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Did increasing use of highly effective contraception contribute to declining abortions in Iowa?☆

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Abstract

Background: Between 2006 and 2008, Iowa increased access to family planning services through a Medicaid expansion and a privately funded initiative. During this same time, Iowa expanded access to abortion through telemedicine provision of medical abortion. Despite increased access to abortion services, abortions in Iowa have declined. This study assessed whether increased provision of long-acting reversible contraception (LARC) may have contributed to the abortion decline.
Study design: We analyzed abortion data from Iowa vital statistics and LARC use data from 14 family planning agencies' records (N=544,248) for the years 2005 to 2012. Mixed-effects logistic regression analyses assessed whether changes in the percentage of LARC users were associated with subsequent reductions in abortion across the state.
Results: From 2005 to 2012, the number of family planning clients using LARC increased from 539 to 8603 (less than 1% to 15%); the number of resident abortions decreased from 5198 to 3887 (8.7 per 1000 women aged 15–44 to 6.7). There were reduced odds of abortion (adjusted odds ratio, 0.96; 95% confidence interval: 0.94–0.97) with increased LARC use.
Conclusions: Declines in abortion followed increases in LARC use in Iowa.

Keywords: Abortion; Long-acting reversible contraception; Iowa; Family planning

1. Introduction

The United States has observed a steady decline in abortions since the early 1990s, reaching 16.9 abortions per 1000 women aged 15–44 years in 2011, the lowest level since the procedure became legal in 1973 [1–3]. A number of factors may explain this decrease, including changes in demographics, desired family size, access to contraceptive and abortion services, and economic conditions.

Some researchers have suggested that the abortion decline may be due to use of more efficacious methods such as long-acting reversible contraception (LARC) [1,3]. LARC methods include the intrauterine contraceptive device (IUD) and the single-rod contraceptive implant [4]. There has been widespread interest in LARC methods because of their safety and suitability for nearly all women, including adolescents, and their potential to reduce unintended pregnancies [5–8].

Emerging evidence suggests that LARC use may be associated with reductions in unintended pregnancies and abortions. The Contraceptive CHOICE project, a prospective cohort study conducted in the St. Louis area, provided contraception at no cost to nearly 10,000 women, with a particular emphasis on promoting LARC use [9,10]. Results from this study showed that the rates of abortion in St. Louis were markedly lower than in comparable regions following the introduction of no-cost LARC [9]. However, because this study was an observational study limited to a small geographic area, it is unknown whether results are generalizable to other settings. More recently, a study in Colorado found that a statewide intervention to increase LARC access among low-income women corresponded to a decline in abortions [11]. Research isolating the effects of LARC use on abortion is limited.

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Declines in access to abortion services, due to either legal restrictions or declines in the number of facilities, could also play a role in decreasing the number of abortions in the United States. However, most legislative restrictions were implemented long after the abortion rate began to decline in the early 1990s, and thus, any real impact of these policy changes is yet to be seen [12,13]. As researchers study the effects of recent legislative restrictions on women's access to abortion services, it will be important to understand the independent contributions of other factors, such as changes in the use of effective contraceptive methods that may also impact the abortion rate.

In this study, we investigated whether changes in LARC use over time were followed by reductions in abortions between 2005 and 2012 in one Midwestern state, Iowa. Like other states in the Midwest, Iowa has a relatively low and declining abortion rate [3]. This trend coincides with a decline in all live births, including teen births [14]. We use family planning visit and vital statistics data to examine whether baseline changes in LARC use led to subsequent reductions in the number of abortions within each of Iowa's 26 Induced Termination of Pregnancy (ITOP) regions. This longitudinal analysis offers a new contribution to the literature by considering the temporality of LARC use and abortion, a prerequisite to establishing causation. To do so, we assess changes within Iowa's 26 ITOP regions over time while controlling for baseline and other known confounders in a real-world setting. We hypothesized that larger regional increases in LARC use would be associated with fewer abortions.

