

Factors associated with delays in the search for care in neonatal and child deaths in Yucatan, Mexico, 2015–2016

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Research article

Keywords: Child mortality, neonatal mortality, Mexico, patient delay, verbal autopsies, three delays model

Posted Date: August 28th, 2019

DOI: <https://doi.org/10.21203/rs.2.13671/v1>

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Abstract

Background Reducing neonatal and child mortality is a top priority for global health agendas and relies in part on the degree to which the population can access quality health services in a timely manner. This study explores the delays faced during the search for care by caregivers of children under the age of 5 who died in the State of Yucatan, Mexico, during 2015–2016 using the three delays framework as a way to identify bottlenecks and areas susceptible to intervention to reduce these deaths.

Methods Cross-sectional study of all children under 5 years of age who died in the State of Yucatan, Mexico, during 2015 – 2016. Information on delays was obtained through household interviews with the caregiver of the child.

Results Among 298 cases of children who experienced a health problem and searched for care, 252 had complete information for the study. Over 61% of those children visited more than one facility to seek care and had long times to start seeking care. The beginning of the search for care process was shorter when mothers or caregivers sought care initially at a public facility, and when some symptoms like coughing, lethargy, or rash were detected in the child. The second delay, travel time to facilities, was longer in children enrolled in Seguro Popular as compared to children covered by other forms of social security. Finally, the third delay, waiting time to be seen in the facility, was more common in public facilities that are not hospitals, and more common among children who also experienced a long travel time.

Conclusions The results suggest that health promotion actions to reduce the time to search for care when facing a health problem and providing resources to mothers and caregivers to access health services in a timely manner may reduce these delays. This information can help in the planning of health services and improve their impact on population health.

Background

Neonatal and child mortality reductions are top priorities in the global health agenda and are included in the targets of the Sustainable Development Goals.[i] These health indicators are related to a population's living conditions and reflect substantial inequalities in a society if they are concentrated in poor areas. In Mexico, neonatal and child mortality are still of concern. By 2017, Mexico had an estimated child mortality rate of 15.7 per 1,000 live births, a reduction from 41.2 in 1990.[ii] The government has taken different actions to address neonatal and child mortality, including developing a national strategy to achieve universal coverage and implementing national programs on immunization and care for diarrheal and respiratory diseases.[iii] There has also been emphasis on targeted actions to attend neonatal emergencies to reduce this type of deaths.[iv]

The State of Yucatan, located in the south-east of Mexico, had a population of 2,102,259 in 2015,^[v] with an estimated child mortality rate of 13.6 per 1,000 live births in 2017.^[vi] Thirty percent of the population speaks an indigenous language,¹⁰ and second- and third-level health services are concentrated in Merida, the state capital, and Valladolid.^[vii] Despite having a child mortality rate lower than the Mexican national average, the concentration of health services and the high proportion of indigenous population suggests that child mortality may be related to access to health care, especially in neonatal and child emergency situations.

While child mortality can be reduced with specific interventions,^[viii] the success of those interventions, and of universal health coverage overall, relies on the degree to which the population can access quality health services in a timely manner.^[ix] In this study, we used the three delay framework to analyze the process of health care-seeking in children under 5. Figure 1 shows the three days model as was proposed initially for the analysis of maternal mortality.^[x]^[xi] However, its utility has been recognized for the analysis and prevention of other types of deaths, including those resulting from emergency situations.^[xii] This model identifies three critical periods in the search for care, which are affected by different factors: 1) deciding to seek care, which is the identification of a health problem or complication and the beginning of search for care, 2) identifying and reaching medical facilities, including transportation time, and 3) receiving adequate and appropriate treatment, measured by the time required to receive care once the subject arrives at a health facility. In the context of maternal mortality, these three delays can be affected by socioeconomic and cultural factors, accessibility of facilities, and quality of care.^{12, 13} In this study, we propose that the delays in seeking care are related to sociodemographic characteristics of women and the type of health service where they seek care for their children. We also propose that these delays, especially the first one (the beginning of the search for care), can be related to socioeconomic and cultural characteristics that can in turn influence the symptoms identified by mothers in the child who died.

Figure 1. The three delay framework^[xiii]

In this study we analyzed the delays in the process of searching for medical care for children under 5 years old who died in Yucatan in 2015–2016 using the three delays framework, as a way to identify bottlenecks and areas susceptible to intervention to reduce these deaths.

[i] United Nations. #Envision2030 Goal 3: Good Health and Well-being. 2015. Available at: <https://www.un.org/development/desa/disabilities/envision2030-goal3.html>.

[ii] Institute for Health Metrics and Evaluation (IHME). Health-Related SDGs. Seattle, WA: IHME, University of Washington. 2017. Available at: <https://vizhub.healthdata.org/sdg/#>. (Accessed July 8, 2019).

[iii] Estados Unidos Mexicanos. Programa de Acción Específico. Prevención de Enfermedades Diarreicas Agudas y Cólera 2013-2018 Programa Sectorial de Salud. Ciudad de México. 2013.

[iv] Secretaría de Salud. Programa de Acción “Arranque Parejo en la vida”. México D.F. México. 2002.

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[xii] Calvello EJ, Skog AP, Tennerb AG, Wallis LA. Applying the lessons of maternal mortality reduction to global emergency health. *Bulletin of the World Health Organization*. 2015;93:417-423. doi:10.2471/BLT.14.146571.

[xiii] Adapted from 'Applying the lessons of maternal mortality reduction to global emergency health,' by Calvello EJ, Skog AP, Tennerb AG, Wallis LA. *World Health Bulletin*. 2015;93:417-423. doi:10.2471/BLT.14.146571.

