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Retail demand for emergency contraception in United States following New Year holiday: time series study

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Additional material is published
online only. To view please visit
the journal online.

Cite this as: *BMJ* 2023;383:e077437
<http://dx.doi.org/10.1136/bmj-2023-077437>

Accepted: 07 November 2023

ABSTRACT

OBJECTIVE

To estimate the increase in sales of emergency contraception following the New Year's Eve/New Year's Day holiday.

DESIGN

Time series analysis using autoregressive integrated moving average (ARIMA) model.

SETTING

Traditional (that is, "bricks and mortar") retail outlets—grocery stores, drug stores, mass merchandisers, club stores, dollar stores, and military outlets—in the United States from 2016 to 2022.

DATA SOURCE

Marketing data on weekly aggregated sales of items classified as emergency contraception gathered between 2016 and 2022 (n=362). On the basis of dates, weeks were classified as following the New Year holiday (n=6) or not (n=356).

MAIN OUTCOME MEASURE

Weekly sales of levonorgestrel emergency contraception per 1000 women of reproductive age in the US population.

RESULTS

Sales of levonorgestrel emergency contraception significantly increased after the New Year holiday (0.63 (95% confidence interval 0.58 to 0.69) unit increase per 1000 women aged 15-44). Holidays that share some aspects of the elevated risks of unprotected sexual intercourse with the New Year holiday (Valentine's Day, St Patrick's Day, US Independence Day) were associated with increased sales, albeit to a lesser degree, with respective sales increases per 1000 women aged 15-44 of 0.31 (0.25 to 0.38), 0.14 (0.06 to 0.23), and 0.20 (0.11 to 0.29).

Holidays without these expectations (Easter, Mother's Day, Father's Day) were not significantly associated with sales of levonorgestrel emergency contraception.

CONCLUSIONS

Increased sales of emergency contraception following the New Year's holiday suggest that this period is associated with increased risks of unprotected vaginal intercourse compared with other holidays. Targeting behavioral risks, prevention strategies to mitigate sexual violence, and improving access to contraception around holidays may limit the risks associated with unprotected vaginal intercourse.

Introduction

Unprotected vaginal intercourse has long been understood as a potential health concern owing to its impact on both individual and population health. For example, one risk of unprotected vaginal intercourse is that of an unwanted pregnancy, which has implications for the future wellbeing of both those who give birth and their children.¹⁻⁴ Behavioral risk factors, such as alcohol and drug use, have been extensively investigated as potential predictors of unprotected vaginal intercourse.⁵⁻¹¹ Although people engage in such behaviors throughout the year, they may be more inclined to do so during specific periods. Consequently, the likelihood of engaging in unprotected vaginal intercourse may be elevated during these periods.

New Year's Eve, as commonly celebrated in the US, combines four distinct sets of risk factors for unprotected vaginal intercourse: increased sexual behavior, decreased use of contraception during intercourse, increased rates of sexual assault, and potentially limited access to contraception. Firstly, New Year's Eve celebrations are commonly associated with increased sexual behavior. In a survey of Americans' views on holidays and their sexual lives, more than 70% of respondents planned to put in extra effort to be sexual with their partner on New Year's Eve.¹² Even among unpartnered individuals, New Year's Eve is often associated with expectations of sexual behavior, with most sexually active unpartnered individuals reporting a good chance of engaging in casual sex on this occasion.¹³ Secondly, intercourse on New Year's Eve may also be less likely to be protected relative to other times of the year. New Year's Eve celebrations are commonly linked to increased alcohol consumption,¹⁴⁻¹⁶ which is associated with elevated probability of unprotected sexual intercourse and a greater likelihood of incorrect use of contraception.^{7 17} Of particular relevance to New Year's Eve, alcohol use has been linked to a higher likelihood of engaging in unprotected sex with casual partners.¹⁸ Thirdly, New Year's Eve is associated with higher rates of

WHAT IS ALREADY KNOWN ON THIS TOPIC

Unprotected vaginal intercourse is associated with population and individual health risks

Common predictors of unprotected vaginal intercourse such as likelihood of having intercourse or use of contraception may vary with holiday celebrations

Emergency contraception can prevent pregnancy after unprotected sex, contraceptive failure, or sexual assault

WHAT THIS STUDY ADDS

Sales of levonorgestrel emergency contraception increased following the New Year holiday in the United States

To a lesser degree, holidays that share some risks for unprotected vaginal intercourse were also followed by increases in sales of levonorgestrel emergency contraception

