Title Page

Intimate partner violence and severe acute maternal morbidity in the intensive care unit: a case control study in Peru

Authors

Beatriz Paulina Ayala Quintanilla MD,^{1,2,5} Wendy E Pollock PhD,^{1,3} Susan J McDonald PhD,^{1,4} Angela J Taft PhD¹

Author affiliations

¹ The Judith Lumley Centre, La Trobe University. Level 3, George Singer Building, Bundoora, Melbourne, VIC 3086, Melbourne, Victoria, Australia.

² Peruvian National Institute of Health, Lima, Peru. Capac Yupanqui 1400, Jesus María, Lima 11, Peru.

³ University of Melbourne, Grattan Street, Parkville, VIC, 3010, Melbourne, Victoria, Australia.

⁴ Mercy Hospital for Women 163 Studley Rd, Heidelberg VIC 3084, Melbourne, Victoria, Australia.

Correspondence:

BP Ayala Quintanilla.
Judith Lumley Centre, La Trobe University, Level 3, George Singer Building, Bundoora, Melbourne, VIC 3086, Melbourne, Victoria, Australia.
Telephone: +61 3 9479 8800. Fax: +61 3 9479 8811
Email: beatrizpayala@yahoo.com

Word count (exclusive of abstract and references): 3,492 words.

This is the author manuscript accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1111/BIRT.12461

This article is protected by copyright. All rights reserved

Article type : Original Article

ABSTRACT

Background

Intimate partner violence is a prevalent public health issue associated with all-cause maternal mortality. This study investigates the relationship between intimate partner violence, severe acute maternal morbidity in the intensive care unit (ICU), and neonatal outcomes.

Methods

This was a prospective case-control study in a hospital in Lima, Peru, with 109 cases (maternal ICU admissions) and 109 controls (obstetric patients not admitted to the ICU). Data were collected through face-to-face interviews and medical record review. Partner violence was assessed using the World Health Organization instrument. Multivariate logistic regression was used to model the association between intimate partner violence and severe acute maternal morbidity.

Results

There was a significantly higher rate of intimate partner violence both before and during pregnancy among cases (58.7%) than controls (27.5%). In multivariate analysis, intimate partner violence both before and during pregnancy aOR 3.83 (95% CI: 1.99—7.37), being married 3.86 (1.27—11.73), <8 antenatal care visits 2.78 (1.14—6.80) and having previous abortions (miscarriages, therapeutic or unsafe) 1.69 (1.13—2.51) were significantly associated with severe acute maternal morbidity. The ICU admission rate was 18.8 (per 1000 live births) and ICU maternal mortality was 1.7%. The perinatal mortality rate was higher in cases (9.3%) than controls (1.8%).

Conclusions

Intimate partner violence was associated with an increased risk of severe acute maternal morbidity. This suggests a more severe impact of intimate partner violence on pregnancy than

has been previously identified. Inquiring about intimate partner violence during prenatal visits may prevent further harm to the mother-baby dyad.

Keywords: Severe acute maternal morbidity, violence against women, intimate partner violence, intensive care unit.

INTRODUCTION

Reducing violence against women and maternal mortality are challenging global commitments. Although the maternal mortality ratio decreased by 44% from 1990 to 2015, maternal mortality is just the tip of the iceberg of the global burden of maternal morbidity.(1) For one maternal death there are many women affected by severe acute maternal morbidity,(1) including those mothers who require specialised management in the intensive care unit (ICU).(2)

There is no universal agreement on a severe acute maternal morbidity definition.(2, 3) Although the World Health Organization (WHO) has developed a tool to facilitate severe acute maternal morbidity identification,(4) many researchers have argued against its applicability in both low and high-income countries.(5, 6) As a consequence, ICU admission may be considered an appropriate marker for identifying severe acute maternal morbidity, (2, 3) because it has high sensitivity (86.4%), specificity (87.8%) and positive predictive value (0.85),(3, 7-9) as it represents the most critically ill obstetric patients.(2, 10) The global maternal ICU admission rate ranges from 0.04 to 4.54%,(2, 11, 12) and the main reasons for admission are hypertensive disorders of pregnancy (0.09% of births), obstetric haemorrhage (0.07%), and sepsis (0.02%).(11)

Violence against women is a prevalent and damaging public health issue. The most common and chronic form of this violence is intimate partner violence. Globally, intimate partner violence affects one third (30%) of women.(13) Intimate partner violence can lead to adverse and/or fatal repercussions on women's health,(14, 15) including during pregnancy,(16) as it may aggravate any current maternal medical conditions and/or trigger serious pregnancy complications.(16) Intimate partner violence has been associated with all-cause maternal deaths (17, 18) and consequently it is important to determine whether intimate partner violence is associated with severe acute maternal morbidity. Therefore, the primary aim of this study was to investigate the relationship between intimate partner violence and severe acute maternal morbidity, and secondly to estimate neonatal outcomes for women with severe acute maternal morbidity in the ICU.

METHODS

Study design and setting

This was a prospective case-control (1:1) study, with a published protocol explaining detailed methodology.(19)

The study was undertaken in a tertiary hospital in Lima, Peru, the main national referral hospital for high risk maternal and neonatal patients throughout Peru, where there are over 22,000 deliveries annually.(20) Peru is an upper-middle income country with an estimated lifetime intimate partner violence rate of 65.5% (emotional 61.5%, physical 30.6% and sexual 6.5%) (21), including 9 cases of femicide monthly.(14) In 2015, the maternal mortality ratio was 68 per 100,000 live births, down from 251 in 1990.(22)

Ethical approval was granted by La Trobe University, Melbourne, Australia and the tertiary hospital in Lima, Peru. This research followed WHO ethical and safety recommendations for research on intimate partner violence.(23, 24)

Sample size and subjects

Since there were no preceding studies assessing the prevalence of intimate partner violence among obstetric patients with severe acute maternal morbidity in the ICU, we considered an intimate partner violence rate of 24.3% for controls and 43.1% for cases in accordance with previous research in Peruvian pregnant women at this hospital.(25) Sample size of 218 participants, (109 controls and 109 cases) calculated using open Epi,(26) with 1:1 case-control ratio, 95% confidence level, and 80% power to detect an 18.8% difference in intimate partner violence (rate) between cases and controls.

