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## Poverty and Paternal Education Associated with Infant Safe Sleep Intentions in a Peri-Urban Community in Ecuador

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## Abstract

Ecuador's annual mortality rate from SIDS is 0.4 per 100 000 people, 4 times higher than neighboring countries Peru, Bolivia, and Brazil. Modifying the infant sleep environment toward safe practice has been demonstrated to be the most effective risk reduction strategy in reducing mortality from SIDS and little is known about sleep practices in Ecuador. The purpose of this study is to describe baseline infant sleep intentions of pregnant women in a peri-urban, low resource community in Ecuador. We also aim to identify demographic and psychosocial factors associated with suboptimal sleep practices in this context to develop long-term strategies to identify infants with high risk for SIDS/SUID. A cross-sectional study design was employed with 100 women in their third trimester of pregnancy. The majority of women were partnered (82%), both parents had approximately 8 years of education, and over half reported that their incomes met or exceeded their basic needs (55%). Significant predictors of safer sleep intention included years of paternal education ( $P = .019$ ) and income meeting their basic needs ( $P = .0049$ ). For each additional year of paternal education, families were 23% more likely to report safer intended infant sleep practices. Compared to those whose income did not allow for basic needs, those who had sufficient income to meet (or exceed) basic needs were 425% more likely to report safer intended sleep practices. Targeted interventions to high-risk populations may reduce the burden of SIDS/SUID in this community.

## Keywords

Safe Infant Sleep, Ecuador, South America, SIDS, SUID, sleep position, bed-sharing

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## Introduction

Sudden unexpected infant death (SUID) is the death of an infant less than 1 year of age that occurs suddenly and unexpectedly, and whose cause of death is not immediately obvious before investigation.<sup>1</sup> SUIDs account for over 4000 deaths annually in the United States (US), this includes deaths categorized as sudden infant death syndrome (SIDS) where after case investigation the death remains unexplained.<sup>2,3</sup> The highest incidence of SIDS occurs between 2 and 4 months of age, and 95% occur prior to 6 months.<sup>3</sup> A dramatic decrease in SIDS mortality (approximately 50%) prior to 1999 in the US, many European countries, Australia, and New Zealand was

attributed to supine sleep promotion and “Back to Sleep” campaigns.<sup>4,5</sup> Modifying the infant sleep environment has been demonstrated to be the most effective risk reduction strategy in reducing mortality from SIDS.<sup>6</sup>

The American Academy of Pediatrics (AAP) in the US updated evidenced based recommendations in 2016,

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(1) to position the infant in the supine position, (2) to use a firm sleep surface, (3) to be in the same room as the infant but not bed-share, and (4) to avoid the use of soft bedding and overheating to prevent SUID.<sup>7,8</sup> Other risk reduction AAP recommendations include avoidance of illicit drugs, alcohol, and exposure to smoke; routine immunization; breastfeeding; and use of a pacifier.<sup>8</sup> Psychosocial, socio-economic, and demographic characteristics that are associated with SIDS mortality or safe sleep practice can be context specific, thus it is imperative to understand factors that are associated with risk by examining the local context.<sup>9-12</sup>

There are no previous studies in Ecuador regarding safe infant sleep practices, however researchers from other South American communities found high rates of unsafe infant sleep practices. In a Peruvian study, caregivers identified back to sleep as the safest position in just 36% of cases and 75% of infants co-slept with their parents.<sup>13</sup> Similarly, in Porto Alegre, Brazil, 24% of infants and in Argentina 49% of infants were placed back to sleep before safe infant sleep practices were implemented in those communities.<sup>14,15</sup> In a different community in Brazil, habitual infant bed-sharing with the mother was 48.3% at 3 months of life.<sup>16</sup>

The purpose of this study is to describe baseline infant sleep intentions of pregnant women prior to AAP safe sleep education in a peri-urban, low resource community in Ecuador. We also aim to identify demographic and psychosocial factors associated with suboptimal sleep practices to develop long-term strategies to identify infants with a high risk for SIUD with our Ecuadorian and community partners.

