


Trends of intrauterine device insertion and ‘Googling’ about intrauterine devices before and during the COVID-19 pandemic in Australia

Digital Health
Volume 8: 1–9
© The Author(s) 2022
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/20552076221145799
journals.sagepub.com/home/dhj


Sarah D’Arcy, Chester Cao, Steve Ahn, Victoria Allan
and Alireza Ahmadvand 

Abstract

Objective: The COVID-19 pandemic significantly disrupted access to primary care in Australia. This could have negatively impacted reproductive health services rates such as intrauterine device insertion rates, and interest in seeking information about intrauterine devices by searching on Google. We aimed to assess the trends of, and the association between, the actual Medicare service utilization rates for intrauterine device insertion and searching about intrauterine devices on Google, before and during the COVID-19 pandemic.

Methods: We conducted systematic analyses of secondary data from June 2017 to May 2022, using Medicare and Google Trends data sources. We visualized the rates of intrauterine device insertion, plus Google’s search volumes about ‘Intrauterine device’ and ‘Progestin IUDs’ as topics. Then, we assessed the correlation between intrauterine device insertion rates and Google search, using Spearman correlation.

Results: The average yearly rates of intrauterine device insertion increased noticeably from 25.1–26.3 in 2018–2019 to 29.3–31.2 per 100,000 population in 2020–2021 (12–18% increase). The highest monthly intrauterine device insertion rate nationally (37 per 100,000 population) was seen in March 2021. By June 2020, search term use for the two intrauterine device-related topics returned to much higher levels (50% increase for ‘Progestin IUDs’, and 54% for ‘Intrauterine device’, respectively). A moderately strong correlation was seen between actual intrauterine device insertion rates and search on Google about intrauterine devices (Spearman $\rho = 0.61$, $p < 0.000$).

Conclusion: We demonstrated a moderately strong correlation between trends of intrauterine device insertion rates and search on Google about intrauterine devices, before and during the COVID-19 pandemic in Australia. Googling about intrauterine devices could, therefore, be a useful indicator to gauge future interest in actual intrauterine device insertion for months thereafter.

Keywords

Intrauterine devices, Levonorgestrel, Australia, Search engine, Correlation of data

Submission date: 8 September 2022; Acceptance date: 29 November 2022

Introduction

The COVID-19 pandemic, caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), created unprecedented disruptions in our lives, especially in the ways we seek and access medical help. To minimize COVID-19 transmission, many countries, including Australia, embraced early

School of Medicine and Dentistry, Griffith University, Gold Coast, QLD, Australia

Corresponding author:

Alireza Ahmadvand, Associate Professor in Primary Care (Academic Title Holder), School of Medicine and Dentistry, Griffith University, Gold Coast, Parklands Drive, Southport, QLD 4222, Australia.
Email: a.ahmadvand@griffith.edu.au



border closures, lockdowns, and work-from-home arrangements. COVID-19 cases increased exponentially worldwide, causing health systems to dramatically reduce, postpone, or replace elective medical services^{1,2} with telehealth-based alternatives.^{3,4}

In Australia, lockdowns were enforced from March 2020. Consequently, most primary care and general practice clinics reduced their in-person services and/or business hours.⁵ Additionally, news and media shifted towards COVID-19-related content, possibly shifting people's focus away from common medical conditions. This significantly reduced access to, and interest in, primary care services, to the point that even sparked efforts by accredited general practice colleges to run social media campaigns to reengage interest in general well-being.⁶

In Australia, most reproductive health procedures for long-acting reversible contraceptives (LARCs), including an intrauterine device (IUD) insertion and removal, are managed in primary care settings. It can be argued that measures implemented in Australia to control the spread of SARS-CoV2 were mostly effective. Yet, at the start of Australia's national lockdowns, it was perceived that most medical services which require face-to-face attendance, including IUD procedures, would be negatively impacted. Future research eventually showed that primary care services, such as reproductive health procedures, were among the first services negatively impacted,⁷⁻⁹ but it was in contrast with the trends that clinicians were observing in some areas of the country, that is, an increasing trend. This created a research gap which led to our first research question.

Moreover, with the overwhelming nature of media coverage of COVID-19, and news reports and social media noticeably shifting towards COVID-19-related content, people's focus was drifted away from seeking information about common medical conditions and procedures. This significantly reduced access to, and interest in, primary care services to the point that it sparked efforts by accredited general practice colleges to run social media campaigns, trying to bring people's attention back to the essential elements of their health and well-being.⁶ Therefore, our second research question was whether interest in seeking information about IUDs could also have been adversely affected during the COVID-19 pandemic.