Cases (severe acute maternal morbidity) were obstetric patients, including women who experienced abortions (miscarriage, therapeutic or unsafe) and ectopic pregnancy, admitted to the ICU. The inclusion criteria were: i) a woman with a maternal ICU admission due to a complication (s) during pregnancy, birth or within 42 days of the ending of pregnancy; ii) 18 years or older; and iii) a Spanish speaker. The exclusion criteria were: i) women with mental illness or disabilities or other similar disabling pathologies, such as women who had not recovered from their acute illness prior to hospital discharge; ii) not able to provide informed consent; iii) those referred from other health care facilities for maternity care; and iv) with an ICU stay less than 24 hours.

Controls were women admitted to the hospital for care during pregnancy, labour and birth, or within 42 days of the ending of pregnancy. The inclusion criteria were: i) not being admitted to the ICU; ii) 18 years old or older; and iii) a Spanish speaker. The exclusion criteria were: i) a woman with mental illness or disabilities or other similar disabling pathologies; ii) not able to provide informed consent or iii) those referred from other health care facilities for maternity care. Controls were selected by using systematic random sampling (without replacement) starting with 18 and with a value of $k = 131$ as the sampling interval (19).

Procedures and outcome

Eligible women were invited to participate by the interviewer and recruited during their hospital stay, once their acute medical condition (s) was resolved (after discharge from the ICU for case women), and before discharge from hospital to home. Women in the control group were recruited within one week of a case woman being interviewed. The interviewer, a Spanish speaking midwife, had prior intimate partner violence research experience. Women who consented were interviewed from 23 October 2015 to 31 December 2016 once, in

private, using a structured questionnaire. Data were also extracted from their medical records using a pretested form.(19)

Information obtained during the face to face interview included: socio-demographic characteristics (age, place of residence, educational level, marital status and occupation) of the participant and her partner; behavioural factors (smoking, use of alcohol or drugs); medical and obstetric characteristics; and experience of intimate partner violence before and during pregnancy.

An estimate of women's experience of intimate partner violence was conducted using the WHO instrument(24), which included questions about emotional (including controlling behaviours), physical and/or sexual abuse perpetrated by intimate-partners experienced 12 months before and during pregnancy. Severe physical intimate partner violence (hit with fist, kicked, dragged or beaten up, choked or burnt, or threat with a weapon) was defined as previously reported in the WHO multi-country study.(24) Information about free social support services for domestic violence (available at this hospital) was given to every participant, including a referral if they wished.

Severe acute maternal morbidity, pregnancy outcome (including miscarriage, therapeutic and unsafe abortions), fetal and neonatal characteristics and outcomes data were extracted from the medical reports of mothers and newborns. Those data included hospital admission date, clinical causes for hospitalization and/or ICU, number of hospital and/or ICU stay days, type of delivery, weeks of pregnancy when severe acute maternal morbidity occurred, organ failure (s), use of technologies and pregnancy outcome.(19) Fetal and neonatal data included birth weight; birth age; sex; Apgar score (at 1 and 5 minutes); outcome at birth; and clinical cause (s) for neonatal intensive care unit (NICU) admission.(19)

Statistical Analysis

Data were analysed using SPSS V.24.0. Univariate analysis described the characteristics of severe acute maternal morbidity, socio-demographic and behavioural characteristics of the women and their partners, women's experience of intimate partner violence and pregnancy and neonatal outcomes. Categorical variables were calculated as frequencies and proportions. Continuous variables were calculated as mean (M) $\pm$ standard deviation (SD). Crude Odds Ratios (ORs) were estimated. We assessed association with intimate partner violence using multivariate logistic regression modelling with ORs and 95% CIs. Statistical significance was $p < 0.05$. We explored effect modification for age, level of education, and alcohol consumption but not use of drugs as participants reported not using drugs (Table 1). Variables with P values of < 0.25 were included in the models,(27) and Hosmer-Lemeshow's

goodness-of-fit test was used to assess model adequacy. The final model included socio-demographic characteristics (age, level of education, marital status and occupation), partner's education level and consumption of alcohol, number of antenatal care visits (<8 and ≥ 8 following WHO recommendations(28)), caesarean sections, previous abortions (miscarriage, therapeutic or unsafe) and presence of previous co-morbidities. Stepwise multiple regression analysis identified the predictive factors in the final model.(27)

RESULTS

Characteristics of the study population

During the study period, there were 25,653 live births, 483 ICU admissions and 8 maternal deaths (all in the ICU).(29) The ICU admission rate was 18.8 (per 1000 live births) and the maternal mortality was 1.7% in the ICU.

We recruited 109 cases and 109 controls (Figure 1). No woman declined participation. Descriptive analysis showed that there were no significant differences between cases and controls with respect to the socio-demographic characteristics of participants (Table 1) or their partners (Supplementary File 1). Co-morbidities were previous anaemia (59.6%), urinary infection (24.8%), chronic hypertension (6.9%), tuberculosis (2.8%), and diabetes mellitus (2.3%). Seventy-seven (35.3%) participants reported previous abortions (miscarriages $n=62$; therapeutic abortions $n=2$; and unsafe abortions $n=13$). Gestational age at first antenatal visit (15.4 ± 6.9 weeks vs. 15.9 ± 7.6 weeks) and rate of antenatal care in the first trimester of pregnancy (43.1% vs. 46.8%, respectively) were not significantly different between cases and controls.

Characteristics of cases (severe acute maternal morbidity) in the ICU

The majority of mothers had pregnancies ending < 37 weeks, were admitted postpartum, and had more than one clinical condition (82.6%). There were 10 (9.2%) twin pregnancies. Direct obstetric disorders, led by hypertensive disorders of pregnancy (67.9%) were the principal indications for ICU admission. Use of ICU technologies such as mechanical ventilation, inotropes/vasopressors, renal replacement therapy and/or, blood transfusion (52.3%) was needed for participants (Table 2). Twenty-one patients required ≥ 3 units of blood products, 18 patients two units and 10 patients one unit. Overall, 85.3% had organ system dysfunction. Nearly half (49.0%) had multiple organ system dysfunction.