Methods

Population and sample

The population under study includes all children under 5 years of age who died in the State of Yucatan, Mexico, during 2015–2016. We identified deaths by examining the state mortality registry and then searched for the location of their families' households using the listed addresses in mortality records. For deaths that occurred in medical units of the Secretary of Health of Yucatan, we additionally searched for information about the place of residence of the families in medical records.

The inclusion criterion for this study was that the death occurred in the State of Yucatan during 2015–2016. The only exclusion criterion was that the family lived outside the State of Yucatan at the moment of the death or during data collection. Cases in which the family of the deceased child could not be located or refused the interview were excluded from the study. Since the interest of this analysis relies on the search for care, we also eliminated cases of neonatal deaths in which the child did not leave the health facility after birth because the complication was detected and attended in the facility right after delivery.

Methodology

This is a cross-sectional study. The outcome variables are the delays in the search for care, as defined in the three delays model, operationalized as: 1) the time between the identification of a health problem and the beginning of search for care; 2) the transportation time to receive care; and 3) the time required to receive care once the subject arrives at a health facility. Information on delays was obtained through direct questions to the mother or caregiver of the child, as detailed in the procedure section.

The first delay refers to the time between noticing the first signs of illness and starting to seek care. This was measured as a continuous variable. We dichotomized this variable using one hour as the cutoff point for the analysis since 56.7% of cases reported started to seek care within one hour of noticing the first signs of illness.

The second delay in the search for care is defined as the travel time required to get to health care facilities to receive care. To better characterize this delay, we also collected information regarding the distance to the health care provider and the cost of transportation. We collected this information for each health care provider visited during the event that led to the death. Since these indicators were correlated, we used travel time as the main indicator for this delay, and incorporated a one-hour cutoff point for analysis since 40% of cases had a travel time of less than one hour and 60% of cases spent one hour or more traveling.

The third delay to access care that we examined was whether care was provided and the waiting time before being attended at the health care facility. As in the case of the second delay, we examined both the costs and time associated with the first visit and those associated with any additional visits to health care for the event that finally caused the death. Since 50% of cases were attended immediately after they arrived at the health facility, we dichotomized this variable for the analysis as immediate versus any further waiting time.

We analyzed variables that may be related to the occurrence of each of the delays mentioned above. The cause of death for each case was obtained from vital registration records, which assign causes of death based on the International Classification of Diseases-

Tenth revision (ICD-10).[i] We classified cases according to their underlying cause of death in three categories: perinatal causes[1], congenital causes, and other causes (including infectious, respiratory, and nervous system diseases). Neonates were classified as under 29 days old and children were classified as 29 days to 5 years.

We constructed a wealth index using principal components analysis, considering household characteristics, assets, and employment, and creating categories for low and high wealth.

We also considered personal characteristics of the mother in the analysis, including education (none, elementary school, middle school, or high school/more), maternal age, enrollment in social security (Social Security Institute - IMSS, Social Security Institute for State Workers -ISSSTE, and Seguro Popular - an insurance scheme for population without a formal job, or no other insurance; only two cases had private medical insurance, and both were also entitled to other forms of social security). The type of facility where care was searched for was classified as private or public and considered in the analysis.

Finally, we used a verbal autopsy interview with the mother or caregiver of the deceased child to identify signs and symptoms as detailed below.

Procedure

We conducted household interviews with families who had children under the age of 5 who died in the years 2015 and 2016 in the state of Yucatan. Interviews were conducted with mothers or caregivers of the children by trained interviewers in the native language of the household, which was primarily Spanish, with 7.5% (19 respondents) either partially or completely conducted in Mayan. All data were collected between March and November 2017, leaving a mourning period of at least three months between the death of the child and the interview.

The interview consisted of two parts, a standardized verbal autopsy using neonatal and child modules of the Population Health Metrics Research Consortium (PHMRC) Shortened

Questionnaire^[ii] and a section with questions about health care-seeking behavior during the final illness and household characteristics. The verbal autopsy questionnaire was applied to the mother or caregiver of the deceased child by trained interviewers. The questionnaire includes a section with closed questions about the symptoms experienced by the child before death and about any condition that was previously diagnosed in the child. It also includes an open question, in which the informant is asked to describe in her/his own words all the events that led to the death of the child. In this section, the interviewer selects words from a previously defined list of keywords, if they are mentioned during the respondent's open narrative. This word checklist was generated according to the utility of a given word to diagnose the cause of death.¹¹ Data were collected electronically using tablets. All interviewees provided signed informed consent to participate, and ethical approval for the study was granted by the Internal Review Boards of the University of Yucatan, the Hospital Agustín O'Horán (Merida, Yucatan), and the University of Washington.

Analysis

We calculated the means, medians, and standard deviations of the different measures related to the delays experienced by caregivers and children in their search for care. We also conducted this analysis stratifying between children who first searched for care in public versus private facilities.

We explored the association between the experience of the three delays and different covariates using logistic regression models in which the outcome variables were each of the delays, dichotomized as previously detailed. We fit four types of models for each delay: 1) bivariable models, exploring the crude association between the outcome variables and each covariate; 2) multivariable models, adjusted by enrollment to medical insurance, type of facility visited, and neonatal versus child death; 3) another set of multivariable models, adding as covariates to Model 2 the cause of death; and 4) a final multivariable model

adding as covariates to Model 3 the diagnosis or symptoms experienced by the child as reported in the verbal autopsy and the previous delays (delay 1 for delay 2 model, and delays 1 and 2 for delay 3 model) experienced in the search for care. We replicated these analyses using only the subset of data from which we had information about the mother's age, education, and occupation (because the mother responded to the interview) and using the cases in which the wealth index could be estimated, and adjusted the models also for these variables as a sensitivity analysis. All models were fitted adjusting for clustering at the health unit level.