## Background

There are challenges in reporting accurate data regarding infant death in the region where this study took place. SIDS data in Ecuador is collected by the Ministerio de Salud Publica (MSP, Ministry of Health) but to our knowledge is not published or reported. One of our co-authors requested unpublished raw mortality data from the Ecuadorian MSP which revealed that the province of Santo Domingo de los Tsáchilas reported the highest number of SIDS deaths of all provinces in 2018, 4 SIDS deaths in a population of 450 694 people (non-age-adjusted; approximately 0.89 per 100 000).<sup>17</sup> Many researchers have cited a health statistics data site no longer available, Healthgrove.com, and reported Ecuador's annual mortality rate from SIDS is 0.4 per 100 000 people, twice the global annual mortality rate for SIDS (0.2 per 100 000 people) and 4 times neighboring countries of Peru, Bolivia, and Brazil (around 0.1 per 100 000 people).<sup>18</sup> Additional information

collected in interviews with clinic partners prior to the onset of this study indicated that there were 3 infant deaths attributed to SIDS in the patient population at the study site, community health clinic, in the last 5 years. Physicians in Ecuador are advised to teach safe sleep guidelines similar to the AAP as part of a well child exam, prevention of injury and disease, as part of their first consult 3 to 5 days after birth and every visit up to 1 year.<sup>19</sup>

The authors of this paper are part of a sustained Ecuadorian partnership between a non-governmental organization, a US academic institution, and a community health clinic in a low-resource community in the province of Santo Domingo de los Tsáchilas. Preliminary interviews with our clinic partners in designing this study revealed that bed-sharing and prone positioning are common in their community, most education regarding infant sleep occurs in the hospitals or from family guidance, and poverty may limit their ability to provide a safe sleep surface. Globally (including in several US states) health providers are distributing a cardboard baby box, mattress, and baby gifts for free as part of a packaged program to incentivize prenatal care and promote safe sleep primarily targeting those living in poverty.<sup>20</sup> The current study is the first phase of a longitudinal randomized control trial to study how AAP safe sleep education and the provision of a cardboard baby box to pregnant women in their last trimester influences infant sleeping practices during the first 6 months of life. This study takes place in a peri-urban, low-resource community with pregnant women receiving care at a community health clinic in the Ecuadorian province of Santo Domingo de los Tsáchilas. These findings inform the longitudinal study and which is part of a long-term strategy to improve infant care and decrease risk factors associated with infant mortality and morbidity with community partners in Ecuador.

## Methods

### *Design and Sample*

A cross-sectional, descriptive design was employed for this stage of the study. Women in their third trimester of pregnancy who received care at a community clinic from May 2018 to September 2019 were invited to participate in the project. All pregnant women voluntarily agreed to participate and provided informed consent to a structured questionnaire in Spanish. Survey questions included risk factors for SIUD and intentions about the infant sleep environment. Prior bioethics board approval was obtained at an Ecuadorian university and Institutional Review Board approval was obtained from the University of Kentucky in the United States.

## Measures

Self-reported demographic data included maternal age, reproductive history, race or ethnicity, income, education level of participant and father of the baby, and relationship status. Self-reported behavioral and psychosocial data included drug/alcohol use, depression, smoking status, and intent to breastfeed. Drug and alcohol use was assessed using the Two-Item Conjoint Screen for Alcohol and other Drug Problems (TICS), which demonstrates nearly 80% sensitivity and specificity to detect current substance use disorders in primary care when at least 1 positive response is elicited.<sup>21</sup> The Patient Health Questionnaire-2 (PHQ2) was used to screen for depression. We selected the cut-point of  $\geq 2$  as this was indicated by Manea et al<sup>22</sup> for screening populations with high risk for depression, prior qualitative work in this community with women of reproductive age suggested this was the case.<sup>23</sup> This tool demonstrates 91% sensitivity, and 70% specificity in identifying depression.<sup>22</sup>

Four categories of sleep environment intentions were collected from the mother as to her future plans for the infant sleep environment; (1) planned sleep location (mother's room or other), (2) sleep surface (mother's bed, bassinet, crib, or other), (3) position (on stomach, on side, or on back), and (4) use of soft/loose bedding/stuffed animals (yes or no). Rationale for choosing those practices was also asked as a brief open-ended question.