Rate of intimate partner violence

Rate of intimate partner violence both before and during pregnancy was significantly higher in cases (58.7%) than controls (27.5%) (Table 1). Three cases (two before pregnancy only

and one both before and during pregnancy) and one control (during pregnancy) were exposed to severe physical intimate partner violence; however, after reviewing the medical records, the severe physical intimate partner violence was not the condition leading to ICU admission.

Neonatal outcomes

Overall, there were 219 neonates, 193 from singleton births and 26 from 13 twin pregnancies (ten in cases and three in controls). There were also seven miscarriages (five septic abortions, one incomplete abortion, and one threatened abortion that ended in complete abortion), one ectopic pregnancy and four cases who were still pregnant after they were discharged from ICU. A higher proportion of neonates from women with severe acute maternal morbidity were born at < 37 weeks, weighed $< 2,500$ grams, and had Apgar scores at 1 and 5 minutes ≤ 6 (those values were not adjusted) than controls (Table 3). The overall proportion of perinatal mortality was 5.5%; this included six stillborn babies (two from the controls and four from cases) and six neonatal deaths (all from cases). There were eight neonates (3.7%) admitted to NICU. The main causes of the six neonatal deaths were sepsis and prematurity. While our sample size did not have sufficient power to draw inferences about the impact of intimate partner violence on neonatal outcomes, there was a higher proportion of perinatal mortality in babies whose mothers were affected by severe acute maternal morbidity (9.3%) than the controls (1.8%).

Association of intimate partner violence with severe acute maternal morbidity

For the final model (Table 4), intimate partner violence was categorised into three mutually exclusive sub-categories: intimate partner violence before pregnancy only, intimate partner violence both before and during pregnancy (the single case of intimate partner violence during pregnancy only was included in the both before and during pregnancy sub-category) and no exposure to intimate partner violence. This model was adjusted for age, level of education, occupation, parity, number of prior caesarean section (none, one, or two or more), co-morbidities, partner's level of education and partner's consumption of alcohol. In multivariate analysis, exposure to intimate partner violence both before and during pregnancy (aOR 3.83; CI 95%: 1.99—7.37, $P < 0.001$), being married 3.86 (1.27—11.73, $P = 0.017$), having < 8 antenatal care visits 2.78 (1.14—6.80, $P = 0.025$) and number of previous abortions (miscarriages, therapeutic and unsafe; none vs one or more) 1.69 (1.13—2.51, $P = 0.010$) were significantly associated with severe acute maternal morbidity.

A sub-analysis was performed, and the association between intimate partner violence and severe acute maternal morbidity remained even after adding gestational age ($P < 0.001$) and then singleton vs. twin pregnancy aOR 4.61 (2.17—9.76, $P < 0.001$) to our final model. Both

these variables were considered as each has demonstrated a relationship with severe acute maternal morbidity in other studies(30, 31). An additional post-hoc sub-analysis was undertaken excluding 92 women with hypertensive disorders of pregnancy (74 cases; 18 controls), to examine the relationship between intimate partner violence and other causes of severe acute maternal morbidity. Of the remaining 126 women (35 cases; 91 controls), a significant difference in exposure to intimate partner violence both before and during pregnancy remained with severe acute maternal morbidity cases (n=23, 65.7%) compared to controls (n=24, 26.4%; $P < 0.001$).

DISCUSSION

This study demonstrated that intimate partner violence before and during pregnancy was associated with a nearly four-fold increase in the likelihood of severe acute maternal morbidity in the ICU. We also found that marital status, sub-optimal antenatal care and history of previous abortions (miscarriage, therapeutic and unsafe) are independently and significantly associated with severe acute maternal morbidity. Additionally, mothers with severe acute maternal morbidity had a higher proportion of premature neonates, and worse perinatal outcomes.

The intimate partner violence rate in women with severe acute maternal morbidity was higher than in preceding studies investigating the relationship between intimate partner violence and preeclampsia and spontaneous preterm birth among Peruvian women at the same hospital; however, intimate partner violence was assessed in those previous studies only during pregnancy and using different tools (32-34). Another preceding study(35) (despite differences in methodology including severe acute maternal morbidity definition), did not find any association between partner violence during pregnancy only and severe acute maternal morbidity. We had only one control who experienced violence during pregnancy only, with the vast majority of women experiencing violence both before and during pregnancy which may explain the difference in our findings. Additionally, a previous study reported that intimate partner violence during pregnancy was associated with an increased risk of preeclampsia.(25) Higher exposure to intimate partner violence persisted in our sub-analysis of women with severe acute maternal morbidity caused by conditions other than preeclampsia, suggesting that intimate partner violence was associated with severe acute maternal morbidity due to other clinical conditions and not just hypertensive conditions.

The possible mechanism explaining the relationship between intimate partner violence and severe acute maternal morbidity remains unclear. One explanation may be that severe acute maternal morbidity is the result of physiological mechanisms in response to acute and/or chronic stress originating from exposure to violence (16, 36) as suggested in previous studies,(25, 37) in addition to other aspects such as sub-optimal antenatal care among participants. Normally, chemical mediators (adrenaline and noradrenaline, cortisol, catecholamines and glucocorticoids) are increased and adequately balanced in response to stress as protective mechanisms. However, long-term exposure may alter the normal balance, and lead to disease (36, 38). This may be also exacerbated by the presence of co-morbidities, reported by participants in this study. Previous studies have proposed a possible pathway between intimate partner violence and preeclampsia or preterm delivery mediated through psychosocial, emotional and physical stress, depression, anxiety, isolation, decreased social support, and low self-esteem.(25, 37) The authors also proposed multiple indirect pathways including less access to prenatal care, increased alcohol consumption, and smoking and illicit drug use (25). However, the reported rate of smoking, alcohol or illicit drug use was very low in our study (Table 1).

