

Original research article

Maintaining rigor in research: flaws in a recent study and a reanalysis of the relationship between state abortion laws and maternal mortality in Mexico

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Abstract

Objective: A recent publication [Koch E, Chireau M, Pliego F, Stanford J, Haddad S, Calhoun B, Aracena P, Bravo M, Gatica S, Thorp J. Abortion legislation, maternal healthcare, fertility, female literacy, sanitation, violence against women and maternal deaths: a natural experiment in 32 Mexican states. *BMJ Open* 2015;5(2):e006013] claimed that Mexican states with more restrictive abortion laws had lower levels of maternal mortality. Our objectives are to replicate the analysis, reanalyze the data and offer a critique of the key flaws of the Koch study.

Study design: We used corrected maternal mortality data (2006–2013), live births, and state-level indicators of poverty. We replicate the published analysis. We then reclassified state-level exposure to abortion on demand based on actual availability of abortion (Mexico City versus the other 31 states) and test the association of abortion access and the maternal mortality ratio (MMR) using descriptives over time, pooled chi-square tests and regression models. We included 256 state-year observations.

Results: We did not find significant differences in MMR between Mexico City (MMR=49.1) and the 31 states (MMR=44.6; $p=.44$). Using Koch's classification of states, we replicated published differences of higher MMR where abortion is more available. We found a significant, negative association between MMR and availability of abortion in the same multivariable models as Koch, but using our state classification ($\beta=-22.49$, 95% CI=-38.9; -5.99). State-level poverty remains highly correlated with MMR.

Conclusion: Koch makes errors in methodology and interpretation, making false causal claims about abortion law and MMR. MMR is falling most rapidly in Mexico City, but our main study limitation is an inability to draw causal inference about abortion law or access and maternal mortality. We need rigorous evidence about the health impacts of increasing access to safe abortion worldwide.

Implications: Transparency and integrity in research is crucial, as well as perhaps even more in politically contested topics such as abortion. Rigorous evidence about the health impacts of increasing access to safe abortion worldwide is needed.

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Keywords: Abortion research; Abortion legislation; Abortion access; Maternal mortality; Mexico; Scientific integrity

1. Introduction

Reducing maternal mortality remains a top global health priority [1]. The large disparities in the maternal mortality ratio (MMR; number of maternal deaths per 100,000 live births) between countries [2] and populations suggest that much of the burden of maternal death is preventable. It is imperative that we have rigorous evidence about the

correlates and causes of maternal death to inform policies, programs and services that contribute to reducing maternal mortality. Unsafe abortion is an important contributor to overall MMR — up to 13% of maternal deaths are due to complications from unsafe abortion [3]; however, where abortion is legal, the fraction of MMR due to abortion is very low [4].

A recent study by Koch et al. [5] focused on state-level MMR in Mexico concluded that states with more restrictive laws “exhibited consistently lower maternal mortality rates” [5]. A press release for the study goes further, stating that the study “confirm[s] that Mexican states with less permissive

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abortion laws exhibited 23% lower overall maternal mortality” [6].

The purpose of this study is to describe MMR and access to abortion over time and test the association of state-level abortion law, maternal mortality and socioeconomic factors in Mexico, using the same data as Koch et al. Our aim is to improve transparency, acknowledge the limitations of data, and contextualize results, as recommended in studies of abortion and abortion-related morbidity and mortality [7]. Our ultimate goal is to improve the evidence available to guide policies and services to reduce unsafe abortion.

We discuss three key flaws in the Koch et al. study: misuse of data sources and overreliance on International Classification of Diseases, 10th edition (ICD-10) codes for measurement of abortion-related mortality; classification of Mexican states by access to abortion and of deaths by residence or place of occurrence; and misuse of the term natural experiment for the study design.

1.1. Abortion-related morbidity and mortality remain difficult to measure

Estimates of the incidence of maternal deaths have improved [2] but cause remains difficult to discern. Abortion incidence as a cause of maternal death is undercoded, underreported [8] and therefore undercounted in civil registration and vital statistics data as well as in hospital discharge data that rely on ICD-10 codes. Even in countries such as Mexico with robust vital statistics systems [9], common causes of direct maternal death, e.g. postpartum hemorrhage and sepsis, may not be explicitly attributed to delivery or abortion.

Relying on abortion-related ICD-10 codes to assess prevalence, safety, mortality or morbidity related to abortion is flawed [7]; ICD-10 codes may not represent the gold standard for causes of maternal death as Koch claims [10]. For these reasons, we focus this study on maternal deaths overall.

The denominator for MMR, live births, is often also captured in several data sources. In Mexico, births are counted via a birth registration system (called INEGI) [11], and the government (in an agency called CONAPO) also produces corrected birth estimates [12]. Koch et al. used birth registration data from INEGI and not the corrected estimates, and thus, they overestimate births due to population mobility for registering, double registration and time lags in registration. Low fertility can also inflate the MMR due to a smaller denominator; thus, researchers also use the ratio of deaths per 100,000 women of reproductive age (15–49 years) to account for this, called the maternal mortality rate [13].

1.2. Misclassification of access to abortion at the state level and classification of deaths by residence or place of occurrence

Mexico City changed its abortion law in 2007 [14], and abortion is available to all women (women younger than 18

years old must have an adult present) in the public, nongovernmental nonprofit, and private for-profit sectors. This is a watershed policy and service delivery advance in Latin America; however, abortion remains highly criminalized outside of Mexico City. Koch et al. classify states in Mexico as “more or less permissive” (i.e. abortion is less or more criminalized/restricted) based on exemption from prosecution of abortion in cases of congenital malformation (see Koch Table 1 and Supplementary Table A1). The congenital malformation exemption appears to have been selected because it was the only classification method that produced significant results. The most common legal indications across states in Mexico are rape, “imprudential conduct” and “risk to the life of the woman” [15]. However, accessing abortion service via these exemptions requires burdensome documentation, which varies by state [16]. The burden of proof (e.g. of rape) to access services means that abortion is essentially not available to women outside of Mexico City, especially for poor women, who have less access to health services in general and to abortion in particular [17].

Koch presents results by place of residence of the woman and place of occurrence of the death. He uses pooled results of place of occurrence of the death to help argue that states with access to abortion have higher MMR; however, the sickest women are most likely to travel outside their state of residence for care and ultimately to die. Koch draws inference from data on place of occurrence of the death, which does not help us understand availability of abortion in the state where the woman resides and the pregnancy presumably occurred.

In sum, the classification of the main exposure variable, availability of abortion, is deeply flawed. Koch presents a complex justification for his selection of congenital malformation as the deciding factor in being classified as “permissive” or not, while ignoring the obvious classification: prior to mid-2007, all 32 Mexican states are restrictive, and from mid-2007 on, only Mexico City has abortion available on request; the other 31 states remain restrictive.

1.3. Study design

The title of the manuscript includes the words “a natural experiment.” The exposure in a natural experiment must be independent of other factors that could affect the outcome [18]. It is part of a researcher’s job to convince readers of the validity of the claim of independence of the “naturally occurring” phenomenon and other observable or nonobservable factors. Koch provides no such justification. Abortion laws are not randomly distributed in Mexico (or globally); there are statistical techniques to address the endogeneity of abortion legislation, but Koch et al. neither employ such techniques nor acknowledge this limitation.

Second, no change is under study here. Koch et al. present descriptive data by year, using ARIMA models to test for time trends [19], and pooled multivariable models. These

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