woman, which are the same as those doctors tell women when they go to the clinic:

"When the pain starts I tell them to walk, if the pain passes they walk and when they are in pain they lie down in their hammock. The doctor says 'walk, you have to walk a lot'; even if there are 10 doctors on your bed, that's what they will say.

The midwife mentions that doctors verbally assault women when they go to the clinic to give birth, because they don't cooperate during labour and want them to be operated on so that they don't have pain:

"They get upset the doctors in the hospital, they scold a lot because the woman screams during labour and doesn't do what the doctor says. So when you feel the pain is strong you have to push, you have to do your part, if you don't do your part, how is the baby going to be born, it dies in its belly".

"Doctors when women are screaming tell them "ah now you are screaming and you don't want to open your legs, but when you did you opened them, now you have to open them too".

3.5. Identification of general categories

With the information collected up to this point, a synthesis was made of the main emerging elements of the discourse, which we call general categories. Through diagrams and figures in a slide presentation, the information was returned to the participants, asking them to analyse whether they agreed that these had been their answers.

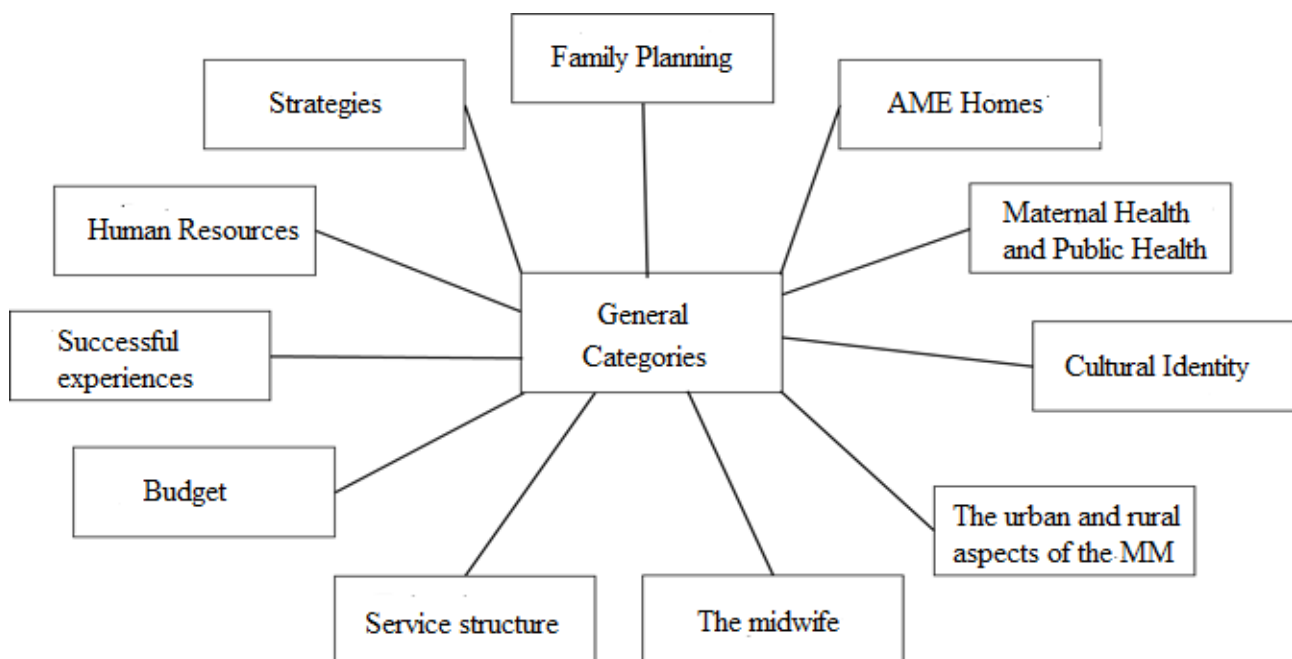
From the general categories, barriers of service organisation, service delivery elements and women's status in society that could cause delay in complication care were identified. In addition, other delays that may be occurring and intervention strategies to prevent them were identified.

In this way, the following general categories were identified that were related to programmes and actions in the care of pregnant women: family planning (FP), AME houses (care of pregnant women), maternal health and public health, cultural identity, maternal mortality in urban and rural areas, the midwife, structure of care, budget, successful experiences, human resources and strategies.

Figure 4 summarises the general categories that emerged for the construction of the preliminary outline of the Preventive Model.

Embedded in these general categories are the individual characteristics of the community and municipal levels in Figure 5; some individual characteristics are repeated in several general categories. The general category budget was also considered as an individual characteristic (Table 7).

Figure 4 General categories for the construction of the preliminary outline of the Preventive Model



Source: Own Elaboration

Table 7 Individual characteristics embedded in the general categories for building the preliminary outline of the Preventive Model

General Category	Individual Characteristic
family planning	Knowledge
AME Houses	Infrastructure and resources
Maternal health and public health	Training Customs and Practices Decision-making
Cultural identity	Customs and habits
Urban and rural of the GM	Socio-economic level Budget
The midwife	Training Usages and Customs
Structure of Attention	Infrastructure and resources
Budget	Budget Socio-economic level
Experiences successful	Infrastructure and resources Usages and Customs
Human resources	Training Attitude Infrastructure and resources
Strategies	Attitude Decision-making Usages and Customs

Source: Own Elaboration

3.5.1 Family Planning

The experts commented that there should be more dissemination about family planning to both partners, not only to the woman, because the promotion is done in the hospital to the pregnant woman and she accepts a contraceptive method, but she does not go for postpartum check-ups; she comes back pregnant again:

"What happens is that after they give birth the method is promoted to them and they accept it, but when they leave the hospital they no longer go for a method. That's where the couple comes in, the couple also needs to be counselled. There is no awareness that they should not get pregnant, women's self-care has not been achieved.

It was also mentioned that there is a "perverse interpretation" of the support scholarships for pregnant women, because although they are economic support scholarships granted by the Government of the State of Yucatan to single mothers with basic education in order to reduce the school backlog and seek to improve the family economy, the couple is not encouraged to plan:

"Support is given to those who get pregnant, but no federal programme gives support to those who plan, FP is important. They give scholarships to have more children and scholarships to pregnant adolescents. This does not favour prevention, the support is misinterpreted. It does not help prevention.

3.5.2. AME Houses

In Jurisdiction 2, there is an AME (posada de ayuda a la mujer embarazada), but it lacks funding, as do other places where pregnant women are cared for. They mentioned that the AME has resisted changes and its existence is now a necessity, both for the authorities and for the people; it needs sufficient resources for its optimal functioning:

"The shelters for pregnant women, the schools for midwives, the AME inns must have funding. We have had a successful experience in Valladolid, with vertical childbirth care, with municipal funding. The Valladolid Health Centre was like a concentration camp, with people coming from 22 municipalities, which is why there is a vertical childbirth facility.

3.5.3. Maternal Health and Public Health

Comments were aimed at emphasising the lack of public health and the way in which resources for maternal health care are organised in Yucatan:

"The problem of maternal health is not addressed as a public health problem, it is addressed from the point of care. In the adolescent programme there is no allocation of families per doctor (there should be 1000 inhabitants per doctor), we don't have enough doctors to attend to the demand, the costs, the resources, it has to do with public policies. Pregnancy and childbirth need to be de-medicalised. It is thought of as a disease, which is why it ends in a caesarean section. There is a large offer from private medicine that pregnancy is an illness.

"There is a lack of public policy, we have to spread the word that it is a natural state, we have to make public policy at the urban level. We should not copy or stick to a western model at the community level, but create a real community system where we could exist; like now with the midwives "it is or it is not", an intercultural model that is truly integrated, a third way, public policies for promotion and dissemination.

"In medical school they teach us to study for the specialty exam, students don't do public health, they "tie the bull", person to person dissemination; about artefacts that impact people. Actions should be promoted at four levels of authority: Federal, Governmental, Municipal and at the level of Municipal Commissioner, the latter is the one that should be promoted, this community element has been underestimated and is the one that should provide resources. There must be social participation in health, but this is manipulated and folkloric, we must think down to the people".

3.5.4. Cultural Identity

Aspects related to the local habits and customs that the model must keep in order to be accepted by the population were commented on, as well as the lack of promotion of health rights in first contact prevention (the first time a woman goes for a consultation); according to the WHO, Primary Health Care (PHC) is the essential health care accessible to all individuals and families in the community through means acceptable to them, with their full participation and at an affordable cost, for the community and the country. It is the core of the country's health system and is an integral part of the overall socio-economic development of the community. They also commented on some changes that are taking place at the higher level in the eastern part of the state involving the health personnel being trained:

"The basic package of health promotion and disease prevention services is far removed from my culture. In order to achieve community participation, language must be important, there must be health workers who speak Mayan, the medical interns they prepare at the Faculty do not know how to speak Mayan, they are not taught, they are taught English. The Mayan language should be introduced, they will be educating us. The norm helps to regulate, but there is a culture that needs to be seen.

"Few people are aware of the PHC approach, which is based on prevention. Human rights are violated because PHC is not attended to.

"At the Universidad de Oriente there is a daily course in the Mayan language from seven to eight in the morning. There is a book in Mayan in letter size, which is being brought to the clinics. There is a nursing school in Valladolid that teaches the Mayan language. Public policy is that they speak the Mayan language. Nurses must speak Mayan in order to be hired. Relevant policy is that there should be a medical school in Valladolid. A few years ago the TABS (social workers) were trained in the Conalep, when the first generation came out nobody wanted them. Some went to the IMSS, they are valuable agents of change. That training was closed down.

3.5.5. Maternal mortality in urban and rural áreas

There is a clear difference in inequalities in maternal health care according to place of residence:

"Maternal mortality is not the same in urban and rural areas. Rural areas have more adverse conditions, the cultural part has to be seen. In rural areas, the one we delegate is the intern, who rotates for a year, but they only think about doing their residency, they don't get involved in the population, they are interns who abandon the localities, they only work for eight hours, they are not integrated into the community, that's why they see them as strangers, there is no credibility, there is no trust with the people. That's why they don't get the message that they shouldn't get pregnant.

3.5.6. The Midwife

The rescue of midwives for the care of uncomplicated local deliveries was a topic of interest raised, because they give advice to pregnant women on how to take care of themselves, attend them at the time of delivery, take care of the baby the days after delivery, but the information about their activities is not recorded:

"Midwives should be community social agents, to create the link of interculturality. At the national level, it is traditional alternative medicine".

"There are no statistics to know if midwives have had pregnant women die. The midwives manipulate (do abdominal palpations, rub the women, accommodate the baby, do vaginal tact) in pregnancy; that is why the structure that is going to function in the area must be well supervised and record information on the activities that both the health personnel and the midwives carry out".

"There are still home births, but this is not a suitable environment. We have managed to reduce puerperal infection and pre-eclampsia-eclampsia, but not haemorrhage, and there must be an adequate structure for the latter. There is a need to review the structures for resolution at different levels: health centres, clinics and hospitals, and to locate blood banks.

3.5.7. Maternal health care structure and personnel

In terms of the number of hospitals and health personnel available to the Ministry of Health for the care of pregnant women with maternal complications, there are second-level hospitals in the eastern part of the state and in the south, but with different numbers of personnel:

"In the east of the state, the hospitals in Valladolid and Tizimín; and in the south the community hospitals in Peto and Ticul. All four are second level, but the one in Valladolid is one of the largest.

3.5.8. Budget for the maternal health programme

The maternal health programme does not have sufficient budget at the level of the health jurisdictions and there is an over-demand for care in the hospitals in the city of Merida:

"Jurisdictionally there is no budget for maternal health. Merida has 60% of the state's population, the Mother and Child Centre cannot cope, there is another hospital on the way, a mother and child hospital with more beds to be built in Merida. Also, there is no longer the geographical responsibility by municipalities assigned to public health institutions, as there used to be".

3.5.9. Successful experiences

Successful experiences were mentioned, such as that of Grupo Carso in Chemax, which provided resources for the "kit mi bebé" and "Amanecer" programmes:

"There was a successful experience that is going to be adopted throughout the state in rural areas, with foetal monitoring and a vertical delivery table".

"Another successful experience is the Casas AME, which has withstood changes; it is already a necessity, both for the authorities and the people. There is a need for co-responsibility on all sides. A sense of responsibility in prenatal care.

The importance of non-governmental organisations (NGOs) also being involved in the pregnant women's health programme was also discussed:

"There has to be budget from the third sector which are the NGOs and the Equity and Gender Commission should be involved".

3.5.10. Training of human resources

There were comments related to the lack of training of human resources to respond to public health problems, as in the case of maternal health:

"They don't train people in public health in the Faculty of Medicine (of the UADY). The training is for doctors to provide care and nothing else. The focus should be on educational public health, not just on presenting for their speciality. Many doctors become administrators, but without knowing how to run a hospital, there is no human resources training in hospital administration. Our Alma Mater should think more about that. Public policy approach to pregnancy".

3.5.11. Recent strategies

Due to the fact that in recent years Yucatan has had a spike in maternal mortality cases, some strategies have been implemented to increase communication among the hospital network:

"There was a spike in maternal mortality. All hospitals are linked, managers are linked by mobile phone. When a maternal complication occurs in a locality, the health centre notifies the hospital where the pregnant woman will be sent by mobile phone so that everything can be prepared for her timely care on arrival.

3.5.12 Proposed intervention strategies

"Pregnant women who are dying now are dying because they have additional illnesses, such as diabetes, high blood pressure, obesity, heart disease; post obstetric event family planning should be more widely disseminated. We propose that there should be an educational proposal that includes preconception information".

"Preconception care is a felt need. Pregnant women need to be empowered, health education through the media, even a newspaper can be used to raise awareness.

"Training is needed for midwives, pregnant women and their families, it should be systematised.

"Standards are the ideal. But there are neglected groups such as pregnant women living in remote areas. There is a Model of Extension of Coverage Strategy that goes to more than 305 localities, but there are 2700 localities and there are no trained health resources, we have to train people from the community itself".

"Public Health is: Massive reproductive health campaign, life line (guaranteed package of care and prevention services). The issue is not in medical care, but in prevention and promotion, through relevant public policies. We need to reflect with people on what we have been taught about pregnancy, childbirth and the postpartum period. The proposal is to design a project for prevention, promotion and lifestyles.

"The proposed structure should incorporate three main components: 1) co-responsibility of the user-public servant, 2) structure of resolution by levels and 3) community care model".

3.6. Hospital obstetrics and gynaecology group

This group was made up of four doctors specialising in obstetrics and gynaecology, from hospitals in the public health sector in the city of Mérida, where women with obstetric complications arrive. Each specialist answered the questions in the guide one by one:

What are the processes of care for pregnant women, do the processes obey any model, what are the barriers that cause delays in care, what do you propose to improve the procedures, what strategies do you propose to reduce the barriers that cause delay?

3.6.1. Standards and procedures for obstetric complication care and model of care

In the main hospitals of the Health Sector in Mérida, pregnant women with complications are received not only from the city of Mérida, but also from different communities in the state and neighbouring states, which leads to overcrowding of the assessment service. The procedure carried out by each hospital differs when deciding what to do with the patient. Hospitals follow guidelines and norms for the management of complicated patients, but there is no universal model; procedures are adapted to the conditions that exist in each hospital at the time:

"We have the ERI (immediate response team) model, it has a relationship with the three levels of care, in real time they are monitoring what is happening in the hospital. The authorities are involved, and if something is missing, which in theory nothing should be missing, everything is triggered for the patient's care".

"Ideally, there should be a universal procedure that can be applied. The current procedures are due to a lack of resources. There must be a procedure for each entity, the procedures must be adapted, the ideal one must be adapted, my infrastructure must be as close to ideal as possible, medicine is too complex to be managed by the administration".

"What the models say: there must be a nurse for every serious patient, that is what the model of care says; that is not the case, that is why what we do is adapt the model to what we have. The human, material and economic resources are not sufficient for the volume of patients we have, for any ideal model that we would like to apply, they are not sufficient".

The general category Standards and procedures was also considered as an individual characteristic of the hospital context in Figure 6.

3.7. Barriers causing delay

3.7.1. Community barriers

The responses that emerged to the question What would be the main barriers to care for pregnant women, the comments were as follows:

- Barriers causing delay in care of pregnant women

From the discourse of the jurisdictional doctors, comments emerged on the main barriers of organisation of services, of enabling elements that affect the quality of services (lack of medical staff and equipment); and barriers related to the status of women in society.

3.7.2. Organisational barriers to services

Comments on these barriers were aimed at pointing out the lack of ambulance in the communities when the woman needs to be transferred to another hospital for emergency care; they also commented that the procedures and services that are carried out for the care of pregnant women need to be reorganised to meet local needs with a model that respects the uses and customs of the community and dissemination in the Mayan language, as well as training for midwives on childbirth care:

"In the communities there are no ambulances to transport pregnant women and there is a lack of dissemination and promotion of intercultural health. There is a model of care that is removed from the culture. There is no promotion and prevention in the Mayan language. The midwives manipulate the woman in labour, because they perform vaginal touches and oedematisation".

a) Barriers of habilitation elements that affect the quality of the service

Regarding the barriers that affect the quality of the service, they mentioned that situations such as the lack of health personnel available at the moment the pregnant woman requests delivery care are intertwined, so she receives care outside her community; There is also a lack of material and equipment to attend births at the health centre, which delays delivery times; staff training is needed on how to deal with obstetric emergencies, on contraception after childbirth and indirect obstetric complications; and there is a lack of budget and structure for the maternal health programme, which also supports work that links education with research:

"The trainee does not stay to attend the emergency, so the woman has to be referred to another clinic, there is no way to attend the delivery in the health centre, that does cause delay. There is no training on obstetric emergencies at the health centre and no equipment to attend to obstetric emergencies.

"There is a lack of post-obstetric family planning counselling and institutional human resources trained in the prevention and management of pregnancies with chronic degenerative diseases, such as diabetes, obesity, hypertension and heart disease.

"There is no education-research linkage and there is no budget or sufficient structure for maternal health care".

b) Barriers related to women's status in society

Barriers related to the status of women in society, which are gender barriers, show the devaluation to which women are subjected, especially rural women, who are seen as providers of children without decision-making power and with few economic resources to pay for the expenses generated by pregnancy and childbirth, especially complicated childbirth:

"There are neglected groups such as pregnant women, who lack empowerment, because they cannot use a contraceptive method. There is no risk awareness among women, there is no culture of self-care for women. When she gives birth in the hospital, the contraceptive method is promoted and she accepts it, but she leaves the hospital and does not take care of herself with a method, there is influence from her husband.

"Most of the women in the communities do not have a source of income, the money is provided by their husbands, so when they have an emergency they do not have the resources to deal with it.

3.7.3. Hospital barriers

On the barriers to care at the hospital level, the comments were directed towards the lack of human resources, materials, equipment and infrastructure, lack of a positive attitude towards care and the demands made on doctors. From the hospital barriers as general categories, individual characteristics corresponding to the hospital context emerged as shown in Figure 6: Training, Attitude, Infrastructure and resources, Culture of demand, and Standards and procedures.

– Training

Lack of training on emergency obstetric care at all levels and for all staff was cited as a need:

"Another barrier in addition to infrastructure is the lack of training for all staff, not only doctors, but also nurses, which creates a communication barrier. Not all staff in the service in the same area are trained to deal with obstetric emergencies.

– Human resources

Comments were that the number of doctors and nurses is insufficient to deal with the complication; over the years the demand for the service has increased but the existing staff is not sufficient. Among the participants, the majority felt that there is a lack of staff:

"There is no emergency doctor, the risk or emergency obstetrician/gynecologist needs to be trained. The gynaecological nurses are already dying out, there are few staff, at night there is only an anaesthesiologist, a doctor and a nursing team, and they tell us that they can only do two procedures and we leave them for tomorrow, this staff prevents us, 50% is the will of the staff".

"The chemist should theoretically take two hours to give results, but as there is only one chemist, it takes four hours. For an emergency it is like that. Each one has his or her own emergency. There should be a permanent doctor in the toco-surgery area. At weekends it is worse, because the gynaecologist who has elective surgery sees the floor and also sees the emergencies, so the system is a bit complicated.

"There are 22 beds on the floor, 10 in labour and 7 low risk, and 17 doctors in total to cover the 4 shifts, there should be a nurse for each serious patient, it is a consequence of the lack of resources. The procedures are similar, but the question of resources counts a lot. Each institution manages resources and limits care".

"There are 13 doctors for all shifts: one at night, one during the day, one at daytime, two at weekends, two for alternate night shifts; there is only one anaesthesiologist with a surgical nursing team".

"In the hospital we are doing well with human resources, we are doing well".