In our study, being married was significantly associated with severe acute maternal morbidity. However, married women had a decreased likelihood of intimate partner violence in the WHO multi-country study.(39) In Peru, there is a higher proportion of women in de facto/cohabiting relationships (36.7%) compared to married women (19.9%) according to the Peruvian Demographic Health Survey,(21) and at this hospital (de facto 70.2%).(20) There may be specific cultural factors associated with marriage in Peru leading to a higher likelihood of intimate partner violence.

Sub-optimal antenatal care was also significantly associated with severe acute maternal morbidity in our study. Contradictory findings have been reported in relation to antenatal care use in women with severe acute maternal morbidity in the ICU from Latin American studies.(40, 41) Since higher rates of intimate partner violence and sub-optimal antenatal care were observed in women with severe acute maternal morbidity, it is possible that intimate partner violence may directly reduce access to antenatal care. In that regard, it was observed that antenatal care among Peruvian pregnant women exposed to intimate partner violence was diminished and delayed compared with non-abused women (42). This is also consistent with a review showing that intimate partner violence was associated with reduced utilisation of antenatal care (43).

Women experiencing intimate partner violence have a greater risk of induced abortions (44) and a higher rate of previous abortions (miscarriage, therapeutic and unsafe) were observed in women with severe acute maternal morbidity in this study. However, data on history of previous abortions (not specified which type) in women with severe acute maternal morbidity in the ICU are usually under-reported (45) irrespective of intimate partner violence.

Given the variation in criteria for ICU admission, the ICU data serves to describe the severity of illness experienced by the women in the study, and thus quantifies the severe acute maternal morbidity of the ICU cohort. The need for ICU technologies along with the Acute Physiology and Chronic Health Evaluation II scores, indicate that case women were at the milder end of the severity of illness spectrum for admission to ICU. Nevertheless, we still found an association between intimate partner violence and severe acute maternal morbidity in the ICU. The ICU admission rate was higher than a previous systematic review;(11) however, it was within the range among other Latin-American studies.(46) The ICU cohort results show that the maternal mortality rate, main clinical conditions (hypertensive disorders of pregnancy), need for ICU technologies, blood transfusion and organ system dysfunction were comparable with preceding studies from Latin America.(46)

While the overall perinatal mortality rate in the ICU was lower than in other high-income countries,(47, 48) the NICU admission rate was comparable,(41, 49) suggesting that mothers with severe acute maternal morbidity had a significantly greater proportion of premature neonates, which can impact on perinatal outcomes including neonatal mortality and NICU admission. Due to the lack of power, we were unable to examine the influence of intimate partner violence on perinatal outcomes independent of the severe acute maternal morbidity.

The main strengths of this study were the use of standardised and validated questions for intimate partner violence assessment, interviews conducted by a trained and experienced midwife, and adherence to WHO ethical and safety recommendations for intimate partner violence research.(23, 24) A further positive aspect was that women were very motivated to participate, and informed about the free social support services for intimate partner violence at this hospital. However, the study findings should be interpreted cautiously. Firstly, this research was undertaken in a single centre and cannot be generalised to other settings. Secondly, intimate partner violence assessment is complex and may be affected by recall

bias, non-disclosure, or cultural and measurement bias, (24) which may lead to over or underestimating the rate of intimate partner violence. Lastly, we prospectively recruited women with severe acute maternal morbidity who met the selection criteria; however, it was difficult to retrospectively determine the denominator from the total number of potential eligible ICU admissions (Figure 1). Nevertheless, by assuming there were equal proportions of eligible women in the 199 women for whom we were unable to assess eligibility retrospectively, and from the 284 women in which we could, we estimate that the sample was 58.9% of potentially eligible women. Furthermore, the clinical conditions of the non-participant cases were similar to the cases suggesting there has been no bias in recruitment.

Health care professionals should understand that intimate partner violence is as common as other frequent chronic diseases of pregnancy and has a negative impact on maternal outcomes. The pregnancy period represents a unique opportunity to identify intimate partner violence, offer support and make a referral if required. As intimate partner violence itself is potentially modifiable and preventable, routine evaluation and documentation of intimate partner violence is highly recommended during pregnancy.(50) This research may provide direction for further studies investigating severe acute maternal morbidity, who represent the most critically ill obstetric patients,(2, 10) which in turn may prevent and/or reduce maternal morbidity, and improve the well-being of the mother-baby dyad.

Exposure to intimate partner violence before and during pregnancy was associated with all main clinical causes of maternal ICU admission. Just as intimate partner violence has been prevalent in maternal mortality reports, the findings of this study warrant further exploration of the link between intimate partner violence and severe acute maternal morbidity, and suggests a more severe impact of intimate partner violence on pregnant women than has previously been found.

Acknowledgments

The authors would like to express our sincere thanks to all the participants, Miss Elisabet Ramos Palomino for her diligent assistance performing the interviews and data collection and the tertiary health care facility.

Funding

This study is part of a doctoral study at La Trobe University supported by the Peruvian Government through PRONABEC (National Program of Scholarship and Educational Loan) and La Trobe University. No funding bodies had any role in study design, collecting data, analysing data, interpreting findings, and writing, reviewing or deciding to publish the manuscript.

