The Enduring Association of a First Pregnancy Abortion with Subsequent Pregnancy Outcomes: A Longitudinal Cohort Study

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Abstract

Introduction: Multiple abortions are consistently associated with adverse health consequences. Prior abortion is a known risk factor for another abortion.

Objective: To determine the persistence of the association of a first-pregnancy abortion with the likelihood of subsequent pregnancy outcomes.

Methods: Data was extracted for a study population of 5453 continuously eligible Medicaid beneficiaries in states which funded and reported elective abortions 1999–2015. Women age 16 in 1999 were organized into three cohorts based upon the first pregnancy outcome: abortion, birth, natural loss.

Results: Women in the abortion cohort are more likely than those in the birth cohort to experience another abortion rather than a birth or natural loss, and less likely to experience a live birth rather than an abortion or natural loss, for every subsequent pregnancy. The tendency toward abortion (OR 2.99, CL 2.02-4.43) and away from birth (OR 0.49, CL 0.39-0.63) peaks at the sixth pregnancy, but persists throughout the reproductive period ages 16–32. The pattern is reversed, but similarly consistent, for women in the birth cohort. They remain likelier to have another birth rather than an abortion or natural loss in subsequent pregnancies. Compared to the birth cohort, the abortion cohort had 1.35 times as many pregnancies: 4.31 times the abortions, 1.53 times the natural losses, but only 0.52 times the births. They were 4.3 and 5.0 times as likely to have 2-plus and 3-plus abortions, but only 0.47 times and 0.31 times as likely to have 2-plus and 3-plus births. Of the abortion cohort, 37.1% had no births. By contrast, 73.6% of the birth cohort had no abortions.

Conclusion: The first-pregnancy abortion maintains a strong and persistent association with the likelihood of another abortion in subsequent pregnancies, enabling a cascade of adverse events associated with multiple abortions.

Keywords

pregnancy outcome sequence, induced abortion, repeat abortion, Medicaid

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Introduction

Women exposed to multiple (two or more) induced abortions are at increased risk of adverse perinatal outcomes in subsequent pregnancies such as preterm birth and low birth weight, other negative longer term medical and psychological outcomes, and a 50% increased risk of death from all causes for each exposure.[1–10] As a result, multiple abortions are a demonstrated risk for reproductive mortality and morbidity.

Increases in the percent of women who underwent multiple abortions appears to be a global phenomenon as in France (18% in 1990% to 41% in 2011), Sweden (19% in 1975% to 38% in 2008), and New Zealand (23% in 1991% to 38% in 2011).[11,12] A 2013 survey in 30 provinces in China reported that among all women with a history of induced abortion, 64.8% had been exposed to multiple abortions.[13] In the United States the percentage of abortions being done on women with a previous history of abortion has ranged between 44%-59%.[14–16]

Many factors have been associated with multiple abortions, including individual sociodemographic characteristics (age, income, marital status, migrant status, parity), contraceptive knowledge and patterns of use, partner violence, drug abuse and others.[17–22] A history of prior abortion, however, appears to be the strongest risk factor for subsequent abortions. In a previous study, we determined that women who experience an abortion for any pregnancy in their reproductive history were more likely to become pregnant again and to experience another abortion in the next subsequent pregnancy.[23] We also found that 23% of Medicaid beneficiaries whose first pregnancy ended in an abortion were pregnant a second time within 12 months with approximately 60% undergoing a second abortion.[24] An important Finnish study followed a cohort of 1269 women who underwent chemical abortion for a follow-up period of 4.2 years ($+/-$ 1.5) and determined that young women with previous abortions were most likely to experience abortion in the subsequent pregnancy.[25]

Since abortion increases the risk of abortion in a subsequent pregnancy, an important question is whether the risk has perseverance. Does an initial abortion, particularly if it occurs with a woman's first pregnancy, have an influence on her entire reproductive history? No published research to date has addressed the association of a first pregnancy outcome with each and every subsequent outcome. In this analysis, we sought to determine whether or not the outcome of the first pregnancy establishes a marker which differentiates a woman's reproductive trajectory. If the outcome of a first pregnancy is associated with the increased risk of lifetime morbidity and mortality, a robust informed consent and educational process is essential.