2. Materials and methods

2.1. Study setting and context

From 2005 to 2012, Iowa presents a unique setting and time period to test the association between LARC use and abortion. In contrast to many other US states that restricted access to abortion during our study period, access to abortion care expanded in Iowa [3]. Since 2008, women in Iowa can obtain medical abortion through telemedicine provision. By 2010, this service was available in 15 facilities throughout the state. All facilities offering surgical abortions prior to the introduction of telemedicine abortion continued to offer this procedure after telemedicine was introduced. While the overall abortion rate declined in Iowa during the 2 years after telemedicine services were introduced, women living in rural areas of the state were more likely to obtain an abortion — especially early medical abortion [15]. The introduction of telemedicine abortion resulted in an overall increase in the number of abortion facilities in Iowa, from 9 in 2005 to 18 in 2011 [3]. As a result, the abortion decline in Iowa cannot be attributed to abortion restrictions or a reduction in abortion facilities, making Iowa an ideal place to test the association between LARC use and abortion.

During the study period, access to contraception expanded for low-income women via two important efforts. In 2006, Iowa expanded its income eligibility requirements so that women at or below 200% of the Federal Poverty Guidelines (FPG) were eligible for Medicaid-funded family planning services. At this time, approximately 160,000 Iowa women were in need of publicly funded family planning services [16]. Furthermore, from 2007 to 2013, a privately funded initiative, the Iowa Initiative to Reduce Unintended Pregnancies, was launched with the aim of reducing unintended pregnancies through increased funding for Title X and other family planning agencies serving low-income women in the state [17]. In 2012, 81% of Title X patients in Iowa were at or below 250% of FPG [18]. This initiative also focused on increasing LARC use by funding family planning agency efforts to train clinicians and staff in both LARC insertions and eligible populations, improve providers' skills and comfort levels providing contraception, expand operating hours and locations, subsidize LARC devices, market services and increase community awareness about LARC.

2.2. Measures

All measures were collected at the level of region and year (2005–2012) which served as the unit of analysis. Iowa has 26 ITOP regions, each the size of approximately four counties. In 2012, the number of women in each region ranged from 6680 to 93,803 women aged 15–44. Iowa ITOP regions are defined by the Iowa Department of Public Health (IDPH) Vital Statistics reports for the years 2005–2012 [14].

2.2.1. Abortion

Our outcome of interest was abortion. Data on abortions among women aged 15–44 in each region and year were obtained from the IDPH Vital Statistics reports [19]. Health care providers who provide abortion services in Iowa are mandated to report each termination to the health department within 30 days. All abortions are reported by the patient's place of residence, not the place of occurrence. Abortions among out-of-state residents were not included in this analysis.

2.2.2. LARC use

The primary independent variable was *change in the percentage of LARC users since 2005* among all agencies funded by the Iowa Initiative to Reduce Unintended Pregnancies. The Iowa Initiative funded all Title X agencies in the State as well as some family planning agencies that do not receive Title X funding. Eight years (2005–2012) of Iowa family planning visit data was obtained from the two organizations which administer Title X family planning services in Iowa: the IDPH and the Family Planning Council of Iowa (FPCI). Additional data were obtained from Planned Parenthood of the Heartland (PPH), which operates family planning clinics with and without Title X funding. All received Iowa Initiative funding. IDPH visit information for eight Title-X-funded family planning agencies (including 45 service sites) was derived from the Iowa Clinic Visit Record form available from Ahlers & Associates, which provides data management services for Title X grantees. PPH visit

information included 24 service sites. One PPH service site was removed from analyses because data were only available for intermittent years. Any remaining family planning service sites not captured from the IDPH and PPH data sources were retrieved from FPCI Family Planning Annual Reports, which provided aggregated numbers of visit information for five Title X agencies (nine service sites).

For each year, all family planning clients who adopted or continued using an IUD or implant in that year are counted as a LARC user. *Percentage of LARC users* was estimated by dividing the total number of LARC users aged 15–44 in each region and year by the total number of women aged 15–44 living in that region for each year. The *change in the percentage of LARC users since 2005* variable was created by subtracting the annual percentage of LARC users from the 2005 percentage of LARC users. An alternative, cumulative version of the *change in the percentage of LARC users* variable was created to account for the long-term effectiveness of LARC. This cumulative variable was used in a sensitivity analysis. We used lower estimates of LARC continuation than those published [19] to account for the fact that our data on LARC use captured both women initiating and continuing LARC use. We assumed that half of LARC users were still using a LARC method the following year, 25% were still using a LARC method after 2 years and 0% were still using after 3 years.