REFERENCES

1. Firoz T, Chou D, von Dadelszen P, Agrawal P, Vanderkruik R, Tuncalp O, et al. Measuring maternal health: focus on maternal morbidity. *Bull World Health Organ.* 2013;91:794—6.
2. Senanayake H, Dias T, Jayawardena A. Maternal mortality and morbidity: Epidemiology of intensive care admissions in pregnancy. *Best Pract Res Clin Obstet Gynaecol.* 2013;27:811—20.
3. Callaghan WM, Grobman WA, Kilpatrick SJ, Main EK, D'Alton M. Facility-based identification of women with severe maternal morbidity: it is time to start. *Obstet Gynecol.* 2014;123:978—81.
4. Say L, Souza JP, Pattinson RC. Maternal near miss towards a standard tool for monitoring quality of maternal health care. *Best Pract Res Clin Obstet Gynaecol.* 2009;23(3):287—96.
5. Witteveen T, Bezstarosti H, de Koning I, Nelissen E, Bloemenkamp KW, van Roosmalen J, et al. Validating the WHO maternal near miss tool: comparing high- and low-resource settings. *BMC Pregnancy Childbirth.* 2017;17:194.
6. Nelissen E, Mduma E, Broerse J, Ersdal H, Evjen-Olsen B, van Roosmalen J, et al. Applicability of the WHO maternal near miss criteria in a low-resource setting. *PloS One.* 2013;8:e61248.
7. Kilpatrick SJ, Berg C, Bernstein P, Bingham D, Delgado A, Callaghan WM, et al. Standardized severe maternal morbidity review: rationale and process. *Obstet Gynecol.* 2014;124:361—6.
8. Hirshberg A, Srinivas SK. Epidemiology of maternal morbidity and mortality. *Semin Perinatol.* 2017;41:332—7.
9. Geller SE, Rosenberg D, Cox S, Brown M, Simonson L, Kilpatrick S. A scoring system identified near-miss maternal morbidity during pregnancy. *J Clin Epidemiol.* 2004;57:716-20.
10. Zwart JJ, Dupuis JR, Richters A, Ory F, van Roosmalen J. Obstetric intensive care unit admission: a 2-year nationwide population-based cohort study. *Intensive Care Med.* 2010;36:256—63.
11. Pollock W, Rose L, Dennis C. Pregnant and postpartum admissions to the intensive care unit: a systematic review. *Intensive Care Med.* 2010;36:1465-74.

12. Tuncalp O, Hindin MJ, Souza JP, Chou D, Say L. The prevalence of maternal near miss: a systematic review. *BJOG*. 2012;119:653-61.
13. Devries KM, Mak JY, Garcia-Moreno C, Petzold M, Child JC, Falder G, et al. Global health. The global prevalence of intimate partner violence against women. *Science*. 2013;340:1527—8.
14. Ayala Quintanilla, Taft, McDonald, Pollock. An examination of femicides in Peru between 2009 and 2014. *Int J Gynaecol Obstet*. 2016;134:342-3.
15. Sugg N. Intimate partner violence: prevalence, health consequences, and intervention. *Med Clin North Am*. 2015;99:629—49.
16. Chisholm CA, Bullock L, Ferguson JEJ. Intimate partner violence and pregnancy: epidemiology and impact. *Am J Obstet Gynecol*. 2017;217:141—4.
17. United Nations. Every Woman Every Child. The global strategy for women's, children's and adolescents' health (2016-2030); 2015 [cited 2016 May 15]. Available from: <http://globalstrategy.everywomaneverychild.org/>.
18. Knight M, Tuffnell DJ, Kenyon S, Shakespeare J, Gray R, Kurinczuk JJE, et al. Saving Lives, Improving Mothers' Care - Surveillance of maternal deaths in the UK 2011-13 and lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2009-13. Oxford: National Perinatal Epidemiology Unit, University of Oxford; 2015 [cited 2016 July 18]. Available from: <https://www.npeu.ox.ac.uk/>.
19. Ayala Quintanilla, Pollock WE, McDonald SJ, Taft AJ. Impact of violence against women on severe acute maternal morbidity in the intensive care unit, including neonatal outcomes: a case-control study protocol in a tertiary healthcare facility in Lima, Peru. *BMJ open*. 2018;8:e020147.
20. Instituto Nacional Materno Perinatal. Boletín Estadístico 2015 – 2016; 2016 [cited 2017 April 9]. Available from: <http://www.inmp.gob.pe/institucional/boletines-estadisticos/1422371837>.
21. Instituto Nacional de Estadística e Informática. Encuesta Demográfica y de Salud Familiar-ENDES. Nacional y Departamental; 2017 [cited 2018 February 12]. Available from: https://www.inei.gob.pe/media/MenuRecursivo/publicaciones_digitales/Est/Lib1525/index.html.
22. World Health Organization. Trends in maternal mortality: 1990 to 2015. Estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division;

2015 [cited 2016 April 18]. Available from:
<http://www.who.int/classifications/icd/factsheet/en/>.

23. World Health Organization. Putting Women First: Ethical and Safety Recommendations for Research on Domestic Violence Against Women; 2001 [cited 2015 Oct 15]. Available from: <http://www.who.int/gender/violence/womenfirtseng.pdf>.

24. Garcia-Moreno C, Jansen HAFM, Ellsberg M, Heise L, Watts C. Prevalence of intimate partner violence: findings from the WHO multi-country study on women's health and domestic violence. *Lancet*. 2006;368:1260—9.

25. Sanchez SE, Qiu C, Perales MT, Lam N, Garcia P, Williams MA. Intimate partner violence (IPV) and preeclampsia among Peruvian women. *Eur J Obstet Gynecol Reprod Biol*. 2008;137:50—5.

26. Open Epi. Sample Size Calculation for Unmatched Case-Control Studies. Version 3.03.17 2014; [cited 2015 Dec 21]. Available from: <http://web1.sph.emory.edu/cdckms/sample%20size%20%20grps%20case%20control.html>.

27. Hosmer DV, Lemeshow S. Applied Logistic Regression. 2nd ed. USA: A Wiley-Interscience Publication; 2000.

28. World Health Organization. Antenatal care; 2016 [cited 2017 Oct 21]. Available from: http://www.who.int/reproductivehealth/publications/maternal_perinatal_health/8-contacts-1090.jpg.

29. Instituto Nacional Materno Perinatal, Oficina de Epidemiología y Salud Ambiental. Sala Situacional 2016; 2016 [cited 2017 Jun 21]. Available from: www.inmp.gob.pe/institucional/sala-situacional/1421334856.

30. Kilpatrick SJ, Abreo A, Gould J, Greene N, Main EK. Confirmed severe maternal morbidity is associated with high rate of preterm delivery. *Am J Obstet Gynecol*. 2016;215(2):233.e1—7.

31. Witteveen T, Van Den Akker T, Zwart JJ, Bloemenkamp KW, Van Roosmalen J. Severe acute maternal morbidity in multiple pregnancies: a nationwide cohort study. *Am J Obstet Gynecol*. 2016;214(5):641.e1—10.