No sales increases followed holidays for which celebration is unlikely to increase the prevalence of unprotected vaginal intercourse

sexual assault during which contraception use is less likely.^{19–21} Finally, access to contraception may be somewhat limited during the holiday period. Retail closures on New Year's Eve specifically could limit on-hand contraception, an important predictor of unprotected sex for young adults.²²

Excess conceptions during the end of year period have been observed in multiple contexts,^{23–24} as has increased sexual activity.²⁵ Indirect evidence from increased abortions and cases of sexually transmitted infections is consistent with some of these sexual encounters being unprotected.^{24–26} With the limited exception of couples who actively attempt to conceive at the new year, these conceptions can arise from either reduced contraceptive vigilance (for example, sex following missed contraceptive pills or failure to use a condom) or couples willing to conceive who do not care about the timing of their pregnancy.²⁷ To focus on unprotected intercourse rather than mistiming of desired pregnancies, we examined demand for emergency contraception. Emergency contraception provides an important last opportunity to prevent pregnancy after unprotected sex, contraceptive failure, or sexual assault. Like many other contraceptives, emergency contraceptive pills prevent fertilization; no evidence suggests that they end a pregnancy or prevent implantation of a fertilized egg.²⁸ As many states in the US have increased restrictions on abortion following the decision in *Dobbs v Jackson Women's Health Organization*,²⁹ emergency contraception represents an increasingly important option for prevention of pregnancy. In the US, emergency contraception is primarily available through intrauterine devices inserted after unprotected intercourse and two dedicated pill formulations: levonorgestrel (sold as sold as Plan B One-Step and several generic brands) and ulipristal acetate (sold as ella). Knowledge about forms of emergency contraception other than levonorgestrel emergency contraception remains limited among potential users,^{30–33} medical providers,^{34–35} and student reproductive rights activists.³⁶ Since 2013, levonorgestrel emergency contraception has been available over the counter with no age restrictions. Although cost, product accessibility at the store, willingness of pharmacists, and confusion surrounding legal restrictions continue to pose barriers to access to levonorgestrel emergency contraception,^{37–40} it is the easiest form of emergency contraception for people to access in the US and demand for it has increased in recent history.⁴¹

Despite its common nickname as the “morning after pill,” levonorgestrel emergency contraception is effective when taken within 96, and possibly 120, hours after unprotected intercourse.⁴² For people who had unprotected vaginal intercourse during the New Year's Eve holiday, emergency contraception taken in the days immediately thereafter could effectively prevent an unwanted pregnancy. To explore whether New Year's Eve or New Year's Day represents a period of elevated risk for unprotected vaginal intercourse, we used data on weekly sales of emergency

contraception in the US, comprised of retail sales aggregated from point-of-sale scans at traditional (that is, “bricks and mortar”) retailers. This exploration will provide important insights into the unmet need for contraception during this period. By comparing this holiday period with other holidays, matching in terms of risk profiles for unprotected vaginal intercourse, we also provide insight into aspects of holiday celebrations that may elevate the risk of unprotected vaginal intercourse.

Methods

Our data on emergency contraceptive sales come from retail scan data compiled by Circana Inc.⁴³ All estimates and analyses in this paper based on Circana's data are by the author and not by Circana. Circana occasionally grants access to data to academic researchers and agreed to license the data used in this study to BW's institution.

As part of Circana's ongoing market data collection, participating retail partners capture data on all consumer purchases at the point of sale. Even when reporting of sales might be delayed (for example, following a holiday), sales are tagged by when they occurred and later aggregated accordingly. Purchases are aggregated by item type, time, and geographic location. For this study, we used aggregated sales from items tagged as emergency contraception sold in the geographic area of the United States, during the period 2016–22. This dataset includes only over-the-counter emergency contraceptive pills (levonorgestrel) and does not include prescription emergency contraception (that is, ulipristal acetate).

The resulting data reflect a count of units sold by participating retailers each week for the 362 weeks in our study period. Each unit is an emergency contraception kit for individual use—for example, a box of Plan B One-Step with a single levonorgestrel emergency contraception tablet. Participating retailers make up the bulk of traditional retail channels, including grocery stores, drug stores, mass merchandisers, club stores, dollar stores, and military outlets. As an estimate of the total market of emergency contraception, these data omit two sales sources. Firstly, these data exclude online sales. Although increasing, online sales represent a very small share of total sales of levonorgestrel emergency contraception (~2% in 2022 on the basis of Circana e-commerce estimates). Secondly, owing to the retailer partnerships necessary to construct these data, the retail scan data exclude smaller, independent pharmacies. We cannot quantify the potential undercount from not capturing these outlets, but previous work suggests that they are less likely to stock over-the-counter emergency contraception than are their chain pharmacy counterparts and are the minority of pharmacy retailers.^{37–44} This dataset also excludes any non-retail provision of emergency contraception, such as through clinics, hospitals, and community distribution. We discuss the implications of this measurement in the discussion section.