[1] Perinatal is defined in this paper according to the ICD-10 Chapter 16 definition as before birth through the 28th day following birth. Should a condition originate in the perinatal period, and continue throughout the life of the patient, the perinatal code should continue to be used regardless of the patient's age.¹⁴

[i] World Health Organization. ICD-10: international statistical classification of diseases and related health problems. World Health Organization. 2004. Tenth revision, 2nd ed. <https://apps.who.int/iris/handle/10665/42980>.

[ii] Serina P, Riley I, Stewart A, Flaxman A, Lozano R, Mooney M, et al. A shortened verbal autopsy instrument for use in routine mortality surveillance systems. BMC Medicine. 2015;13:302; doi:10.1186/s12916-015-0528-8.

Results

We collected information on 298 neonatal and child deaths of patients who sought care during the illness that led to death, excluding children who were born in a hospital and had a complication there, not leaving the hospital to search for care. Out of these, 252 cases provided full information on the study covariates not related to the mother's characteristics. Since there were no major variations in cases with or without complete information, results are reported for the sample of children with complete information (n=252), and analyses were replicated for children with additional information about the mother's characteristics (n=69).

Table 1: Characteristics of sample N=252

| Measure | Neonates ^a (n=95) | | Children (n=157) | | Total (n=252) | |
|---------------------------------|------------------------------|----------------|------------------|----------------|---------------|----------------|
| | <i>N</i> | <i>Percent</i> | <i>N</i> | <i>Percent</i> | <i>N</i> | <i>Percent</i> |
| Care sought | 95 | 100% | 157 | 100% | 252 | 100% |
| Mother is respondent | 66 | 69% | 115 | 73% | 181 | 72% |
| Male deceased | 65 | 68% | 86 | 55% | 151 | 60% |
| Location of death | | | | | | |
| Hospital deaths | 88 | 93% | 127 | 81% | 215 | 85% |
| En route deaths | 2 | 2% | 6 | 4% | 8 | 3% |
| Home deaths | 3 | 3% | 20 | 13% | 23 | 9% |
| Other health facility deaths | 1 | 1% | 2 | 1% | 3 | 1% |
| Cause of death | | | | | | |
| Perinatal | 56 | 59% | 6 | 4% | 62 | 25% |
| Congenital | 17 | 18% | 31 | 20% | 48 | 19% |
| Other ^b | 22 | 23% | 120 | 76% | 142 | 56% |
| Signs and symptoms ^c | | | | | | |
| Bulging fontanelle | 0 | 0% | 11 | 7% | 11 | 4% |
| Cough | 0 | 0% | 47 | 30% | 47 | 19% |
| Cough severe | 0 | 0% | 18 | 11% | 18 | 7% |
| Lasting cough | 0 | 0% | 27 | 17% | 27 | 11% |
| Diarrhea | 0 | 0% | 42 | 27% | 42 | 17% |
| Die suddenly | 55 | 58% | 10 | 6% | 65 | 26% |
| Fever | 0 | 0% | 79 | 50% | 79 | 31% |
| Fever severe | 0 | 0% | 24 | 15% | 24 | 10% |
| Lasting fever | 0 | 0% | 14 | 9% | 14 | 6% |
| Grunt | 0 | 0% | 45 | 29% | 45 | 18% |
| Lethargic | 37 | 39% | 7 | 4% | 44 | 17% |
| Rash | 0 | 0% | 31 | 20% | 31 | 12% |
| Lasting rash | 0 | 0% | 9 | 6% | 9 | 4% |
| Skin: flaking | 0 | 0% | 15 | 10% | 15 | 6% |
| Skin: red | 9 | 9% | 6 | 4% | 15 | 6% |
| Skin: black | 0 | 0% | 13 | 8% | 13 | 5% |

^a Neonates are classified as under 29 days old and children are classified as 29 days to 5 years.

^b For children, the top three “other” causes of death include infectious and parasitic diseases (17%), respiratory diseases (16%), and nervous system diseases (8%).

^c Some informants reported several symptoms, so the report of symptoms adds up to more than 100%.

General characteristics of the sample are presented in Table 1. A total of 95 patients (37.7%) were neonates, 157 (62.3%) were children under the age of 5, and 138 (59.7%) were male. The mean age at the moment of death was 6.61 days (SD=6.77) for neonates and 11.7 months (SD=13.9) for children. The most common causes of death for neonates were perinatal (59%), and congenital (18%) while the most common causes of death for children were congenital (20%), infectious and parasitic diseases (17%), and respiratory diseases (16%). A total of 215 (85.3%) of the deaths occurred in a hospital, 3 (1.2%) in

another health facility or with a doctor, 8 (3.2%) en route to a hospital or other health care center, and 23 (9.1%) in the household or community. The mother was the respondent in 71.8% of cases. The most common symptoms for neonates included sudden death (58%), lethargy (39%), and having red skin (9%). For children, the most common symptoms included fever (50%), cough (30%), grunting (29%), and diarrhea (27%).