We aimed to quantify the effects of reduced access to primary care during the COVID-19 pandemic on the actual service utilization rates for IUD insertion, versus search term use about IUDs. We focused on answering the following questions:

1. Before and during the COVID-19 pandemic, what were the trends for:
 - (a) the rates of service utilization for IUD insertion?
 - (b) interest in searching on the internet for information about IUDs?

2. Has there been any association between search term used for information about IUDs on the internet and actual rates of IUD insertion?

Methods

Study design and data sources

This study was based on the analysis of secondary data from two major sources:

1. Medicare data on service utilization rates (Medicare is Australia's national health fund); and
2. Google Trends data, for population-level insight on health information-seeking behaviours and metrics.

Each medical service covered by Medicare has a unique item number. Medicare provides publicly available statistics on the number of services claimed, as well as service utilization rates per 100,000 population.¹⁰ The services included in these statistics are the ones that qualify for Medicare Benefit Scheme (MBS) and are performed by a medical practitioner as a registered provider, for which a claim has been processed.

Google Trends (Google Inc., Mountain View, California, USA) is a freely available service that analyses the number of searches over time on Google for a specified term, topic, or keyword, relative to the total number of searches on Google. The results are shown as *Search Volume* and defined as the 'likelihood of a random user to search for a particular term from a certain location at a certain time'.¹¹

Outcome variables

We extracted data on the following variables:

1. Monthly per capita service utilization rates, per 100,000 population, for IUD insertion (item number: 35503).

Medicare calculates this rate by dividing the number of processed services/benefits in a month by the number of people enrolled in Medicare at the end of that month, which is determined by the date the service is processed by Services Australia. Within the scope of our article, we only analysed the national data. Data for six states and two territories are being analysed separately.

2. Weekly search volume data for Google-assigned Topics related to LARC of interest, namely, 'Intrauterine device', 'Copper IUDs', and 'Progestin IUDs'.

The choice of these three topics was made after comparing the preliminary yield from assessing different keywords, search terms, or Topics on Google Trends. Eventually, instead of 'Search term', 'Topic' was chosen as the more appropriate approach because a 'Topic' provided a higher

search volume average. This gave us the opportunity to visualize search term use over time with more detail.

Google Trends provided three topics of relevance to IUDs in our preliminary assessments: 'Progestin IUDs', 'Intrauterine devices' and 'Copper IUDs'. As topics, the first two topics yielded far more search volume and details in comparison to 'Copper IUDs'. Therefore, for the purpose of relevance, we limited our trend visualisation for information seeking to 'Progestin IUDs' and 'Intrauterine device' topics only.

As Google Trends usually reports data as 'weekly' and Medicare as 'monthly', we then had to calculate 'monthly' average search volumes to enable comparing topic searches in Google versus Medicare service utilization rates.

Timeframe

We extracted 5 years of data, from June 2017 to May 2022. The rationale behind choosing this timeframe was to enable us to compare the trends from almost 2 years into the pandemic and its lockdown-induced disruptions (March 2020 to May 2022), with trends in a similar duration of time before the pandemic (March 2018 to February 2020). However, as the pandemic started in March 2020 and we had aimed to address likely seasonal variations (e.g. possible reduction of service provision around December each year), we extended the start of data extraction to a few months before, that is, June 2017. This helped us visualize the extent of change in access to primary care, before, during and after COVID-19-related disruptions.

Data visualization and statistical analysis

We imported data from both data sources into Microsoft Office Excel version 16.63.1 (Microsoft, Redmond, WA, USA) for cross-checking, description, refinement, and aggregation. Then, we exported aggregated data to STATA 16.1 (Stata Corp, College Station, TX, USA) for graphing the trends, smoothing, and statistical analysis.

For smoothing, we used locally weighted scatterplot smoothing (LOWESS) methodology, as both outcome variables of interest did not follow a normal distribution. LOWESS finds a curve of best fit without assuming the data must fit some distribution shape. It depends on the user-defined parameter(s), most importantly, the 'bandwidth' or 'smoothing parameter' known as alpha. We chose alpha as 0.10, thus using 10% of data points for smoothing.

We calculated Spearman rank correlation coefficients to quantify possible associations between Medicare service utilization rates and Google search volumes, considering a $p < 0.05$ as statistically significant.