– Infrastructure, materials and equipment

Some hospitals have the material, equipment and infrastructure for emergency care, however, most reported that it is not always available during emergencies, due to the lack of organisation of services, saturation of services and lack of knowledge of procedures (protocols for action), because the procedures are adapted to the resources we have:

"There is no longer a stock of medicines on the floor. If a patient starts to convulse, we have a locked red trolley, (...), we see a lot of patient volume. In the hospital we are fine with human resources but in equipment we fail with cautery and lamp".

"We have barriers in the physical area, they took away our area, but if there is an emergency you have to wait, I feel that instead of moving forward we are going backwards".

"Many changes have been made in the physical area (...) with the aim of streamlining services. They haven't found a physical infrastructure model that speeds up the service, that's one of the barriers. In the physical area we have, there is no privacy, the door is open, it does not have surgical functionality".

"There are no stretchers, we have to lend them to another service, I speak to another service and they don't want to give them to us because they are from the operating theatre, they are marked, they are from there, I speak to the deputy director and he tells me: I'm sorry doctor, it's not possible".

– Attitude and culture of demand

Many of the delays in care are due to the inadequate attitude of staff or their unwillingness to provide the required medical care, shift changes, saturation of operating theatres and lack of staff; but they are also due to the current culture of demand that puts doctors under permanent stress due to fear of demand, which has deteriorated the doctor-patient relationship and created a defensive environment on both sides.

They also commented on experiences related to the delay in the doctor's decision to provide timely care to the patient with an obstetric complication, which is due to the attitude that some doctors have towards the case, for which they put their own convenience first:

"What we see a lot is the willingness of the staff at the time of the emergency. It is a subjective question. There are few resources, which influences 50%, but the other 50% that can give the patient survival, or benefits for the patient, depends on the will of the doctor".

"I can have 100 night doctors, but there is no attitude (...). Attitude has been modified by many things that are around. The main enemy that modifies attitude is oneself, the problems that may exist around are multifactorial. Many are the doctors who have had the cause of this loss of identity and confidence in the doctor: we copy our northern neighbours, the culture of demand; and there is also something else that intervenes, the famous trade union. What is practised nowadays is defensive medicine".

"I see a patient who may have an ectopic (pregnancy), (...) but she does not have an updated beta fraction (...). If it is not an ectopic pregnancy, it is not an emergency, but if it is and she does not go to the operating theatre, the patient will die. Medical decisions should not be made for the convenience of the doctor, but with responsible criteria.

"There is no defence in an institution; if you have a problem, the institution will not shelter you. The one who saw and did nothing is going to get a bad rap more than the one who went in and tried to do what was necessary. So there is an attitude towards decision making so that the doctor feels protected again and that it is not the cause of being targeted right now. Because that's the big problem with the vast majority of delays in decision making, and that's also why the volume of patients is so high.

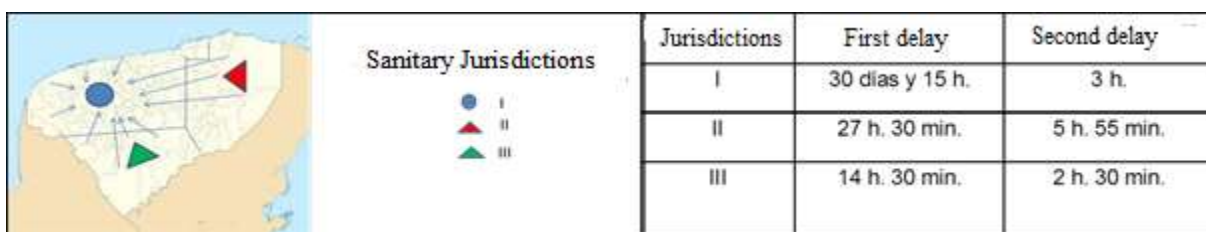
"We have to operate. They pass the order from the operating theatre and say that you have to operate there, hours go by, an hour, two hours, if that product has problems, they tell you why didn't you insist (...)."

3.8. Pregnant women's care times

3.8.1. Care times in the community-municipal area

The times that generally prevail in the health jurisdictions (community-municipal context) for the care of pregnant women with obstetric complications were also obtained. These times depend on the territorial conditions of the municipalities and their police stations, as well as their distance from the second and third level hospitals. The longest time found for the first delay was 30 days and 15 hours and corresponded to women in the municipalities of Jurisdiction I; and the longest time for the second delay was 5 hours and 55 minutes for Jurisdiction II (Table 8).

Table 8 Delay times in complication care, as perceived by jurisdictional specialists.



Jurisdictions	First delay	Second delay
I	30 días y 15 h.	3 h.
II	27 h. 30 min.	5 h. 55 min.
III	14 h. 30 min.	2 h. 30 min.

Source: Own Elaboration

3.8.2. Time taken to provide care in the assessment area

In order to be more precise in the description of the barriers that cause delays in the care of pregnant women in hospitals, among the questions asked to the staff working in the assessment service, the times allocated to the care of pregnant women arriving in this area were extracted. The care times at this site depend on whether the patient comes on her own or is referred from a clinic or health centre, whether she is transferred from a municipality in the interior of the state, as well as the demand for patients at that time.

The times perceived for the third delay corresponded to the assessment area of two hospitals, finding that the longest elapsed time occurs when a pregnant woman arrives with an obstetric complication, who comes on her own, without clinical data on her state of health, which takes from 45 minutes to an hour for registration and examination to establish a diagnosis.

The time is even longer if the woman comes alone and if she only speaks the Mayan language. Administrative procedures take even longer (up to 12 hours) because not all shifts are covered by the assessment assistants.

The perception of the time it takes to transfer the patient to the floor, to the operating room or to intensive care depends on the saturation of the services, but there are conditions that delay care, such as the lack of stretchers (Table 9).

Table 9 Perceived times of care for pregnant women in the assessment area

Perceived times of care for pregnant women in the assessment area	
Registration and classification of the pregnant woman	3-5 minutes
Waiting in the assessment area	20 minutes to 5 hours
Medical assessment	45-60 minutes
Transfer to floor or operating theatre	2-48 hours

Source: Own Elaboration

4. Preliminary results of the preventive model

With the information from the specialists, the problem of maternal death was conceived as a multidimensional construct, made up of social, institutional and governance elements, in which there are individual characteristics that predominate according to the level of the context: community, municipal and hospital, and which gave rise to the first outline of the Preventive Model (Figure 6).

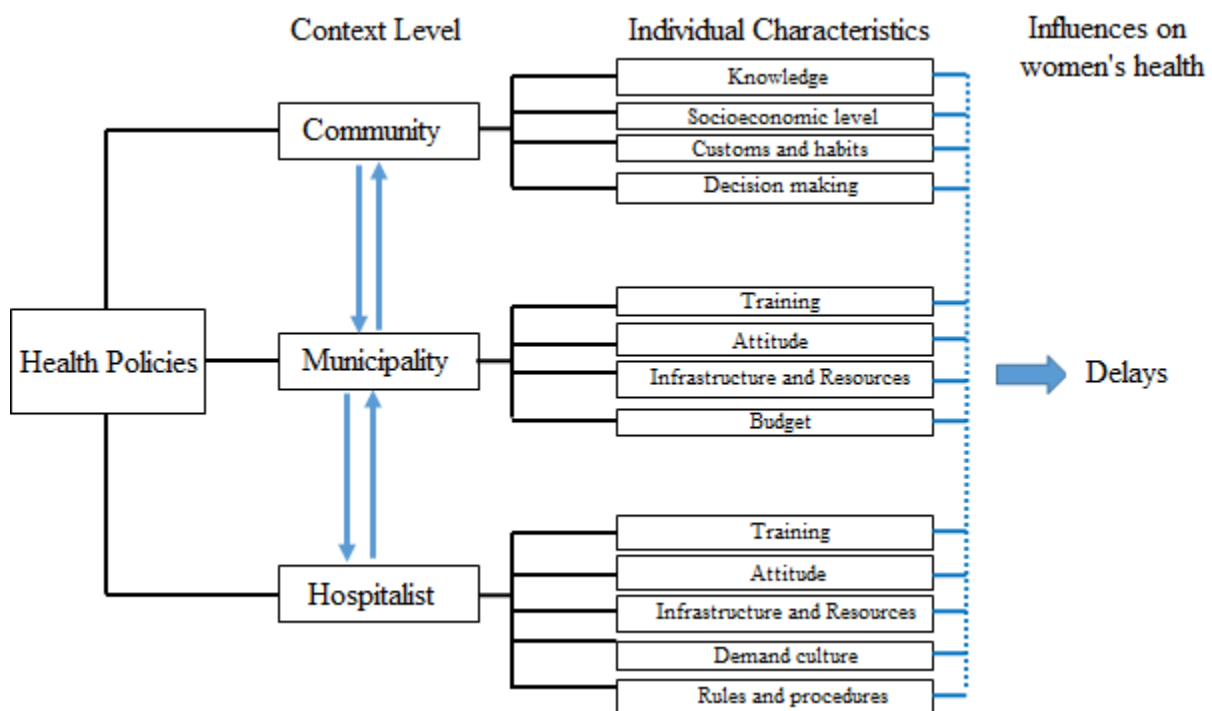
In these contexts, there are factors that influence women's health and cause delays in their care. The three levels of the setting are interrelated, as pregnant women have to be transferred from their community to another level of care.

In the community context, the lack of knowledge of women and their families about warning signs of complications, low socio-economic status, reproductive customs and practices, and lack of self-care decision-making are key factors.

In the municipal context, closely related to the community context, the main individual characteristics are the lack of training of personnel, equipment and budget in the jurisdictional Health Centres to deal with obstetric emergencies, as well as the lack of attitude and availability of personnel to attend to pregnant women.

In the hospital context, individual characteristics also emerge that in turn influence the community and municipal levels, and again the lack of training, attitude, infrastructure and resources predominate; but in this context the culture of demand and the lack of universal norms and procedures for treating emergencies also stand out.

Figure 5 Preliminary outline of the preventive model, with individual characteristics of each setting that influence pregnant women's health and cause delays



Source: Own Elaboration

Once the individual characteristics that influence women's health had been identified, whether at the community, municipal or hospital level, we proceeded to identify from among these individual characteristics, barriers in the care of obstetric complications that cause first, second or third delays. With the incorporation of information on barriers that cause delay according to the context, progress was made towards the construction of a model that incorporated intervention proposals to reduce them; and in this way, to be able to propose health policies aimed at preventing the causes of delay in their community (first and second delay) and hospital (third delay) dimensions. At this point, new categories of delay barriers were integrated and others were repeated, such as lack of self-care, lack of empowerment, pregnant women as non-priority groups, and lack of family support at the time of the emergency.

Likewise, the difficulties in obtaining transport to get to the hospital, the lack of budget and equipment, and the lack of a community model in keeping with Mayan culture; the latter were individual characteristics of the context that were repeated during the sessions and interviews with the participants. The same was true for the individual characteristics for the third delay, where the lack of physical space, equipment, infrastructure, medicines, medical decisions and training in emergency obstetric care (EmOC) were again mentioned as the main barriers to this delay.

Tables 10, 11 and 12 summarise the process of extracting the information from the general categories, followed by the identification of individual characteristics of the context, from which the barriers causing first, second or third delays were obtained.

Table 10 Reduction of general categories of the community setting into barriers causing delay in obstetric complication care

Community Context		
General category	Individual characteristic	Barrier
Family planning	Knowledge	Lack of Self-Care, Family Support and Empowerment
Maternal health and public health, cultural identity, the midwife, success stories, strategies	Uses and Customs	Lack of family support
Strategies, Maternal health and public health	Decision-making	Lack of Self-Care, Empowerment, and Family Support
Budget, The urban and the rural of the GM	Socio-economic status	Groups left behind Lack of financial resources

Source: Own Elaboration

Table 11 Reduction of general categories from the municipal context to barriers that cause delays in obstetric complication care.

Municipal Context		
General category	Individual characteristic	Barrier
Family planning, maternal health	Capacitation	Lack of trained personnel
Maternal health, success stories	Attitude	Lack of staff readiness to respond to the emergency.
The urban and rural aspects of the GM	Infrastructure and resources	Model detached from culture No way to deal with the emergency Lack of transport
Urban and rural GM, strategies, cultural identity, the midwife	Budget	Lack of Transport Delay in getting to the hospital Lack of staff and equipment Model removed from culture

Source: Own Elaboration

Table 12 Reduction of general categories of the hospital setting to barriers that cause delays in obstetric complication care

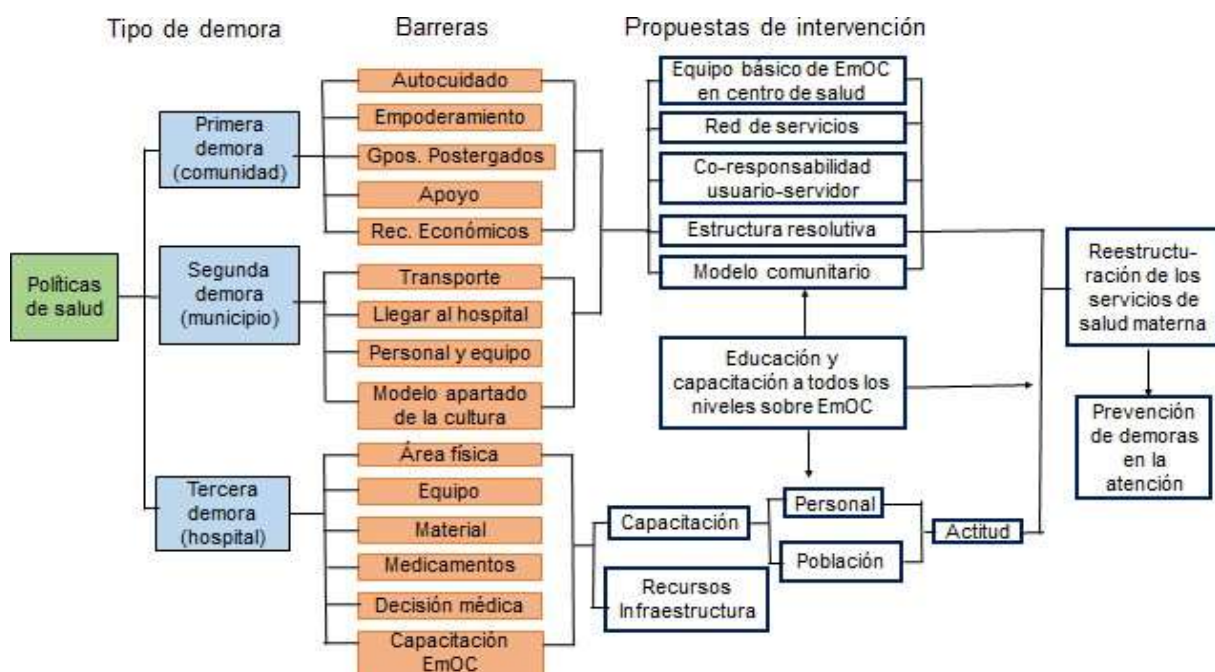
Hospital Context		
General category	Individual characteristic	Barrier
Training	Capacitation	Lack of EmOC training
Defensive attitude and medicine	Attitude Demand culture	Lack of Medical Decision
Infrastructure, materials and equipment	Infrastructure and resources	Lack of Physical Area Lack of Equipment Lack of Equipment Lack of Supplies Lack of Medicines
Training, attitude and defensive medicine, infrastructure, materials and equipment	Rules and procedures	Lack of Physical Area Lack of Equipment Lack of Medicines Lack of Medical Decision Lack of Training

Source: Own Elaboration

Based on the barriers by type of delay, interventions were proposed for the community-municipal level in order to prevent the first and second delays; the proposals were related to the organisation of health services (basic EmOC team, network of services for clinical analysis, user-server co-responsibility, decision-making structure by levels, intercultural community model); and to prevent the third delay, with the provision of quality service elements (training of staff at all levels on obstetric emergencies, training of the population and the health person on medical demands, courses to promote a positive attitude towards care, as well as resources and infrastructure ideal for care). The proposals to prevent first, second and third delays were linked by the essential component of EmOC education and training at all levels, all aimed at restructuring the health services for pregnant women to prevent delays in care.

Figure 6 presents the second part of the preliminary outline of the Preventive Model, which incorporates health policies by type of delay and level of context, through proposals for intervention by health specialists to prevent barriers that cause delays in obstetric complication care.

Figure 6 Second part of the preliminary outline of the Preventive Model of delays in pregnant women with obstetric complications



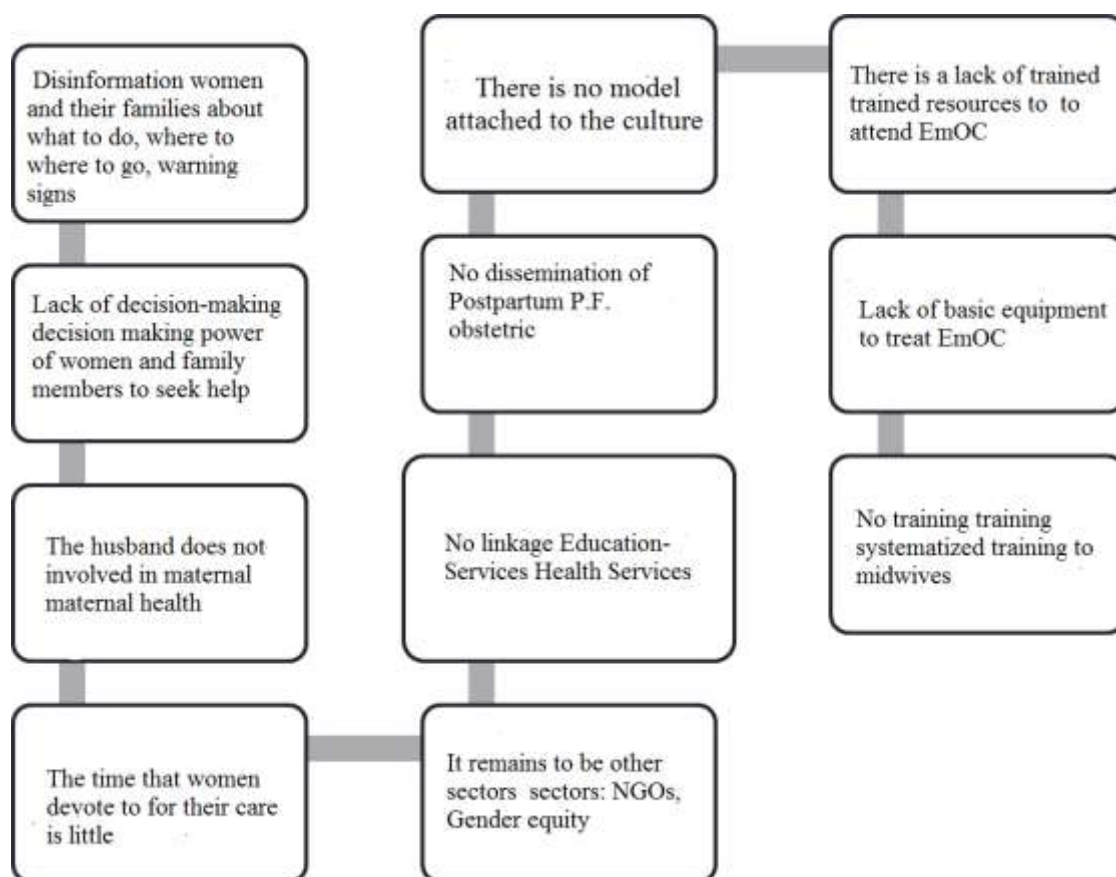
Source: Own Elaboration

5. Identification of key points from specialists from other disciplines to build the final outline of the Preventive Model

In addition to the information obtained from health personnel, comments from specialists from other disciplines were added on barriers by type of delay. Some of the barriers mentioned by the latter reinforced those that had been identified by the medical specialists and others emerged that, from their perspective, should be addressed.

The main barriers that were classified in the first delay were related to the lack of information for women and their families about what to do when they have a complication, what the warning signs of the complication are and where to go for help (Lack of Support Barrier). Other barriers causing delay were the absence of decision-making power for women to seek help (Lack of Empowerment Barrier). The lack of a culturally sensitive model, the low participation of the husband in women's health care and family planning, as well as the lack of permanent and systematised training of midwives, were other barriers encountered (Barriers: Backward Groups, Lack of Family Support). The lack of time available to women for self-care (Barrier Lack of self-care) was also mentioned as a barrier. The lack of linkage between Education and Health Services, as well as the lack of participation of other sectors such as NGOs and the Institute for Gender Equity of the State of Yucatan, were considered of little or no help because they do not provide budget in rural municipalities to support actions aimed at improving maternal health (Barriers Groups left behind, Lack of Family Support) (Figure 7).