2.2.3. Demographic variables

We controlled for variables that could confound the relationship between LARC use and abortion. *Percentage of people living below the federal poverty level* was retrieved from the US Census Bureau's Small Area Income and Poverty Estimates, which are derived from the American Community Survey. *Change in the percentage of people living in poverty since 2005* variable was created by subtracting the annual poverty percentage from the 2005 poverty percentage. *Population density* was estimated by dividing the total land area in square miles in each county, as reported in the 2010 US Census, by the total county population. Population estimates for 2010–2012 were based on the 2010 US Census; population estimates for 2005–2009 were derived from the 2000 US Census and prepared by the State Library of Iowa, State Data Center Program. Poverty and population data were only available at the county level. Therefore, data for all counties within each of Iowa's regions were summed by year. The *number of abortion facilities* in each region and year was retrieved from the main agency that provides abortions in the state, as well as from published reports [3].

Finally, to account for variation in the number of reproductive-aged women by region and year, we included a *reproductive age women* variable to weigh analyses. This also served as our denominator to estimate the proportions of reproductive age LARC users and abortions. The IDPH yearly Vital Statistics reports [14] were used to assess the total number of women aged 15–44 by region and year.

2.3. Statistical analyses

First, we describe statewide trends in population demographics, abortions and LARC use from 2005 to 2012. Then, to assess the effect of baseline change in the proportion of LARC users on abortion, we used a multivariable mixed-effects logistic regression model, with random intercepts for region to account for clustering. *Change in the percentage of LARC users since 2005* served as our primary independent variable. Covariates included *population density*, the number of *abortion facilities* and *change in the percentage of people living in poverty since 2005*. We also included two baseline measures as covariates: the *2005 percentage of LARC users* and the *2005 percentage of people living in poverty*. By including baseline LARC use and focusing on the primary predictor of change in the proportion of LARC users since baseline, we were able to account for confounding at the cluster (region) level [20]. We conducted two separate sensitivity analyses to test the robustness of our results. To test the assumption of equal correlation across years within regions in the mixed-effects model, we also fit the data using a general estimating equation (GEE) approach, with robust standard errors. In the second sensitivity analysis, we ran the mixed-effects logistic regression model with the cumulative change in LARC use variable. Data were analyzed with STATA 13. The study protocol was approved by the University of California, San Francisco, Institutional Review Board.

3. Results

Statewide LARC use at these family planning agencies increased from less than 1% of reproductive age family planning clients in 2005 to 15% in 2012, with similar proportions using the IUD and implant in 2012 (Table 1). In absolute numbers, this represents an increase of 8064 LARC users during our study period. The percentage of LARC users among reproductive age women in the population increased from 0.09% in 2005 to 1.48% in 2012. The number of in-state resident abortions per 1000 reproductive age women declined from 8.7 abortions in 2005 to 6.7 in 2012; this represents a decline of 1311 abortions. The greatest increase in LARC use occurred after the launch of the Iowa Initiative in 2007, with peaks in the proportion of LARC users occurring in 2009 and 2011 (Fig. 1); the abortion rate began to decline shortly after abortion access expanded. The percentage of Iowans living in poverty increased during this time period.

Results from the mixed-effects logistic regression analysis with abortion as the outcome indicate that greater increases in the regional percentage of LARC users over time were associated with reduced odds of abortion in that region [adjusted odds ratio (aOR), 0.96; 95% confidence interval (CI): 0.94–0.97] (Table 2). Specifically, a temporal increase over baseline of 1 LARC user per 100 women in a given

Table 1
Trends in number of reproductive age women, female family planning clients, LARC users, resident abortions, abortion facilities and poverty, Iowa, 2005–2012