Methods

Data were obtained from the enrollee-level Medicaid Analytic eXtract (MAX) files licensed through the Centers for Medicare and Medicaid Services (CMS) Chronic Condition Data Warehouse (CCW). The total analytic dataset is comprised of enrollees at least 13 years of age with at least one pregnancy outcome from the 17 states who allocated state funds to induced abortions not covered by federal Medicaid. For this specific design, we limited the study population to the seven states which had consistently submitted full Medicaid claims data during every year of the study observation period (1999-2015): Connecticut, New Jersey, New Mexico, New York, Oregon, Vermont, and West Virginia. Similarly, each eligible enrollee admitted to the study population had at least one month of Medicaid eligibility in each year of the 17-year study period. Identifying these states from which to draw the study population assured that no pregnancy outcomes would be lost to periods of non-reporting among the states or lack of eligibility among Medicaid beneficiaries. The study cohorts were determined from all women who were or turned 16 years of age in 1999. Analysis of a similarly defined population but of women 15 years of age in 1999 showed less than 0.47% experienced a pregnancy, providing high confidence that the study cohort assignment was based on the woman's first pregnancy outcome. Three cohorts were produced based upon the first pregnancy outcome: abortion cohort, birth cohort, or natural loss cohort. For each beneficiary, all unique pregnancy outcomes were identified using International Classification of Diseases, Ninth Revision (ICD-9) and Tenth Revision (ICD-10) codes. Additionally, Current Procedural Terminology, Fourth Edition (CPT4) and Healthcare Common Procedure Coding System (HCPCS) codes were used to confirm pregnancy outcomes.

All pregnancy outcomes were subdivided into three categories using these codes: live birth (ICD9 V27.0, V27.2, V27.5 and ICD10 Z370, Z372, V375), natural loss (ICD9 V27.1, V27.4, V27.7, 630, 631, 633, 634 and ICD10 O00, O01, O02, O03), and induced abortion (ICD9 635.xx, ICD10 O04, CPT4: 59840, 59841, 59850, 59851, 59852, 59855, 59856, 59857, and HCPCS: S0199, S2260, S2265, S2266, S2267, X7724, X7726, S0190, S0191). In order to uniquely define each pregnancy event, multiple diagnostic or treatment codes within 30 days of a pregnancy loss (natural or induced) were rolled into a single pregnancy outcome using the first date associated with that cluster of Medicaid claims. Multiple diagnostic or treatment codes within 180 days of a delivery were also collapsed into a single pregnancy outcome. Twins or higher-order pregnancies that resulted in both live birth and pregnancy loss were excluded from the analysis.

The analytic strategy was composed of three phases. First, each eligible enrollee was assigned to one of three cohorts based upon the first pregnancy outcome. For every enrollee, each subsequent pregnancy outcome during the study period was identified to create a pregnancy outcome sequence for each woman. Second, we calculated a series of logistic regression odds ratios and confidence intervals to determine the likelihood of experiencing a subsequent outcome event based only (exclusively) on the type of the first pregnancy outcome exposure. This would enable determination of the association of the first pregnancy outcome with the likelihood of each and every subsequent pregnancy outcome. Third, we calculated a series of summary statistics which allowed us to categorize the average reproductive histories of the three cohorts during the entire study period.

Summary analytic tables, and logistic regression models, including odds ratios and 95% confidence intervals were created using (SAS/STAT) software, version[10] of the SAS system for (Unix), copyright (2019) SAS Institute, Inc. The study has been exempted from Institutional Review Board (IRB) review pursuant to the U.S. Department of Health and Human Services Policy for Protection of Human Research Subjects at C.F.R. 46.101(b). See IRB ID: 7269, www.sterlingirb.com.