32. Stark E, Flitcraft A, Zuckerman D, Grey A, Robison J, Frazier W. Wife abuse in the medical setting: an introduction for Health Personnel. Domestic Violence. Monograph Series, No 7 Rockville, MD: National Clearinghouse on Domestic Violence; 1981.

33. Tolman RM. The validation of the Psychological Maltreatment of Women Inventory. *Violence Vict*. 1999;14:25—37

34. Pan HS, Ehrensaft MK, Heyman RE, O'Leary KD, Schwartz R. Evaluating domestic partner abuse in a family practice clinic. *Fam Med*. 1997;29:492—5.
35. Rosselli Puccia MI, Villela Mamede M, De Souza L. Intimate partner violence and severe maternal morbidity among pregnant and postpartum women in São Paulo, Brazil. *J Hum Growth Dev*. 2018;28:165-74.
36. Black MC. Intimate Partner Violence and Adverse Health Consequences: Implications for Clinicians. *Am J Lifestyle Med*. 2011;5:428—39.
37. Sanchez SE, Alva AV, Diez Chang G, Qiu C, Yanez D, Gelaye B, et al. Risk of spontaneous preterm birth in relation to maternal exposure to intimate partner violence during pregnancy in Peru. *Matern Child Health J*. 2013;17:485—92.
38. McEwen BS. Protective and damaging effects of stress mediators: central role of the brain. *Dialogues Clin Neurosci*. 2006;8:367—81.
39. Abramsky T, Watts CH, Garcia-Moreno C, Devries K, Kiss L, Ellsberg M, et al. What factors are associated with recent intimate partner violence? findings from the WHO multi-country study on women's health and domestic violence. *BMC Public Health*. 2011;11:109.
40. Gálvez-Vengoechea ML, Arreaza-Graterol M, Rodríguez-Ortiz JA. Mortalidad materna de pacientes atendidas en la UCI del Hospital Simón Bolívar, Bogotá (Colombia) 2004 - 2006. Maternal mortality of obstetrics patients requiring ICU attention at the Simón Bolívar hospital in Bogotá, Colombia 2004-2006. *Rev Colomb Obstet Ginecol*. 2009;60:152—8.
41. Vasquez DN, Das Neves AV, Vidal L, Moseinco M, Lapadula J, Zakalik G, et al. Characteristics, Outcomes, and Predictability of Critically Ill Obstetric Patients: A Multicenter Prospective Cohort Study. *Crit Care Med*. 2015;43:1887—97.
42. Perales MT, Cripe SM, Lam N, Sanchez SE, Sanchez E, Williams MA. Prevalence, types, and pattern of intimate partner violence among pregnant women in Lima, Peru. *Violence Against Women*. 2009;15:224—50.
43. Metheny N, Stephenson R. Intimate Partner Violence and Uptake of Antenatal Care: A Scoping Review of Low- and Middle-Income Country Studies. *Int Perspect Sex Reprod Health*. 2017;43:163—171.
44. Pallitto CC, Garcia-Moreno C, Jansen HA, Heise L, Ellsberg M, Watts C. Intimate partner violence, abortion, and unintended pregnancy: results from the WHO Multi-country Study on Women's Health and Domestic Violence. *Int J Gynaecol Obstet*. 2013;120:3—9.
45. Noor NM, Nik Hussain NH, Sulaiman Z, Abdul Razak A. Contributory Factors for Severe Maternal Morbidity: A 10-Year Review of the Literature. *Asia Pac J Public Health*. 2015;27(8 Suppl):9—18S.

46. Ayala Quintanilla, Taft A, McDonald S, Pollock W. Severe maternal morbidity in the intensive care unit of Latin America and Caribbean countries. *J Paediatr Child Health*. 2016;52(S2):41.
47. Ng VKS, Lo TK, Tsang HH, Lau WL, Leung WC. Intensive care unit admission of obstetric cases: A single centre experience with contemporary update. *Hong Kong Med J*. 2014;20:24—31.
48. Keizer JL, Zwart JJ, Meerman RH, Harinck BIJ, Feuth HDM, van Roosmalen J. Obstetric intensive care admissions: A 12-year review in a tertiary care centre. *Eur J Obstet Gynecol Reproductive Biol*. 2006;128:152—6.
49. Rojas JA, Miranda JE, Ramos E, Fernández JC. Cuidado crítico en la paciente obstétrica. Complications, interventions and maternal and fetal outcomes. *Clin Invest Ginecol Obstet*. 2011;38:44—9.
50. World Health Organization. Responding to intimate partner violence and sexual violence against women: WHO clinical and policy guidelines; 2013 [cited 2015 Nov 21]. Available from: http://apps.who.int/iris/bitstream/handle/10665/85240/9789241548595_eng.pdf?sequence=1.

Table 1 Socio-demographic and obstetric characteristics, and intimate partner violence rate between cases and controls in a tertiary health care facility, Lima, Peru, 2015-2016

Items	Total (n=218)	Cases ^j (n=109)	Controls ^j (n=109)
	Mean ± SD or n (%)		
Age (years)	28.6 ± 6.9	29.3 ± 6.9	27.9 ± 6.7
≥ 35 years	47 (21.6)	28 (25.7)	19 (17.4)
Level of education			
Secondary level or less ^a	173 (79.4)	85 (78.0)	88 (80.7)
Higher level	45 (20.6)	24 (22.0)	21 (19.3)
Marital status			
Single/Separate/Divorced	31 (14.2)	12 (11.0)	19 (17.4)
Cohabitant	165 (75.7)	81 (74.3)	84 (77.1)
Married	22 (10.1)	16 (14.7)	6 (5.5)
Occupation (employed ^b)	42 (19.3)	26 (23.9)	16 (14.7)
Household income^c			