Ethical considerations

As this study focused on secondary analysis of administrative, population-level, and deidentified data, ethical approval of its research protocol was not required.

Results

Data about 60 months of service utilization rates for IUD insertion were extracted from Medicare. The search volumes for two topics over 261 weeks were also extracted from Google Trends.

Service utilization

Monthly per capita Medicare service utilization rates per 100,000 population for IUD insertion are visualized in Figure 1. As seasonal variations, declines in IUD insertion rates could be noted during the December holidays, followed by an increase in the months after. However, a sudden large decline in rates was noted in March 2020, concurrent with reduced access to primary care services due to COVID-19-related restrictions. This decline was followed by a prominent increase in service utilization for IUD insertion in the following months, which surpassed the baseline rates prior to the COVID-19 pandemic.

The average yearly rates of IUD insertion continued to increase noticeably from 25.1–26.3 per 100,000 population in 2018–2019 to 29.3–31.2 per 100,000 population in 2020–2021. This is an equivalent of a 12–18% increase in rates of IUD insertion during the 2 years of the pandemic in comparison to the year before. Historically, the highest monthly IUD insertion rate nationally (i.e. 37 per 100,000 population) was seen in March 2021, 1 year into the pandemic.

Information seeking

Smoothed monthly search trends from Google for 'Progestin IUDs' and 'Intrauterine device' topics are visualized in Figure 2. Seasonal declines in Google search volumes were noted close to the December holidays, followed by a return to baseline. However, during 2020, an additional decline in searches occurred in March and April, followed by a prominent increase beyond the baseline. This pattern was then repeated in 2021.

In comparison to February 2020, Google search volumes in Australia dramatically reduced in March 2020 for the 'Progestin IUDs' topic (average monthly search volumes from 78 to 58 [−26% reduction]), and 'Intrauterine device' topic (61 to 46 [−25%]). By June 2020, search term use for the two IUD-related topics returned to much higher levels (58 to 87 [+50% increase] for 'Progestin IUDs', and 46 to 71 [+54%] for 'Intrauterine device', respectively).

Correlation between service utilization and information seeking

Correlation coefficients, and their statistical significance, are summarized in Table 1.

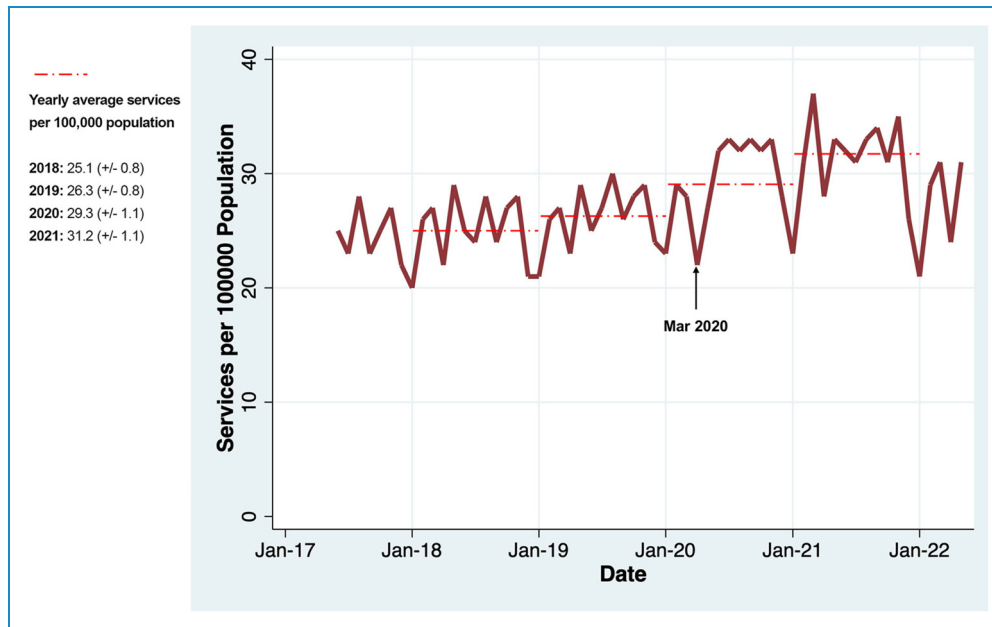


Figure 1. Monthly per capita Medicare service utilization rates per 100,000 population for IUD insertion in Australia, June 2017 to May 2022 (red dashed line: yearly average, 2 years before and 2 years into COVID-19 pandemic; March 2020 is marked because it was the month in which the Australian Government introduced national COVID-19-related lockdowns for the first time).