Delays in the search for care for all children and for those who first sought care in public or private facilities are presented in Tables 2a and 2b. Among the cases with information on the search for care process (n=252), 154 cases (61.1%) visited more than one facility. Of the complete cases, 199 (79%) visited a public facility first, and 53 (21%) visited a private facility first. On average, children visited 1.88 places to seek care, with this number significantly higher for children who initially visited a private facility (mean=2.58, SD=0.13) rather than a public facility (mean=1.7, SD=0.06). Regarding the first delay (time to start seeking care), the mean time to start seeking care was 98.6 hours, or 4.1 days. It is important to note 143 (56.7%) of respondents reported under one hour for the first delay, but the mean is skewed due to some respondents reporting time up until 60 days. Median measures are presented in Table 2b. In relation to the second delay (time to get to the facility where care was provided), the mean travel time to the first facility where care was sought was 1.41 hours, and the total travel time was 2.9 hours. For the third delay, adding the waiting time in all places visited, children had to wait on average 1.32 hours to receive care. There was a marginally significant difference between children who first sought care at a public versus a private facility, with children who first visited a private facility having higher odds of experiencing any delay.

Table 2a: Means of measure of delay experienced by deceased children in the search for care

| Measure | Total (n=252) | Public first (n=199) | Private first (n=53) | p-value |
|---|-------------------|----------------------|----------------------|---------|
| Delay 1: Time to start seeking care (hours) | 98.6 (23.08) | 82.46 (24.25) | 159.19 (61.04) | |
| Number of places visited to seek care | 1.88 (0.06) | 1.7 (0.06) | 2.58 (0.13) | *** |
| Travel distance to first facility (kms) | 68.78 (48.74) | 84.42 (62.73) | 14.73 (10.6) | |
| Travel time to first facility (hours) | 1.41 (0.36) | 1.67 (0.46) | 0.45 (0.06) | |
| Travel cost to first facility (MX pesos) | 176.73 (25.69) | 195.33 (34.26) | 134.74 (31.46) | |
| Total distance traveled for all visits (kms) | 82.78 (49.04) | 95.95 (62.61) | 37.27 (32.3) | |
| Delay 2: Total travel time for all visits (hours) | 2.9 (0.48) | 3.17 (0.61) | 1.88 (0.27) | |
| Total travel cost to all facilities (MX pesos) | 345.7 (48.5) | 301.42 (52.03) | 445.66 (104.99) | |
| Cost of care at first facility (MX pesos) | 3555 (1865.54) | 1283.33 (302.99) | 4139.14 (2340.66) | |
| Total cost for all visits (MX pesos) | 6749.32 (2915.49) | 1350 (328.93) | 8137.71 (3637.41) | |
| Delay 3: Wait time at first facility (hours) | 1.32 (0.29) | 1.58 (0.36) | 0.29 (0.08) | * |

*** p<.01, ** p<.05, * p<.1

Table 2b: Medians of measure of delay experienced by deceased children in the search for care

| Measure | Total (n=252) | Public first (n=199) | Private first (n=53) | p-value |
|---|---------------|----------------------|----------------------|---------|
| Delay 1: Time to start seeking care (hours) | 1 | 1 | 3 | |
| Number of places visited to seek care | 2 | 2 | 2 | *** |
| Travel distance to first facility (kms) | 6 | 6.5 | 3 | |
| Travel time to first facility (hours) | 0.5 | 0.5 | 0.33 | |
| Travel cost to first facility (MX pesos) | 70 | 70 | 70 | |
| Total distance traveled for all visits (kms) | 12 | 17 | 4 | |
| Delay 2: Total travel time for all visits (hours) | 1 | 1 | 1.17 | |
| Total travel cost to all facilities (MX pesos) | 120 | 100 | 150 | |
| Cost of care at first facility (MX pesos) | 700 | 1000 | 700 | |
| Total cost for all visits (MX pesos) | 800 | 1000 | 750 | |
| Delay 3: Wait time at first facility (hours) | 0 | 0 | 0 | * |

*** p<.01, ** p<.05, * p<.1

We then explored the factors associated with the occurrence of each delay. Table 3 presents the odds ratios of presenting the first delay (start search for care) for each covariate, crude and adjusted for all variables in the final model. After adjustment for covariates, children who sought care first in public hospitals had lower odds of presenting this delay, that is, starting the search for care one hour or more after the problem was identified by the mother (adjusted OR=0.38, 95% CI 0.16, 0.86). Children whose caregiver reported coughing, lethargy, or rash as a symptom in the verbal autopsy were more likely to delay

the start of searching for care as compared to children whose caregiver did not report these symptoms (adjusted OR=4.38, 95% CI 1.14, 18.06, adjusted OR=2.68, 95% CI 1.20, 6.16, and adjusted OR=5.54, 95% CI 1.71, 21.54, respectively). Contrastingly, children whose caregivers reported grunting as a symptom were less likely to delay the start of the search for care than those whose caregiver did not report this symptom (adjusted OR=0.23, 95% CI 0.08, 0.57).