Findings

Overall, there were 5453 eligible beneficiaries in the three cohorts (Table 1): abortion (1331), birth (3517), and natural loss (605). The three cohorts accumulated a total of 14,451 pregnancies during the study period: abortion (4291), birth (8412), and natural loss (1748). The total distribution of all pregnancy outcomes for each cohort was as follows: abortion (abortion 65%, birth 28%, natural loss 7%); birth (abortion 20%, birth 73%, natural loss 7%); natural loss (abortion 22%, birth 39%, natural loss 39%). Notably, subsequent natural losses among women who had a first-pregnancy abortion were 1.53 times more common than among women whose first pregnancy ended in a live birth and 1.72 times more likely than women whose first pregnancy ended in a natural loss. Overall, 65.5% of our study population had two or more pregnancies. Women in the abortion cohort were more likely (79.2%) than women in the birth cohort (57.7%) to have two or more pregnancies. For the natural loss cohort, 81.1% had two or more pregnancies. This is consistent with the finding that the abortion cohort had 1.35 times as many pregnancies as women in the birth cohort. Birth cohort women are, therefore, about twice as likely as women in the abortion cohort to have only a single pregnancy.

Persistence of the First Outcome Association

Abortion cohort women are more likely than women in the birth cohort to experience another abortion rather than a birth or natural loss in subsequent pregnancies. This likelihood is progressively stronger, peaking at the sixth pregnancy (OR 2.99, CL 2.02-4.43). Similarly, these women are less likely to experience a live birth rather than an induced abortion or natural loss in subsequent pregnancies. The likelihood of a birth in this cohort is also minimized in the sixth pregnancy (OR 0.49, CL 0.39-0.63) (Table 2).

When compared with women in the abortion cohort, women in the birth cohort are less likely to experience an abortion rather than a birth or natural loss for subsequent pregnancies. These women are similarly more likely to have another birth in subsequent pregnancies. For the birth cohort, the tendency for another birth (OR 3.12, CL 2.06-4.70) and away from an abortion (OR 0.33, CL 0.23-0.50) also peaks at the sixth pregnancy (Table 2).

The first pregnancy outcome is a strong and consistent indicator of the likelihood of subsequent pregnancy outcomes. Abortion in the first pregnancy is associated with more

Table 1. Total Study Population in Three Cohorts, by Pregnancy Number, Number of Beneficiaries, and Pregnancy Outcome.

Pregnancy	First Pregnancy Abortion Cohort							First Pregnancy Birth Cohort							First Pregnancy Natural Loss Cohort						
	Abortion		Birth		Natural Loss		Total	Abortion		Birth		Natural Loss		Total	Abortion		Birth		Natural Loss		Total
	N	%	N	%	N	%	N	N	%	N	%	N	%	N	N	%	N	%	N	%	N
1	1331	100%	0	0%	0	0%	1331	0	0%	3517	100%	0	0%	3517	0	0%	0	0%	605	100%	605
2	383	36%	562	53%	109	10%	1054	662	33%	1127	56%	239	12%	2028	121	25%	336	69%	33	7%	490
3	332	49%	272	40%	79	12%	683	375	32%	673	57%	134	11%	1182	93	33%	163	58%	27	10%	283
4	249	53%	168	36%	54	11%	471	251	36%	371	53%	80	11%	702	67	42%	83	52%	11	7%	161
5	178	59%	95	31%	29	10%	302	152	36%	228	53%	48	11%	428	38	47%	35	43%	8	10%	81
6	124	67%	46	25%	15	8%	185	106	40%	133	51%	23	9%	262	22	49%	21	47%	2	4%	45
7–16	169	64%	64	24%	32	12%	265	150	51%	116	40%	27	9%	293	44	53%	36	43%	3	4%	83
Total	2766	65%	1207	28%	318	7%	4291	1696	20%	6165	73%	551	7%	8412	385	22%	674	39%	689	39%	1748

Table 2. Logistic Regression (Walde) Odds Ratios and 95% Confidence Intervals by First and Subsequent Pregnancy Outcomes.