A comparison of raw sales data across time could be confounded by changes in the size of the population at risk of pregnancy. To account for this potential change, we divided weekly sales by the size of this population. For an estimate of the US population at risk of pregnancy, we used the female population aged 15-44 from the preceding year by using the five year American Community Survey estimates from the US Census Bureau. In supplemental models (supplementary table A), we replicated our model with three alternative specifications for the outcome measure constructed by dividing weekly sales of levonorgestrel emergency contraception by a wider set of people at risk of pregnancy (women aged 10-49), all individuals who identify as female, or the entire US population. The substance of our results was robust to the choice of reference population used in standardization.

We differentiated weeks as either immediately following New Year's Eve and New Year's Day or not. For this holiday, we sought to align the period following unprotected intercourse during which levonorgestrel emergency contraception might be effective (potentially up to 120 hours) with the holiday of interest. As sales data are aggregated every week on Sunday, where the New Year holiday falls within a week shifts over time. Given the goal of capturing unprotected intercourse during this holiday, we categorized the week as following the New Year holiday if it was the closest week after New Year's Day. Weeks coded as following the New Year holiday included weeks ending on 1 January (2017) through 7 January (2018). In the last case, using the previous week (week ending 31 December 2017) would not capture the effective period of levonorgestrel following unprotected intercourse during this holiday.

The expectation of increased sales following the New Year holiday is based on multiple possible risk factors (increased sexual behavior, decreased use of contraception during intercourse, increased rates of sexual assault, and potentially limited access to contraception). To examine whether one of these population risk factors was most responsible for any observed increase in sales, we also examined holidays that share a subset of risk factors. To test whether decreased use of contraception during intercourse was the primary driver of the observed increase in emergency contraception sales following New Year's Eve, we included indicators for whether the week

followed St Patrick's Day and US Independence Day, two holidays with similar patterns of alcohol consumption to the New Year holiday.⁴⁵ To test whether sexual activity was the primary driver of any observed increase in emergency contraception sales following the New Year holiday, we included an indicator for whether the week followed Valentine's Day, the holiday for which Americans intend to make the most effort to be sexual with their partners.¹² However, focusing on limited periods of time may be misleading when examining effects of holidays on health behavior,⁴⁶ so we also included indicators for three negative controls (that is, holidays for which increases in emergency contraception sales would not be expected): Easter, Mother's Day, and Father's Day. As these holidays fall on Sundays (the day ending weekly sales collections), we used the week following these holidays. A full list of dates by classified holiday is available in supplementary table B.

We used a time trend ecological study design over the study period. We examined the number of weekly unit sales of levonorgestrel emergency contraception in the US per 1000 women aged 15-44. We analyzed these weekly sales data by using an autoregressive integrated moving average (ARIMA) regression to determine whether retail sales of levonorgestrel emergency contraception significantly increased during the tested holiday periods. After application of first differences, the series was stationary.

The ARIMA modeling procedure consists of three iterative steps: identification, estimation, and diagnostic checking.⁴⁷ Based on the possible ARIMA models identified from examination of the autocorrelation and partial autocorrelation functions, model selection of an optimum model is usually based on minimizing Akaike information criterion and Schwartz bayesian criterion. The selected model that we estimated was an ARIMA(1,1,1). Although we selected the potential model that minimized these criteria, the reported results are robust to model specification of autoregressive and moving average order among possible models.

To evaluate changes in sales corresponding to the holiday periods, we included dichotomous covariates in the selected ARIMA model. We visually and statistically inspected the residuals of this final model to validate that they were normally distributed without autocorrelation.⁴⁸ We used Stata 17.0 for all tests. We used the STROBE cross sectional checklist when writing our report.⁴⁹

Patient and public involvement

Neither patients nor the public were involved in the conception, design, or execution of this study.