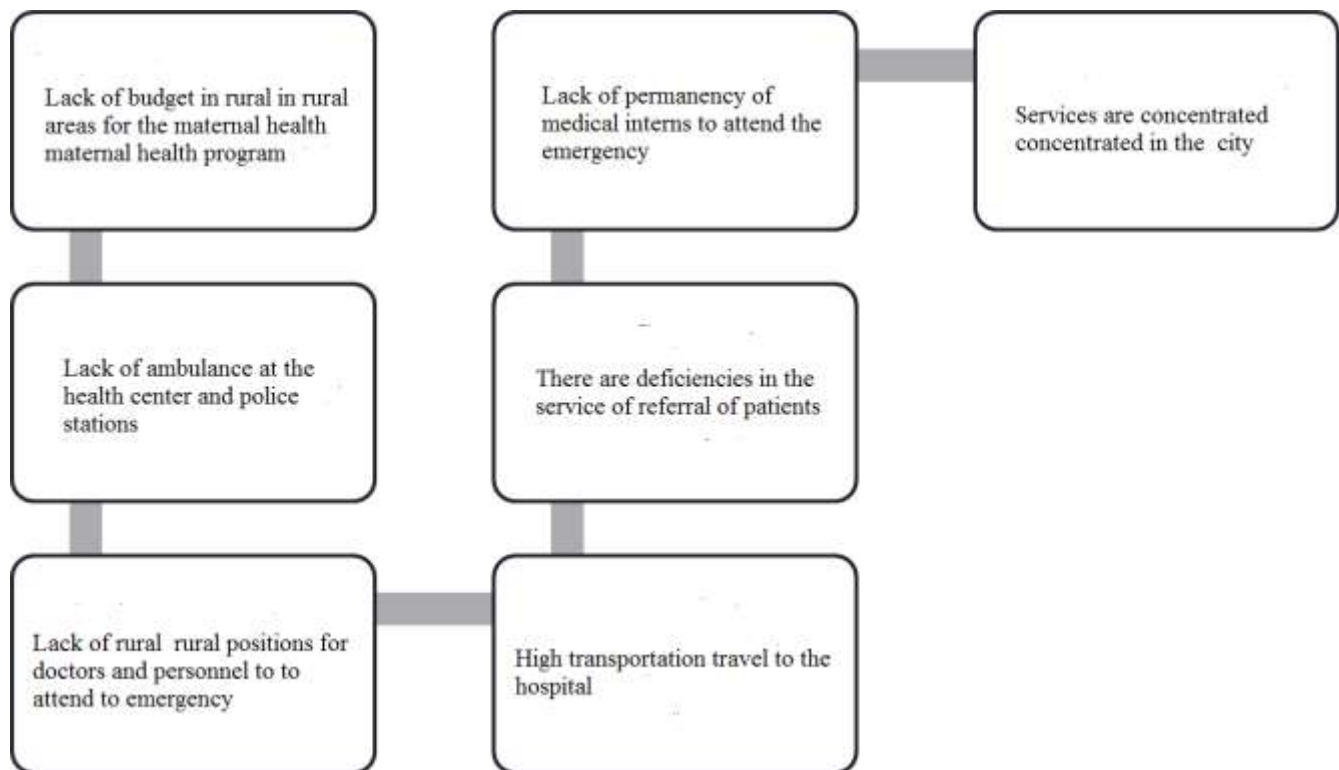
Figure 7 Main barriers perceived by specialists from various disciplines, which cause the first delay



Source: Own Elaboration

For the second delay, the barriers encountered were the lack of ambulance for transfers (Barrier Personnel and equipment), the lack of budget for the maternal health programme in the municipalities (Barrier Lack of budget), the lack of doctors in the health centres trained to attend the emergency and the lack of permanence and attitude of the medical intern in the Health Centre to treat the emergency (Barrier Lack of personnel and equipment). Other barriers that cause delay are the lack of economic resources to transfer to another hospital (Barriers Lack of Transportation to get to the hospital), because the services are concentrated in the hospitals of the State capital and there are also deficiencies in the referral of patients (Barriers Model of culture, Lack of Personnel) (Figure 8).

Figure 8 Main barriers perceived by specialists from various disciplines, which cause the second delay



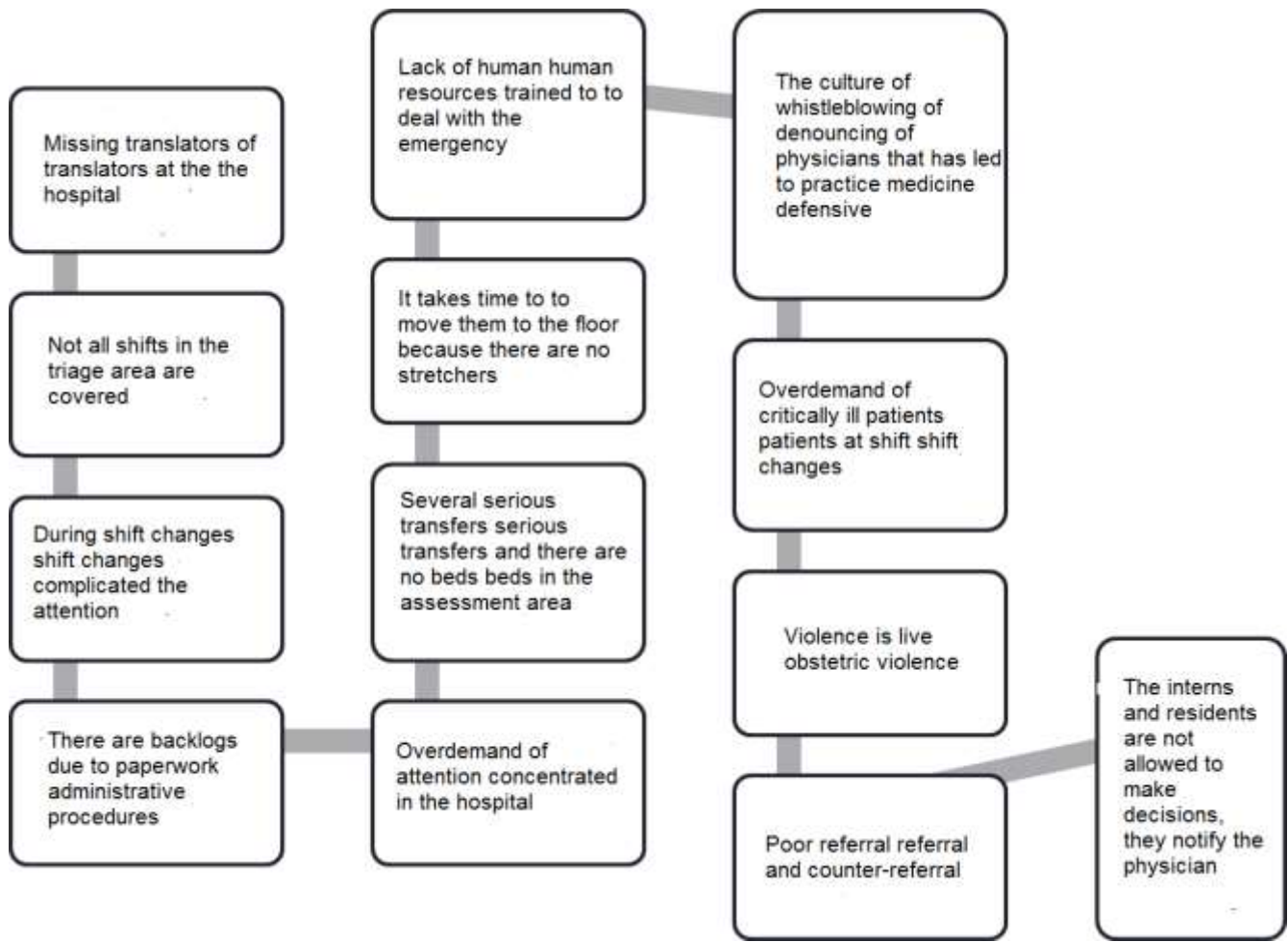
Source: Own Elaboration

For the third delay, the main barriers were the lack of definition and implementation of multi-institutional clinical management guidelines for treating COI in hospitals, including the non-application of regulations related to these, because each institution has its own guidelines and the procedures are adapted to the existing resources in each one of them. Likewise, there is a lack of Mayan language translators when patients arrive at the emergency department (lack of personnel, lack of training), not all shifts are covered in the triage area (where the patient is received and a diagnosis of the state of gravity is made according to signs of alarm); In addition, there is an over-demand for care in the hospital (Barriers Lack of personnel, physical area, equipment and medicines) and a lack of training of personnel in obstetric emergencies (Barriers Lack of training), as well as a lack of medicines, material and equipment to treat them (Barriers Lack of medicines, material and equipment), not only in hospitals, but also in community health centres.

In the communities, there is no network of services for women to get their basic laboratory tests done (Barrier Lack of Personnel, Physical Area, Material and Equipment). Other perceived barriers causing delay include the fact that undergraduate interns and resident doctors, who have the first contact with pregnant women with obstetric complications, cannot make decisions without the authorisation of the basic doctor (Barrier Lack of Medical Decision), who sometimes does not stay in the service or is outside the hospital and has to be located; although in other circumstances this may be considered good practice since only sufficiently trained staff would be deciding on the clinical course of action to be followed. Other barriers are the lack of stretchers which delays the transfer of the patient to the floor or operating theatre (Equipment Barrier), the arrival of several serious transfers at the same time and there are only two beds in assessment to attend them (Lack of Equipment Barrier), attitudes of medical mistreatment towards women (obstetric violence), unwillingness of staff to attend to emergencies and it is during staff shift changes that care is complicated (Lack of Staff Barriers, Medical Decision).

Complaints by family members against doctors for poor care of women with obstetric complications have led to a deterioration of the doctor-patient relationship, but it tends to be a widespread problem in other areas of medical care. This situation has created a tense atmosphere during the care of pregnant women, which has led doctors to practice defensive medicine, in which laboratory studies are often requested that are unnecessary and surgical procedures (hysterectomies) are avoided for fear of making a mistake that could lead to a lawsuit and the suspension of the doctor's licence to practice; there is a culture of denunciation, which has led to demands from relatives for compensation and this in turn has led to the practice of defensive medicine (Barrier Medical Decision) (Figure 9).

Figure 9 Main barriers perceived by specialists in various disciplines and in the area of assessments, which cause the third delay



Source: Own Elaboration

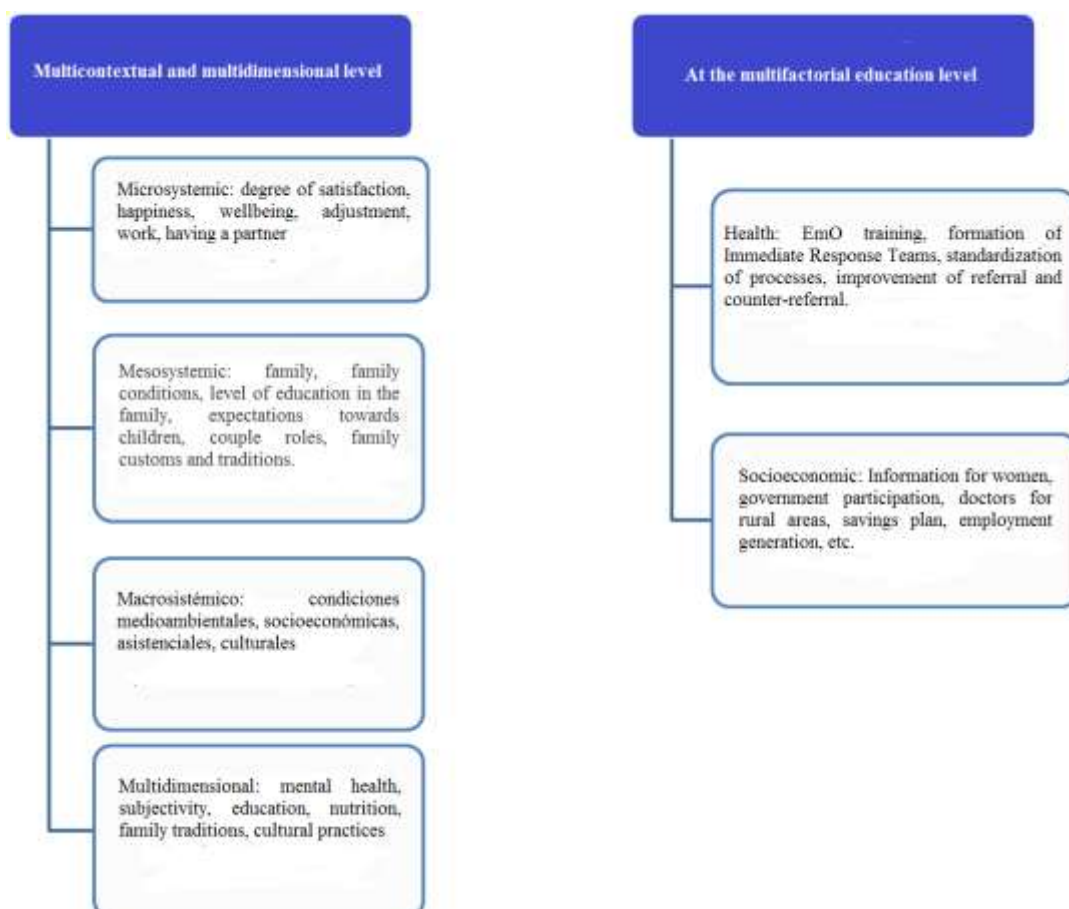
6. Intervention proposals from specialists from different disciplines

The intervention proposals of the health specialists presented in Figure 6 were fed back to those of the specialists from various disciplines and could be implemented for the prevention of barriers that cause delays from the home of the pregnant woman with obstetric complications, her care at the local health centre, her transfer to the tertiary hospital, her treatment at the hospital, until her discharge. All of them were aimed at restructuring public policies to prevent delays in the care of maternal complications.

One of the themes that led to the proposed interventions was to consider in the initiatives developed to improve maternal health the attention not only to biomedical variables, but also to those that involve individual health, such as emotional well-being, work, satisfaction; family conditions from the point of view of relationships with children, partners, customs and traditions; environmental, socio-economic, welfare and cultural conditions; mental health, subjectivity, and nutrition, which make it possible to understand how they affect maternal health and cause delays in women and families seeking early help in the event of obstetric complications. In other words, the proposal encompasses a multicontextual (microsystemic, mesosystemic and macrosystemic) and multidimensional model, which incorporates variables that should also be considered in the study of delays in the care of pregnant women with obstetric complications in order to prevent them.

Another theme was education on the multiple factors that influence maternal mortality, such as staff training on maternal emergency care, including training at all levels of care and in all service areas; and the proposal for the formation of immediate response teams (ERI) in each hospital and health centre. Also in this area, it was proposed to standardise the processes followed for the care of complications and to improve referral and counter-referral services. In the socio-economic aspects, the generation of employment and family savings plans, which would allow pregnant women to have a fund to finance expenses in the event of an obstetric emergency, are part of the proposal in which the government should be involved (Figure 10).

Figure 10 Characteristics of the multi-contextual, multidimensional and multifactorial model to prevent delays in the care of pregnant women with obstetric complications, which contributes to reducing the risk of death.

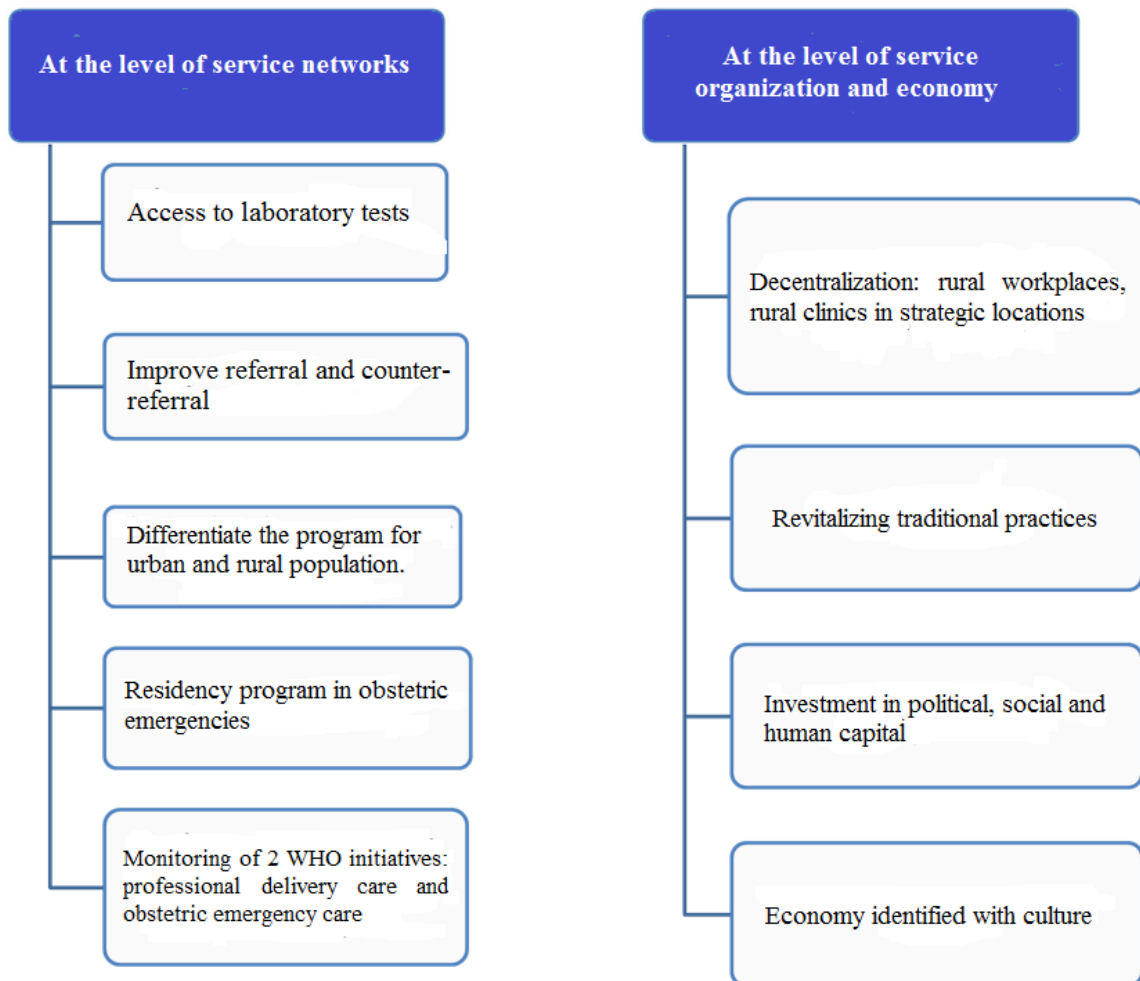


Source: Own Elaboration

The Service Networks theme is a proposal to improve the access of users to basic laboratory tests during pregnancy, and again to improve the referral and counter-referral system for patients during transport. In developing programmes aimed at maternal health, it is proposed that there should be two programmes: one for rural areas and one for urban areas, in which cultural, social, political, socio-demographic and economic characteristics should be distinguished. It was proposed to implement a medical residency training programme in obstetric emergencies.

The monitoring of two WHO initiatives such as skilled birth attendance and emergency obstetric care was included in this theme. Another theme was the structural reform of public health in Yucatan, in which it is recommended to decentralise services, rescue certain traditional practices that would help health services, for certain non-serious ailments or as preventive-educational support; for all that, the investment of political, social and human capital and the (health) economy identified with culture would be part of the restructuring of health services to be incorporated into the model (Figure 11).