Table 3. Factors associated with beginning search for care among deceased children under 5, Yucatan, Mexico, 2015-2016

| | First delay (n=252) Crude OR (95% CI) | Adjusted OR (95% CI) ^a |
|-------------------------------------|--|-----------------------------------|
| Enrollment in medical insurance | | |
| Social security (IMSS or ISSSTE) | 1.0 (Ref) | 1.0 (Ref) |
| No insurance | 1.28 (0.87, 1.89) | 2.83 (0.43, 24.48) |
| Seguro Popular | 0.94 (0.82, 1.09) | 0.85 (0.43, 1.68) |
| Place of death | | |
| Private facility | 1.0 (Ref) | 1.0 (Ref) |
| Private hospital | 1.21 (0.88, 1.65) | 1.12 (0.23, 6.62) |
| Public facility | 0.94 (0.77, 1.14) | 0.55 (0.22, 1.36) |
| Public hospital | 0.80** (0.68, 0.95) | 0.38** (0.16, 0.86) |
| Age group | | |
| Neonate ^b | 1.0 (Ref) | 1.0 (Ref) |
| Child | 1.21*** (1.06, 1.37) | 1.53 (0.59, 4.11) |
| Cause of death | | |
| CoD other | 1.0 (Ref) | 1.0 (Ref) |
| CoD congenital | 0.88 (0.75, 1.04) | 0.75 (0.31, 1.73) |
| CoD perinatal | 0.84** (0.72, 0.97) | 0.75 (0.31, 1.80) |
| Symptoms reported in verbal autopsy | | |
| Bulging fontanelle | 1.13 (0.83, 1.52) | 0.76 (0.15, 3.67) |
| Cough | 1.29*** (1.10, 1.50) | 4.38** (1.14, 18.06) |
| Cough severe | 1.14 (0.90, 1.45) | 0.51 (0.12, 2.16) |
| Lasting cough | 1.35*** (1.11, 1.65) | 1.46 (0.33, 6.71) |
| Diarrhea | 1.25*** (1.06, 1.47) | 1.78 (0.73, 4.48) |
| Die suddenly | 0.90 (0.78, 1.03) | 1.28 (0.57, 2.87) |
| Fever | 1.24*** (1.09, 1.42) | 1.61 (0.66, 3.93) |
| Fever severe | 1.08 (0.87, 1.33) | 0.60 (0.18, 1.94) |
| Lasting fever | 1.16 (0.89, 1.52) | 1.01 (0.23, 4.68) |
| Grunt | 0.96 (0.82, 1.13) | 0.23*** (0.08, 0.57) |
| Lethargic | 1.06 (0.90, 1.24) | 2.68** (1.20, 6.16) |
| Rash | 1.42*** (1.19, 1.71) | 5.54*** (1.71, 21.54) |
| Lasting rash | 1.27 (0.92, 1.78) | 0.54 (0.08, 3.80) |
| Skin (flaking, red, or black) | 1.10 (0.93, 1.30) | 1.50 (0.66, 3.44) |

^a Adjusted by variables in the table.

^b Neonates are classified as under 29 days old and children are classified as 29 days to 5 years.

*** p<.01, ** p<.05, * p<.1

Table 4 presents the analysis of factors associated with the second delay (transport time). After adjustment for covariates, children who were entitled to Seguro Popular had twice the odds of having a one-hour or longer travel time as compared to children with other forms of medical insurance (adjusted OR=2.31, 95% CI 1.10, 5.00). When analyzing the symptoms reported in the verbal autopsy, children whose caregiver reported cough or a skin condition as a symptom were more likely to have long travel times (adjusted OR=6.02, 95% CI 1.25, 35.77, adjusted OR=2.14, 95% CI 0.89, 5.32 respectively), while children whose caregiver reported lasting cough as a symptom had lower odds of presenting this delay as compared

to those who did not report it (adjusted OR=0.15, 95% CI 0.02, 0.78). Children who had to visit two or more facilities to seek care had much higher odds of experiencing this delay compared to children who visited only one facility (adjusted OR=16.13, 95% CI 7.16, 39.48). We also adjusted for cost of transportation; however, due to missing data, this brought the number of complete cases down by over half to n=114. Cases that had higher than the median transportation costs had significantly higher odds of experiencing a travel time of one hour or longer (adjusted OR=4.30, 95% CI 1.19, 17.71).

Table 4. Factors associated with delays in transportation among deceased children under 5, Yucatan, Mexico, 2015-2016

| | Second delay (n=252) | |
|-------------------------------------|----------------------|-----------------------------------|
| | Crude OR (95% CI) | Adjusted OR (95% CI) ^a |
| Enrollment in medical insurance | | |
| Social security (IMSS or ISSSTE) | 1.0 (Ref) | 1.0 (Ref) |
| No insurance | 1.06 (0.72, 1.57) | 1.14 (0.14, 8.88) |
| Seguro Popular | 1.16** (1.00, 1.34) | 2.31** (1.10, 5.00) |
| Place of death | | |
| Private facility | 1.0 (Ref) | 1.0 (Ref) |
| Private hospital | 0.80 (0.58, 1.11) | 0.65 (0.12, 3.38) |
| Public facility | 0.87 (0.72, 1.07) | 0.92 (0.34, 2.44) |
| Public hospital | 0.82** (0.69, 0.97) | 1.85 (0.69, 5.09) |
| Age group | | |
| Neonate ^b | 1.0 (Ref) | 1.0 (Ref) |
| Child | 1.01 (0.89, 1.15) | 0.43 (0.14, 1.26) |
| Cause of death | | |
| CoD other | 1.0 (Ref) | 1.0 (Ref) |
| CoD congenital | 1.16* (0.98, 1.36) | 2.09 (0.82, 5.47) |
| CoD perinatal | 1.07 (0.92, 1.24) | 1.69 (0.66, 4.37) |
| Delay | | |
| First delay | 1.08 (0.95, 1.22) | 0.96 (0.47, 1.97) |
| Number of places visited | | |
| One facility | 1.0 (Ref) | 1.0 (Ref) |
| Two or more facilities | 1.60*** (1.43, 1.79) | 16.13*** (7.16, 39.48) |
| Symptoms reported in verbal autopsy | | |
| Bulging fontanelle | 1.07 (0.79, 1.45) | 0.74 (0.14, 4.08) |
| Cough | 1.15* (0.98, 1.35) | 6.02** (1.25, 35.77) |
| Cough severe | 1.08 (0.85, 1.38) | 0.60 (0.11, 3.19) |
| Lasting cough | 0.96 (0.79, 1.17) | 0.15** (0.02, 0.78) |
| Diarrhea | 1.08 (0.92, 1.28) | 1.69 (0.63, 4.58) |
| Die suddenly | 0.88* (0.76, 1.01) | 0.80 (0.34, 1.90) |
| Fever | 1.08 (0.94, 1.23) | 1.46 (0.55, 3.92) |
| Fever severe | 1.07 (0.87, 1.32) | 0.71 (0.20, 2.46) |
| Lasting fever | 1.19 (0.91, 1.56) | 1.81 (0.38, 9.79) |
| Grunt | 1.22** (1.04, 1.43) | 1.77 (0.67, 4.82) |
| Lethargic | 1.00 (0.85, 1.17) | 0.95 (0.39, 2.33) |
| Rash | 1.08 (0.89, 1.31) | 1.36 (0.43, 4.57) |
| Lasting rash | 0.86 (0.61, 1.20) | 0.24 (0.03, 1.57) |
| Skin (flaking, red, or black) | 1.17* (0.99, 1.38) | 2.14* (0.89, 5.32) |