US Dollars per month	363.7 ± 146.5	368.9 ± 159.6	358.6 ± 132.9
≤ 260.0 US Dollars per month	48 (22.0)	19 (17.4)	29 (26.6)
Alcohol consumption during pregnancy^d	16 (7.3)	10 (9.2)	6 (5.5)
Smoking during^e pregnancy	8 (3.7)	5 (4.6)	3 (2.8)
Use of illicit drugs during pregnancy^f	0 (0)	0 (0)	0 (0)
Use of family planning methods^g	176 (80.7)	86 (78.9)	90 (82.6)
Parity (multiparous)	131 (60.1)	69 (63.3)	62 (56.9)
< 8 Antenatal visits^h	185 (84.9)	98 (89.9)*	87 (79.8)
Caesarean sections	1.4 ± 0.9	1.4 ± 0.9	1.3 ± 1.0
> 1	76 (34.9)	37 (33.9)	39 (35.8)
1	110 (50.5)	59 (54.1)	51 (46.8)
0	32 (14.7)	13 (11.9)	19 (17.4)
Previous abortions (miscarriage, therapeutic or induced)	0.5 ± 0.8	0.7 ± 0.9**	0.3 ± 0.6
> 1	25 (11.5)	18 (16.5)*	7 (6.4)
1	52 (23.9)	29 (26.6)	23 (21.2)
0	141 (64.7)	62 (56.9)	79 (72.5)
Co-morbiditiesⁱ	154 (70.6)	85 (78.0)*	69 (63.3)
Intimate partner violence			
Before pregnancy only	37 (17.0)	15 (13.8)	22 (20.2)
During pregnancy only	1 (0.5)	0 (0.0)	1 (0.9)
Both before and during pregnancy	94 (43.1)	64 (58.7)***	30 (27.5)
No	86 (39.4)	30 (27.5)	56 (51.4)

^a≤11 years of education.

^bTwo controls did not answer.

^cPeruvian monthly minimum wage is 850 PEN (approx. 246.5 USD); eight participants (three controls and five cases) did not provide this information.

^dOne case did not answer.

^eOne case and one control did not answer.

^fThree cases did not answer.

^gThis indicates previous use of family planning methods. Five cases and two controls did not answer.

^hWorld Health Organization classification.

ⁱMore than one co-morbidity including anaemia, urine infection, chronic hypertension, tuberculosis, diabetes, and epilepsy.

^jCases, women with severe acute maternal morbidity in the intensive care unit (ICU).

Controls, obstetric patients not admitted to the ICU.

*P < .05, **P < .01, ***P < .001 compared with controls.

Table 2 Characteristics of patients with severe acute maternal morbidity (cases) in the intensive care unit in a tertiary health care facility, Lima, Peru, 2015-2016

Items	Cases (n=109)
	Mean $\pm$ SD or n (%)
Main clinical conditions in the ICU ^a	
Hypertensive disorders of pregnancy	74 (67.9)
Obstetric haemorrhage	31 (28.4)
Sepsis	21 (19.3)
Abortion (miscarriage) ^b	6 (5.5)
Other direct obstetric complications ^c	28 (25.6)
Non-direct obstetric complications ^d	40 (36.7)
Use of ICU technologies ^a	
Invasive mechanical ventilation	7 (6.4)
Inotropes/vasopressors	18 (16.5)
Renal replacement therapy	3 (2.8)
Blood transfusion	49 (45.0)
Organ system dysfunction in the ICU	93 (85.3)
ICU stay (days) ^e	2.9 $\pm$ 2.1
Hospital stay (days) ^f	8.7 $\pm$ 5.0
Postpartum admission to the ICU ^g	83 (76.1)
Gestational age when pregnancy ended for postnatal women admitted to the ICU (weeks) ^g	33.7 $\pm$ 6.6
Gestational age when admitted antepartum to the ICU (weeks)	32.2 $\pm$ 7.3
Delivery by caesarean section	90 (82.6)
Acute Physiology and Chronic Health Evaluation (APACHE) II score in the ICU ^h	5.2 $\pm$ 3.4

ICU, intensive care unit.

^aSome patients had more than one clinical condition or had used more than one technology.

^bThere were six abortions (miscarriages) and one threatened abortion that ended in complete abortion (miscarriage) during ICU stay.

^cObstructed labour, premature rupture of fetal membranes. one threatened abortion that ended in complete

^dUrine infection, diabetes mellitus, hypothyroidism, appendicitis, cardiac disease and epilepsy (excluding anaemia).

^eMaximum ICU stay was 14 days.

^fTotal hospital stay, and the maximum hospital stay was 35 days.

^gIt included six patients with post-abortions (miscarriages).

^bConcerning APACHE score: no parameters were described in the medical records in 13 patients, and seven medical records were not available during data collection period.

Table 3 Neonatal outcomes in cases and controls in a tertiary health care facility, Lima, Peru, 2015-2016

Items	Total (n=219)	Cases ^c (n=107)	Controls ^c (n=112)
	Mean $\pm$ SD or n (%)		
Gestational age at birth (weeks)	36.9 $\pm$ 3.8	35.1 $\pm$ 4.3***	38.6 $\pm$ 2.2
< 37 weeks	60 (27.4)	51 (47.7)***	9 (8.0)
Apgar 1 minute ($\leq$6)	28 (12.8)	21 (19.6)**	7 (6.3)
Apgar 5 minute ($\leq$6)	16 (7.3)	12 (11.2)*	4 (3.6)

Birth weight (g)	2909.5 ± 915.5	2,471.1 ± 932.5***	3,328.4 ± 673.3
<2500 g	60 (27.4)	48 (44.9)***	12 (10.7)
Perinatal mortality^a	12 (5.5)	10 (9.3)*	2 (1.8)
Early neonatal mortality^b	6 (2.7)	6 (5.6)	0 (0.0)
NICU admission rate	8 (3.7)	8 (7.5)	0 (0.0)

NICU, Neonatal Intensive Care Unit.

g, gram.

NS, not statistically significant.

^aPerinatal mortality, the death of a fetus after 22 week of gestation plus neonatal deaths within the first seven days of life.

^bEarly neonatal mortality, a death of a live-born baby within the first seven days of life.

^cCases, women with severe acute maternal morbidity in the intensive care unit (ICU).