Results

Table 1 shows coefficients for the estimated model. These coefficients correspond to the change in weekly emergency contraception sales per 1000 women aged 15-44 for weeks following a given holiday compared with weeks that did not follow that holiday. We

Table 1 | Regression results for weekly levonorgestrel emergency contraception sales per 1000 women aged 15-44

Week	Change (95% CI) in weekly sales units
Week following:	
New Year	0.63 (0.58 to 0.69)
Valentine's Day	0.31 (0.25 to 0.38)
St Patrick's Day	0.14 (0.06 to 0.23)
US Independence Day	0.20 (0.11 to 0.29)
Easter	-0.04 (-0.17 to 0.09)
Mother's Day	-0.09 (-0.21 to 0.03)
Father's Day	0.05 (-0.02 to 0.13)

CI=confidence interval.

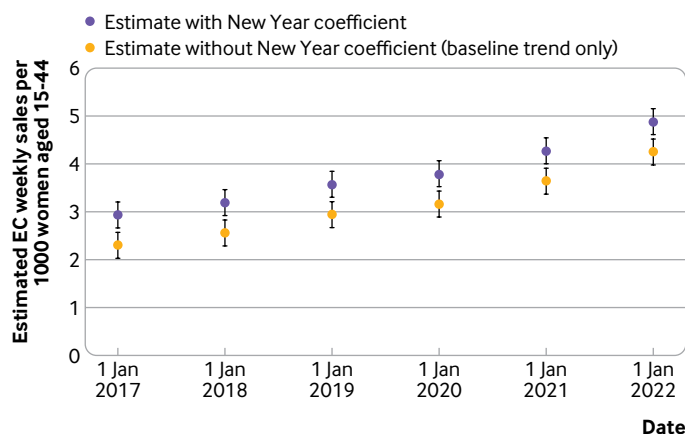


Fig 1 | Estimated weekly sales of levonorgestrel emergency contraception (EC) following New Year holiday, 2016-22. For weeks following New Year holiday, predictions are based on model of weekly levonorgestrel emergency contraception sales per 1000 women aged 15-44. Sales estimates are calculated for week as is (estimate with New Year coefficient) and with New Year indicator set to 0 (estimate without New Year coefficient)

first noted significant differences in levonorgestrel emergency contraception sales by whether the week followed the New Year holiday or not ($P < 0.001$). Sales of levonorgestrel emergency contraception increased by 0.63 (95% confidence interval 0.58 to 0.69) units per 1000 women aged 15-44 for weeks following this holiday. Based on the 2022 American Community Survey estimates of the size of the female population aged 15-44 (64.9 million), this increase in sales corresponds to an increase of almost 41 000 additional units sold in the US in the week following New Year 2022 compared with this same week if it hypothetically did not follow the New Year holiday.

To give scale to this increase across time, figure 1 shows the predicted values of emergency contraception sales following the New Year holiday, with 95% confidence intervals, using two predicted values from the model shown in table 1. The first value (labeled “Estimate with New Year coefficient”) shows the estimated weekly sales following this holiday incorporating both the estimated New Year coefficient and the underlying trend of the data. For comparison, we created a counterfactual prediction (labeled “Estimate without New Year coefficient”) based solely on the underlying trend in the model (that is, estimated with the holiday indicator artificially set to 0).

Although not to the same extent as the New Year holiday, some other holidays were also significantly associated with increased sales of levonorgestrel emergency contraception. Valentine’s Day was associated with an increase in sales about half of the size of the New Year’s increase: 0.31 (0.25 to 0.38) units per 1000 women aged 15-44. St Patrick’s Day and US Independence Day holidays, when contraception use during intercourse is believed to decrease, were also associated with significant increases in sales of levonorgestrel emergency contraception (0.14 and 0.20 units per 1000 women aged 15-44, respectively). That said, not every holiday was associated with

increased retail sales of levonorgestrel emergency contraception. For the holidays we examined without these elevated risk factor levels (Easter, Mother’s Day, and Father’s Day), we found no significant change in retail sales of levonorgestrel emergency contraception. To put these values in context, figure 2 shows the predicted values for weekly sales of levonorgestrel emergency contraception in all holiday weeks in our study period. For comparison, the displayed trend line depicts weekly sales estimates with all holiday indicators set to 0.