As a means to simplify the data the authors created an Index of the Safest Infant Sleep Practices based on the 4 AAP recommended safe sleep variables being measured (mother's bedroom, no bed-sharing, supine position, and no items in the sleep environment). Each variable was given equal weight (1 point, with a range of 0–4). This index was used to characterize the intentions of all participants.

## Data Analysis

Descriptive statistics, including means and standard deviations or frequency distributions, were used to summarize the study variables. Multiple logistic regression modeling was used to evaluate whether demographic, personal, and depressive symptoms indicators were associated with the intention to practice safe sleeping following the birth of their baby. Some of the demographic and personal characteristics were not included in this model either because of small group sizes or because there were few to no participants who were positive for a given attribute. For example, race/ethnicity was not included in the multivariable model because

the majority of participants were Mestizo, but there was not an intuitive way to combine any of the remaining racial/ethnic groups, and the number of women in each of these smaller racial/ethnic categories was too limited to consider separately in the model. As another example, there was no variability in plans to breastfeed and very few were positive for smoking and/or drug/alcohol screening. We evaluated the overall model significance with the likelihood ratio test with the remaining variables included in the model as potential predictors of safer sleep practices, and the fit of the model with the Hosmer-Lemeshow goodness-of-fit test. Variance inflation factors were evaluated as a check against the presence of multicollinearity. All analysis was done with SAS<sup>®</sup>, v. 9.4; an alpha level of .05 was used for inferential testing.

## Results

As shown in Table 1, the average age of the 100 pregnant women who participated in the study was 24 years, with a range from 15 to 41. The majority of participants were Mestizo (81%), while the remaining mothers belonged to smaller racial/ethnic groups, including Afro-Ecuadorian ( $n=7$ ), White ( $n=6$ ), Montubio ( $n=3$ ), and Indigenous ( $n=2$ ). The average number of years of education for both mothers and fathers was 8; maternal education ranged from 1 to 15 years, while paternal education had a range from 1 to 12 years. More than 3-quarters of the participants were married/partnered (82%). A slight majority indicated their household income met or exceed their basic needs (55%). Most of the participants indicated they had been pregnant prior to this pregnancy (65%), and all of the women said they intended to breastfeed their baby. Only 1 indicated current smoking (1%) and 6% had a positive drug/alcohol screen. Slightly more than half had an elevated PHQ-2 assessment for depression, as evidenced by a score of 2 or greater (54%).

Slightly more than 1-third responded to the sleep practices question with a score of 3 or 4, suggesting they are planning to use the AAP safe sleep practices (35%). All but 1 participant intended for the new baby to sleep in their room, 75% intended to bed-share. Over half of the participants planned to have their child sleep on their side (51%), 28% intend to place their newborn on their back to sleep/supine, and 20% on their stomach/prone. Almost a quarter (23%) intended to let their baby sleep with loose blankets/pillows or stuffed animals (Table 2).

The logistic model was significant overall (likelihood ratio  $\chi^2=21.8$ ,  $P=.0027$ ), suggesting the variables included in the model predicted the safer sleep practices

**Table 1.** Demographics, Personal Characteristics, Depressive Symptoms Screening, and Planned Sleep Practices, As Indicated by All Participants (N= 100).

Variable	Mean (SD) with range OR n (%)
Age	24.2 (6.2) range: 15-41 years
Race/ethnicity	
Mestizo	81 (82%)
Other race/ethnicity	18 (18%)
Maternal education	8.0 (3.3) range: 1-15 years
Paternal education	7.8 (3.2) range: 1-12 years
Relationship status	
Married/partnered	82 (82%)
Single	18 (18%)
Income meets basic needs	
Yes	54 (55%)
No	45 (45%)
Primipara	
Yes	35 (35%)
No	65 (65%)
Plan to breastfeed this baby	
Yes	100 (100%)
No	0 (0%)
Smoke cigarettes	
Yes	1 (1%)
No	99 (99%)
Positive drug/alcohol screen	
Yes	6 (6%)
No	94 (94%)
Depressive symptoms (PHQ-2 $\geq$ 2)	
Yes	53 (54%)
No	46 (46%)
Intend safer sleep practice	
Yes (3 – 4)	35 (35%)
No (0 – 2)	65 (65%)