	First Pregnancy Abortion Cohort			
	Likelihood of Abortion		Likelihood of Birth	
Pregnancy	OR	LCL-UCL	OR	LCL-UCL
2	1.18	1.01–1.38	0.91	0.79–1.06
3	2.04	1.68–2.47	0.50	0.41–0.61
4	2.02	1.59–2.56	0.49	0.39–0.63
5	2.61	1.93–3.53	0.40	0.30–0.55
6	2.99	2.02–4.43	0.32	0.21–0.49
7	1.94	1.18–3.21	0.45	0.15–2.27
8	2.38	1.20–4.72	0.39	0.16–3.60
	First Pregnancy Birth Cohort			
	Likelihood of Abortion		Likelihood of Birth	
Pregnancy	OR	LCL-UCL	OR	LCL-UCL
2	0.85	0.73–0.99	1.10	0.94–1.27
3	0.49	0.41–0.60	2.00	1.65–2.42
4	0.5	0.39–0.63	2.02	1.59–2.57
5	0.38	0.28–0.52	2.48	1.83–3.38
6	0.33	0.23–0.50	3.12	2.06–4.70
7	0.51	0.31–0.85	2.22	1.31–3.78
8	0.42	0.21–0.83	2.55	1.25–5.23

Table 3. Number and Percent of Women with Subsequent Pregnancies, by First Pregnancy Outcome Cohort.

	First Pregnancy Abortion Cohort		First Pregnancy Birth Cohort		% abortion ÷ % birth
Pregnancy	n	%	n	%	
1	1331	100.0%	3517	100.0%	1.00
2	1054	79.2%	2028	57.7%	1.37
3	683	51.3%	1182	33.6%	1.53
4	471	35.4%	702	20.0%	1.77
5	302	22.7%	428	12.2%	1.86
6	185	13.9%	262	7.4%	1.87
7	118	8.9%	138	3.9%	2.26
8	73	5.5%	71	2.0%	2.72
9	37	2.8%	40	1.1%	2.44
10	22	1.7%	21	0.6%	2.77
Total Pregnancies (1–10)	4276		8389		

abortions and fewer births in subsequent pregnancies. Birth in the first pregnancy is associated with more subsequent births and fewer abortions. The first pregnancy outcome is a persistent indicator of subsequent reproductive outcomes.

Pregnancies

For the study period, women in the abortion cohort averaged 3.22 pregnancies. Women in the birth cohort averaged 2.39 pregnancies. Therefore, abortion cohort women have more than a third (34.8%) more total pregnancies than women in the birth cohort.

Further, the likelihood of a subsequent pregnancy following a first-pregnancy abortion, relative to a woman with a first-pregnancy birth, increases progressively through 10 pregnancies (Table 3). Of abortion cohort women, 79.2% achieve a second pregnancy, but only 57.7% of women in the birth cohort have a second pregnancy, so there are 1.37 times as many second pregnancies among the abortion cohort. By the sixth pregnancy the ratio is 1.87 times and, by pregnancy 10, women in the abortion cohort have 2.77 times as many tenth pregnancies as women in the birth cohort.

Distribution of Abortions and Births

Nearly three quarters (73.6%) of women in the birth cohort and 66.3% of the women in the natural loss cohort had no abortions. While 41.5% of the abortion cohort had more than a single abortion, only 9.7% of women in the birth cohort and 13% of the natural loss cohort did so. Of the abortion cohort, 26.5%

had three or more (3+) abortions compared to only 5.3% of the birth cohort and 6.6% of the natural loss cohort. Over 11% (11.3%) of the abortion cohort women had five or more (5+) abortions compared to only 1.6% of the birth cohort and 2.1% of the natural loss cohort (Table 4).

Over one-third (37.1%) of the abortion cohort and 30.7% of the natural loss cohort had no births. While 39.4% of the birth cohort had more than a single birth, 18.6% of women in the abortion cohort and 23.5% of the natural loss cohort had more than one child. The percentages for three or more (3+) births are as follows: abortion cohort, 5.8%; birth cohort, 18.8%; natural loss cohort, 10.2% (Table 5).