^a Adjusted by variables in the table.

^b Neonates are classified as under 29 days old and children are classified as 29 days to 5 years.

*** p<.01, ** p<.05, * p<.1

Factors related to the third delay (waiting times in health facilities) are presented in Table 5. In the final multivariable model, children who first sought care in a public facility or

hospital had higher odds of having a wait time as compared to those waiting up to one hour (adjusted OR=4.97, 95% CI 1.83, 14.57, adjusted OR=4.56, 95% CI 1.70, 13.25, respectively). Children reported to have had a bulging fontanelle as a symptom had higher odds of having long waiting times at the health unit (adjusted OR=17.77, 95% CI 2.67, 360.25). Children whose caregiver reported a rash or sudden infant death syndrome as a symptom had lower odds of having this delay (adjusted OR=0.24, 95% CI 0.07, 0.75, and adjusted OR=0.46, 95% CI 0.19, 1.07, respectively). Children who presented the first delay (time to decide to seek care) and visited two or more facilities also had positive odds of presenting the third one (adjusted OR=2.26, 95% CI 1.18, 4.41, adjusted OR=2.79, 95% CI 1.29, 6.15).

Table 5. Factors associated with facility waiting times among deceased children under 5, Yucatan, Mexico, 2015-2016

| | Third delay (n=252) | |
|-------------------------------------|----------------------|-----------------------------------|
| | Crude OR (95% CI) | Adjusted OR (95% CI) ^a |
| Enrollment in medical insurance | | |
| Social security (IMSS or ISSSTE) | 1.0 (Ref) | 1.0 (Ref) |
| No insurance | 0.82 (0.56, 1.21) | 0.31 (0.03, 2.44) |
| Seguro Popular | 0.92 (0.80, 1.06) | 0.59 (0.29, 1.20) |
| Place of death | | |
| Private facility | 1.0 (Ref) | 1.0 (Ref) |
| Private hospital | 1.31 (0.95, 1.79) | 3.04 (0.61, 15.90) |
| Public facility | 1.20* (0.99, 1.46) | 4.97*** (1.83, 14.57) |
| Public hospital | 1.08 (0.91, 1.29) | 4.56*** (1.70, 13.25) |
| Age group | | |
| Neonate ^b | 1.0 (Ref) | 1.0 (Ref) |
| Child | 1.22*** (1.07, 1.38) | 0.71 (0.24, 2.09) |
| Cause of death | | |
| CoD other | 1.0 (Ref) | 1.0 (Ref) |
| CoD congenital | 0.88 (0.75, 1.04) | 0.53 (0.21, 1.25) |
| CoD perinatal | 0.86** (0.74, 0.99) | 1.08 (0.42, 2.87) |
| Delays | | |
| First delay | 1.19*** (1.05, 1.34) | 2.26** (1.18, 4.41) |
| Second delay | 1.08 (0.95, 1.22) | 0.90 (0.45, 1.79) |
| Number of places visited | | |
| One facility | 1.0 (Ref) | 1.0 (Ref) |
| Two or more facilities | 1.22*** (1.08, 1.38) | 2.79*** (1.29, 6.15) |
| Symptoms reported in verbal autopsy | | |
| Bulging fontanelle | 1.67*** (1.25, 2.24) | 17.77** (2.67, 360.25) |
| Cough | 1.21** (1.04, 1.42) | 1.77 (0.46, 6.92) |
| Cough severe | 1.09 (0.86, 1.39) | 0.44 (0.10, 1.87) |
| Lasting cough | 1.27** (1.04, 1.54) | 0.65 (0.15, 2.87) |
| Diarrhea | 1.24** (1.05, 1.46) | 1.63 (0.65, 4.15) |
| Die suddenly | 0.78*** (0.68, 0.89) | 0.46* (0.19, 1.07) |
| Fever | 1.32*** (1.16, 1.50) | 2.05 (0.86, 4.95) |
| Fever severe | 1.32*** (1.07, 1.62) | 2.32 (0.75, 7.77) |
| Lasting fever | 1.37** (1.05, 1.79) | 2.07 (0.46, 10.26) |
| Grunt | 1.22** (1.04, 1.43) | 1.91 (0.76, 4.88) |
| Lethargic | 0.89 (0.76, 1.04) | 0.86 (0.34, 2.09) |
| Rash | 1.08 (0.90, 1.30) | 0.24** (0.07, 0.75) |
| Lasting rash | 1.03 (0.74, 1.43) | 1.10 (0.15, 7.60) |
| Skin (flaking, red, or black) | 1.00 (0.84, 1.18) | 0.56 (0.22, 1.35) |

^a Adjusted by variables in the table.