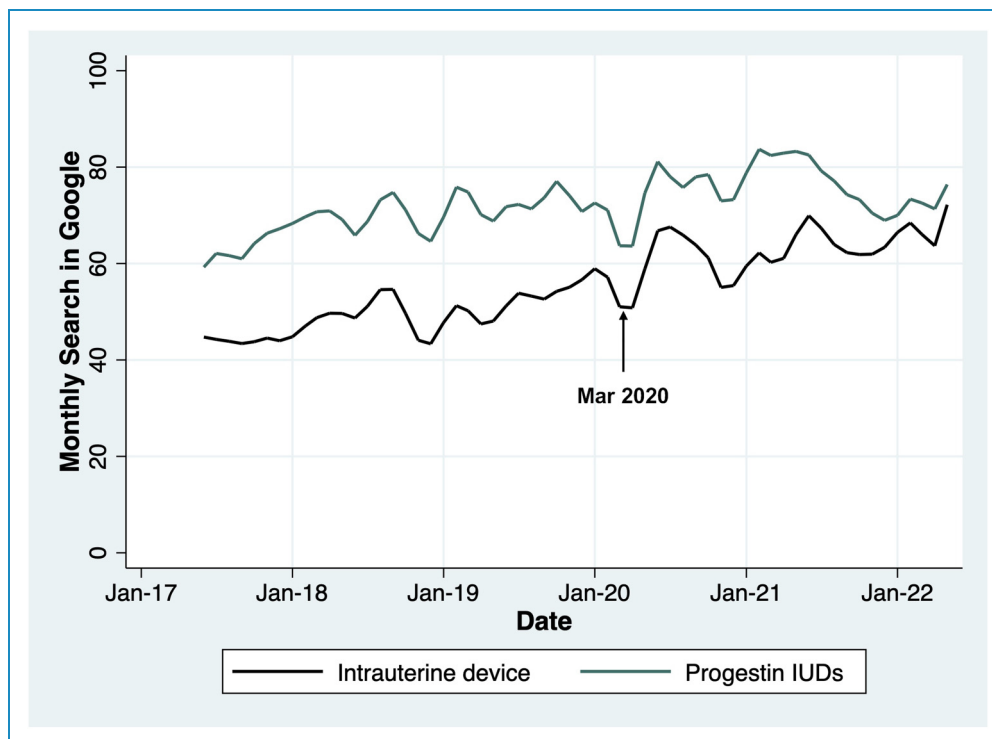


Figure 2. Monthly search volumes in Google for 'Intrauterine device' and 'Progestin IUDs' in Australia, June 2017 to May 2022 [LOWESS-smoothed] (March 2020 is marked because it was the month in which the Australian Government introduced national COVID-19-related lockdowns for the first time).

Table 1. Correlation between Medicare services and search topics in Google in Australia between June 2017 and May 2022.

Spearman's rank correlation			
Number of observations = 60			
Medicare service	Search topic in Google	Spearman's rho	p-value*
IUD insertion	<i>Intrauterine device</i>	0.61	<0.000
	<i>Progestin IUDs</i>	0.56	<0.000
	<i>Copper IUDs</i>	0.22	0.094

* $p < 0.05$ is statistically significant.

A moderately strong correlation was demonstrated between IUD insertion rates and searching for 'Intrauterine device' on Google as a topic (Spearman's $\rho = 0.61$, $p < 0.000$).

Figure 3 shows details of time trends via visualising smoothed monthly per capita Medicare service utilization rates per 100,000 population for IUD insertion versus search volumes in Google for 'Intrauterine device' and 'Progestin IUDs' topics.

Discussion

Our study quantified that even though IUD insertion rates were generally on the rise in Australia over the past few years, there was a significant increase in IUD insertion rates early on into the pandemic, after a short period of sharp decline. This was an equivalent of a 12–18% increase in rates of IUD insertion in comparison to the year before. Also, we found that searching on Google for IUDs showed a significant increase early on into the pandemic, after a short period of sharp decline, and the trend was upwards, overall, in the second year as well. Ultimately, the strongest statistically significant correlation was noticed between IUD insertion rates in Australia and searching for 'Intrauterine device' on Google as a topic over the past 5 years.