Figure 11 Categories of service network and maternal health restructuring

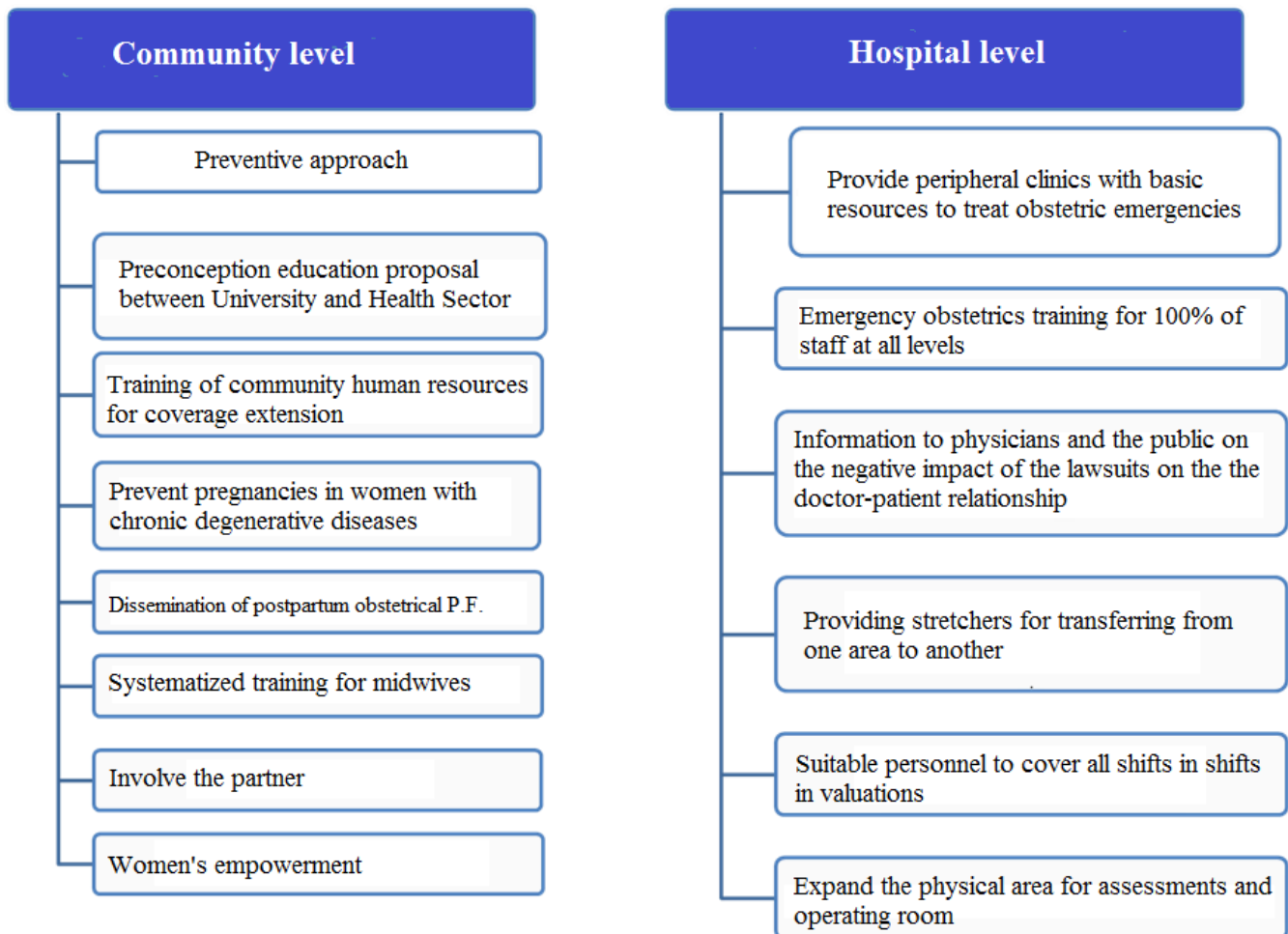


Source: Own Elaboration

At the community level, a participatory model is proposed, with a preventive approach, with human resources to extend the coverage of family planning before and after pregnancy, which is planned and developed by users, family, midwife, education and services, including those issues whose presentation is associated with the death of pregnant women, such as non-communicable diseases, involving the couple and empowering women in decision-making to choose a contraceptive method.

The proposal of the hospital model is that all rural clinics and health centres should have infrastructure and equipment to treat obstetric emergencies while they arrive at the hospital, as well as the training of 100% of staff at all levels, both in hospitals and in rural clinics and health centres. The importance of informing doctors and the population about the negative impact that medical demands have had on the doctor-patient relationship was also stressed. There must be adequate staff to cover all shifts in the assessment area and in the triage operation; and more physical space in the assessment area and operating theatre, more beds and more stretchers because of the over-demand of women coming to the hospitals (Figure 12).

Figure 12 Categories of information and restructuring of services at community and hospital level.

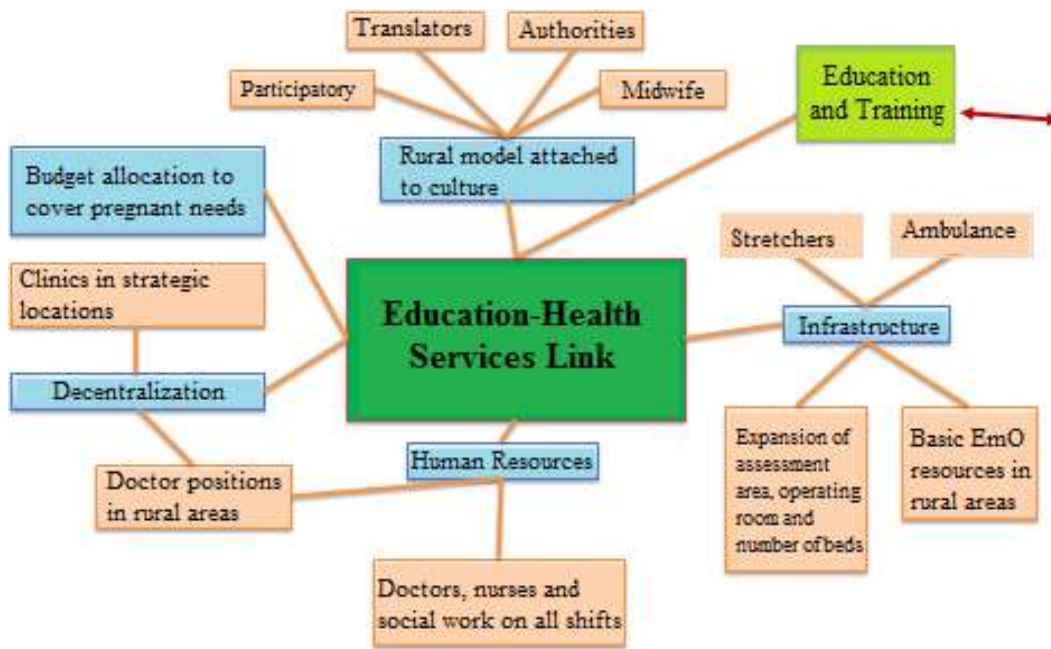


Source: Own Elaboration

7. Preventive Model

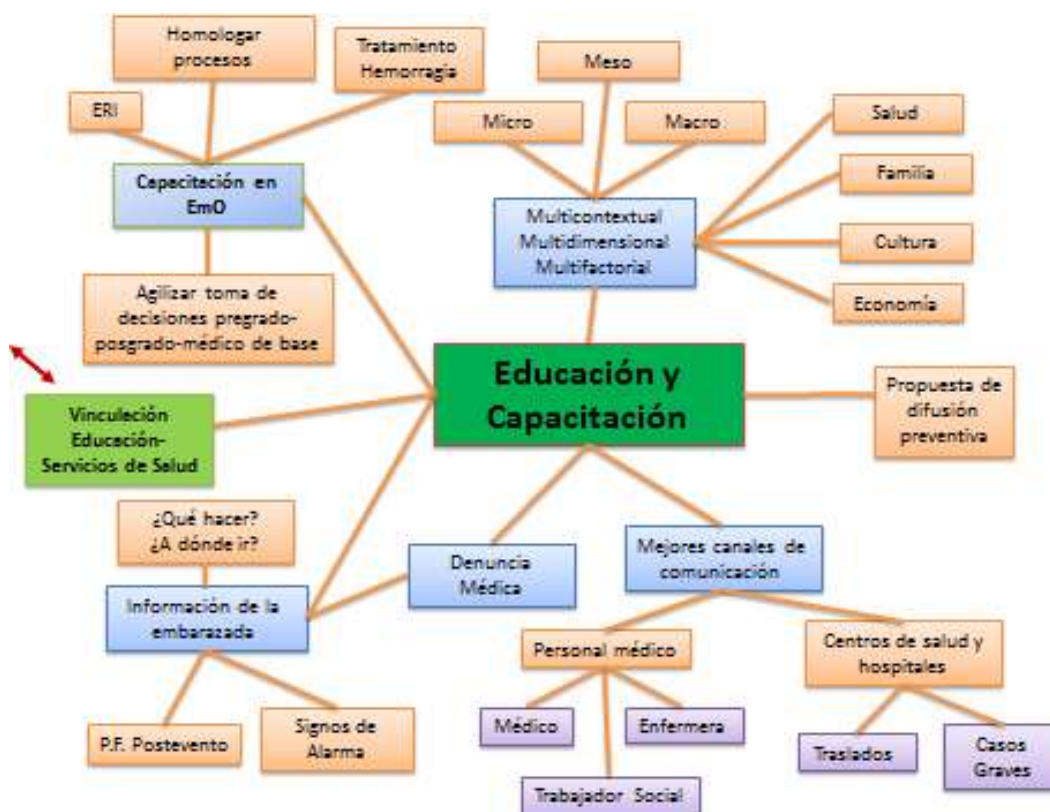
The Preventive Model proposal focused on one main axis: the education-health services linkage and its education and training component (Figures 13 and 14). The education-health services linkage, in turn, comprises six fundamental themes: a culturally sensitive rural model, infrastructure, human resources, decentralisation, budget allocation, and education and training in EmOC. The first five components have to do with the organisation of health services; and the last component with the quality of service by personnel specialised in emergency obstetric care.

Figure 13 Indispensable elements in the Preventive Model of Delays in Care for Pregnant Women with Obstetric Complications



Source: Own Elaboration

Figure 14 Essential educational component in the Preventive Model for Delays in Care of Pregnant Women with Obstetric Complications.



Source: Own Elaboration

– **Education-health services linkage**

From the linkage of the education sector with the health sector, indispensable elements of the Model for Preventing Delays in Care of Pregnant Women with Obstetric Complications emerge, such as a culturally sensitive model, EmOC training, human resources, infrastructure, decentralisation and budget. From each of these, actions and strategies are proposed to improve the care of pregnant women and prevent delays. Similarly, the coordinated work between these two sectors will allow for the elaboration and development of a proposal that links academia with public health services to work on a long-term dissemination plan to prevent delays not only in care, but also to have an impact before the woman is able to conceive, prevent teenage pregnancy and advise future couples on how to prevent the risk of illness prior to conception. A challenge of the model is to incorporate men and family members into the pregnant woman's support network.

- Culturally sensitive rural model. It incorporates participatory methodology, where knowledge transfer is a two-way process: communicator-recipient, receiver-communicator. In other words, knowledge does not go in one direction only, but encourages dialogue and the exchange of knowledge and know-how among participants. The participation of Mayan language translators is vital in this process for good communication. Municipal authorities actively participate in decision-making for the programming of maternal health outreach campaigns. The midwife, as a valuable community element in the care of pregnant women, is revalued and her work is taken into account by the health team and the support network for pregnant women.
- Infrastructure. The provision of stretchers in the hospitals and the permanence of ambulances in the hospitals for emergency services for pregnant women are important elements to be addressed in this component. Likewise, the expansion of the assessment service (triage) where pregnant women with obstetric complications are received, as well as the operating theatre and the number of hospital beds need to be reorganised in order to speed up in-hospital care for pregnant women. In rural health centres, basic resources are needed to treat obstetric emergencies while the woman is transferred to an intensive care unit.
- Human resources. This component demands the allocation of increased numbers of doctors, nurses, social workers, in all shifts in rural hospitals and health centres. Therefore, the opening of medical posts in these areas is linked to the decentralisation process.
- Decentralisation. This process proposes to take health services out of the big cities, i.e. to create more rural places to deconcentrate care for pregnant women with obstetric complications centred in the state capital; it also entails setting up clinics in strategic locations to deal with emergencies.
- Budget allocation. The revision of the budget allocated to cover the needs of pregnant women, such as the cost of transport to another medical unit, as well as the cost of food and lodging for accompanying family members and the purchase of medicines, is a fundamental necessity in the model, as long as the country's economy does not allow them better job opportunities and a fair salary.
- **Education and training in EmOC**

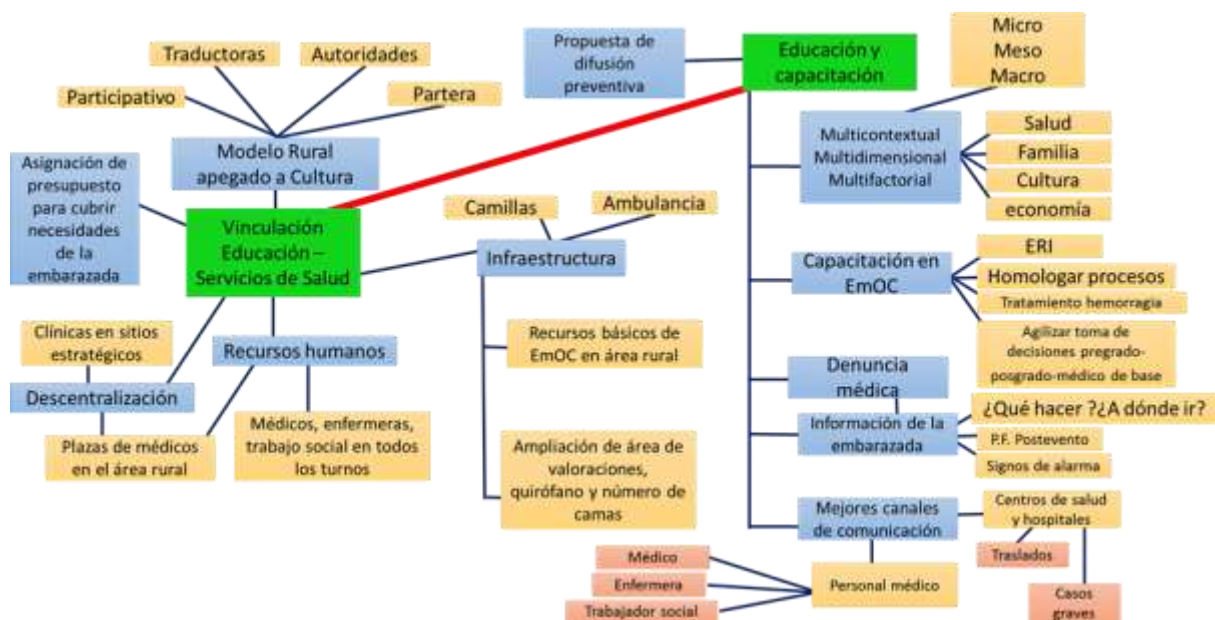
The process of linking the health sector with academia includes a fundamental educational component, which is based on education and training in EmOC for all those who make up the health care teams: doctors, nurses, social workers, orderlies, midwives, administrative assistants, medical personnel working in the assessment area, ambulance volunteers, drivers in charge of transport, in short, all medical and non-medical personnel who have a role in the process of caring for pregnant women with obstetric complications, whether in urban or rural areas. This component also seeks to standardise the processes of care for pregnant women in hospitals, clinics and health centres for the treatment of obstetric haemorrhage and the formation of immediate response teams in all hospitals. Also, to create mechanisms to streamline medical decision-making for timely emergency care.

In addition, the educational and training component incorporates elements such as the study of maternal health from a multi-contextual, multidimensional and multifactorial approach, in which not only the biological aspects of pregnancy are addressed, but also the study of variables related to individual health, the family, culture and the economy. In other words, approaching the study of maternal health from the micro, meso and macrosystemic levels.

- Improved communication channels. This element relates to the referral and counter-referral system for pregnant women with obstetric complications. The transfer of severe cases requires streamlining the mechanisms for sending the patient, not only for hospital care, but also for laboratory and ultrasound tests, which are not available in the community. Likewise, good communication among health personnel in dealing with the emergency must be a team effort, with everyone aware of and willing to play their role at the time.
- Medical demand. The impact that medical demand has had on medical practice needs to be studied in greater depth, both in the population and by health personnel, in order to find mechanisms to reverse this practice and restore trust in the doctor-patient relationship. It should be noted that improving practice outcomes as well as modifying those aspects that promote medical demand are necessary to change the course of this phenomenon.
- Information to pregnant women. Information to the pregnant woman about contraceptive methods after the obstetric event and about warning signs of complications is also part of the educational component of the preventive model. Information for pregnant women on what to do and where to go when warning signs appear are issues to be incorporated mainly for pregnant women in rural areas, who have to follow a long path consisting of several stages, from seeking help in their community until they find specialised care in a hospital outside their locality. Likewise, informing pregnant women about the effects of medical complaints is an issue linked to the educational component that merits a more in-depth approach.

In this way, the link between the health sector and education and its educational and training components are integrated as proposals in the interweaving of these in Figure 15:

Figure 15 Preventive model of delays in the care of pregnant women with obstetric complications



Source: Own Elaboration

Summary of the qualitative part of the preventive model

The construction of the preventive model of delays was based on the analysis of the Technical Standard for Pregnancy Care in Mexico and a review of the literature on delays. In the construction of the preliminary outline of the preventive model, aspects were identified that are not addressed in the regulations and that are not visible in government programmes, such as the lack of pre-gestational consultation and a safety plan for childbirth.

The focus group workshops with specialists who care for pregnant women with obstetric complications made it possible to identify key points to be addressed, based on particular characteristics according to the level of the context (community, municipal and hospital), which influence women's health and cause delays. Interviews with specialists from other disciplines provided the socio-cultural aspects that form part of the interweaving of factors that interact and interrelate in maternal health.

The information analysed made it possible to construct a preventive model for delays in the care of pregnant women who develop an obstetric complication, with proposals that incorporate structural changes in public health, with education and training as a fundamental component.

8. Probabilistic model

8.1. Introduction

In order to answer the second objective of this study: to build a probabilistic model to quantify the risk of delays on the probability of maternal death, the process of probability elicitation with a panel of experts was carried out.

In public health interventions, difficult decisions must be made that affect large numbers of individuals or involve high costs. In this study, in order to make the best decision for action to prevent delays in the care of pregnant women with obstetric complications, we used a set of probabilities (elicited by experts) attributed to delays in the care of the pregnant woman with a maternal complication, which when combined with each other resulted in probabilities attributable to death or survival for having or not having one or more delays in the care of the obstetric complication.

Here we plot the probabilities of the presence of each of the three delays independently, in a tree that encompasses all possible combinations of delays.

Its purpose is to better communicate how these probabilities combine with the probabilities of death surrounding each situation. The tree containing the probabilities is a type of systematic analysis, which allows to finally arrive at probabilities of death for each of the delays. The results are assumed to have a level of uncertainty that is not represented by the moment, given the point outcome of each probability.

With the results of the elicitation of probabilities with a panel of local experts, the final predictive model of maternal death was constructed, based on Bayesian statistics.

8.2. Ethical considerations

To conduct the probability elicitation process, each participant was asked to sign a voluntary consent form containing the objectives of the elicitation. Each participant signed the letter freely and informedly; they were guaranteed confidentiality and anonymity, as well as the freedom to withdraw from the research at any time they decided not to continue participating, with no repercussions for personal or work-related treatment. Consent was also sought to record their voice during the elicitation process.

8.3. Methodology

The methodology followed to carry out the expert panel elicitation process was based on that described by (Apud) Gartawaite, Kadane and O'Hogan, 2005 (Gartawaite, Kadane and O'Hagan, 2005). Bayesian statistics were used to estimate the probability distribution of the parameters of interest. In order to develop the elicitation process, the method described in section 2.2.1.1 was adapted to the context of this study.

In this procedure, the same health care specialists who were present in the qualitative part of the study participated, i.e. the medical specialists of the local-municipal area, referred to in this section as jurisdictional specialists, and the hospital specialists, i.e. the specialists of the local-municipal area.

Through a letter of invitation, the experts were asked to participate in the study. The date, time and place of the elicitation session was agreed with each expert.

Health Jurisdiction 1, based in Mérida, was represented by a medical doctor and obstetrician-gynecologists responsible for obstetric complications, with more than 10 years of experience in the pregnancy care programme. Health Jurisdictions 2 and 3, whose bases are in Valladolid and Ticul respectively, were represented by the heads of the jurisdictions and medical specialists with experience in the care of pregnant women and who were familiar with the system of referral and counter-referral of pregnant women from their localities to their transfer to second-level clinics and tertiary hospitals.

Prior to the elicitation process, each participant was given, along with their letter of invitation, brief information about the purpose of the study and how their participation would be useful in identifying the likelihood of delays for pregnant women, and that this would assist in decision making to improve care (Annex 5).

The following steps were taken to develop the probability model:

1. Development of probability elicitation instruments
2. Probability simulation exercise
3. Probability identification
4. Probability tree construction

8.3.1. Development of probability elicitation tools

In order to elicit participants' beliefs about the likelihood of pregnant women dying, two documents were developed: one adapted to the scenarios of the first and second delay, which was used with jurisdictional participants (Annex 5-7); and another that incorporated the third delay, which was used with hospital participants (Annex 8). This same final instrument was used to capture the average delays resulting from the combination of jurisdictional and hospital specialist probabilities.