^b Neonates are classified as under 29 days old and children are classified as 29 days to 5 years.

*** p<.01, ** p<.05, * p<.1

After fitting models adjusting by the wealth index, mother's education, and mother's age, results were overall consistent when analyzing the subsample of cases with information about the woman's characteristics (N=69), with the exception that cases with Seguro Popular were less likely to present the first delay as compared to cases using other forms of

insurance (adjusted OR=0.66, 95% CI 0.46, 0.94). When adjusting for socioeconomic characteristics, all variables in the second delay model kept odd ratios estimates in the same direction but became non-significant (maybe due to a reduced sample size), and in the third delay model, cases that experienced a second delay of longer than one-hour travel time had higher odds of experiencing a wait time at the health facility (adjusted OR=1.44, 95% CI 1.06, 1.95). Children who showed symptoms of diarrhea and severe fever had higher odds of experiencing a wait time at the health facility when controlling for socioeconomic characteristics (adjusted OR=1.63, 95% CI 1.05, 2.54, adjusted OR=2.11, 95% CI 1.23, 3.62, respectively).

Discussion

This study showed that children under 5 who died in the State of Yucatan, Mexico, during 2015 and 2016 still faced important delays in their search for care. A substantial proportion of children visited more than one facility to seek care, with long times to start seeking care. The beginning of the search for care process was shorter when mothers or caregivers sought care initially at a public facility, and longer when some symptoms like coughing, lethargy, or rash were detected in the child. The second delay, travel time to facilities, was longer for children enrolled in Seguro Popular as compared to children covered by other forms of social security. Finally, the third delay, waiting time to be attended in the facility, was more common in public facilities that are not hospitals, and longer among children who also experienced a long travel time to seek care.

Despite the claim that Mexico reached universal health coverage in 2012,^[i] delays in the search for care, such as those documented in this paper, suggest that this population still faces important delays in accessing health care for children under 5. The use of verbal autopsies allowed us to identify that certain symptoms were related to an early or late search for care. Among the Mexican population, the presence of some symptoms can be considered “normal” and does not trigger care-seeking in a timely manner.^[ii] Health promotion activities are required among mothers and caregivers for early recognition of

alarming signs and symptoms in children under 5, and a prompt start of the search for care.

When searching for care, 22.6% of cases visited two or more facilities, and 5.6% went to three or four facilities. This is likely because families are seeking care at nearby health facilities that may not have the appropriate capacity to treat life-threatening illness in children. These cases may have been referred to appropriate facilities. In 5.6% of the cases that were referred to a second facility, the family was referred a second time to go to a third facility. We cannot tell from our data whether the first referral was medically inappropriate or whether the child's condition changed while traveling to the second facility and if upon arrival the second facility was no longer appropriate. However, it is concerning that children who had long travel times (either visiting only one facility or having to visit several facilities to receive care) were also at higher risk of facing long waiting times. On one hand, it is important to empower the population with resources to look for care for children in an effective way and in a timely manner, as it has been done in other cases like delivery care in Mexico.⁴ But it is also important to reinforce referral systems across the health system to facilitate prompt care in cases that have visited different health facilities searching for care and have a longer travel time.

This study has some limitations that should be considered in the interpretation of results. First, our analysis only includes children who died and therefore may have experienced a more complicated search for care process than those who survived after facing a comparable medical condition. We are presenting the search for case process only in cases with death as the outcome, and the process may have been more effective in cases in which the child survived. However, the problems faced by this population are also relevant in the planning of health systems. In a future phase of this project, we hope to capture information about the search for care process of children who had complications but survived.

Another limitation of this study is that we capture information about the symptoms experienced by the child in the verbal autopsy through the report of the child's mother or caregiver. Limitations in the quality of information from verbal autopsies and its variations

over time have been documented.[iii] However, we have focused this study on how the recognition of symptoms by the mother or caregiver can affect the search for care, more than on the actual accuracy of the reporting.

Finally, although receiving appropriate care once the health facility is reached is important, [iv] in this study we were not able to analyze in detail factors related to the prompt provision of care or quality of care. This can affect the final outcome of the care of a child, and in turn could influence the inclusion of a case in the study.

[i] Editorial Board. Mexico: celebrating universal health coverage. *The Lancet*. 2012;380(9842):622; doi: 10.1016/S0140-6736(12)61342-7.

[ii] Castro R, Campero L, Hernández B, Langer A. A Study on Maternal Mortality in Mexico Through a Qualitative Approach. *J Womens Health Gen Based Med*. 2000;9(6):679-690; doi:10.1089/15246090050118206.

[iii] Serina P, Riley I, Hernandez B, Flaxman AD, Praveen D, Tallo V, Joshi R, Sanvictores D, Stewart A, Mooney M, Murray CJL, Lopez AD. What is the optimal recall period for verbal autopsies? Validation study based on repeat interviews in three populations. *Population Health Metrics*. 2016;14:40; doi:10.1186/s12963-016-0105-1.