Our results showed that during March and April 2020, coincidental with the introduction of COVID-19-related lockdowns, service utilization rates reduced significantly for IUD insertion. The reduction was followed by a strong 'rebound' effect in the months after, in a way that surpassed baseline rates. Concurrently, a similar 'reduction-rebound' pattern was seen in search term use for information via Google regarding IUDs.

The noticeable rebound in IUD insertion rates during the pandemic is interesting and it could be related to women's preference for a longer-acting contraceptive option.^{12–14} However, a more detailed assessment of rates of IUD insertion might shed light on the interpretability of these results. This comparison can be the subject of future research projects. Even though some researchers claim that the uptake of long-acting reversible contraceptives in Australia has

been slow,¹⁵ generally, the uptake has been on the rise, with claims for hormonal IUDs and implants almost doubling between 2006 and 2018.¹⁶ Our analysis of IUD insertion rates prior to 2020 highlighted a relatively predictable trend throughout a year; a 'reduction' in service utilization during December, coinciding with the Christmas and New Year Holidays, followed by a 'rebound' in January. The difference in 2020 was that the 'reduction-rebound' pattern happened early in the year (March–May 2020), fully surpassing the baseline rates from 2019. The 'reduction-rebound' pattern continued to happen, even more noticeably, in 2021. Even though the reduction in IUD insertion rates in March 2020 was mainly the result of restricted access time to primary care clinics early into the pandemic, further COVID-19 lockdowns in the following months seemed not to have negatively impacted service utilisation.¹⁷

At the individual level, Coombe et al.¹⁸ published results from an online survey which showed 22% of women of reproductive age had needed to access healthcare services for their sexual or reproductive health matters during the first Australian COVID-19 lockdown. This could potentially explain part of the rebound increase in IUD insertion rates that we found in the following months after the lockdowns were imposed. Of particular note are younger women and women from more disadvantaged socioeconomic backgrounds which seem to have been negatively impacted by reduced access to contraceptive choices.¹⁹

From the unmet need perspective, Weinberger et al.²⁰ have commented on the Guttmacher Institute's report explaining that even a 10% decline in the use of contraceptives can significantly increase the unmet contraceptive needs of women and lead to additional unintended pregnancies. This issue is important to be considered, knowing the sharp reduction in IUD insertion rates early on in 2020. The Guttmacher Institute uses statistics from developing countries however it remains an important observation and the implications should be considered for Australia.

We also compared information seeking on Google about IUDs versus Medicare IUD insertion rates. Interestingly, similar seasonal changes became noticeable for searching