Discussion

For the week following the New Year holiday, weekly sales of emergency contraception increased by more than half a unit per 1000 women aged 15-44, a substantial increase based on the existing sales level—about 10% of the approximately five units sold weekly per 1000 women aged 15-44 at the end of the study period. This specific value reflects our choice of reference population (women aged 15-44), a population that excludes others who may use or purchase levonorgestrel emergency contraception. However, regardless of the population used to standardize the sales data across time, a significant increase in sales of levonorgestrel emergency contraception occurred following this holiday. The marked increase in emergency contraception sales is consistent with the expectations of risk factors during this period—expectations of sexual behavior, decreased use of contraception during intercourse due to increased consumption of alcohol, increased prevalence of sexual assault, and limited access to other forms of contraception due to the limited hours of clinics, medical offices, and retail outlets. Although our findings suggest that holidays that elevate some of these risk factors may also increase the risk of unprotected vaginal intercourse, New Year’s Eve and New Year’s Day seem to uniquely combine these risks.

Policy implications

This last point provides some insights into possible interventions to reduce the incidence of unprotected vaginal intercourse during this period. Allowing same day appointments or increasing provider availability during the holiday period for long acting removable contraceptives, such as intrauterine devices or implants, could reduce dependence on contraception such as condoms for those at risk of pregnancy. Limiting the need to purchase condoms by having condoms on hand would reduce the impact of holiday or late night store closures on unmet contraceptive need. Although outlets for purchasing condoms may be closed after the end of the New Year’s Eve festivities, increasing the availability of condoms in general may offset this limitation. For example, increased availability of condoms is positively associated with condom use in undergraduate populations in the US.^{50 51} Similar measures enacted in settings of New Year celebrations could increase condom usage and therefore reduce the rate of unprotected vaginal

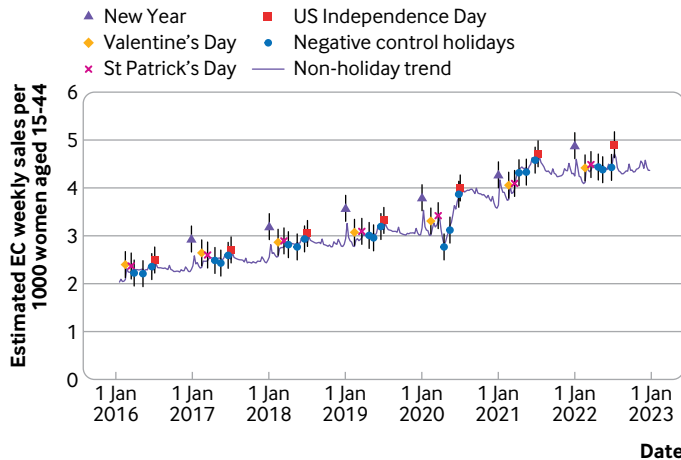


Fig 2 | Estimated weekly sales of levonorgestrel emergency contraception (EC) during holidays in United States, 2016-22. Holiday estimates derived from model of weekly levonorgestrel EC sales per 1000 women aged 15-44 for corresponding week. For context, non-holiday trend is estimated from same model with all holiday indicators set to 0

intercourse. Similarly, the recent approval of over-the-counter sales of oral contraceptive pills in the US may to help overcome limited access to medical providers during holidays.^{52 53} Encouraging people to explore options for ongoing contraception, keep a supply of condoms on hand, and have the more effective emergency contraceptive pill (ulipristal acetate) available at home before it is needed can help to mitigate the potential for unprotected sex to result in undesired pregnancy during times of high risk and low availability of healthcare providers.

Our results suggest that the nature of certain celebrations might make them important public health targets owing to their implications for sexual and reproductive health. The holiday related increases in emergency contraception sales that we observed are consistent with an increase in unprotected vaginal intercourse during these periods. Targeting interventions to periods during which the levels of unprotected vaginal intercourse are increased may reduce both unmet need for contraception and spread of sexually transmitted infections. This targeting requires understanding of how these and other holidays not examined here (for example, Christmas) may structure risk factors for unprotected vaginal intercourse. Notably, the mechanisms for meeting unmet need for contraceptives may differ by the nature of the holiday. For example, increased availability of ongoing contraception and condoms may be more effective for holidays that elevate sexual behavior but less effective for holidays that elevate alcohol consumption, as alcohol consumption is associated with increased rates of sexual assault and non-use or misuse of contraception. In these cases, emergency contraception is an essential option that must be widely accessible.

Limitations of study

Our study has some limitations that we must note. Firstly, measures of emergency contraception sales are

not synonymous with use of emergency contraception. As evidenced by shortages and store policies surrounding emergency contraception sales following the *Dobbs v Jackson Women's Health Organization* decision,⁵⁴ emergency contraception sales are, at times, distinct from emergency contraception use. Although no change in policy, such as increased restrictions on reproductive rights, that could affect either stockpiling or use of existing stockpiles, co-occurs with the examined holidays, we must be cautious about potentially conflating use and sales of emergency contraception.