8.3.2. Probability simulation exercise

A probability simulation exercise was conducted with questions similar to those that would be asked for the final elicitation (Annex 6). The purpose of the exercise was for the participants to remember what probabilities are and how they are calculated; it was also useful for the facilitators to identify doubts in this regard and for these to be clarified in a timely manner so that they could then proceed to the tendering exercise.

8.3.3. Identifying probabilities

Through the elicitation process, the probabilities of delays were first identified independently, i.e. the probability of having experienced the first, second and third delay was identified first, followed by the probability of death for each of the possible combinations.

To identify the probabilities of each type of delay, we first asked for a range of values (upper and lower limits of the interval) in which the probability of occurrence of that delay would lie. We then asked for a probability within that range (not necessarily the central one) in which the delay would occur (Median). This measure was calculated because it represents an average of numerical values whose range includes extreme quantities, as we have found in reports of delay prevalence in the scientific literature. Therefore, the probabilities elicited were expected to be estimates that were as close to reality as possible. Thus, for each type of delay, a range of values including the median was requested. At the end of the process, the median and its ranges were obtained for the first, second and third delay.

Using Excel, tables were constructed that included the question asked to the experts, the upper range of probability, the lower range of probability, the highest probability (median) and the specific probabilities.

In a second step, the probabilities of dying for having had the three delays, for having the first and second but not the third, for having the first and third but not the second, for having the first but not the second or third, the probability of not having the first but having the second and third, for not having the first and third but having the second, for not having the first and second but having the third, and the probability of dying without having had any of the three delays (Annex 8).

To elicit the probability of death from not having delays:

What would be the probability of dying from having no delays in the care of the pregnant woman with obstetric complication?

We also elicited the probabilities of death for pregnant patients with uncomplicated delay, as well as the probability for pregnant patients without uncomplicated delay.

Finally, the probabilities of dying for uncomplicated pregnant women with and without delays were summed and averaged for incorporation into the decision tree.

Using the participants' elicited probabilities for each of the delays and their possible combinations, averages of the probabilities were calculated by summing all the elicited probabilities and dividing by the number of participants.

The elicited probabilities of dying (Table 13) were placed in a probability tree (Figure 16). The procedure followed for the calculation of the probabilities of dying followed a backward calculation process, where the probabilities are summed and multiplied with all possible combinations, as outlined in section 4.3.1, in the description of the probability tree. The probability tree was presented to the experts who discussed whether these probabilities reflected what they had expressed. The elicitation of probabilities was first done individually and then in groups. The venue was the Faculty of Medicine and the Regional Research Centre. Each session lasted a maximum of 4 hours.

When there was not enough time to finish the session, another session was scheduled with each of them. Individual elicitation began and was followed by a group meeting to allow for discussion of experiences and feedback on the information provided in the individual sessions, to finally reach consensus on the distribution of elicited probabilities.

The participating specialists from the hospitals were one obstetrician-gynecologist from Hospital O'Horán, two from hospitals of the Mexican Social Security Institute: Hospital Benito Juárez and Dr. Ignacio García Téllez and one from ISSSTE. Both Hospital O'Horán and those of the IMSS have the largest coverage of care for pregnant women in the state of Yucatán. Also, as specialists attend cases in both public and private institutions, the representativeness of both sectors in the state was ensured.

8.3.4. Construction of the probability tree

TreeAge Pro 12, (TreeAge Pro, 2012) was used to build the analytical model through a probability tree which allows us to calculate the probabilities of interest.

In order to build the probability tree, the following steps were developed:

- 1st Identification of the situation to be known.
- 2nd Identification of objectives.
- 3rd Development of the branches to represent the probabilities.
- 4th Calculating the probabilities.

1st Identification of the situation to be known

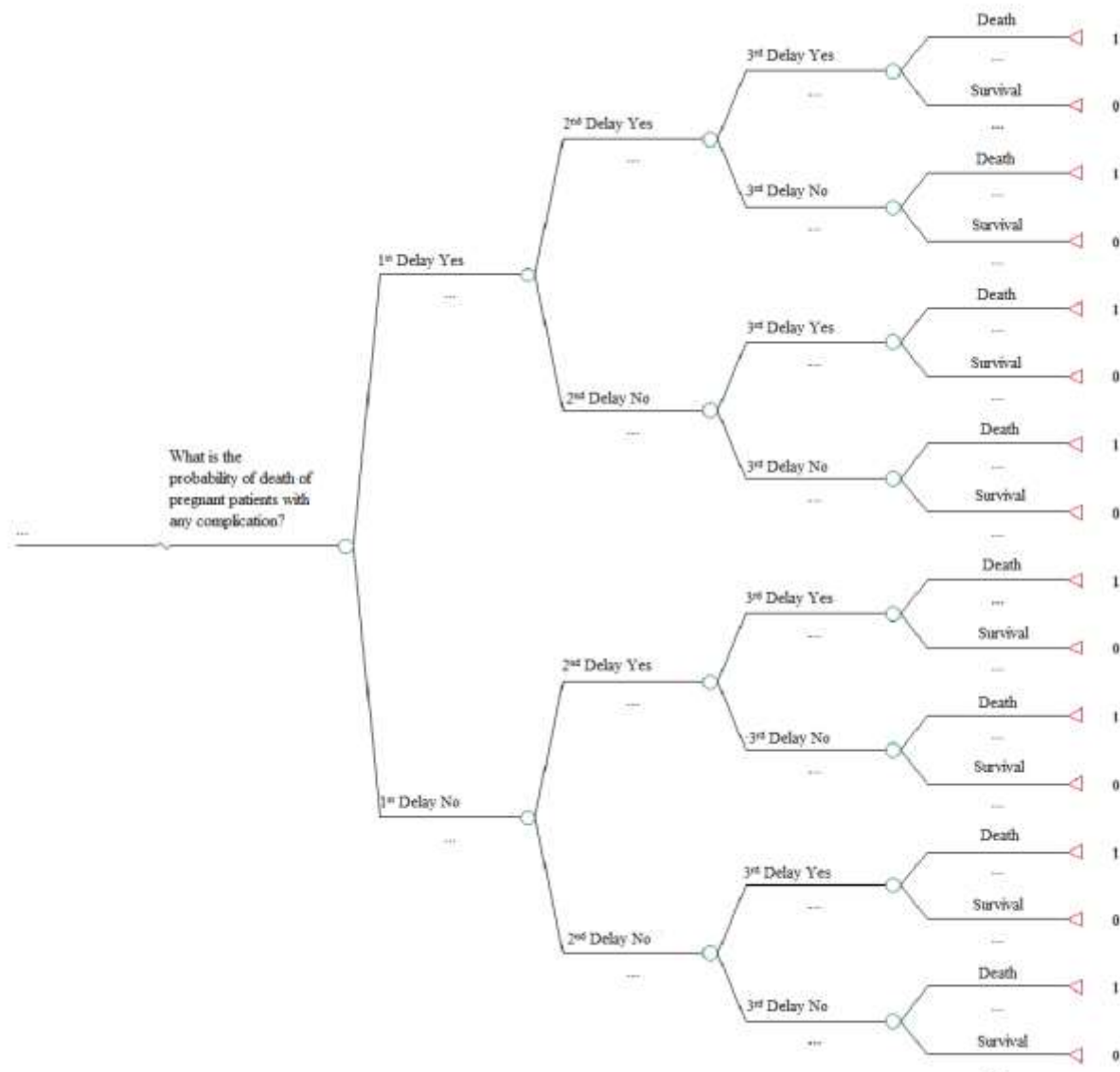
The identified situation to be known is the probability of death of pregnant patients with any complication, which appears as the main axis, to the left of the beginning of the branches of the tree (Figure 16).

2nd Identification of objectives

- To know the overall probability of death of patients with complications.
- To determine the probability of death of patients with a complication who had first, second and third delays independently.

- To determine the probability of death of pregnant patients with complications for each of the possible combinations of delays.
- To know the final probability of death and survival in a group of women with obstetric complication, under the model of the three delays.

Figure 16 Tree to calculate the probabilities with all possible combinations of delays, with the question about the situation to be known



3rd Development of the branches to represent the probabilities of all scenarios

In this step, the tree (Figure 17) representing all possible combinations of the three delays was constructed. The branches of the tree were fed from left to right with the probabilities elicited by the experts as follows:

- First branch, upper arm. Probability of pregnant patients with any complication who had a first delay.
- Second upper branch, upper arm. Probability of pregnant patients with any complication who had second delay. This probability also fed into the upper arm of the second lower branch.
- Third upper branch, upper arm. Probability of pregnant patients with a complication who had a third delay. This probability also fed the upper arms of the other three third branches corresponding to the third delay.

- Upper arm of each of the fourth branches. In order from top to bottom: probability of death of pregnant patients with any complication who had all three delays, the first and second, the first and third, only the first, the second and third, the second, only the third delay, none of the three delays.

Figure 17 shows the probability tree; on the left is the main study problem with a (circular) probability node from which two branches emerge, an upper one representing the presence of the first delay and in which its probability can be seen immediately below it; and a lower one representing the absence of the first delay and in which the # sign can be seen immediately below it, representing the complementary probability to 1 (1-p) of each branch.

Each of these branches ends in turn in another probability node, from which emerge two branches representing the presence or absence of the second delay, with their respective probabilities, from which in turn emerge two branches representing the presence or absence of the third delay, with their respective probabilities; eight nodes representing the final probability of the delays. From these eight nodes, two branches emerge again, ending in a triangular node (terminal, signalling the end of the model), which represents the probability of death and survival of each of the possible combinations. On the right hand side of Figure 17 we see values of "1" which equals death and "0" which equals survival.

Finally, the tree of probabilities of death due to delay contemplates all possible combinations; and from there, the decision tree was built, which provided the answer to the probabilistic model.

4th Calculating the probabilities

The calculation of probabilities consists of taking the probabilities of death and survival and incorporating them into the probabilities of each of the delays (independently elicited), resulting in the probability of death (given that it is the event of interest) associated with each terminal node, starting with the eight terminal nodes of the presence of the first delay, followed by the four probability nodes of the third delay and the two nodes of the second delay, until reaching the presence of the first delay; This procedure is equivalent to calculating roll back probabilities, i.e. taking the probability of the event of interest (death), denoted as 1 in Figure 17, and rolling back to apply that event to the probabilities of the delays.

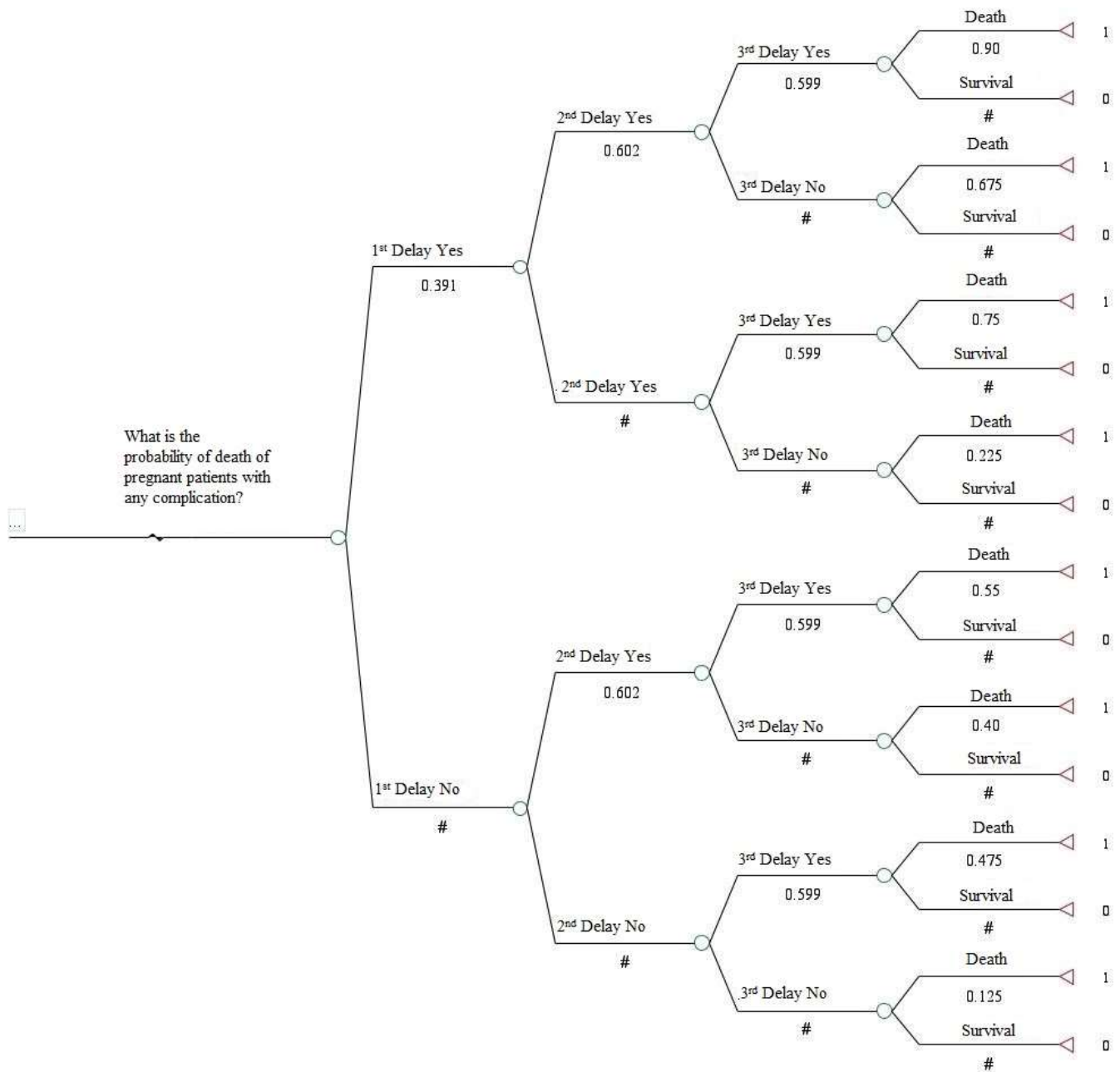
9. Results

The elicited quantities of the probabilities of experiencing any delay due to obstetric complication were as follows:

1st delay 0.391
 2nd delay 0.602
 3rd delay 0.599

The probabilities of death from combined delays are shown in the last branch (on the right) of figure 17.

Figure 17 Elicited probability tree under the three delays model for pregnant patients with obstetric complication



9.1. Description of probabilities of death

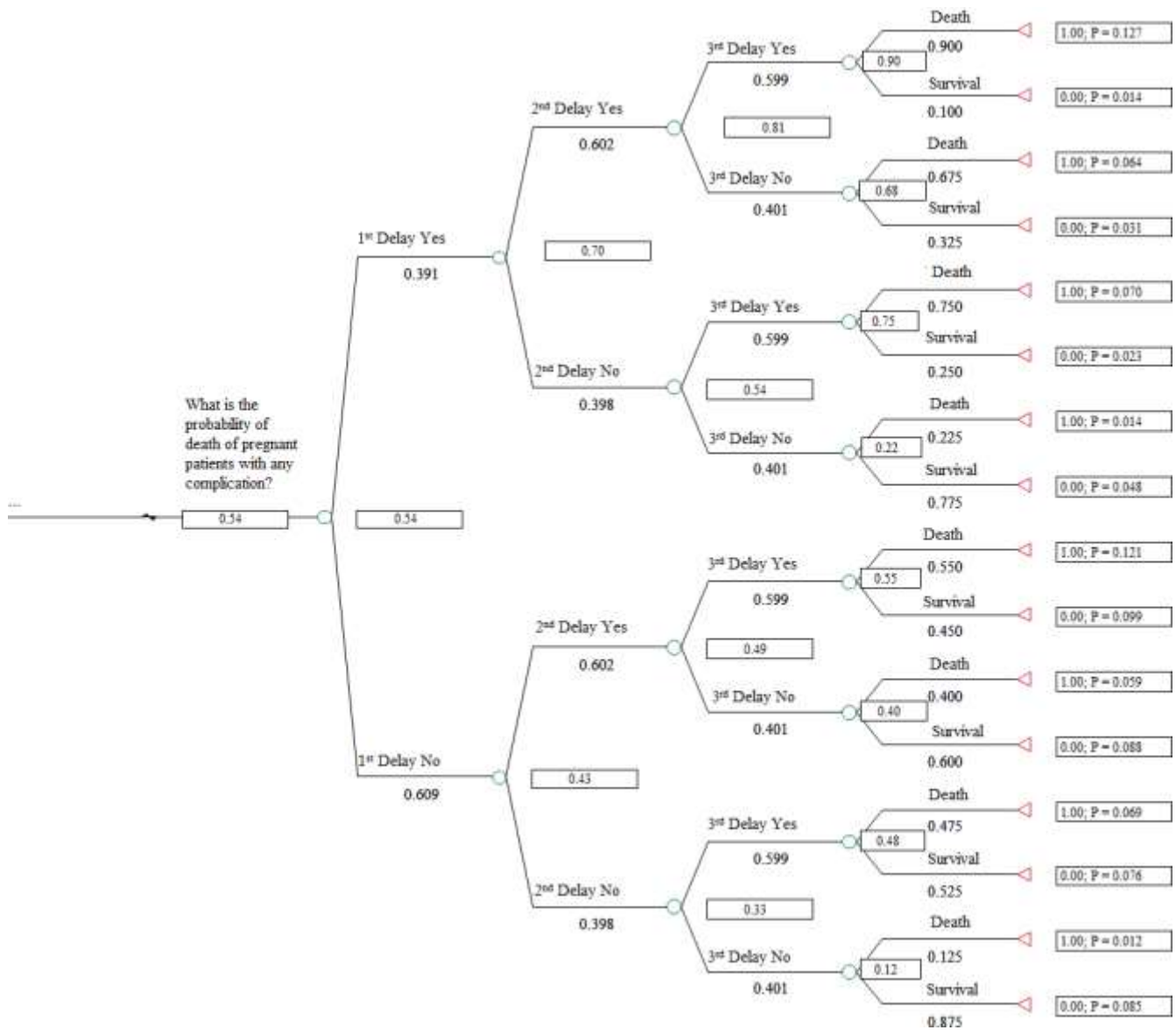
Taking into account the probabilities given by the jurisdictional specialists, as well as those of the hospital specialists on delays in care, the calculation of probabilities of death was made for the third delay, followed by the second and ending with the first delay, which represents the probability of death of pregnant patients with some complication. This calculation ("Roll back"), was performed as follows, for example:

Elicited probability of death for having the three delays multiplied by the probability elicited for the third delay (0.90×0.599) = 0.5391; and this result was added to the result obtained by multiplying the probability of death for having the first, second but not the third delay, by the probability of not having the third delay (0.675×0.401) = 0.2706. So: $0.5391 + 0.2706 = 0.81$. Then 0.81 is the probability of dying from the second delay.

$(0.81 \times 0.602) + (0.54 \times 0.398) = 0.70$ is the probability of dying from the first delay.

$(0.70 \times 0.391) + (0.43 \times 0.609) = 0.54$ is the probability of dying for pregnant women with complications.

Figure 18 Probability tree under the three-delay model of pregnant patients with obstetric complication, with probability of death results for each delay



In Figure 18, the resulting roll back value is plotted within a rectangular frame to the right of each node. Thus, from left to right we have:

- The probability of death of pregnant patients with any obstetric complication under the three-delay model is 0.54.
- The probability of death from the first delay is 0.70, while the probability of death without this delay is 0.43. The increase in death is 1.6 times for having the first delay compared to not having the first delay.

- The probability of death from the second delay and also having suffered the first delay is 0.81, while the probability of death from the first delay but in the absence of the second delay is 0.54. That is, there is a 1.5-fold reduction in mortality in the absence of the second delay.
- The probability of death from the first delay (0.70) is reduced 1.3 times when the first delay is present but not the second delay (0.54).
- The probability of death of patients with the first, second and third delay is 0.90, while the probability of death of having the first, second but not the third delay is 0.68. The probability of death increases 1.3 times when all three delays are present compared to having only the first and second delays.
- The probability of death of patients with first and third but not second delay is 0.75, while the probability of death of having first delay but not second or third delay is 0.22. The probability of death increases 3.4 times in the presence of first and third delays.
- The probability of death for patients with the second delay and who did not suffer the first delay is 0.49, while the probability of death for patients who did not suffer the second or first delay is 0.33. The increase is 1.48 times in the presence of the second delay.
- The probability of death of patients who had no first delay (0.43) increases 1.13 times when they have the second delay but not the first delay (0.49).
- The probability of death for patients with second and third delays but no first delay is 0.55, while the probability for patients who had second delay but no first or third delay was 0.40. The increase in mortality is 1.37 times when having two delays (second and third), compared to having only one (second delay).
- The probability of death for patients who had a third delay but no second or first delay is 0.48, while the probability of death for patients without any of the three delays is 0.12. The increase in mortality in this case is 4-fold when having a delay (the third delay), compared to those who did not have any delay.