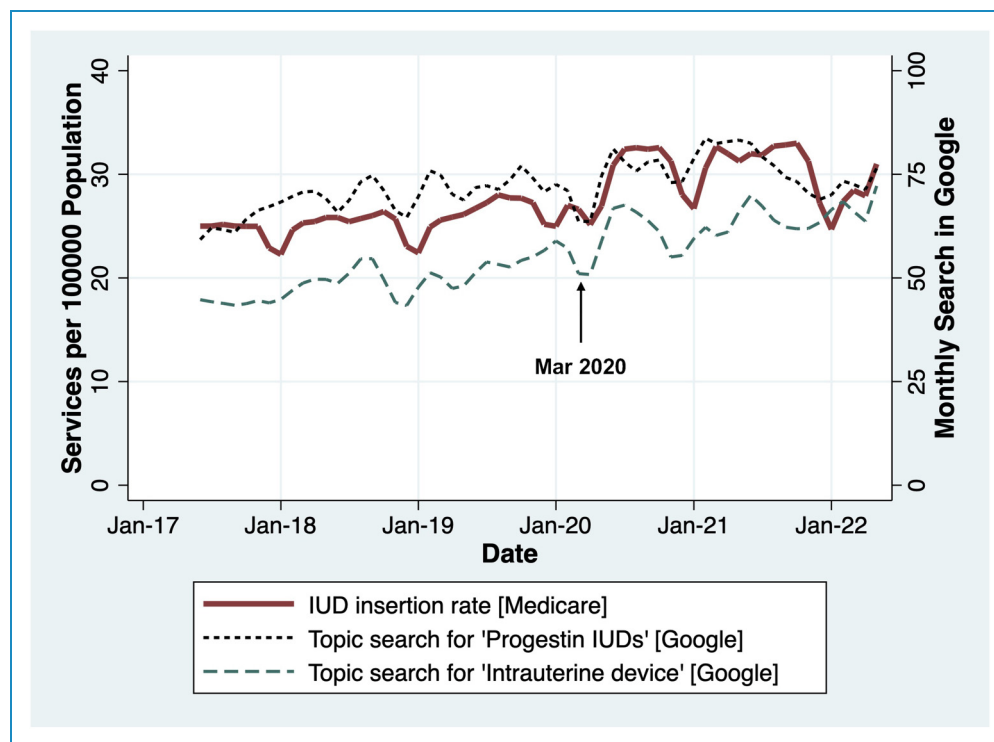


Figure 3. Monthly per capita Medicare service utilization rates per 100,000 population for IUD insertion versus search volumes in Google for ‘Intrauterine device’ and ‘Progestin IUDs’ topics, June 2017 to May 2022 [LOWESS-smoothed] (March 2020 is marked because it was the month in which the Australian Government introduced national COVID-19-related lockdowns for the first time).

on Google about IUDs, specifically Progestin IUDs. A predictable time trend could be observed each year, with troughs in search term use in December followed by an increase until mid-year. Remarkably, a reduction was overserved in March and April 2020 with a subsequent noticeable rebound, which was then repeated more visibly in 2022.

In terms of correlation between searching on Google and actual service utilisation, the highest statistically significant correlation was between IUD insertion rates and search term use about ‘Intrauterine device’. This was shown through a close match of the seasonal variations of the two independent phenomena and in the moderately high Spearman rank correlation coefficient (i.e. 0.61; $p < 0.000$). The more interesting pattern was the search term used on Google about ‘Progestin IUDs’ being slightly ahead of the actual service utilization. This precedence could be an incidental finding, or it could be an indicator of an increased need for information seeking before seeking service provision in a timeframe with high demand.

Correlation with Google search queries has been investigated for vastly different medical conditions and in various clinical or population scenarios and settings, both related and unrelated to reproductive health issues.^{21–25} However, the correlation estimates that we quantified between search on Google about IUDs and actual IUD insertion rates is a new contribution to the evidence in this area. Related literature includes Guendelman et al.²⁶

who showed US state policies on abortion could predict search volumes for abortion. Patel et al.²⁷ investigated the effects of National Infertility Awareness Week on internet search volumes about infertility, however, they did not quantify the effect on actual services provided for infertility.

Research studies have also assessed theories behind people’s information searching. One theory that has gained interest lately is the Optimal Foraging Theory (OFT). OFT was initially developed to study the food foraging behaviour of animals, but has recently been used to explore people’s information-searching behaviour and its effectiveness and efficiency. According to OFT, people make effort to maximise their search success and information reliability, by avoiding time-consuming information sources and instead, using sources with a higher information reward per unit of time searched.²⁸ Therefore, one can theorise that during a pandemic and its inevitable lockdowns, plus reduced access to primary care providers to provide health information (‘inefficiency’), people may tend to search for their information sources on a platform that is accessible and available to them. This can potentially explain why after a downward trend in searching for IUDs at the beginning of lockdowns, there was a noticeable rise in searches on Google for the months after.

Research has also focused on theories relating to mothers’ health information-seeking behaviours and linking them to potential service provision. Lee HS aimed

to examine research trends related to those theories and was able to identify 22 different theories and models that have been utilized in examining mothers' health information-seeking behaviours, with the theory of planned behaviour (TPB) being the most cited.²⁹

Holmes et al.³⁰ have tried to explain the relevance of TPB to information-seeking behaviour and then, the intention to receive related services. The topic of their study was different, that is, breast cancer survivors' intention to get information via the internet on complementary and alternative medicine (CAM) options for breast cancer management. Yet, they found that three factors may influence a survivor's intention to get information on CAM via the internet: '(a) a positive attitude towards using the internet, (b) the view that using the internet for this purpose is a normal behaviour and (c) a belief that they have the ability and resources to use the internet for this purpose'. TPB eventually focuses on the 'behaviour' domain as the ultimate reflection of someone's intention. So, one is safe to theorise that higher intention to search on the internet for IUDs, might have an impact on the rates of IUD insertion.

Public health and policy considerations

A few findings from our study could be relevant to public health decision or policy makers. First, with any nationwide public health decision or recommendation (in this case, lockdowns to prevent COVID-19 spread), one could expect noticeable shifts in the way other health or medical services are demanded or being provided. Understandably, the rate of IUD insertion dropped significantly in the beginning after lockdown enforcement (i.e. in March 2020); however, the rate caught up and surpassed the baseline. This highlights a dramatic shift in women's demand for a reproductive health procedure during a pandemic. It shows that balancing health priorities (not catching COVID-19 via staying home vs. addressing the need for long-acting contraception during the pandemic by going to a clinic) is truly dynamic in nature and can fluctuate significantly.