Secondly, our estimates of emergency contraception sales likely undercount total sales as they exclude emergency contraception acquired through non-retail (that is, medical) outlets as well as independent pharmacies and online retailers. The exclusion of emergency contraception sales from retail channels that are not represented in our dataset likely had only a limited effect on our findings. Although yielding a conservative estimate of total sales, these exclusions would bias our findings only if people shift their purchases of emergency contraception from omitted outlets to those in our data during this holiday and this shift was substantial relative to the sales volume that we captured. Even if people did for some reason prefer to purchase emergency contraception from retailers in our data following New Year's Eve, the limited average volume of sales online and through independent pharmacy outlets challenges the likelihood that any such shift would be significant. Of more concern for our findings is the omission of emergency contraception provision from medical offices and clinics. The overwhelming majority of people in the US who acquire emergency contraception do so from retail outlets,⁵⁵ but family planning clinics and medical providers are an important component of access to emergency contraception, particularly for provider dependent methods such as ulipristal acetate and intrauterine devices or for people who need a prescription for insurance coverage. The difference between weeks following New Year's Eve and other weeks could reflect a substitution of emergency contraception acquired from a clinic or doctor with emergency contraception purchased from a large retailer. This substitution would not explain the increases that we saw following some other holidays, such as Valentine's Day and US Independence Day. It also would represent a massive switch in how people acquire emergency contraception. Back of the envelope calculations suggest that offsetting the observed New Year increase would require about half of those who get emergency contraception from non-retail settings to purchase it instead.

Thirdly, our results may reflect other characteristics co-occurring with the New Year rather than predictors of unprotected sexual intercourse previously discussed. For example, although cash on hand may be limited following the winter holidays, resetting of health plan deductibles and refilling of flexible health spending accounts may incentivize purchasing

levonorgestrel emergency contraception rather than visiting a doctor or clinic. However, the high price of levonorgestrel emergency contraception at pharmacies (\$40-50 (£32-40; €37-46)) may offset some of the other financial incentives to switch acquisition of emergency contraception from clinics to retail stores and pharmacies.

Finally, the generalizability of these findings has limits. Our description applies to the United States. Contextual differences in how and which holidays are celebrated and how reproductive healthcare is accessed may limit the generalizability to other settings. Our findings cannot be generalized to all holidays either; future work should examine holidays with less clear risk profiles (for example, Christmas, Halloween, US Thanksgiving). We should also be careful when applying these findings to upcoming holidays owing to massive shifts in the US reproductive rights landscape.²⁹

Conclusions

More than ever, emergency contraception is a critically important option for people in the US, particularly those living in regions with bans or severe restrictions on abortion. Although this annual spike in sales might seem humorous, it is indicative of unmet contraceptive need that calls for further attention. Future work will explore how other dynamics at play in the US context, including state abortion restrictions, affect emergency contraception purchasing behavior and imply potential public health interventions to provide contraceptive care to those who need it the most.

We thank Circana Inc for allowing us to use its data for this project. All estimates and analyses in this paper based on Circana's data are by the authors and not by Circana Inc.

Contributors: BW developed the concept and design of the study and did the statistical analysis of the data. BW and KC drafted the manuscript. Both authors approved the manuscript after revision and gave final permission for publication. BW is the guarantor. The corresponding author attests that listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

Funding: None.

Competing interests: All authors have completed the ICMJE uniform disclosure form at <https://www.icmje.org/disclosure-of-interest/> and declare: no support from any organization for the submitted work; no financial relationships with any organizations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

Ethical approval: The Texas Tech Institutional Review Board determined that this project did not meet the definition of human subjects research (Ref: TTU IRB 2023-714).

Data sharing: The researchers are not able to make supporting data available owing to contractual requirements. The analysis code is available on request from the corresponding author at brandon.wagner@ttu.edu.

The lead author affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

Dissemination to participants and related patient and public communities: Dissemination of this research to relevant public groups will occur in concert with the American Society of Emergency Contraception. Working with this group and its initiative EC4EC (Emergency Contraception for Every Campus), we will share insights from the study with college activists interested in expanding access to emergency contraception on campus to help them to anticipate

periods of increased demand. Results will also be disseminated through lay and social media.

Provenance and peer review: Not commissioned; externally peer reviewed.

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Web appendix: Supplementary tables