Women in the abortion cohort (Figure 1) are consistently and increasingly likely to have an abortion rather than a birth. For women with only two abortions (15% - see Table 4) and only two births (12.8% - see Table 5), the A/B ratio (15%/12.8%) is 1.17. For women with six abortions and women with six births, the A/B ratio is 10.0. The birth cohort (Figure 2) of women are consistently less likely to have an abortion rather than a birth for any discrete count of pregnancy outcomes. At 2 only abortions and births, the A/B ratio is 0.21. For 6 only abortions and births, the A/B ratio is 0.26. Compared to the consistently increasing ratio of abortions to births in the abortion cohort, the birth cohort trajectory is reversed (ie, consistently more births than abortions) and also relatively stable through six pregnancies. Beyond six pregnancies, the A/B ratio spikes for both cohorts because of the overall likelihood of an abortion versus a birth for women achieving this number of pregnancies independent of the outcome of the first pregnancy.

Discussion

Compared to a woman who carries her first pregnancy to term, the woman who terminates her first pregnancy has 1.35 times as

Table 4. Number (%) of Women by Discrete Count of Abortions, by First Pregnancy Outcome.

Discrete Count of Abortions	First Pregnancy Abortion Cohort 1331		First Pregnancy Birth Cohort 3517		First Pregnancy Natural Loss Cohort 605		Total 5453	
	n	%	n	%	n	%	n	%
0			2590	73.6%	401	66.3%	2991	54.9%
1	778	58.5%	587	16.7%	125	20.7%	1490	27.3%
2	200	15.0%	152	4.3%	39	6.4%	391	7.2%
3	130	9.8%	86	2.4%	17	2.8%	233	4.3%
4	73	5.5%	44	1.3%	10	1.7%	127	2.3%
5	67	5.0%	19	>1.0%	4	>1.0%	90	1.7%
6	40	3.0%	17	>1.0%	4	>1.0%	61	1.1%
7	23	1.7%	11	>1.0%	1	>1.0%	35	>1.0%
8	13	1.0%	4	>1.0%	2	>1.0%	19	>1.0%
9	4	>1.0%	5	>1.0%	0	0.0%	9	>1.0%
10	3	>1.0%	2	>1.0%	0	0.0%	5	>1.0%
11	0	0.0%	0	0.0%	0	0.0%	0	0.0%
12	0	0.0%	0	0.0%	2	>1.0%	2	>1.0%

Table 5. Number (%) of Women by Discrete Count of Births, by First Pregnancy Outcome.

Discrete Count of Births	First Pregnancy Abortion Cohort 1331		First Pregnancy Birth Cohort 3517		First Pregnancy Natural Loss Cohort 605		Total 5453	
	n	%	n	%	n	%	n	%
0	494	37.1%			186	30.7%	680	12.5%
1	589	44.3%	2133	60.6%	277	45.8%	2999	55.0%
2	171	12.8%	723	20.6%	80	13.2%	974	17.9%
3	52	3.9%	364	10.3%	36	6.0%	452	8.3%
4	11	>1.0%	127	3.6%	15	2.5%	153	2.8%
5	9	>1.0%	74	2.1%	4	>1.0%	87	1.6%
6	4	>1.0%	65	1.8%	3	>1.0%	72	1.3%
7	1	>1.0%	23	>1.0%	2	>1.0%	26	>1.0%
8	0	0.0%	7	>1.0%	1	>1.0%	8	>1.0%
9	0	0.0%	1	>1.0%	1	>1.0%	2	>1.0%

many pregnancies, 4.31 times as many abortions, 1.53 times as many natural losses, but only 0.52 times as many births. She is 4.3 times as likely to have 2 or more abortions but only 0.47 times as likely to have 2 or more children; 5.0 times as likely to have 3 or more abortions, but only 0.31 times as likely to have 3 or more children. Of her peers in the abortion cohort, 37.1% will be childless at age 32. By contrast, 73.6% of the birth cohort will not have had an abortion.