Second, whether one calls it bad or good, Googling for health-related information is an established phenomenon in today's modern societies. It has the potential to shed light on the 'information seeking' pulse of society, with opportunities to use search patterns and statistics in predictions for the future.

Limitations

As we analysed population-level data, applications of findings to the individual level may not be relevant due to the methodology of our study using data from two secondary data sources.

Medicare database only identifies services provided to eligible cardholders, not privately billed services. This may lead to 'underestimation' in the actual rates of service utilization. Also, a percentage of IUD insertions happen in hospitals across Australia, the data of which cannot necessarily be retrieved using item number 35503. Also, clinical indications for IUD insertion (contraception or otherwise) cannot be verified using this data.

Google is estimated to be the most frequently used search engine in Australia with a market share of around 95%.³¹ However, other sources, such as Bing, Yahoo! and Facebook are also used for information seeking. Therefore, our study is not able to quantify search term use from other search engines or social media platforms.

To compare the association between IUD insertion rates and searching about IUDs in Google, we calculated a monthly average of weekly search volumes as provided by Google Trends.³² This data aggregation through averaging has the benefit of reducing the noise in search volumes and making them more reliable, yet it may reduce the variance of search volumes as well. The averaging practice has been tested and accepted in other studies.³³

Conclusions

Our study is the newest in Australia to show a strong positive correlation between the rates of IUD insertion, and search term used on Google about IUDs, before and during the COVID-19 pandemic. It shows that the temporal trends of the two phenomena have been similar for most of the last 5 years, with a more significant association during the COVID-19 pandemic. Googling about IUDs could, therefore, be a useful indicator to gauge future interest in actual IUD insertion in months thereafter. Future studies can potentially quantify this correlation either retrospectively or prospectively, by assessing a time-frame longer than the timeframe in our study.

Acknowledgements: The authors would like to thank Professor David Ellwood, Professor of Obstetrics & Gynaecology and Director of the Maternal-Fetal Medicine Unit at Gold Coast University Hospital, for his professional comments and constructive inputs on the manuscript draft. The authors also would like to acknowledge the collective efforts of all healthcare professionals and frontline workers who served people in need during the COVID-19 pandemic.

Authors' note: Alireza Ahmadvand takes full responsibility for the article, including for the accuracy and appropriateness of the reference list.

Contributorship: All authors have had equal contributions to the design, conduct, and finalization of this research and its manuscript.

Declaration of conflicting interests: The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval: Not applicable.

Funding: The authors received no financial support for the research, authorship, and/or publication of this article.

Guarantor: Alireza Ahmadvand.