	2005	2006	2007	2008	2009	2010	2011	2012	Absolute change 2005–2012
Total females aged 15–44 in the population	600,820	587,468	582,948	579,125	577,743	576,760	578,260	579,691	−21,129
Total female family planning clients aged 15–44	62,778	67,775	66,121	67,487	68,869	66,463	62,601	57,352	−5,426
Percent female family planning clients by age group									
15–17 years	12%	12%	12%	12%	12%	11%	11%	10%	−2%
18–19 years	17%	16%	15%	15%	15%	14%	14%	13%	−3%
20–24 years	40%	39%	38%	37%	36%	36%	35%	35%	−5%
25–29 years	16%	17%	18%	19%	19%	20%	20%	21%	5%
30–34 years	7%	8%	8%	9%	9%	10%	11%	12%	4%
35–39 years	5%	5%	5%	5%	5%	5%	6%	6%	1%
40–44 years	3%	3%	3%	3%	3%	3%	4%	4%	<1%
Total female family planning clients aged 15–44 using LARC	539	1,047	2,063	7618	10,037	8314	9,141	8603	8064
IUD users	524	1039	1673	4859	6061	4860	5056	4547	4023
Implant users	15	8	399	2800	4031	3477	4117	4077	4062
Percent of female family planning clients aged 15–44 using LARC	0.86%	1.54%	3.12%	11.29%	14.57%	12.51%	14.60%	15.00%	14.14%
IUD users	0.83%	1.53%	2.53%	7.20%	8.80%	7.31%	8.08%	7.93%	7.09%
Implant users	0.02%	0.01%	0.60%	4.15%	5.85%	5.23%	6.58%	7.11%	7.08%
Percent of LARC users among women aged 15–44 in the population	0.09%	0.18%	0.35%	1.32%	1.74%	1.44%	1.58%	1.48%	1.39%
IUD users	0.09%	0.18%	0.29%	0.84%	1.05%	0.84%	0.87%	0.78%	0.70%
Implant users	0.00%	0.00%	0.07%	0.48%	0.70%	0.60%	0.71%	0.70%	0.70%
Number of abortion facilities	9	9	9	9	18	19	19	19	10
Abortions to in-state residents	5198	5588	5283	5550	4883	4375	4031	3887	−1311
In-state resident abortions per 1000 women aged 15–44	8.65	9.51	9.06	9.58	8.45	7.59	6.97	6.71	−1.94
Percent of population living in poverty	10.82%	10.98%	10.98%	11.42%	11.78%	12.51%	12.70%	12.68%	1.86%

region was associated with a 4% reduction in the odds of abortion for women living in that region. Increases in the percentage of the population living in poverty were also associated with significantly reduced odds of abortion (aOR, 0.92; 95% CI: 0.91–0.94).

In sensitivity analyses using GEE, baseline change in LARC use remained significantly associated with odds of abortion (aOR, 0.96; 95% CI: 0.93–0.99), closely mirroring primary analyses. Similarly, when we assumed that LARC users continued to use LARC beyond the initial year they were counted, results were consistent (aOR, 0.95; CI: 0.94–0.96).

4. Discussion

This study demonstrates a significant longitudinal association between increases in LARC use and the subsequent declines in abortion across Iowa regions. Our estimates suggest that a small increase of 1 new LARC user per 100 women in a region was associated with a 4% decline in abortions each year. This decline happened in conjunction with an increase in the number of facilities offering abortion care to women, particularly in rural and remote areas [15]. Given the increase in abortion access and lack of legal restrictions placed on abortion from 2005 to 2012, we can reasonably assume that reductions in abortions over the study period were not a result of restricted access to care.

The reasons to explain the increase of more than 8000 women using LARC in this study are likely similar to those that could be attributed to the national increase in LARC uptake [21]. These include the introduction of the single-rod contraceptive implant to the US market in 2006, changing professional guidelines recommending LARC for a broader spectrum of women [22–24], providers' changing and more favorable views about LARC, and women's increasing awareness and knowledge about LARC [25,26]. Likely further impacting the increase in LARC use specifically in Iowa is the fact that low-income women had access to low or no-cost contraception through the Medicaid family planning waiver and dedicated funding to Title X and other family planning agencies as part of the Iowa Initiative to Reduce Unintended Pregnancies. The larger increases in LARC use observed in 2009 and 2011 are likely a result of two statewide social marketing and media campaigns funded by the Initiative aimed at increasing LARC use. These two campaigns were active during the peak LARC use periods [27,28]. The ensuing decline in LARC use observed as the Iowa Initiative came to a close suggests that existing levels of LARC use may not be sustained over time.