Abortion, and especially exposure to multiple abortions, can predispose to future pregnancy complications. For example, surgical trauma to the uterine lining in a dilation and suction, curettage or evacuation procedure may cause an abnormal placental attachment in the next pregnancy. Placental abruption (separation) or placental accreta syndrome (invasion) can occur, and either can lead to life-threatening bleeding at delivery. Abortion has been documented to increase risk of subsequent preterm birth. Obstetric interventions to delay delivery in the instance of premature labor or premature rupture of membranes can increase a woman's risk of medication toxicity and infection. Abortion, especially repeat abortion, is linked to increased risk of premature deaths from all causes, including suicide, and also other mental health disorders such as anxiety, depression, substance abuse or overdose, and excessive risk-taking behavior.[10]

It is clear that the outcome of a first pregnancy is at least a strong marker, and perhaps an important influencer, of the frequency and outcomes of subsequent pregnancies, including
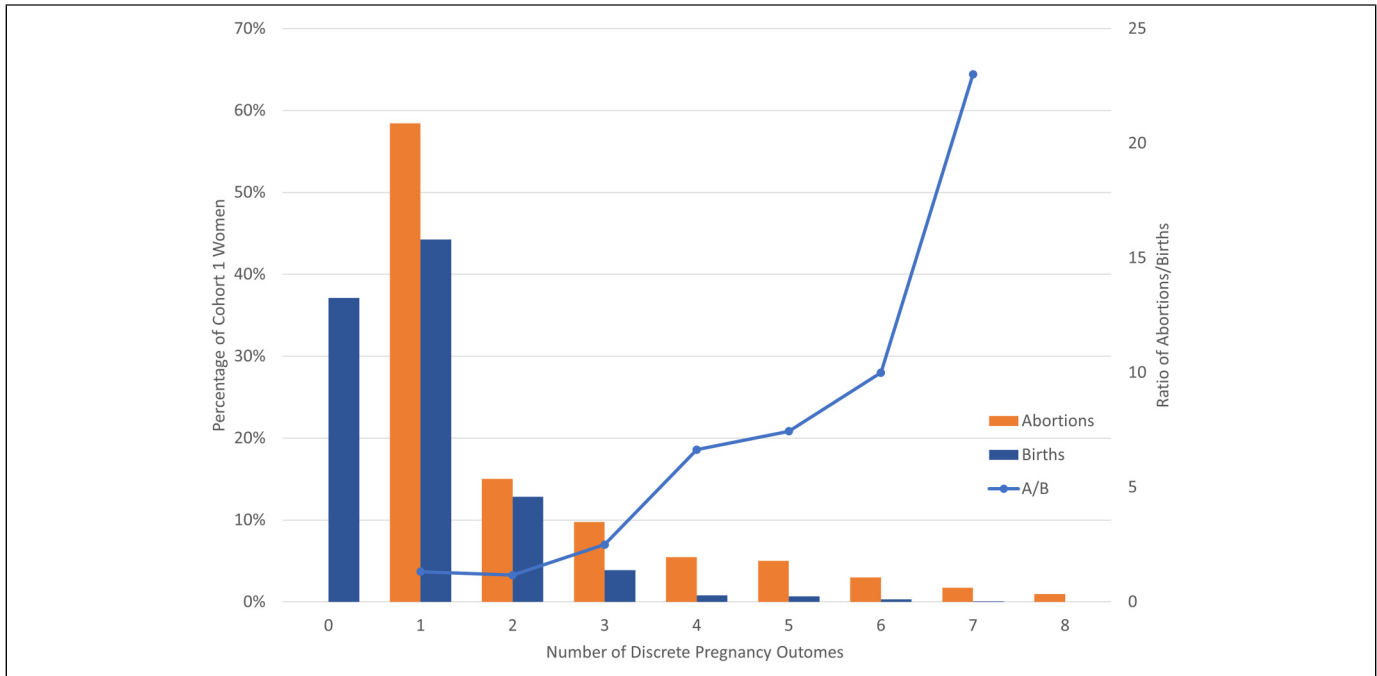
Figure 1. Distribution of birth and abortion pregnancy outcomes: first pregnancy abortion cohort.
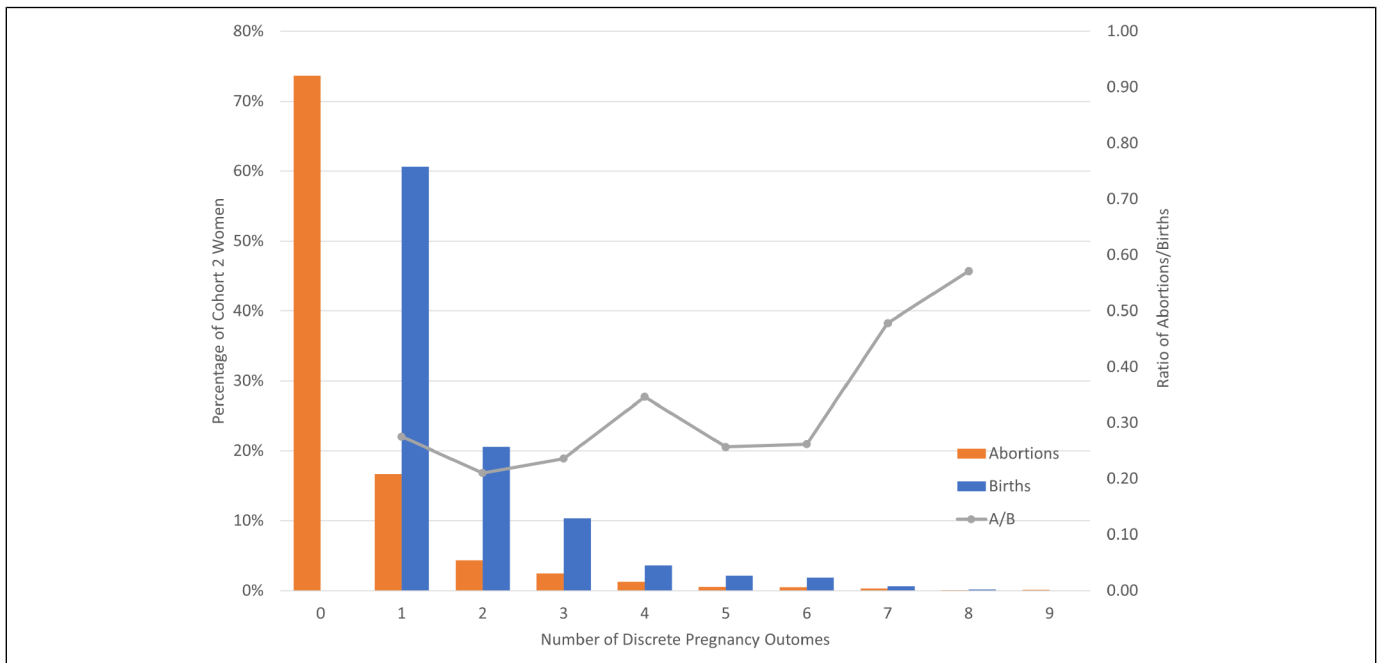