Abbreviation: PHQ-2=Patient Health Questionnaire-2.

indicator. As shown in Table 3, the significant predictors included years of paternal education ( $P=.019$ ) and the indicator for whether the household income met their basic needs ( $P=.0049$ ). For each additional year of paternal education, families were 23% more likely to indicate they planned to use safer sleep practices. Compared to those whose income did not allow for basic needs, those who had sufficient income to meet (or exceed) basic needs were 425% more likely to indicate they planned to use safer sleep practices. Other variables in the model were not significant predictors of this outcome. The Hosmer-Lemeshow test for this model was not significant ( $P=.63$ ), indicating that the data fit the model well. In addition, the variance inflation factors were all less than 1.5, which suggests that there was no distortion of parameters due to multicollinearity.

## Open-Ended Rationale Responses

Women were asked to elaborate on their rationale for why they chose each intended sleep practice. The authors then characterized these in to similar categories and ranked the most common open-ended response to least common. The first 2 categories; room and sleep surface were combined in rationale part of the survey and referred to as “place to put your baby to sleep?” (Table 2).

### Place

The majority of the participants who answered the safest place (mothers who intended to have the infant sleep in their room, but not in the mother’s bed) reported they did this for comfort followed by safety. Several indicated responses tied to independence; “avoid spoiling the baby,” “the baby needs his own space,” and to “teach him to sleep alone.”

Mothers who intended to bed-share reported that this was most convenient to provide care, comfort, and for breastfeeding, followed by protecting the infant, to have close-proximity, and safety. Several did not have a crib, and many reported they lacked money to purchase one. Lastly, social norms and tradition were identified as rationales by several with responses such as “babies sleep with me for 1 year,” “have always done this,” and “because I want to.”

### Position

Mothers who intended to put the infant on their backs to sleep reported that their rationale for doing this was the following in ranked order; safety, avoid choking/suffocation, and the infant will sleep better. Of those who answered they intend to place the infant on their stomachs, they ranked the same first 3 as above, followed by tradition or norms, and a couple also reported this position to avoid scaring the baby. Mothers who intended to place the baby on their sides also prioritized safety, they indicated this was safer and better for the baby, as well as being more comfortable, followed by avoidance of choking, will allow the infant to sleep longer, and a few indicated they chose this for ease of breastfeeding.

### Items in the Sleep Environment

Mothers who intended to allow soft bedding, heavy blankets, or stuffed animals in the sleep environment prioritized their rationale as to provide warmth and protection, followed by comfort/“to snuggle” them, to avoid falls/safety, and finally due to habit or social norms or preference.



**Table 2.** Infant Sleep Patterns/Risks; Intentions for Current Pregnancy (n = 100).

Sleep intentions	n (%)	Reason for choices: ranked order from most to least common response
In the mother's room	99 (99%)	<i>Reasons for in Mother's bed and room:</i> (1) Convenience to provide care, comfort and for breastfeeding. (2) Protection, to have close. (3) Safety. (4) Don't have a crib/lack money. (5) Norms/tradition
Sleep surface*		<i>Reasons for NOT in mother's bed:</i> (1) For comfort, (2) Safety/avoid suffocation, and (3) independence ("baby need its own space," "to avoid spoiling him," and "teach him to sleep alone")
Mother's bed	75 (75%)	
Crib	20 (20%)	
Bassinet	3 (3%)	
Pack and Play( <i>corral</i> )	1 (1%)	
Sleep position*		<i>Reason to choose this position:</i>
On back	28 (28%)	On back: (1) Safety, (2) avoid choking/suffocation, and (3) sleeps better
On stomach	20 (20%)	On stomach: (1) Safety, (2) avoid choking, (3) sleeps better/comfort, (4) tradition/norms, and (5) Other: "so baby doesn't get scared"
On side	51 (51%)	On side: (1) Safer and better, (2) comfort, (3) avoid choking, (4) sleeps longer, (5) breastfeeding, and (6) other
Items in sleep space: loose or heavy blankets, pillows, and/or stuffed animals.		<i>If yes why:</i> (1) Warmth and protection, (2) comfort and to snuggle, (3) avoid falls/safety, and (4) norms/preference
No	77 (77%)	
Yes	23 (23%)	

\*Missing 1.