According to this model, if a woman has the first delay she has a 0.70 probability of dying, and that this would increase to 0.81 if she also has the second delay and 0.90 if she has the third delay; but would drop to 0.68 if she has the first and second, but not the third delay. But if it does not have the second delay, its initial probability of death (0.70) would drop to 0.54, and to 0.22 if it does not have the third delay either (if it did, it would increase its probability of death to 0.75). The presence of the second delay together with the first delay increases mortality by 66% compared to the absence of the second delay.

Conversely, if a woman with a complication does not suffer the first delay (probability 0.43) but does suffer the second delay, she has a probability of dying of 0.49, which would increase to 0.55 if she had the third delay; but would decrease to 0.40 if she had the second delay. 0.40 if it had the second delay, but neither the first nor the third; to 0.33 if it had neither the first nor the second; and to 0.12 if it had neither the third delay; but if it had the third delay the mortality would rise to 0.48.

Table 13 summarises the probabilities of dying, extracted from Figure 18 (rectangles to the right of the circular nodes located to the right of the tree), under the three-delay model. The highest probabilities of death (marked in bold) occur when the pregnant woman is exposed to all three delays (0.90), the first and third delays (0.75), the first and second delays (0.68) and the second and third delays (0.55). That is, the highest probability of death occurs with the presence of all three delays or with the combination of two of them. The probability of dying in women with only the third delay is higher (48%) compared to the probability of having only the second (40%) or only the first delay (22%). Note that the first delay is present in the three highest mortality probabilities.

Table 13 Results of Probabilities of death under the three-delay model of pregnant patients with obstetric complication

Probability	Delay 1	Delay 2	Delay 3
0.90	√	√	√
0.75	√	-	√
0.68	√	√	-
0.55	-	√	√
0.48	-	-	√
0.40	-	√	-
0.22	√	-	-
0.12	-	-	-

Source: Own Elaboration

The 54% mortality of the model is distributed in the delays as follows:

Note on the right hand side of Figure 18, the values of 1.00 representing death with its probability (p), and 0.00 equating to survival, with its respective p.

To exemplify the impact of this 54% mortality under the delay model, in the final or real scenario, all the probabilities of the terminal nodes must add up to 1 and therefore represent the real outcome scenario. Let us imagine that we have N number of women with obstetric complications, who have gone through all the possibilities of having delays or not, then we can verify what is the resulting probability of death and how delays in their care contribute to their mortality:

- In the first rectangle at the top right of Figure 18 we can observe $P=0.127$, which means that in the final count 12.7% of the women with obstetric complication would result dead by the fact of having the three delays (note that this probability does not correspond to the probability of death of the three delays which is still 90% for that branch); while only 1.4% (second rectangle on the right) of the women with the three delays would result alive (see also Table 14).
- 6.4% (third rectangle on the right) of the deaths were among pregnant women who experienced the first and second delays, while 3.1% (fourth rectangle on the right) of pregnant women with the same history were alive. The final impact of the third delay when the first two delays have been suffered is enormous: 12.7% die compared with 6.4% (in the absence of the third delay), i.e. 2 times more mortality in the presence of the third delay.
- Seven per cent of the women who died would have the third and first delay, but not the second; and only 2.3 per cent of the survivors would have the same history. Meanwhile, 1.4% of those who died would have the first delay, and 4.8% of survivors would have only the first delay. When comparing the final probability of death among those who had the first and third delay, but not the second delay (7%); with those who had only the first delay (1.4%), mortality was 5 times higher in the former than in the latter.
- 12.1% of deaths had both the third and second delay, and 9.9% would be alive with the same history, but 5.9% of deaths had only the second delay, while 8.8% of survivors would also have only the second delay. Mortality was increased 2.05 times for having two delays (third and second), compared to those with only the second delay.
- Death in 6.9% would correspond to those women who had only the third delay and 7.6% would correspond to survivors with the same condition; but only 1.2% of them would be dead without any delay (i.e. it would take 1,000 pregnant women with a complication for twelve deaths to occur in the absence of all delays), and 8.5% of women would survive without any delay.
- Finally, when comparing mortality in the final scenario (first with penultimate rectangle to the right of the end nodes), the probability of death with the presence of the 3 delays decreased 10.58 times in the absence of the delays.

9.2. Description of survival probabilities

- In the survival comparisons of the branch with the three delays (1.4) (second upper branch of the tree) vs. the branch without any delay (8.5) (last lower branch of the tree), we observe 6.07 times more survival without any delay compared to the survival of the three delays together (Table 14).
- In this scenario we observe that 3.1% of the survival would have had the first and second delay but not the third delay, compared to 7.6% survival if they had had only the third delay, i.e. 2.45 times more compared to those who did not have the first and second delay but did suffer the first and second delay.
- If we compare the 2.3% survival rate with first and third delays but no second delay with 8.8% survival rate with second delay but no first or third delay, the increase is 3.82 times the survival rate for the latter.
- Survival is higher (9.9%) when the first delay is absent but the second and third delays are present, compared to the survival of having the first delay but not the second and third delays (4.8%); in this case, survival increases 2.06 times without the presence of the first delay.

Table 14 Final scenario of death and survival rates under the three-delay model

Dead %	Survival %	1 ^a D	2 ^a D	3 ^a D
12.7	1.4	√	√	√
6.4	3.1	√	√	-
7.0	2.3	√	-	√
1.4	4.8	√	-	-
12.1	9.9	-	√	√
5.9	8.8	-	√	-
6.9	7.6	-	-	√
1.2	8.5	-	-	-
Total: 54%	Total: 46%			

Source: Own Elaboration

- When there was a first delay but no second or third delay, women would survive less (4.8%) than those who had a second delay but no first and third delays (8.8%); and those who had a third delay but no second and first delays (7.6%). The survival of women who had first and second but not third delays (3.1%) was lower than the survival of those who had first but not second or third delays (4.8%). This means that the probabilities with which delays occur impact the final scenario, with having the second delay being more likely (60.2%) vs. not having it (39.8%), but not survival (32.5% vs. 77%) respectively. Higher survival was also found among those who had second and third delays but not the first (9.9%) and those who had third delays but not second and first (7.6%).
- When comparing survivals in this scenario, there would be more survivors with only the second delay (8.8%), than with the third (7.6%) or first (4.8%), and this is because of the frequency with which the second delay occurs, although its mortality is twice that of the first delay.

9.3. Decision pathway

To quantify the impact of preventing delays in care, a decision tree was constructed to determine the best pathway for the health sector to take to prevent maternal mortality (Figure 19).

In this case, the situation to be identified is which of the pathways should the health sector prioritise to reduce MM, that of pregnant women with or without delays in care, a question located in the decision node (square) on the left hand side of the tree (Figure 19).

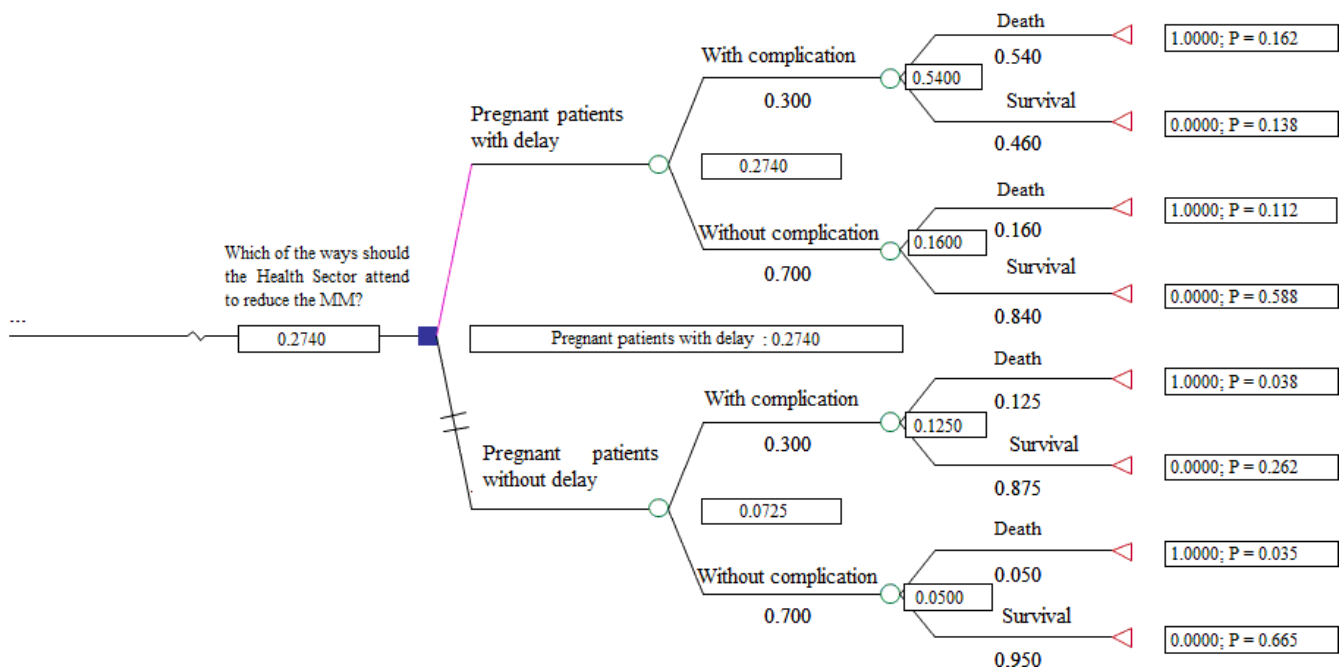
The tree consists of two pathways, an upper pathway that includes the group of pregnant women with delay and a lower pathway that includes pregnant women without delay, with complication and without complication, with their probabilities of death and survival in each pathway. The elicited probabilities of the experts who fed the branches of the tree were:

- Total probability of pregnant women with complication (0.30).
- Total probability of pregnant women without complication (0.70).
- Probability of death of delayed patients without complication (0.160).
- Probability of death of patients without delays without complication (0.050).

The overall probability of death of patients with delays with complication (0.54) was obtained from the above analysis, as was the probability of death of patients without delays with complication (0.12).

The probabilities of survival were the complement of the probabilities of death. The procedure followed the same steps that were carried out to construct the probability tree, i.e. the calculation of backward probabilities ("Roll back").

Figure 19 Decision tree: Which of the pathways should the health sector address to reduce maternal mortality?



Source: Own Elaboration

- The probability of death for pregnant patients with delays was 0.27, while the probability of death without delay at presentation was 0.072, regardless of the presence or absence of complications. The increase in death from having delays is almost 4 times that of not having delays.
- The probability of death for pregnant patients with complications and delays is 0.540, while the probability of death for uncomplicated pregnant patients with delays is 0.160. The increase in mortality is 3.37 times in complicated with delays compared to uncomplicated.
- The probability of death for uncomplicated pregnant patients without delay with complication is 0.125, and for uncomplicated pregnant patients without complication is 0.050. Mortality increases 2.5 times when there is complication, even without delay of care.
- The probability of death of pregnant women with complication and with delay (0.540) is 4.32 times higher than in the same group but without delay of care (0.125).

- The probability of death in uncomplicated pregnant women with delays (0.16) is 3.2 times higher than in the same group without delay of care (0.05).

To exemplify the impact on death or survival of having or not having delays in pregnant patients with or without complications, the final scenario of probabilities at the end nodes is described; the probabilities of each group (with delays, without delays) sum to 1.

- In the first rectangle at the top right of Figure 19, we can observe $P=0.162$, which represents that in a group of N pregnant women 16.2% will die from delays and complication, while 11.2% will die from delays, even if not complicated. Mortality increases 1.4 times in the presence of complication and delay.
- However, 3.8% of mortality was among women with complications without delay, while 3.5% of mortality was among women without complications and without delay. Mortality among uncomplicated patients was almost unchanged by whether or not there were delays.
- The impact on mortality of preventing delays in all pregnant women $[(0.162 + 0.112) = 0.274 / (0.038 + 0.035) = 0.0725]$ is reduced by 1.3 times.
- But the impact on mortality in complicated patients with delays (0.162) is reduced 4.3 times compared to the group with the same characteristics but without delays (0.038).

In the lower branch, parallel lines indicate the pathway to be rejected.

- The probability that pregnant women survive because they have delays and have developed a complication is 0.138, while the probability for those without a complication is 0.588.
- The probability of survival for pregnant women without delays with a complication is 0.262, while for those without both delays and complications it is 0.665.
- The impact on survival of preventing delays for all pregnant women $[(0.138 + 0.588) = 0.726 / (0.262 + 0.665) = 0.927]$ increases 1.28 times.
- But survival increases almost twice (1.89) by preventing delays in complicated patients $(0.138/0.262)$.

Summary of the quantitative part of the preventive model

In this chapter Bayesian statistics were used to elicit beliefs of experts in the care of pregnant women with obstetric complications. The elicited probabilities of death allowed us to construct a probability tree including all possible combinations of delays. Mortality increased the more delays there were, and the highest mortality weight was given by having all three delays and the third delay along with the first.

The overall risk of maternal death from complications under the three-delay model is 54%. The probability of the presence of the third delay is twice as high when accompanied by the first and second delays compared to those with only the first two delays but not the third.

The lowest probability is in the presence of the first delay, compared to only having the second or only having the third delay. Combining all probabilities, in the final mortality impact 12.7% of deaths corresponded to the presence of all three delays and only 1.2% of deaths corresponded to the absence of delays, i.e. 10.6 times less mortality.

In the decision tree, more than a quarter (27.4%) of pregnant women have delays in care. However, the impact on maternal mortality of preventing delays in all of them is reduced 3.78 times; and it is reduced even more (4.3) times in patients with complications. The impact on survival of preventing delays for all pregnant women is increased by 1.3 times; and increases by almost 2 times (1.89) for those with complication.

10. Conclusion and discussion of results

10.1 Introduction

In this final section of the thesis, we discuss the conclusions reached with the methodologies carried out to achieve the objectives: the conclusions of the problem, for each of the hypotheses, and discuss the implications of those conclusions for the theories. The novelty of the proposal lies in the results of combining the qualitative method with the quantitative method for the study of delays in the care of pregnant women with obstetric complications.

The limitations of the study and the achievements are also discussed. Finally, Table 15 summarises the main proposals to the health sector for the restructuring of public policies on maternal health, which would be the key points for reorienting programmes and maternal care.

In such a way that the contributions of this study can serve as guidelines for public health decision-making that will have an impact on the prevention of maternal deaths.

With the information gathered in this study, a guiding document is available for incorporating preventive public policies on maternal health, which will be delivered to the Yucatan Health Services, and which will allow the implementation of preventive actions to reduce delays in the care of pregnant women with obstetric complications, in order to reduce the probability of death due to delays, which is what ultimately causes the fatal outcome of a pregnant woman with a complication. This will require linking the education sector with the health sector and other sectors of society in order to implement comprehensive studies that will guide decision-making based on public health research. The challenge following the incorporation of policies will be to monitor and evaluate how the key elements proposed in the Model are impacting on maternal health.

Due to the complexity of the origin of the problem, the conclusions focus on results that not only cover the health system, but also include the community-municipal area, where a multiplicity of social, economic, political and gender-related causes intervene, which when linked together increase the risk of the woman dying at any point along her journey, from her home to the hospital where she receives treatment (Kalter, Mohan, Mishra, Gaonkar, Biswas, Balakrishnan et al., 2011).

Thus, the inclusion in the study not only of medical specialists in the field of pregnancy care, but also of specialists from various disciplines, as well as the community midwife, with knowledge and experience of the process experienced by pregnant women in the communities and municipalities of the State of Yucatan, allowed for feedback on the knowledge that was available to date about the magnitude and problems of care experienced by women and their families in the different geographical areas of the State; This knowledge has been generated by previous studies with relatives of deceased women, review of medical certificates and records of women who died due to obstetric complications, community experiences with women and their families, and risk analysis of associations of delays with maternal deaths. (Rodríguez, Montero, & Manrique, 2007; Rodríguez, Aguilar, & Andueza, 2012; Rodríguez, Andueza, & Montero, 2012; Rodríguez, Urtecho, & Ojeda, 2015; Rosado, Rodríguez, & Andueza, 2008; Rodríguez, Andueza, & Kú, 2006).

The accumulated expert knowledge provided an answer to the first question of the study problem: Can we use the accumulated expert knowledge on the subject to build a preventive model that reduces the risk of delays in the care of pregnant women with obstetric complications? The information gathered from the focus group and individual interviews with participants made it possible to systematise a set of elements of the pregnant woman's context that need to be understood and addressed in order to reduce delays in the care of obstetric complications and thus contribute to the reduction of maternal mortality.

The perceptions of specialists on the processes of care of pregnant women with obstetric complications is confidential information due to professional ethics; it is restricted only to the medical profession working in a hospital. Therefore, the willingness of the participants to improve the conditions of care for pregnant women in their areas of work, by recognising the deficiencies in training and availability of health personnel for emergency obstetric care, constitutes a fundamental starting point in the Model.

This situation contrasts with other studies, where professionals considered that maternal deaths were due to failures in the families before arriving at the hospital, because they did not recognise the warning signs. These same studies propose a change in maternal health care policies and the prevention of delays as a driver of maternal deaths (Karolinski, Mercer, Micone, Ocampo, Salgado, Szulik et al., 2015).

When the woman manages to get to the referral hospital in time for the complication to be treated, it does not mean that everything will be resolved, as the specialists in the hospital group make clear in their discourse. Although the hospitals in Yucatan are classified as hospitals prepared to provide specialised services in maternal emergencies, the procedures carried out in each of them do not follow the same clinical guidelines, nor do they have the human resources, materials and equipment to resolve the emergency in time. This is an unresolved problem also in other countries, especially for treating haemorrhage, where the health team was not available, the equipment was incompetent and there was a lack of guidelines for obstetric care (Paul, Mohapatra and Kar, 2011).

Poor medical decisions at the time of emergency reflect poor quality of care, as has also been reported from other countries such as Malawi, Brazil, India and France (Combs, Sundby and Malata, 2012; Lotufo, Parpinelli and Cecatti, 2012; Ghazi, Moudi and Vedahir, 2012; Bonnet and Deneux, 2011). In Yucatan, Mexico there are also reports of maternal deaths that had inadequate and untimely medical treatment, as well as lack of resources and medicines.⁸ What causes obstetrics and gynaecology specialists to make poor decisions when complications occur is one of the challenges to be investigated in future studies.

Poor attitudes to medical care go beyond the ethical principles of physician training centred on humanism and a vocation of service to preserve life and health. This unwillingness to provide care is one of the main perceived barriers that damage the doctor-patient relationship, alienate the population from health services and foster a poor image of obstetrics and gynaecology specialists. For this reason, although some of them try to do their job well, they also enter the circle of those labelled by the population as negligent (Kabali, Gourbin and De Brouwere, 2011).

The malpractices carried out, not because of the absence of knowledge or expertise in dealing with obstetric complications, but because of the excessive use of resources, could be influenced by the increase in medical lawsuits that may have led to what is known as defensive medicine, which consists of performing diagnostic and therapeutic procedures as a safeguard against possible liability for negligence. As reported in a study conducted in Israel, the authors report that this type of attitude in daily medical practice is frequent and exposes patients to complications due to unnecessary tests and treatments, affects the quality of care and costs, and deteriorates the doctor's relationship with the patient (Asher, Greenberg, Halevy, Glick, & Reuveni, 2012).

In Turkey, due to concerns and perceptions of medical liability, 72% of neurosurgeons studied practised defensive medicine, avoiding high-risk surgeries and performing unnecessary laboratory and radiodiagnostic tests; almost 90% felt that courts cannot distinguish between negligence and complications (Solaroglu, Izci, Yeter, Metin, & Keles, 2014). Further studies will be needed to propose strategies to minimise defensive medicine as a result of a larger malpractice liability market.

There is growing evidence that contextual elements influence pregnant women's health; reproductive customs, habits and risks differ from one culture to another (Adames, Chavez, Fuentes, Salas and Perez, 2014; National Institute of Statistics and Census, 2013). Women in rural areas have the custom of going to the community midwife to attend their childbirth; they do not always go from the onset of pain, but wait until the pain becomes severe before requesting the midwife's help. If the foetus has a cephalic presentation and there are no complications, the delivery should be successful; but if the presentation is breech or transverse, although the midwife often places the foetus in an upright position, if complications such as pre-eclampsia-eclampsia occur, the midwife cannot attend the delivery. The pregnant woman's husband or family may influence the midwife to attend the birth, and despite the fact that the midwife explains to them that it should be attended by a doctor, they insist on attending the birth at home, with the risks of infection or haemorrhage that this entails, since it is not carried out in an adequate environment nor does it have the necessary equipment for a quality birth. In Yucatan, in urban areas, midwives have practically disappeared, so pregnant women go directly to the medical service for care, but they do not always come on time.

