Effects of Abortion Legalization in Nepal, 2001-2010

Jillian Henderson, Mahesh Puri, Kasturi Malla, Ashma Rana, Sudha Sharma, Indira Satyal, Kiran Regmi, Shridhar Acharya, Cynthia Harper, Daniel Grossman, Maya Blum, Prabhat Lamichhane, Dolmaya Thogra, Philip Darney

BACKGROUND
The legal status of induced abortion in Nepal shifted dramatically in 2002, owing in part to advocacy efforts aimed at reducing high maternal mortality from unsafe abortion in the country. In 2004, legal services commenced, permitting women to obtain safe and legal abortion for any reason up to 12 weeks of gestation, in the case of rape up to 18 weeks gestation, and with a physician's approval at any stage of pregnancy to protect the woman's health or in cases of fetal anomaly (Dahal 2004). The Nepali government, in partnership with non-governmental organizations, launched a nationwide program to train abortion providers and regulate the safety and availability of services.

The increased availability of safe services was expected to reduce maternal mortality in the country, and reduce the number of women experiencing serious health complications from abortion. To monitor the effects of the law change, we reviewed all abortion cases presenting at four large tertiary care hospitals in the country, similar to studies undertaken in the United States following legalization (Cates et al. 1978). Patient medical charts at the hospitals were retrospectively reviewed and abstracted for all women admitted with abortion (spontaneous and induced) complications during the years 2001-2010.

Interim results examining data from one hospital were presented at PAA in 2008, and the findings suggested an emerging downward trend in severe complications. Data from two additional years and three additional study sites (including two in rural areas) are now available, representing nearly six years of follow-up data from the start of legal services. With these data, we can test the hypothesis that with legalization of abortion, the risk of severe health consequences from unsafe abortion declines, and hospital caseloads of for sepsis and other unsafe abortion-related complications fall.

METHODS
Trained research staff conducted eligibility review for all charts filed as gynecological or mortality cases using a flow chart to capture cases of abortion, abortion complications, and treatments for abortion complications. All cases with surgical treatments commonly related to serious abortion complications were also abstracted (e.g., repair of uterine perforation) even when abortion was not recorded. Charts that were selected by this criterion were subject to additional review by clinicians to determine whether the case was likely to have been abortion related. A total of 18,205 eligible cases are included in our analysis. Of these, the majority are from a large urban maternity hospital (n = 12,808). All cases capture in our review process that were for fetal anomaly, induction for health reasons, molar pregnancy, ectopic pregnancy, and blighted ovum were excluded.

A measure of the severity of abortion complications presenting at the hospitals was developed for our study, drawing on the work of others (Jewkes et al. 1997). Low severity cases are those with no sign of infection or injury to the reproductive tract,

receiving conservative treatment, manual vacuum aspiration, or dilation and curettage. Medium severity cases show evidence of moderate infection (temperature >100.4 and <102°F) or corresponding treatments such as oral antibiotics. High severity cases are those with more serious infection, injury, or systemic complications (temperature of 102°F or above, a pulse of $\geq$120 bpm, septic shock or septicemia, generalized and local peritonitis, endometritis, pelvic or genital tract infection, signs of mechanical injury from the abortion, organ failure or death). Determination of high severity was in some cases augmented with information on treatments, such as intravenous antibiotics, transfusion, surgical repair, or time in the intensive care unit. The severity index does not incorporate evidence on whether the abortion was induced. A separate variable was constructed to indicate the likelihood that the case was induced, based on information in the medical chart and signs of instrumentation. Complications of medium and high severity are more likely to result from unsafe induced abortion, and we expect that reductions in complications following legalization would be greatest for these cases.

Analysis
The data were analyzed using segmented Poisson regression analysis. The Poisson distribution is considered optimal for modeling counts of events, and particularly to account for variability in the denominator and numerator of rates by specifying an exposure variable (the natural log of the population at risk) (Kuhn, Davidson and Durkin 1994; Sims et al. 2010; Wagner et al. 2002). Using a segmented model approach, we tested for differences in the trend in abortion cases, by severity, before and after the legal provisions became clinical and programmatic reality. A variable for season is included in the model to account for underlying cyclic trends. Tests for changes in the relative risk of complications of low, moderate, and high severity before and after legalization were conducted. In addition, we specify segments of the time period where policy changes occurred to estimate the association of events with changes in the trend.

For our full, final analysis, logistic models will be used to evaluate whether differences in the complication rate differs by whether the abortion was likely to have been induced and whether changes in the gestational age of presentation occur over the time period. We will also conduct model diagnostics and sensitivity tests to evaluate the influence of different model specifications on our results. For the post-implementation period, relationships between the place of residence, concentration of certified providers, and severity of complications will be tested in multivariate models. This analysis will help us to interpret our results and evaluate competing interpretations of the trend observed. Finally, we will describe in the types of complications showing the greatest decline and persisting after legalization.