**Table 3.** Logistic Regression to Identify Predictors of Planning for Safer Baby Sleep Practices (n = 92).

Variable	Regression estimate	Standard error	Odds ratio (OR)	95% Confidence interval for OR	Wald chi-square (P-value)
Age	0.0369	0.0487	1.04	0.94-1.14	0.57 (.45)
Maternal education	-0.0059	0.0869	0.99	0.84-1.18	<0.1 (.95)
Paternal education	0.208	0.0885	1.23	1.04-1.46	5.52 (.019)*
Married/partnered	-0.200	0.695	0.82	0.21-3.20	0.083 (.77)
Income meets basic needs	1.658	0.590	5.25	1.65-16.66	7.90 (.0049)*
Primipara	0.214	0.620	5.25	0.37-4.17	0.12 (.73)
Depressive symptoms (PHQ-2 $\geq$ 2)	-0.536	0.517	0.59	0.21-1.61	1.08 (.30)
Hosmer-Lemeshow goodness-of-fit test: $\chi^2 = 6.15$ ; $P = .63$					

\* $p < 0.05$ .

Abbreviation: PHQ-2=Patient Health Questionnaire-2.

## Discussion

Understanding the context of infant sleep intentions and practices is vital to developing interventions to prevent SUID. The largest predictor of greater safe sleep practices in the community was related to socioeconomic status; women who reported their basic needs were met or exceeded were over 4 times more likely to report safer sleep practices. This is consistent with European literature related to SUID/SIDS. In England and Wales poverty and deprivation are identified as a predictor of SUID; the odds of a SUID is 3.5 higher in the poorest quintile as compared to the richest quintile.<sup>24</sup> Similarly, in the US, Bartick and Tomori<sup>25</sup> suggest SUID/SIDS deaths are the result of a co-occurring socially driven epidemics linked to poverty, discrimination, and structural inequities.

The only other independent protective factor associated with safer sleep practice in this study was paternal education. To our knowledge, this is the first study to indicate that each year of the father's education is associated with safer sleep intentions and presumably lowers the risk of SUID. Father involvement and support confer numerous perinatal, infant, and child health benefits,<sup>26</sup> but paternal education level has not been rigorously researched as it relates to sleep practices, SIDS, or infant mortality. Investigators in Indonesia found the father's level of education was equally as important as the mother's level in reducing child mortality.<sup>27</sup> However, in the Indonesian study the mother's education level was similar to that of the fathers, whereas in the current study the mother's education was not correlated with the father's. Surprisingly, the mother's age and level of education

was not related to the number of safe sleep practices, prior research with low income mothers in the US also failed to demonstrate a clear relationship between high levels of education and high maternal health literacy leading to safe infant sleep practices.<sup>28</sup>

Although antenatal and post-natal depression has been independently associated with SIDS,<sup>10</sup> in this context depression was not associated with safe sleep intentions. The women in this study had numerous protective factors related to SIDS, such as high rates of intention to breast feed, high rates of room-sharing, low rates of smoking, and drug/alcohol misuse.

Almost all women in the study (99%) reported their intention to place their sleeping infant in their room, citing mostly safety as their rationale. This practice conforms with the AAP recommendation of room-sharing, without bed-sharing, for ideally 1 year, but at least 6 months. In Ecuador it is very common to have 1 room for the whole family to sleep, which can be a cultural preference and not necessarily related to poverty.<sup>29</sup> Room sharing is likely easier to achieve in the context of poverty and close living quarters, where there are no other rooms to spare or where the whole living environment may be a single room.