Interestingly, the proportion of LARC users in Iowa was equally divided between IUD (7.9%) and implant (7.1%) users, whereas for the United States as a whole, the overall proportion of LARC users is mostly due to IUD users (7.7% vs. 0.8%) [27,28]. By the end of the study period, nearly all

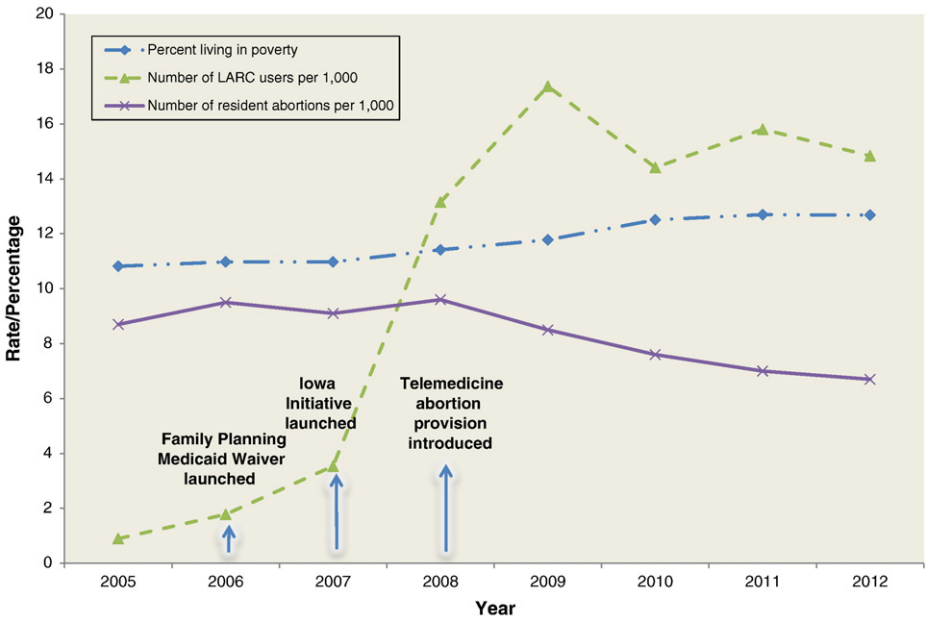

Fig. 1. Number of LARC users and abortions per 1000 women aged 15–44 and percentage of population living in poverty, Iowa, 2005–2012.

agencies reported that they offered both IUD and implants onsite with no differences in availability by method [17], which may explain the equal proportions of women adopting each method. Nationally and in other states, it is estimated that about two thirds of sites offer IUDs and 40% offer implants onsite [26,29].

Our finding that increases in the percentage of the Iowa population living in poverty were associated with reduced odds of abortion is intriguing. One explanation proposed by Jones and Jerman and others [3,30] is that the economic recession may have increased women's motivation to avoid pregnancy, which in turn would increase their use of contraceptives and/or reduce their sexual activity, thereby contributing to the abortion decline. This hypothesis, however, could also explain a rise in abortions: women who are motivated to prevent pregnancy are also those motivated to seek abortion when faced with an unintended pregnancy. Moreover, even when women are motivated to prevent pregnancy, some may still engage in unprotected intercourse for a number of reasons ranging from misunderstanding their risk of experiencing an unintended pregnancy to lack of convenient and affordable access to effective contraceptive methods [31,32]. The results of our study are consistent with the Jones and Jerman hypothesis perhaps because women in Iowa, unlike women in other states, had greater access to no-cost contraception in a broad range of clinics and locations through the Medicaid Waiver and Iowa Initiative to Reduce Unintended Pregnancies.

We were surprised that the number of abortion facilities in a given region was associated with reduced odds of abortion. The number of abortion facilities in a region may be an indicator of LARC access. Eleven of the 15 facilities where telemedicine abortion provision was introduced were existing family planning facilities that had not previously offered abortion services [15]. Thus, the places where women had access to abortion services in Iowa were the same places where women could access LARC methods. This may explain why there were fewer abortions in areas with an abortion facility.

4.1. Limitations

This study has a number of limitations that must be considered when interpreting its findings. We likely underestimate the true number of abortions in Iowa. Abortion data in general are known to suffer from underreporting. According to the Guttmacher Institute, which is known to have more complete abortion data than governmental reports, the abortion rate in Iowa was 9.3 per 1000 reproductive age women in 2011, whereas the Iowa Vital Statistics indicate a rate of 8.3 for that same year [3,33]. Both these figures include in-state abortions including those of out-of-state residents. Nonetheless, the relationship between LARC use and abortion is unlikely to have been affected by an abortion undercount. Another limitation is that we did not take into account the portion of abortions that may have been therapeutic and/or among wanted pregnancies. We have no reason to believe that LARC use would have an impact on wanted pregnancies ending in abortion.