RESULTS
Differences in the trend before and after legalization were observed, and these varied by case severity (Figure 1). A significant decrease in the risk of high severity abortions was observed in the period following implementation of the legal abortion policy (Table 1). Cases of moderate severity also declined, but less so. Following legalization, cases of low severity rose, and there were more cases presenting to the hospitals overall. Tests for significant changes in the slope indicate that a downward trend in decline in high severity cases did not begin to emerge until early 2007 (data not shown).
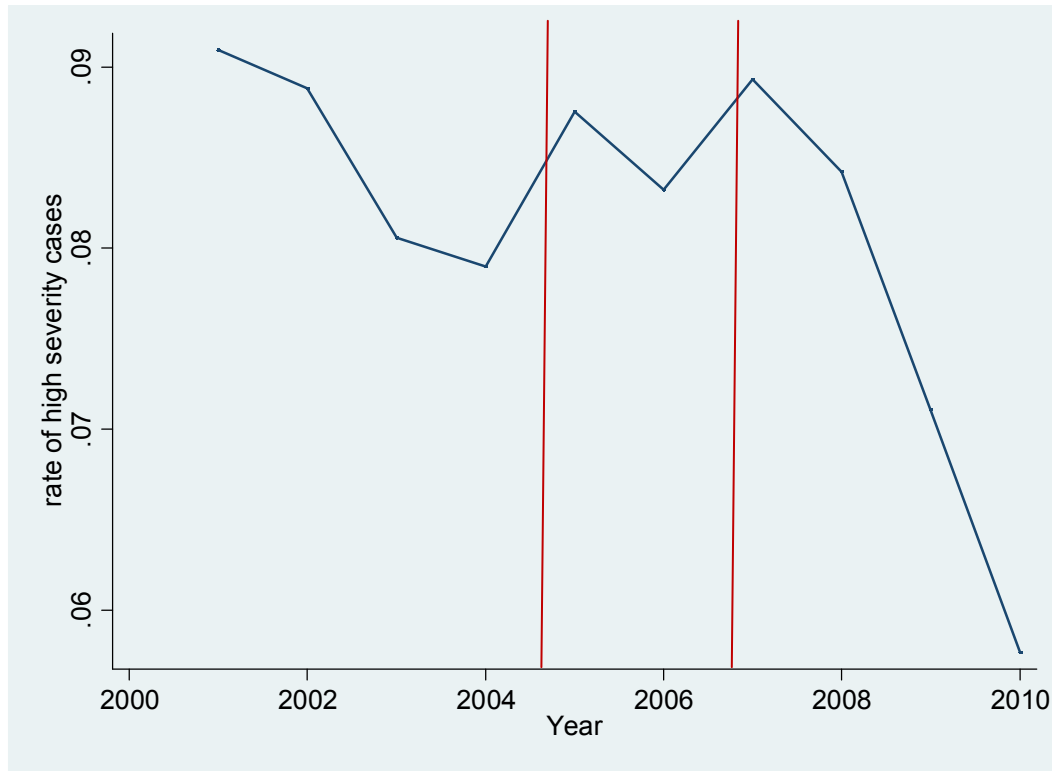
Figure 1. Rate of high severity complications, 2001-2010, n = 18,205

Table 1. Incidence rate ratio of abortion complications by severity, adjusted interrupted time series Poisson regression estimates, IRR (95% CI)

	Pre-post March 2004	Pre-post April 2007
High severity	0.997 (0.87, 0.89)	0.85 (0.84, 0.86)
Moderate severity	0.96 (0.95, 0.97)	1.07 (1.06, 1.08)
Low severity	1.18 (1.17, 1.19)	1.01 (1.01, 1.01)

Adjusted for season.

DISCUSSION

The change in abortion policy was followed by a decline in the most severe types of abortion complications, most precipitously after 2007 when second trimester training began and medication abortion was formally introduced into the safe abortion program. By 2008, the training program had certified at least one abortion provider in every district in the country, and this was facilitated by provisions permitting mid-level providers to receive training and certification.

There are some threats to validity for this hospital-based, natural experiment that warrant consideration, and could potentially inflate or conceal the trend over this time period. An increased willingness to seek induced abortion, in safe or unsafe settings, and to seek care for complications from abortion, would likely lead to a rise in abortion admissions.

However, presumably, the most life-threatening cases would be more likely to present and receive treatment across the entire study period. The underlying abortion rate (both spontaneous and induced) is also affected by the contraceptive prevalence and age distribution of the population. Data from the Nepal Demographic and Health Survey will be used to assess whether this could have affected our results. Access to health care likely changed over the study time period, with an expansion of free services occurring in the later years of the study. A review of the total gynecological and obstetric hospital admissions, and the number of live births, will be used to adjust for changes in health care use. Data on the number of facilities and providers certified by the national safe abortion program will also be reported to assess how the trend in complications correlates with the trend in the availability of safe services.

Our results can be used to inform policies on abortion, maternal health and service delivery in low-resource countries where abortion is both legal and illegal (Grimes et al. 2006). The data from this study will also be useful in assessing the contribution of the abortion policy change to the improvement in maternal mortality that has recently been reported by the Ministry of Health in Nepal. Observation of a decline in complications at major tertiary care hospitals helps attribute the decline in maternal mortality observed in Nepal to the legalization of abortion (Basnet et al. 2004). Our findings can aid the advocacy efforts for abortion legalization as an approach for reducing maternal mortality in other settings. The legalization of abortion in Nepal was motivated, in part, by the public health argument claiming that unsafe abortion is a major contributor to maternal mortality. Results from this study contribute to the literature on the potential causal link between abortion legalization and improvements in maternal health.

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