In some regions of Mexico, efforts are being made to bring health services closer to the population by promoting interculturalism, i.e., respect for the customs and language of reproduction of the different ethnic groups in the region in order to improve understanding between the population and health services. Through the Centro de Investigaciones de Estudios Sociales y Antropológicos del Sureste (CIESAS), in the State of Chiapas where the highest number of maternal deaths in the country occur; and the Centro de Investigaciones Regionales "Dr. Hideyo Noguchi", collaborative alliances have been established to work in the Observatory of Maternal Mortality, establishing synergies that can contribute to continue studies in pregnant women to reduce deaths caused by delays (Freyermuth, 2014).

Therefore, programmes and models aimed at preventing maternal deaths should be designed taking into account the cultural characteristics of the population, addressing the needs of rural areas that are not the same as those of urban areas (Adames, Chavez, Fuentes, Salas and Perez, 2014; Demaria, Campero, Vidler and Walker, 2012); so that they can be accepted by the population, respecting their customs and habits towards reproduction, especially in rural areas, where the ways of giving birth are deeply rooted and are different from those established by the health sector in Yucatan.

Although it was recognised that a preventive model should exist in the communities, there is no budget or plans and programmes that include the incorporation of human and material resources to treat obstetric emergencies. One of the main barriers that the jurisdictional specialists mentioned is the lack of permanence of the medical intern in the community. This same situation occurs in other states of the Mexican Republic and has been reported as a problem that does not contribute to the improvement of services (Id. Ibid.); therefore, it will be necessary in the future to study the causes for not fulfilling the mission entrusted to them during the 12 months that they must serve the community. Studies have been initiated that provide the basis for future ethical research on physicians' healthcare work around the world (Chew, Rom, Heckman, & Rhee, 2015).

Jurisdictional doctors' perceptions of the current model of care in the communities of Yucatan are consistent with what is being developed in other communities in Mexico and other countries, where the participation of traditional midwives continues to be indispensable for the care of births and the accompaniment of mothers, as a support to health services in the communities; (National Centre for Gender Equity and Reproductive Health, 2010; Lowell, Kildea, Liddle, Cox and Paterson, 2015); although in their discourses they still mention that they cause harm to the pregnant woman because they perform manoeuvres on her that put her at risk. But when the pregnant woman suffers a complication, they recognise the warning signs and accompany the pregnant woman to the health centre for referral to hospital (Rodríguez, Urtecho, Andueza, Hoil, Santana, Ordóñez et al., 2015). There are few midwives in the communities in Yucatan who have not wanted to participate in the midwife training programme; most of these cases are older women who find it difficult to travel to the training sites.

However, it has been shown that not all midwives engage in risky practices. There are professional midwives and nurse-midwives who are trained to attend normal births and have the same or better skills than general practitioners and medical interns who attend births in the communities (Walker, DeMaria, Suarez and Cragin, 2012). This was demonstrated by comparing three groups of birth attendants in five hospitals in different states of Mexico. The study was conducted over 11 months (August 2005 to June 2006), during which 2566 births were registered, of which 1143 were vaginal deliveries. Of these, 876 (77%) were directly observed. The service providers were 8 professional midwives, 19 obstetric nurses and 53 medical trainees.

Another element of the Model was based on economic theory, where poverty and marginalisation in the rural communities of Yucatan, as well as the lack of accessibility to emergency obstetric care, make it necessary for women with obstetric complications to be transferred to a hospital outside their locality, which entails monetary expenses that are often not foreseen by the family and which further compromise the household economy. The transmission of globalisation to rural areas through mobile phones and refrigerators at home has led to cultural changes in nutrition and the appearance of pathologies that indirectly affect the care and outcome of obstetric complications, such as obesity (Becerril, Castañeda and Solís, 2014).

In 2006, the state of Yucatán ranked first in the country in obesity (ENSANUT, 2006) and in the latest national survey of 2012 it continues to be among the first places. Therefore, pregnant women are not exempt from suffering the consequences of this disease, which further complicates serious obstetric cases. This will be an area for future studies to address the causes of the increase in deaths from indirect obstetric causes.

The Preventive Model of Delays in Obstetric Complication Care, built on information from specialists, incorporates key elements that need to be addressed to reduce maternal mortality. Its main elements, such as a culturally sensitive model, with decentralised infrastructure and human resources and budget allocation to cover the needs of pregnant women in order to prevent delays, respond to a paradigm shift in which the needs of pregnant women are addressed, which are more closely linked to the context in which they live, respect for their reproductive habits and customs, and not only to address obstetric complications. Each of the indispensable elements of the model is related to key points to be addressed.

The linkage of the Education Sector with the Health Sector to address the component of education and training in EmOC at all levels, incorporating the multi-contextual, multidimensional and multifactorial vision of maternal mortality, the gender focus on decision-making by pregnant women and their families in seeking help to deal with obstetric complications, proposals for preventive dissemination on family planning and warning signs, better communication channels in referral and counter-referral services, information to the population and health personnel on medical complaints and information to pregnant women on warning signs and where to go in case of emergency. Linking the education sector with the health sector will be the basis for addressing the training element in obstetric emergencies, but will also require the incorporation of other social sectors such as the economic sector, NGOs, and financing, in order to address key points in other elements that form part of the Preventive Model. All these elements and their key points are part of the main component of the Preventive Model, which is Education and Training.

The strategies that are developed to respond to each of the key points of the elements of the Preventive Model will require the participation of all the sectors that represent it, in order to identify problems, prioritize, monitor and evaluate them, and in this way maintain a permanent feedback for the search for continuous improvement in the quality of care for pregnant women with obstetric complications.

Likewise, the elicitation with a panel of experts was a key point in the quantification of the probabilities of having delays, both in isolation and as a product of combining them with each other. The advantages for the health sector of incorporating the preventive model in the population would be to have an impact on the 54% global probability of maternal mortality due to delays in pregnant women with obstetric complications; by preventing delays, maternal mortality would be reduced fourfold in patients with complications.

Due to the confidential nature of the information provided by the specialists, the elicitation process made it possible to extract the probabilities of death in women with obstetric complications who experience delays in care, which was used to construct the probability tree. Although more and more studies are being conducted using this methodology (Ainslie, Butler, Thomas, & Pintar, 2015; Schoorel, Vankan, Sheepers, Augustijn, Dirksen, Koning et al., 2014; Cousien, Obach, & Deuffic, Mostafa, Esmat, Canva et al., 2014), at the end of this study we found no studies in the literature that applied it to investigate the odds of maternal mortality delays. Therefore, our results set a precedent for the use of this methodology for future studies on the subject and for other research topics where information is not available due to lack of studies, is difficult to reproduce due to health or environmental risks, or is extremely costly.

Regarding the second research question: What interventions are relevant to avoid delays in the care of pregnant women with obstetric complications, the information provided by the participants: economist, anthropologist, obstetrician-gynecologist, community doctors, psychologist, nutritionist, midwife, nurse and assistants in the assessment area, made it possible to integrate proposals with a global vision to respond to the problem.

Hence the proposal for the decentralisation of health services to improve access to care for obstetric emergencies, with the training and equipping of personnel in the strategic Rural Health Centres, not only for the causes of delays in the care of direct obstetric complications, but also for indirect obstetric causes, which will reduce the risks of delays and unnecessary economic burdens that cause delays in care due to transfers and contribute to maternal mortality. In addition, the incorporation of the educational component in the proposal, with all its key elements and points mentioned above, provides a comprehensive view of what needs to be done to have an impact on the prevention of delays in obstetric complication care.

10.2. Conclusions on each hypothesis

The first theoretical hypothesis: It is possible to construct a preventive model of care for pregnant women, taking into account the available literature and the long-standing experience of delays, and to suggest relevant interventions that contribute to the reduction of maternal mortality, was elaborated with the participants' experience of the health-illness-care process for pregnant women.

Likewise, the interventions were proposed in response to each of the areas of the pregnant woman's context: community, municipal and hospital, bringing together elements that together led to the central point to suggest to the authorities of the Health Sector the restructuring of public policies to prevent delays in the care of pregnant women with obstetric complications, with the educational component on emergency obstetric care at all levels as a strategic element. Therefore, the experience acquired by the members of a panel of experts in obstetric care allowed them to accumulate technical and scientific knowledge through the analysis of which it was possible to propose specific interventions, feasible to be embodied in a preventive model of care for pregnant women.

In relation to the second theoretical hypothesis: It is possible to construct a probabilistic model to estimate the risk that delays represent for maternal death. The construction of the probability tree of delays made it possible to identify the probabilities of death and survival of pregnant women with obstetric complications, demonstrating that the longer the delays, the greater the risk of death. The model combined all the possible situations that can occur in pregnant women with obstetric complications, whether or not they are exposed to the first, second or third delays or a combination of these, with the third delay alone or in combination appearing in three of the four highest probabilities of death. Thus, the probability of death for pregnant women with obstetric complications increased as the number of delays increased.

Finally, by combining the probabilities of death and survival of pregnant women with and without obstetric complication in a tree, in both cases, who had and had not had delays, it was possible to identify which pathway needs to be acted upon to increase the survival of women with complication. The delay prevention pathway has an impact of 98.8% on the survival of women with obstetric complication compared to only 10% for those who survive with delay.

10.3. Implications of the theories

The preventive model of delays in the care of obstetric complications that has been constructed represents an opportunity to have a methodological guide that can be used by health authorities and decision-makers to undertake actions aimed at addressing elements of the context of the pregnant woman, not only in hospitals, but also in the community and municipalities, identified by specialists who are knowledgeable about the situations experienced by women who suffer obstetric complications; elements that are having an impact on maternal mortality.

The conclusions reached in this study imply organising a series of actions aimed at addressing key points in the health-illness-care process for pregnant women that will have an impact on reducing maternal mortality. The elements identified, which converge in the restructuring of maternal health policies, imply moving through a type of complex open system (Betancourt and Cerero, 2009), with multiple elements of institutional, social and managerial relations, linked to an educational component focused on the prevention of delays in care; and therefore, to a positive impact on the survival of women. This also implies that the proposal is a starting point for decision-making and the implementation of strategies to prevent delays in care.

Using the qualitative method, the supporting evidence was based not only on the extensive review of the known literature on the "Three Delays Model" and its application in the study of maternal mortality, but also on the accumulated experience over many years of the specialists participating in the study, who provided their experiences of the care practices carried out when an obstetric complication occurs and pregnant women seek help to resolve it, which represent real scenarios of death or survival.

Likewise, the multifactorial approach to the study problem provided a more complete and holistic view of the barriers that cause delays in the care of obstetric complications in each of the real scenarios experienced by women as they go through the care pathway from the onset of the complication until they receive treatment and leave or die in hospital.

With the quantitative method using Bayesian statistics, the study was strengthened, showing the probabilities of death and survival according to the different scenarios of the pregnant woman when there is or is not a delay/s in the care of the complication. The overall maternal mortality obtained is 54% from the three-delay model approach and the fact of having an obstetric complication. The presence of the third delay in three of the four highest probability delays implied recognition of the responsibility of the health system to implement measures to improve the quality of emergency obstetric care in hospitals.

Thus, if actions are directed towards eliminating delays in the care of pregnant women with maternal complications, the probability of survival will be 98.8%. This also implies revising the system of referral and counter-referral of women, since many of them come from the municipalities in the interior of the state and there are no resources in the municipalities to treat the emergency; two strong barriers that cause delays in the care of obstetric complications.

In this study, the presence of the first delay together with the third delay resulted in a high probability of maternal death (75%). Lower results (67%) were found in 2012 in deceased women from six municipalities in the south of the state, who had the third and first delay present (Rodríguez, Aguilar, Montero, Hoil and Andueza, 2012). These studies also found that the main causes of the first delay had to do not only with the lack of recognition of the warning signs of the complication, but also with gender conditions, such as the lack of decision-making power of rural women to attend to their health; in the 2012 study, in 89% of the cases, the mother-in-law or mother decided for the pregnant woman who should attend her in childbirth.

In other studies carried out in Yucatan, it was found that in communities that are still deeply rooted in their traditions, women were socialised to do only what their husbands say (Rodríguez, Andueza and Kú, 2006). It is therefore necessary that the underlying causes of the first delay are also taken into account in order to implement strategic preventive measures focused not only on promoting the warning signs of the main maternal complications but also on the recognition of reproductive rights and gender equity, which reduce the delays that occur when the complication begins and so that both women and their closest family members do not delay in going to the health service as soon as possible.

11. Limitations

Because the participants were a homogenous group, where they all knew each other from work, their free and spontaneous participation would not be assured. However, in our case, we had the voluntary consent to record their voice and from the content of the answers and comments that were provided during the group interview sessions, we could see their interest in participating and contributing to the construction of the delay prevention model. Likewise, only one specialist from each of the other disciplines was interviewed, which limited the knowledge to only what they contributed from their perspective, although it was possible that with their proposals, the preventive model could be fed back on aspects that had not been mentioned by the health specialists and that complement the multifactorial approach of the model.

Another limitation of this study is that it did not include the discourses of women in rural communities in Yucatan to understand their views on the care they seek and receive when they experience obstetric complications. However, there is evidence accumulated over more than ten years by researchers at the Autonomous University of Yucatan on the perceptions of family members of women who have died and women who have survived obstetric complications about the limitations they experience during the health-illness-care process and the barriers that limit timely access to medical care (Rodriguez, Montero and Manrique). (Rodriguez, Montero and Manrique, 2007; Rodriguez, Aguilar and Andueza, 2012; Rodriguez, Andueza and Montero, 2012; Rodriguez, Urtecho and Ojeda, 2015; Rodriguez, Andueza and Hernandez, 2012; Rodriguez, Andueza and Hoil, 2005; Rodriguez, 2010; Ministry of Health, 2014; Paul, Mohapatra and Kar, 2011). The main constraints for women are the lack of a support network for pregnant women at the community level to keep them informed and monitored about warning signs of complications; and what to do, where to go and who to seek help from in case of an obstetric complication.

In addition, lack of spousal support during pregnancy and at the time of the complication; lack of decision making in dealing with the complication; and limited financial resources to cover the costs of transferring to another clinic have been among the main causes of delay.

Regarding the limitations of the elicitation process, it is obvious that there may be imperfections in the elicitation of probabilities, because a number of probabilities that were not taken into account by the expert are being left out. However, for pragmatic reasons the probabilities elicited are given as true, very close to reality, because care was taken to ensure that the participants were experts not only in the care of pregnant women with obstetric complications, but also in the diverse situations experienced in the communities when the complication occurs.

Another limitation of the elicitation process is the conditioning factors of the experts, which refers to the way in which they initiate the elicitation process, which may be altered by having experienced some private life event that would modify their responses at the time of elicitation, as would be the case of negative responses in some of them when proposing solutions to the study problem. However, this limitation may not have been present because during the sessions, all of them were willing to make proposals to reduce delays in the care of obstetric complications.

12. Proposals to the health sector

Interventions such as emergency obstetric training for all medical and non-medical personnel, more infrastructure and equipment in the communities to treat severe cases, support networks for the pregnant woman involving the midwife and family members, are aspects that are constantly referred to in local studies and in other studies around the world as preventive strategies for maternal death. Recommendations to prevent death from haemorrhage become important because blood is not available in the communities and in most cases there are no intravenous solutions that can replace fluid loss while reaching the hospital, as is the case in other regions where accessibility of services needs to be addressed (Hancock, Weeks and Lavender, 2015).

Table 15 Intervention proposals for the restructuring of public policies for maternal health in Yucatan maternal health in Yucatan

Intervention proposals for the restructuring of public policies for maternal health in Yucatan maternal health in Yucatan	
Human resources	Training of 100% of staff on emergency obstetric care at all levels Design and develop an obstetric emergency residency programme Facilitating pregnant women's access to basic laboratory tests (BH, QS) Adequate staffing to cover all shifts in the work area Information to doctors and population on demands and repercussions
Participatory community model	Midwives, users, health sector and education sector, focusing on prevention rather than cure Mayan language translators in hospitals, clinics and health centres
Decentralisation of care	Increasing the number of rural doctor places Rural clinics in strategic locations
Infrastructure and equipment	Provide stretchers, beds in assessments and floor and ambulance. Expand physical areas for assessment and operating theatre. Material and equipment to treat EmOC in rural areas.
Budget	Expand the specific budget for maternal health
Capacitation	Midwives, pre-pregnancy couples, pregnant women, community in general. Standardise emergency procedures
Vinculation	Multi-contextual, multi-dimensional, multi-factorial model

Source: Own Elaboration

Every day more and more models emerge as evidence in a country or region to reduce MM in the world. In our case, the proposals for intervention to restructure public policies on maternal health in Yucatan are aimed at following up on key points that emerged in the construction of the Model for the prevention of delays in the care of pregnant women with obstetric complications and that contribute to the ongoing search for new strategies to prevent delays and thus reduce maternal deaths in Yucatan (Table 15).

12.1. Human Resources

In the first place, it is proposed to address aspects related to the training and skills of human resources, with the training of all personnel, not only health personnel, but also administrative and technical personnel, i.e., everyone who is present in the health-illness-care process for pregnant women with obstetric complications should be one hundred percent trained to contribute to the part they must play during care. Therefore, this training should not only be for medical personnel, but also for nurses, social workers, chemists, radiological technicians, orderlies, staff in the assessment area, emergency transport drivers, hospital admission staff, in short, anyone who plays a role during care.

In the assessment area, the ideal human resources should be trained to attend to pregnant women who arrive with obstetric complications, because they are the first contact in the hospital and it is up to them to expedite the care of women for their prompt treatment.

The training of resident doctors in obstetric emergencies forms a key part of the proposal, through the development of a medical residency programme.

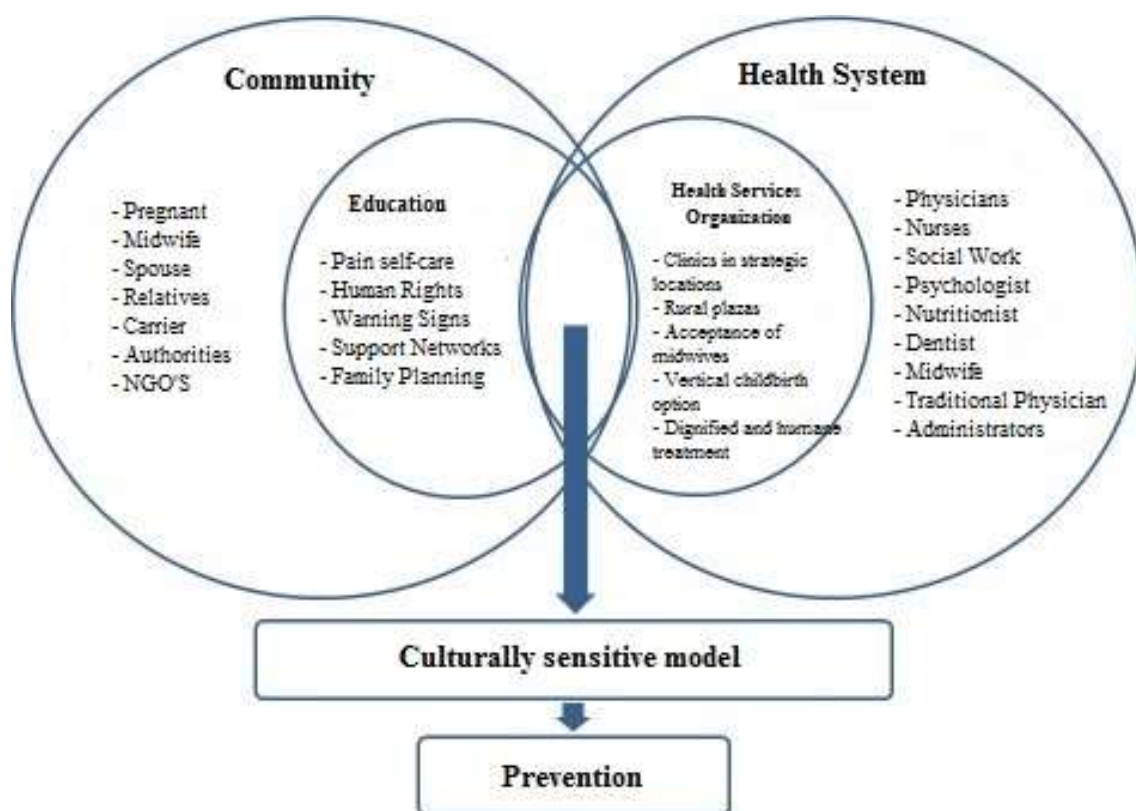
12.2. Participatory community model

At the community level, a participatory, culturally sensitive model is proposed for preventive purposes (Figure 20), based on two dimensions: the community and the health services. In the community environment there are pregnant women, midwives, husbands, family members, transport workers, municipal authorities and NGOs; and in the health system there are doctors, nurses, social workers, psychologists, nutritionists, dentists, midwives, traditional doctors and administrators.