Furthermore, while our analysis included the entire universe of resident abortions performed in the state, our data on family planning clients were limited to sites that received Iowa Initiative funding. While these included all Title-X-funded facilities as well as other family planning agencies, women accessing contraceptive services from private practices or other, smaller clinics were not captured by this analysis. In 2010, it is estimated that 36% of the need for publicly funded contraceptive services in Iowa was met by

Table 2
Multivariate mixed-effects logistic regression estimating association of changes in LARC use with odds of abortion over time

	aOR	95% CI	p value
Change since 2005 in percentage of LARC users	0.96	0.94–0.97	.000
Model covariates			
Baseline (2005) percentage of LARC users	2.34	0.55–9.91	.248
Baseline (2005) percentage living in poverty	1.05	0.97–1.14	.217
Change in percentage living in poverty since 2005	0.92	0.91–0.94	.000
Number of abortion facilities	0.98	0.96–0.99	.000
Population density	1.00	1.00–1.00	.726

Title-X-funded facilities [34]. Because Title-X-funded facilities are a key source of contraceptive care to low-income women, a substantial proportion of the family planning care used by low-income women was captured.

Another limitation is that we lacked data on method continuation. LARC methods are effective from 3 to over 10 years; between 78% and 84% of LARC users are still using the method at 1 year [19]. Because we only counted LARC use if a family planning client had a clinic visit, the true impact of LARC use is underestimated by our analysis as many LARC users may not return for a clinic visit in subsequent years. The results of our sensitivity analysis, in which we took into account the cumulative effect of LARC continuation, were consistent with our main findings, further supporting the robustness of our results. Finally, our findings may not be generalizable to other settings and states with different policies around abortion and contraception.

4.2. Strengths

This analysis also has several important strengths. By assessing changes in LARC use and subsequent abortion while controlling for initial LARC use, we are able to remove region-level confounding, isolate the effect of LARC use on abortion and establish a clear temporal relationship between LARC and abortion [35]. It is the first study to our knowledge to evaluate the statistical effect of changes in LARC use over time on abortion. Although the magnitude of the effect may appear small, such an effect could have important implications on the population level from a public-health perspective.

In conclusion, increases in LARC use were associated with the abortion declines in Iowa. Although it would require further study, LARC use likely also had a significant impact on unintended pregnancies and births in the state. Our findings support the need to continuously provide women with access to both abortion and contraceptive services which together help to ensure that women can make and carry out their own childbearing decisions.

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References

[1] Pazol K, Creanga AA, Burley KD, Hayes B, Jamieson DJ. Abortion surveillance — United States, 2010. Morb Mortal Wkly Rep Surveill Summ 2013;62:1–4.
[2] Gamble SB, Strauss LT, Parker WY, Cook. DA, Zane SB, Hamdan S. Abortion surveillance — United States, 2005. MMWR Surveill Summ 2008;57:1–2.
[3] Jones RK, Jerman J. Abortion incidence and service availability in the United States, 2011. Perspect Sex Reprod Health 2014;46:3–4.
[4] Trussell J. Contraceptive efficacy. In: Hatcher RA, Trussell J, Nelson AL, Cates W, Kowal D, & Policar M, editors. Contraceptive technology. NewYork, NY: Ardent Media; 2011. [Twentieth, Revised ed.].
[5] Grimes DA. Forgettable contraception. Contraception 2009;80:497–9.
[6] Speidel JJ, Harper CC, Shields WC. The potential of long-acting reversible contraception to decrease unintended pregnancy. Contraception 2008;78:197–200.
[7] Secura G. Long-acting reversible contraception: a practical solution to reduce unintended pregnancy. Minerva Ginecol 2013;65:271–7.
[8] Finer LB, Zolna MR. Unintended pregnancy in the United States: incidence and disparities, 2006. Contraception 2011;84:478–85.
[9] Peipert JF, Madden T, Allsworth JE, Secura GM. Preventing unintended pregnancies by providing no-cost contraception. Obstet Gynecol 2012;120:1291–7.
[10] Winner B, Peipert JF, Zhao Q, et al. Effectiveness of long-acting reversible contraception. N Engl J Med 2012;366:1998–2007.
[11] Ricketts S, Klingler G, Schwalberg R. Game change in Colorado: widespread use of long-acting reversible contraceptives and rapid decline in births among young, low-income women. Perspect Sex Reprod Health 2014;46:125–32.
[12] Gold RB, Nash E. Troubling trend: more states hostile to abortion rights as middle ground shrinks. Guttmacher Policy Rev 2012;15:14–9.
[13] Boonstra HD, Nash E. A Surge of state abortion restrictions puts providers — and the women they serve — in the crosshairs. Guttmacher Policy Rev 2014;17:9–4.
[14] Iowa Department of Public Health. Vital statistics of Iowa; 2005–2012.
[15] Grossman DA, Grindlay K, Buchacker T, Potter JE, Schmertmann CP. Changes in service delivery patterns after introduction of telemedicine provision of medical abortion in Iowa. Am J Public Health 2013;103:73–8.
[16] Guttmacher Institute. Contraceptive needs and services, 2006; 2009.
[17] Biggs MA, Arons A, Turner R, Brindis CD. Same-day LARC insertion attitudes and practices. Contraception 2013;88:629–35.
[18] Fowler C, Gable J, Wang J, McClure E. Family planning annual report: 2012 national summary. Research Triangle Park, NC: RTI International; 2013.
[19] Trussell J. Contraceptive failure in the United States. Contraception 2011;83:397–404.
[20] Neuhaus JM, McCulloch CE. Separating between- and within-cluster covariate effects using conditional and partitioning methods. J R Stat Soc Ser B 2006:859–72.
[21] Finer LB, Jerman J, Kavanaugh ML. Changes in use of long-acting contraceptive methods in the United States, 2007–2009. Fertil Steril 2012;98:893–7.
[22] American College of Obstetricians and Gynecologists. Adolescents and long-acting reversible contraception: implants and intrauterine devices, Committee Opinion No. 539. Obstet Gynecol 2012;120:983–8.
[23] American College of Obstetricians Gynecologists. ACOG Practice Bulletin No. 121: long-acting reversible contraception: implants and intrauterine devices. Obstet Gynecol 2011;118:184–96.