Controls, obstetric patients not admitted to the ICU.

*P < .05, **P < .01, ***P < .001 compared with controls.

Table 4 Multivariate logistic regression analysis showing the association of intimate partner violence and severe acute maternal morbidity in the intensive care unit of a tertiary care hospital in Lima, Peru, 2015-2016

	Adjusted OR^a (95% CI)
Intimate partner violence	
Before pregnancy only	1.17 (0.50—2.72)
Both before and during pregnancy ^b	3.83 (1.99—7.37)
No	Reference
Marital status	
Married	3.86 (1.27—11.73)
Cohabitant	Reference
Single/separated/divorced	0.62 (0.26 to 1.46)
Antenatal visits	

<8	2.78 (1.14—6.80)
≥8	Reference
Number of previous abortions^c	1.69 (1.13—2.51)

^aAdjusted for age, level of education, occupation, parity, number of prior caesareans, co-morbidities, partner's level of education and partner's consumption of alcohol. The Hosmer-Lemeshow goodness-of-fit chi square: 6.292, P = 0.506.

^bThis category included one obstetric patient who was exposed to intimate partner violence during pregnancy only.

^cThe number of previous abortion category included miscarriage, therapeutic and unsafe abortions

CI: Confidence interval.

Table/Figure Caption List

Table 1 Socio-demographic and obstetric characteristics, and intimate partner violence rate between cases and controls in a tertiary health care facility, Lima, Peru, 2015-2016

^a≤11 years of education.

^bTwo controls did not answer.

^cPeruvian monthly minimum wage is 850 PEN (approx. 246.5 USD); eight participants (three controls and five cases) did not provide this information.

^dOne case did not answer.

^eOne case and one control did not answer.

^fThree cases did not answer.

^gThis indicates previous use of family planning methods Five cases and one control did not answer.

^hWorld Health Organization classification.

ⁱMore than one co-morbidity including anaemia, urine infection, chronic hypertension, tuberculosis, diabetes, and epilepsy.

^jCases, women with severe acute maternal morbidity in the intensive care unit (ICU).

Controls, obstetric patients not admitted to the ICU.

*P < .05, **P < .01, ***P < .001 compared with controls.

Table 2 Characteristics of patients with severe acute maternal morbidity in the intensive care unit (cases) in a tertiary health care facility, Lima, Peru, 2015-2016

ICU, intensive care unit.

^aSome patients had more than one clinical condition or had used more than one technology.

^bThere were six abortions (miscarriages) and one threatened abortion that ended in complete abortion (miscarriage) during ICU stay.

^cObstructed labour, premature rupture of fetal membranes.

^dUrine infection, diabetes mellitus, hypothyroidism, appendicitis, cardiac disease and epilepsy (excluding anaemia).

^eMaximum ICU stay was 14 days.

^fTotal hospital stay, and the maximum hospital stay was 35 days.

^gIt included six patients post-abortions (miscarriages).

^hConcerning APACHE score: no parameters were described in the medical records in 13 patients, and seven medical records were not available during data collection period.

Table 3 Neonatal outcomes in cases and controls in a tertiary health care facility, Lima, Peru, 2015-2016

NICU, Neonatal Intensive Care Unit.

g, gram.

NS, not statistically significant.

^aPerinatal mortality, the death of a fetus after 22 week of gestation plus neonatal deaths within the first seven days of life.

^bEarly neonatal mortality, a death of a live-born baby within the first seven days of life.

^cCases, women with severe acute maternal morbidity in the intensive care unit (ICU).

Controls, obstetric patients not admitted to the ICU.

*P < .05, **P < .01, ***P < .001 compared with controls.

Table 4 Multivariate logistic regression analysis showing the association of intimate partner violence and severe acute maternal morbidity in the intensive care unit of a tertiary care hospital in Lima, Peru, 2015-2016

¹Reference.

^aAdjusted for age, level of education, occupation, parity, caesarean sections number, co-morbidities, partner's level of education and partner's consumption of alcohol. The Hosmer-Lemeshow goodness-of-fit chi square: 6.292, P = 0.506.

^bThis category included one obstetric patient who was exposed to intimate partner violence during pregnancy only.

^cThe number of previous abortion category included miscarriage, therapeutic and unsafe abortions.

CI: Confidence interval.

Figure 1 Recruitment flow chart of patients with severe acute maternal morbidity in the intensive care unit (cases) in a tertiary health care facility, Lima, Peru, 2015-2016

ICU: Intensive care unit.

SAMM: Severe acute maternal morbidity.

Supplementary Files

Supplementary File 1 Socio-demographic characteristics of partner reported by cases and controls in a tertiary health care facility, Lima-Peru, 2015, 2016

^aReported by the participants.

^bThree participants (controls) did not provide this information.

^c≤11 years of education; twelve cases and ten controls did not answer this item.

^dEight cases and eleven controls did not answer this item.

^eOne case and two controls did not answer this item.

^fOne case and one control did not answer this item.

^gTwo case and five controls did not answer this item.

^hThere were no significant differences between partners of cases and controls with respect to age, level of education, use of illicit drugs during pregnancy, occupation, use of illicit drug during pregnancy, consumption of alcohol during pregnancy and binge consumption of alcohol.

ⁱCases, women with severe acute maternal morbidity in the intensive care unit (ICU).

Controls, obstetric patients not admitted to the ICU.

Author Manuscript

Minerva Access is the Institutional Repository of The University of Melbourne

Author/s:

Ayala Quintanilla, BP;Pollock, WE;McDonald, SJ;Taft, AJ

Title:

Intimate partner violence and severe acute maternal morbidity in the intensive care unit: A case-control study in Peru

Date:

2019-10-28

Citation:

Ayala Quintanilla, B. P., Pollock, W. E., McDonald, S. J. & Taft, A. J. (2019). Intimate partner violence and severe acute maternal morbidity in the intensive care unit: A case-control study in Peru. BIRTH-ISSUES IN PERINATAL CARE, 47 (1), pp.29-38. <https://doi.org/10.1111/birt.12461>.

Persistent Link:

<http://hdl.handle.net/11343/286550>