[iv] Knight HE, Self A, Kennedy SH. Why Are Women Dying When They Reach Hospital on Time? A Systematic Review of the 'Third Delay'. *PLoS ONE*. 2013;8(5):e63846; doi:10.1371/journal.pone.0063846

Conclusions

This study highlighted the delays faced by mothers and caregivers in the search for care for children under the age of five who died in the State of Yucatan, Mexico, during 2015–2016. The results suggest that health promotion actions to reduce the time to search for care when facing a health problem and providing resources to mothers and caregivers to access health services in a timely manner are required these delays. Given the relative importance of the first delay, special efforts to reduce it should be implemented. Innovative approaches using mass media have been successful in other countries to promote early search for care in the prevention of child mortality, and could be implemented in settings like this as well.[i]

Actions of the health system to improve referral systems and care for emergencies may also help to reduce delays in care for children under 5. This information can help in the planning of health services and improve their impact on population health.

[i] Murray J, Remes P, Ilboudo R, Belem M, Salouka S, Snell W, Wood C, Lavoie M, Deboise L, Head R. The Saturation+ Approach to Behavior Change: Case Study of a Child Survival Radio Campaign in Burkina Faso. *Glob Health Sci Pract.* 2015;3(4):544-556; doi:[10.9745/GHSP-D-15-00049](https://doi.org/10.9745/GHSP-D-15-00049).

Declarations

Ethics approval and consent to participate

All interviewees provided a signed informed consent to participate, and ethical approval for the study was granted by the Internal Review Boards of the University of Yucatan, the Hospital Agustín O'Horán (Merida, Yucatan), and University of Washington.

Consent for publication

Not applicable

Availability of data and materials

The datasets generated and analyzed during the current study are available in the Global Health Data Exchange repository, <http://ghdx.healthdata.org/>.

Competing interests

The authors declare that they have no competing interests.

Funding

This study was funded by the W.K. Kellogg Foundation, grant number P3032287. AMK is funded by the National Institutes of Health T32 grant (T32GM086270). The funding bodies did not have any role in the design, analysis, or drafting of this manuscript.

Author contributions

BH: conceptualization and design of the study, analysis and interpretation of the data, writing and preparation of the manuscript. ER: conceptualization and design of the study,

interpretation of the data. AF, EP, and JC: conceptualization and design of the study, analysis and interpretation. RO, RO, and MGA: analysis and interpretation of the data. LJ: analysis and interpretation of the data and preparation of the manuscript. AC and NM: analysis of the data. CJ: conceptualization and design of the study. AMK: design and interpretation of the data. All authors read and approved the final manuscript.

Acknowledgments

We appreciate the collaboration of the authorities of the Secretary of Health of Yucatan and the Hospital Agustín O´Horán for the conduction of this study.

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Figures

Factors affecting service utilization and outcome

Delays

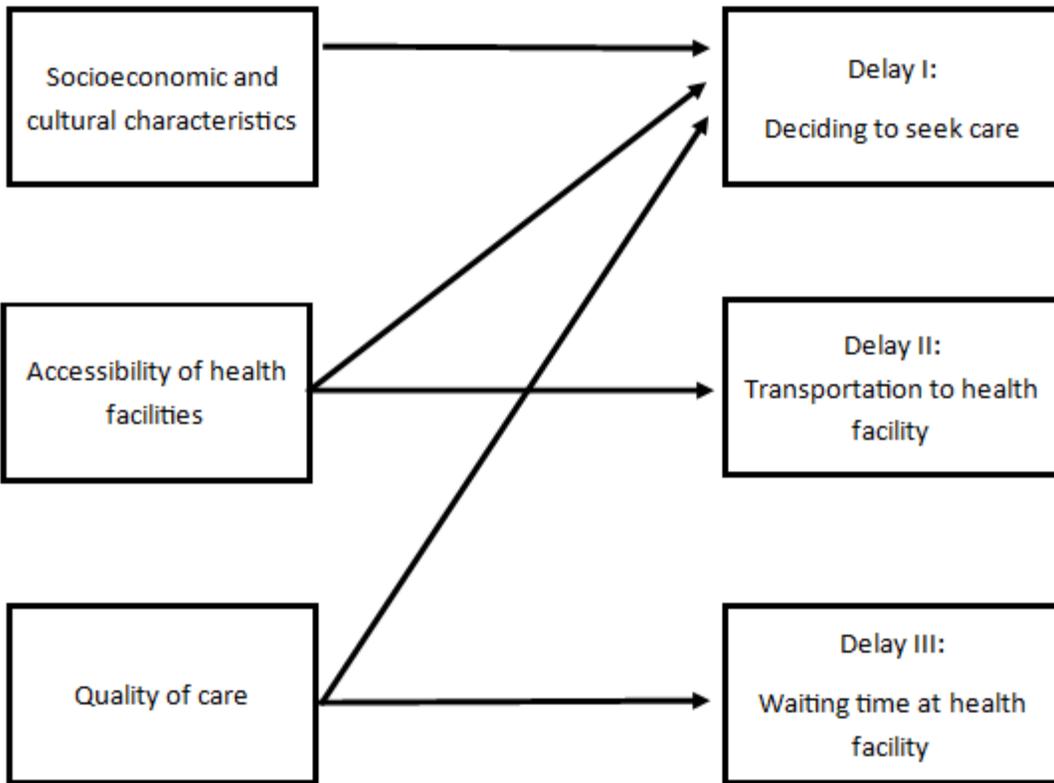


Figure 1

The three delay framework