[24] Centers for Disease Control and Prevention. U S. medical eligibility criteria for contraceptive use, 2010. MMWR Recomm Rep 2010;59:1–6.
[25] Kavanaugh ML, Frohwirth L, Jerman J, Popkin R, Ethier K. Long-acting reversible contraception for adolescents and young adults: patient and provider perspectives. J Pediatr Adolesc Gynecol 2013;26:86–95.
[26] Biggs MA, Harper CC, Malvin J, Brindis CD. Factors influencing the provision of long-acting reversible contraception in California. Obstet Gynecol 2014;123:593–602.
[27] Hirsch H, Turner R, Philliber A, Philliber S, Biggs M. Increasing LARC use in an effort to reduce unintended pregnancies: a look at the Iowa initiative to reduce unintended pregnancies. American Public Health Association Annual Meeting. Boston, MA; 2013.
[28] Campo S, Askelson N, Spies E, Campos-Castillo C, Losch M. Behind the feathers: evaluation of Until You're Ready, Avoidthestork.Com©, a surround campaign to prevent adult unintended pregnancy. National Conference on Health Communication, Marketing and Media. Atlanta, GA: Centers for Disease Control and Prevention; 2012.
[29] Frost J, Gold R, Frohwirth L, Blades N. Variation in service delivery practices among clinics providing publicly funded family planning services in 2010. New York, NY: Guttmacher Institute; 2012.
[30] Ananat EO, Gassman-Pines A, Gibson-Davis C. Community-wide job loss and teenage fertility: evidence from North Carolina. Demography 2013;50:2151–71.
[31] Biggs MA, Foster DG. Misunderstanding the risk of conception from unprotected and protected sex. Womens Health Issues 2013;23: e47–53.
[32] Biggs MA, Karasek D, Foster DG. Unprotected intercourse among women wanting to avoid pregnancy: attitudes, behaviors, and beliefs. Womens Health Issues 2012;22:e311–8.
[33] Henshaw SK, Kost K. Trends in the characteristics of women obtaining abortions, 1974 to 2004. New York: Guttmacher Institute; 2008.
[34] Frost JJ, Zolna MR, Frohwirth L. Contraceptive needs and services, 2010. New York, NY: Guttmacher Institute; 2013.
[35] Fitzmaurice G, Davidian M, Verbeke G, Molenberghs G. Longitudinal data analysis: a handbook of modern statistical methods. London: Chapman & Hall/CRC Press; 2008.