Figure 2. Distribution of birth and abortion pregnancy outcomes: first pregnancy birth cohort.

rapid repeat pregnancies[24] and the risks associated with exposure to multiple induced abortions. The robust and enduring effect of the first pregnancy outcome on a woman's reproductive life and aspirational goals must be honestly and widely communicated. The screening and risk disclosures for women considering abortion, especially of a first pregnancy, should include a discussion of the elevated risks associated with

multiple abortions and the critical importance of the first pregnancy outcome.

The study population is limited to low-income women and cannot be generalized to a more affluent population. However, socioeconomic factors are not likely to significantly contribute to the differences found between the cohorts in our study population. For example, the states included in the

study population all provide abortion services and, since 1972, coverage for prescription contraceptives.[26] Therefore, access to family planning services and abortion is uniformly assured within the study population across cohorts. Our study period does not capture the entire reproductive history, missing the pregnancy outcomes beyond 32 years of age. We estimate that about 11% of future births and 14% of future abortions are not included in this analysis.[27,28] In a previous analysis, we determined that women 36 + years of age are increasingly more likely to abort a subsequent pregnancy and less likely to experience childbirth following an index abortion, no matter the pregnancy for which the abortion occurred.[23] The results of the current study also indicate that abortion is increasingly likely with increasing age and pregnancy order, independent of the first pregnancy outcome. Therefore, there is no reason to believe that the missing pregnancy outcomes in later reproductive years are a threat to the validity of our findings.

Declaration of Conflicting Interests

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