The proposal lies in carrying out education for pregnant women and the population on pain self-care, human rights, obstetric warning signs, pregnancy support networks and family planning (Eslami, Sany, SBT, Tehrani, Ghavami and Peyman, 2023; Shreuder, Mokadem, Smeets, Spaanderman, Roeleveld, Lupattelli and van Gelder, 2023). Likewise, the other dimension, the health system, through the reorganisation of health services for pregnant women, implements elements of service provision that also contribute to the prevention of delays, such as the location of clinics in strategic places, provision of rural places for doctors and nurses, acceptance of midwives in medical units, the option of vertical birth when women request it and there is no medical contraindication, and dignified and humane treatment of pregnant women in health sector units.

In this way, participants and strategic actions interrelate in their two dimensions to address the Model with preventive purposes, focused on building preventive rather than curative strategies, with translators of the Mayan language not only in the communities, but also in the hospitals that receive women who are transferred from the different geographical points of the State.

Figure 20 Culturally sensitive preventive model that includes participants and strategic actions in its community and health system dimensions



Source: Own Elaboration

12.3. Decentralisation of care

The proposal is to deconcentrate emergency obstetric services, providing the nearest second-level clinics and health centres with equipment and drugs to treat emergencies while they reach critical medical services.

12.4. Infrastructure and equipment

The proposal is to conduct a serious health engineering study to transform the assessment area, which is the first point of contact for pregnant women when they arrive at the hospital.

Likewise, through permanent internal audits, it will be possible to find out how many stretchers and beds need to be increased to improve the transfer of the admitted patient from one service to another in the hospital. Another service that needs to be upgraded is the operating theatre; it must always be available for obstetric emergencies, with material and equipment to treat the seriously ill patient. In the second level clinics in the community area, it is proposed to provide them with these resources so that the cases that can be treated there will reduce the delays in transferring them to third level hospitals.

12.5. Budget

It is proposed to invest in favour of maternal health. The budget for maternal health has always been minimal compared to that allocated to other health programmes. Although Yucatan is one of the 10 Mexican states committed to meeting the goals of reducing the MMR by three quarters in the 12-19 age group (UNICEF 10xInfancia Programme 2014-2018), the budget allocated for this purpose is not visualised or referred to in any official document. Studies involving budget analysis are proposed to address the intervention strategies proposed in this study to prevent delays in care.

12.6. Training

This proposal is linked to that related to human resources mentioned at the beginning of this section (5.6.1) and will be aimed at developing instruments to standardize procedures in institutions in the area of emergency obstetric care.

12.7. Linkages

The proposal for this policy involves including future studies on factors that affect maternal health, in order to broaden the framework of knowledge to include not only studies of the biological part of the problem, but also to incorporate aspects of education, the family, adolescent pregnancy, and mental health issues, i.e. a multi-contextual, multidimensional and multifactorial approach to maternal health is proposed.

In the Health Sector Plan 2013-2018, in its strategy 4. 2 Ensure a comprehensive approach and the participation of all stakeholders to reduce maternal mortality, especially in marginalised communities, proposes eight specific lines of action to reduce maternal mortality, which reinforce those set out in the Preventive Model of Delays, such as the co-responsibility of family members and pregnant women with institutions in the care of pregnancy, childbirth and puerperium; improving the quality of maternal care at all levels of care; promoting an intercultural approach; counselling; and improving the quality of maternal care at all levels of care; promoting an intercultural approach; counselling and access to contraceptive methods to prevent unplanned pregnancies; risk-based pregnancy surveillance and timely referral to the specialised level; effective inter-institutional networks for emergency obstetric care; consolidating surveillance, intentional search and reclassification of maternal deaths; and promoting community participation to support pregnant women and women with obstetric emergencies.

In the recently updated NOM-007-SSA2-2016, we found that most of the proposals of the Preventive Model were reinforced with the criteria and guidelines of the NOM. However, some proposals were left unaddressed that would be important to take into account in its next revision in November 2016, and that are essential to incorporate in order to comply with what the Model proposes to contribute to the reduction of maternal mortality in Yucatan; These include the provision of basic EmOC care equipment in health centres, the hiring of specific health personnel for the follow-up and monitoring of pregnant women, the training of suitable personnel for the triage area in clinics and hospitals, and EmOC training for all personnel at all levels in all areas (Table 16).

Table 16 Approaches and actions of the Preventive model for delays in the care of pregnant women with obstetric complications reinforced (√) and not reinforced (X) by the NOM-007- SSA2-2016

Approaches/Actions	Preventive model	NOM-007-SSA2-2016
- Human rights	√	√
- Interculturality	√	√
- Gender perspective	√	√
- Improving care in the preconception period	√	√
- Co-responsibility partner-health institution	√	√
- Dignified and respectful treatment	√	√
- Vertical delivery option	√	√
- Acceptance of low-risk birth attended by midwives	√	√
- Greater involvement of municipal authorities	√	√
- Safety plan for childbirth	√	√
- Basic EmOC equipment in health centres	√	X
- Cultural relevance	√	√
- Improving conditions for childbirth care	√	√
- Intentional Search for Violence	√	√
- Specific staff for follow-up and monitoring of pregnant women	√	X
- Mayan language translators	√	√
- Triage area with qualified staff	√	X
- Empowerment for decision-making	√	X

Source: Own Elaboration

12.8. Future research

The present study opens up a field of research to continue studying the problem of maternal health in the state. With the proposal of the preventive model of delays in the care of pregnant women with obstetric complications, which implies a change in public policies for the restructuring of services, new paradigms appear that set guidelines for the generation of new knowledge. Proposals for further research include:

- Studies that evaluate the impact of the public policies proposed for restructuring, through service quality indicators.
- Studies that analyse the time delays per service in the health-illness-care process for pregnant women with maternal complications.
- Intervention studies to evaluate community strategies that have an impact on maternal health.
- Cost-effectiveness studies on the budget allocated to address the problem of maternal health.
- Studies on defensive medicine to understand its causes and impact on the care of pregnant women.
- Studies that incorporate a gender perspective in decision-making for self-care.

Acknowledgements

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Funding

There were no sources of funding.

Conclusions

This paper contributes to the reduction of maternal mortality in Yucatan, Mexico. It presents qualitative and quantitative results that demonstrate that there are community and hospital barriers that lead to delays in the care of pregnant women with obstetric complications and put their lives and those of their future children at risk. The community barriers have to do with the lack of a functioning model that is culturally sensitive to the needs of the population and the health system. The main component of hospital barriers is the lack of training in the care of obstetric complications for staff not only at the medical level, but at all levels. Integrating the community and hospital results of the study, strategies are proposed to improve the transformation of the process of care for obstetric complications in pregnant women in order to reduce the barriers that cause delays at both the community and hospital levels. Three strategies are proposed as areas of opportunity: 1. Training in emergency obstetric care at all levels of staff, with a culturally sensitive model, with provision of basic obstetric care equipment to health centres; 2. Training of specific community staff for monitoring and follow-up of the pregnant woman; and 3.

Annexes

Annex 1 Letter of invitation to discussion workshops

Merida, Yuc. 5 March 2014

Dr.

Head of Health Jurisdiction No. 3 Ministry of Health Ticul, Yuc.

Dear Dr.:

I am pleased to hereby extend a cordial invitation to attend a working meeting that will aim to contribute to the search for new strategies for the prevention of maternal deaths in Yucatan.

The meeting will be attended by MSP Elsa María Rodríguez Angulo, who is a professor-researcher at this Research Centre and is currently studying for her PhD in Health Sciences at the Autonomous University of Yucatán; her doctoral thesis deals with the problem of maternal mortality.

Therefore, the experience that you have on the subject, as well as the referral and counter-referral mechanisms for pregnant women in your jurisdiction, identify you as one of the ideal people to provide feedback for this work meeting.

That is why we invite you to participate in the meeting to be held on March 14, 2014, in the Audiovisual Room 3 of the Health Sciences Library (upstairs), Av. Itzaes x 59, at 10 am. It is worth mentioning that the duration of the meeting is approximately 4 hours (10-14 hs).

We thank you for your participation and look forward to seeing you on the day and time of the meeting.

Attentametants

Dr. Jorge Eduardo Zavala Castro Director

Code: EJS-1 Annex 2. Brief information about the participant

Academic background

Years of experience in the Maternal Health Programme

Years of experience in current position

In which areas or themes have you worked

What scientific support material do you consult

Annex 3 Informed Consent

Project: Preventive model of delays in the care of pregnant women with obstetric complications.

This study aims to find out about the delays or delays that occur in the care of a complication when a woman is pregnant, during labour or during quarantine.

We would like to invite you to answer the questions that will be asked about the time it takes for a pregnant woman to recognise signs and symptoms of a complication, the time it takes to seek help, the time it takes to get help, the transfer time and the time it takes to be attended to when she arrives at a hospital.

The questions asked are aimed at finding out what happened to the pregnant woman from the moment she started to feel ill until she was attended to and how the outcome turned out. The interview will be recorded. All information will be kept confidential and you will not be identified or harmed. You are free to opt out of the study if you choose to do so.

The results of this project will be analysed and provided to the health services of Yucatan in order to contribute to the search for solutions that will help to improve the care of complications in pregnant women. Thank you very much if you decide to participate.

Name of participant

Researcher:

Date: _____

Project manager: Dra. Elsa Rodríguez Angulo. Calle 59 Núm. 490 x Av. Itzáes. Colonia Centro. Mérida, Yuc.
Tel. 924 64 12 ext

Thank you for your answers!

2. Guide to questions. Meeting with hospital experts

Date: 3 June 2014 Venue: Faculty of Medicine

Room I UICE Time: 9-12 hs.

Objective. To discuss the process of care for pregnant women from their arrival at the hospital to their discharge, in order to propose strategies for improving care.

Question guide

1. What is the procedure followed in your hospital for the care of a pregnant woman who arrives with a maternal complication?
2. Does the procedure for the care of the pregnant woman follow any model?
3. What are the main hospital barriers to timely care for pregnant women (decisions, time, human resources, material resources, equipment, blood bank, infrastructure, etc.)?
4. What needs to be improved in the care of pregnant women in hospital?
5. What strategies do you propose to improve in-hospital care for pregnant women?

¡Thanks!

5. Elicitation with heads of health jurisdictions

Step 1. Introduction

Thank you for attending this meeting. You have been invited to participate in an elicitation process, which aims to document experts' beliefs about care times for pregnant women with obstetric complications. In the elicitation we will try to quantify your beliefs about care times. So we will ask you to express your beliefs as a probability and to express the lack of accuracy around your beliefs. The parameter we will study will be the median. We would be grateful if you could briefly describe your knowledge of what this parameter is. If you have any questions, we are here to help you. The questionnaire will take approximately 30 minutes to complete.

Description of knowledge of the parameter:

Briefly describe what a probability distribution is:

Step 2. Confidentiality

You will be provided with a letter stating your voluntary participation in this study and that there is no conflict of interest. Your answers will be kept anonymous and will only be used for research purposes only. You will be assigned an identification code which will be written at the top of your questionnaire. The code will be kept confidential.

Please read the letter of informed consent. If you agree to participate in the study, please sign it. If you choose not to, thank you for your time up to this point.

5. Simulation exercise

Before starting the questionnaire, we have an example to practice what you will be asked to answer. The example is about the time it takes for the pregnant woman to travel from her home to the midwife's house to get a check-up. This example is identical to the questionnaire you will answer after doing the practice, except for the amount of time you will be asked to answer it.

If you have any questions before starting the practice exercise you can ask them.

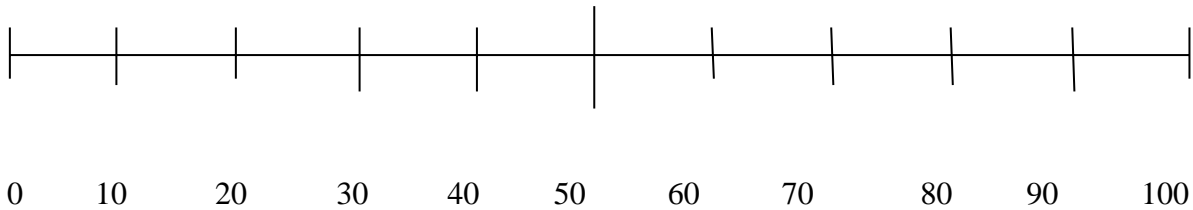
Example

Use the line to answer the questions.

Question 1.

Pregnant women in the communities go to a midwife's house to be "rubbed". Think of two quantities in minutes between which would be the average time for a woman who lives 42 km from the midwife's house to arrive to get a check-up. What do you think the two quantities would be?

_____ and _____



Question 2.

Having thought of a range of values, what do you think would be the central value between these two values?

Question 3.

You have already thought of three values: one central, one lower than the central and one higher than the central. Now, thinking about the possible inaccuracy of the values, could you think about how far below the central value or how far above the central value those values might be now?

_____ and _____

Do you have any questions?

If you do, ask us and we will assist you. If not, we will move on to the next step.

Step 4

We are now going to create a probability distribution with the data you have given us. It may take a few minutes to do this, so we ask you to take a 15-minute break and then restart the meeting.

Step 5

Look at the resulting distribution you are now shown and see if it reflects your beliefs. If you are not happy with the distribution, you can change the values again to readjust the distribution. If you are satisfied with the distribution, you will proceed to answer the elicitation questionnaire of this study.

5. Questionnaire for eliciting beliefs about the time to care for pregnant women with obstetric complications

Code: _____

After the practice exercise, this questionnaire follows the same procedure. Only in this case, we will try to document your beliefs about how long it takes to care for a pregnant woman with an obstetric complication. Do you have any questions?

Question 1. How long do you think it takes pregnant women with an obstetric complication to seek help, from the onset of the complication until they realise it is a complication? Think of two values in minutes between which you think is an average central value in minutes.

_____ and _____

Question 2. Think of a central value in minutes between the above-mentioned values. What is the central value?

Question 3. You have already thought of three values: one central, one lower than the central and one higher than the central. Now, thinking about the possible inaccuracy of the values, could you think about how far below the central value or how far above the central value those values might be now?

_____ and _____

Question 4. How long do you think it takes pregnant women with an obstetric complication to decide to seek help, from the time they realise it is a complication until they go for help? Think of two values in minutes between which you think is the average central value in minutes.

_____ and _____

Question 5. Think of a central value in minutes between the values mentioned above. What is the central value?

Question 6. You have already thought of three values: one central, one lower than the central and one higher than the central. Now, thinking about the possible inaccuracy of the values, could you think about how far below the central value or how far above the central value those values might be now?

_____ and _____

Question 7. How long do you think it takes pregnant women with an obstetric complication to get help from the time they leave their home to get help until they get a vehicle to transport them to another unit? Think of two values in minutes between which you think is the average central value in minutes.

_____ and _____

Question 8. Think of a central value in minutes between the values mentioned above. What is the central value?

Question 9. You have already thought of three values: one central, one lower than the central and one higher than the central. Now, thinking about the possible inaccuracy of the values, could you think about how far below the central value or how far above the central value those values might be now?

_____ and _____

Question 10. How long do you think it takes pregnant women with an obstetric complication to reach another medical facility after getting the transfer vehicle? Think of two values in minutes between which you think is the average central value in minutes.

_____ and _____

Question 11. Think of a central value in minutes between the values mentioned above. What is the central value?

Question 12. You have already thought of three values: one central, one lower than the central and one higher than the central. Now, thinking about the possible inaccuracy of the values, could you think about how far below the central value or how far above the central value those values might be now?

_____ And _____

You have completed the questionnaire, do you have any questions?

If so, please ask us to assist you. When you no longer have any questions, we will work out the probability distributions you have given us.

We ask you to take a 30-minute break while we work on them.

Probability distributions

Discuss each of the distributions for each of the answers you gave. If they do not reflect what you think the probability is, we will have to make some adjustments with you and elicit with new questions. Once you are comfortable with your distribution, then we are done with the study.

Acknowledgements

Thank you very much for sharing your beliefs with us and participating in this study. Your beliefs will be synthesised with those of other colleagues to make one. When the study is completed we will let you know the results. Thank you for your interest and time.

9. Carta del Comité de Bioética

**NOTIFICACIÓN DEL COMITÉ DE BIOÉTICA**

Título del proyecto: Modelo preventivo de demoras en la atención de la embarazada con complicación obstétrica.

Código: CBI-CIR-2013-10

Investigador Responsable: m. EN c. Elsa Rodríguez Angulo.

Fecha de notificación: 11-06-2013.

Vigencia: 11-06-2014.

El proyecto ha sido debidamente revisado por el Comité de Bioética del Centro de Investigaciones Regionales "Dr. Hideyo Noguchi", de la Universidad Autónoma de Yucatán, en cuanto a su valor social, científico, validez científica, relación riesgo-beneficio, consentimiento informado, competencia del personal responsable e infraestructura disponible. La investigadora responsable se compromete a seguir los lineamientos establecidos en la Declaración de Helsinki de la Asociación Médica Mundial 1964, con las modificaciones realizadas en Tokio 1975, Venecia 1983, Hong Kong 1989, Sudáfrica 1996 y Edimburgo 2000, así como a lo establecido en el Artículo 7 del Convenio Internacional de Derechos Civiles y Políticos de La Asamblea General de las Naciones Unidas de 1986 y el Reglamento de la Ley General en Salud en Materia de Investigación para la salud publicado en el Diario Oficial de la Federación el 6 de enero de 1987. Con base en todo lo anterior el presente proyecto queda **APROBADO**.

Atentamente,

A handwritten signature in blue ink, appearing to read 'Fernando J. Andrade-Narváez'.

Dr. Fernando J. Andrade-Narváez.
Presidente del Comité de Bioética CIR/UADY

cc: Mtro. Efraín Poot Capetillo, Coordinador Académico del CIR, UADY.
cc: archivo CBI-CIR-UADY.

Appropriate tables and sources.

Acknowledgement

Indicate if they were financed by any Institution, University or Company.

Funding

State the sources of funding using the following standard format required by funding bodies:

Funding: The present work has been funded by CONACYT [grant number xxxx, yyyy]; PROMEP [grant number zzzz].

Conclusions

Clearly explain the results obtained and the possibilities for improvement.

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General explanation of the subject and explain why it is important.

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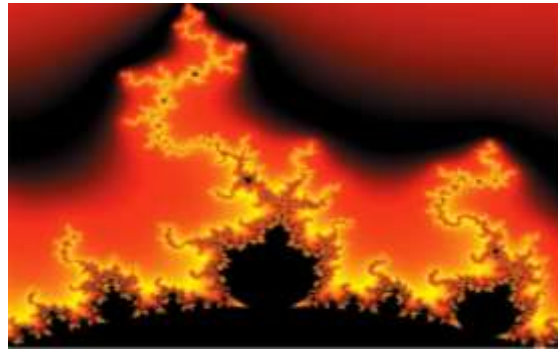
Table 1.1 Title

Variable	Descripción	Valor
V_V	Volumen de Venta	20000
P_V	Postura de venta	490.61
V_C	Volumen de Compra	20000
P_C	Postura de Compra	485.39
p^{Uh}	Precio último Hecho	491.61
V_o	Volumen Operado	1241979
P_u	Precio/Utilidad	0
p^{VL}	Precio/Valor Libro	0
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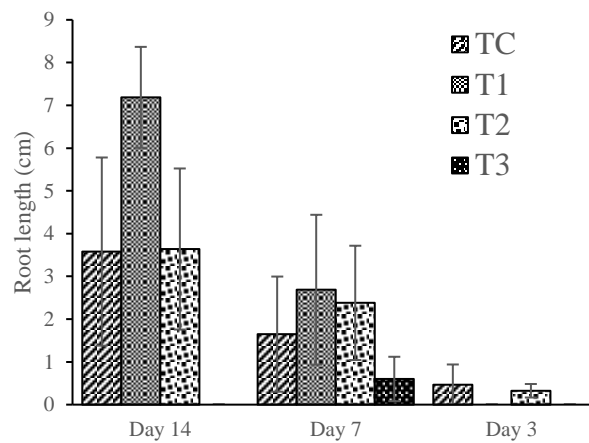
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