Women in this study also reported high rates of bed-sharing intentions, history of bed-sharing, and breast-feeding. The analysis of the narrative rationales about bed-sharing suggest that poverty reinforces this practice. Some mothers indicated they did not have other sleep options, and some reported keeping infants in mother's bed protects them from other hazards related to animals, pests, and earthquakes. Women in the study also stated that at night it is easier to care for and breastfeed the infant in bed.

Bed-sharing while breastfeeding is a controversial topic regarding infant safety and risks for SUID/SIDS. In many cultures, the combination of both practices is widely adopted.<sup>16,30</sup> Recent published protocols developed by the Academy of Breastfeeding Medicine supported the concept of "breast-sleeping" defined as bed-sharing while breastfeeding and postulate that in the absence of known hazards, this may promote initiation, duration, and exclusivity of breastfeeding.<sup>31,32</sup> Further, some anthropologists argue that the labeling of one sleeping arrangement as unsafe without assessing the social context can be harmful, and that breastfeeding and bed-sharing constitute an integrated system in which bed-sharing facilitates breastfeeding at night and reinforces the mother's desire for bed-sharing.<sup>16,30</sup>

Safety was the primary driver as the rationale for why mothers selected the specific sleep position for the infant. For those who chose side and stomach positions, this may indicate lack of knowledge to make informed,

safe choices. Women in Ecuador do have access to free perinatal care, where they could receive this education through the local ministry of health clinic, however in this community, there is only 1 public clinic to serve a large catchment area. Findings from a qualitative study in this community included women reporting difficulty getting appointments, poor quality of care and inconsistent services.<sup>23</sup> Informal pre-educational survey with the nursing staff and lay health workers at the community clinic, where the study was conducted, revealed that they believed that prone sleep position was a safe position to avoid choking. Even when the data and AAP guidelines were presented, there was some hesitation and disbelief, as this does not immediately over-ride generations of traditions and familial advice.

## Limitations

A more comprehensive mixed methods study would have elicited a better understanding of cultural and socio-economic factors that contribute to infant sleep practices. In the context of "breast-sleeping" or family co-sleeping, important factors that increase the risk of SUID not assessed in this study include parental Body Mass Index, paternal or partner smoking behaviors, alcohol, and drug use, if the partner is also bed-sharing.

## Conclusions

In this community, poverty has a negative impact on safe infant sleep practices, as women who were not able to meet their basic needs were significantly less likely to meet the current safe sleep recommendations from the AAP. Surprisingly, paternal and not maternal education had a positive impact on safe infant sleep intentions on the mothers-to-be. This finding may reflect patriarchal challenges in Ecuador. In spite of gains over the last decade, Ecuador continues to rank poorly in terms of gender equality and greater than 50% of women report gender violence in all provinces according to the United Nations.<sup>33</sup> Our findings suggest that greater levels of paternal education increase maternal health literacy regarding safe infant sleep and may allow for more agency to modify some traditional practices based on current health professional recommendations.

The high prevalence of unsafe infant sleep intentions was similar to studies in other South American communities. Based on the results, further interventions should be targeted toward sleep positions and bed-sharing. A holistic approach is needed to have a deeper understanding of the role that bed-sharing plays in the context of "breast-sleeping" and its negative or positive impact on SIUD in this community. Our follow up RCT study will



assess if the provision of the baby box has an impact on safe infant sleep practices, especially for those whose largest barrier may have been socioeconomic and a lack of access to safe sleep surfaces.

### Authors' Note

Reasonable requests for de-identified research data will be granted from the corresponding author.

### Author Contributions

Dr.'s Ceballos, Young, Bahamonde and Feld devised the project, the study design and the main conceptual ideas. Dr. Ceballos initiated funding from Children's Miracle Network. Dr. Bahamonde and Pablo Boada worked on the training, organization, and supervision of the study in country. Dr. Ceballos and Dr. Feld met with the research team throughout the process, designed the data collection tools and supervised data management. Dr. Rayens performed the analysis, aided in interpreting the results, and worked on the methods, tables and results of the manuscript. Dr.'s Feld and Ceballos led the writing of the manuscript, but all authors contributed, were engaged, edited, discussed results and commented on the manuscript.

### Declaration of Conflicting Interests

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