ORCID iD: Alireza Ahmadvand  <https://orcid.org/0000-0001-5568-8787>

References

1. McBride KE, Brown KGM, Fisher OM, et al. Impact of the COVID-19 pandemic on surgical services: early experiences at a nominated COVID-19 centre. *ANZ J Surg* 2020; 90: 663–665.
2. Surgeons ACo. COVID-19: Recommendations for Management of Elective Surgical Procedures 2020 [updated March 13, 2020; cited 2021 February 28]. Available from: <https://www.facs.org/covid-19/clinical-guidance/elective-surgery>.
3. Fisk M, Livingstone A and Pit SW. Telehealth in the context of COVID-19: changing perspectives in Australia, the United Kingdom, and the United States. *J Med Internet Res* 2020; 22: e19264.
4. Desborough J, Hall Dykgraaf S, de Toca L, et al. Australia's national COVID-19 primary care response. *Med J Aust* 2020; 213: 104–6 e1.
5. Scott A. The impact of COVID-19 on GPs and non-GP specialists in private practice. Melbourne Institute: Applied Economic & Social Research; 2020 2020.
6. RACGP. Major new campaign encourages patients to see their GP: RACGP; 2020 [updated April 24, 2020; cited 2021 February 28]. Available from: <https://www1.racgp.org.au/newsgp/racgp/major-new-campaign-encourages-patients-to-see-thei>.
7. Aly J, Haeger KO, Christy AY, et al. Contraception access during the COVID-19 pandemic. *Contracept Reprod Med* 2020; 5: 17.
8. Ferreira-Filho ES, de Melo NR, Sorpreso ICE, et al. Contraception and reproductive planning during the COVID-19 pandemic. *Expert Rev Clin Pharmacol* 2020; 13: 615–622.
9. Kumar N. COVID 19 Era: a beginning of upsurge in unwanted pregnancies, unmet need for contraception and other women related issues. *Eur J Contracept Reprod Health Care* 2020; 25: 323–325.
10. Medicare Item Reports [Internet]. [cited February 28, 2021]. Available from: http://medicarestatistics.humanservices.gov.au/statistics/mbs_item.jsp.
11. Inc G. FAQ about Google Trends data [cited 2021 February 28]. Available from: <https://support.google.com/trends/answer/4365533?hl=en#:~:text=Google%20Trends%20normalizes%20search%20data%20to%20make%20comparisons%20between%20terms%20easier.&text=Each%20data%20point%20is%20divided,would%20always%20be%20ranked%20highest>
12. Hubacher D, Spector H, Monteith C, et al. Long-acting reversible contraceptive acceptability and unintended pregnancy among women presenting for short-acting methods: a randomized patient preference trial. *Am J Obstet Gynecol* 2017; 216: 101–109.
13. Kaneshiro B and Aeby T. Long-term safety, efficacy, and patient acceptability of the intrauterine copper T-380A contraceptive device. *Int J Womens Health* 2010; 2: 211–220.
14. McNicholas C, Maddipati R, Zhao Q, et al. Use of the etonogestrel implant and levonorgestrel intrauterine device beyond the U.S. Food and drug administration-approved duration. *Obstet Gynecol* 2015; 125: 599–604.
15. Haas M, Church J, Street DJ, et al. The preferences of women in Australia for the features of long-acting reversible contraception: results of a discrete choice experiment. *Eur J Contracept Reprod Health Care* 2022; 27: 424–430.
16. Pearson S, Boerma CJ, McNamee K, et al. Long-acting reversible contraceptives: new evidence to support clinical practice. *Aust J Gen Pract* 2022; 51: 246–252.
17. McSpedon C. Reproductive care during COVID-19. *Am J Nurs* 2020; 120: 19–20.
18. Coombe J, Kong F, Bittleston H, et al. Contraceptive use and pregnancy plans among women of reproductive age during the first Australian COVID-19 lockdown: findings from an online survey. *Eur J Contracept Reprod Health Care* 2021; 26: 265–271.
19. Lewis R, Blake C, Shimonovich M, et al. Disrupted prevention: condom and contraception access and use among young adults during the initial months of the COVID-19 pandemic. An online survey. *BMJ Sex Reprod Health* 2021; 47: 269–276.
20. Weinberger M, Hayes B, White J, et al. Doing things differently: what it would take to ensure continued access to contraception during COVID-19. *Glob Health Sci Pract* 2020; 8: 169–175.
21. Baazeem M and Abenhaim H. Google and women's health-related issues: what does the search engine data reveal? *Online J Public Health Inform* 2014; 6: e187.
22. Flanagan R, Kuo B and Staller K. Utilizing Google trends to assess worldwide interest in irritable bowel syndrome and commonly associated treatments. *Dig Dis Sci* 2020; 66: 814–822.
23. Li Z and Filobos G. What is the UK public searching for? A correlation analysis of Google trends search terms and cosmetic surgery in the UK. *Aesthetic Plast Surg* 2020; 44: 2312–2318.
24. Walker A, Hopkins C and Surda P. Use of Google trends to investigate loss-of-smell-related searches during the COVID-19 outbreak. *Int Forum Allergy Rhinol* 2020; 10: 839–847.
25. Fulk A, Romero-Alvarez D, Abu-Saymeh Q, et al. Using Google health trends to investigate COVID-19 incidence in Africa. *PLoS One* 2022; 17: e0269573.
26. Guendelman S, Yon E, Pleasants E, et al. Shining the light on abortion: drivers of online abortion searches across the United States in 2018. *PLoS One* 2020; 15: e0231672.
27. Patel M, Halpern J, Darves-Bornoz A, et al. National infertility awareness week and internet search volume: a Google trends analysis. *Fertil Steril* 2019; 112: e422.

28. Dwairy M, Dowell AC and Stahl JC. The application of foraging theory to the information searching behaviour of general practitioners. *BMC Fam Pract* 2011; 12: 90.
 29. Lee HS. Research trends in mothers' health information seeking behaviors: a review of the literature. *Proc Assoc Inf Sci Technol* 2016; 53: 1–6.
 30. Holmes MM, Bishop FL and Calman L. "I just googled and read everything": exploring breast cancer survivors' use of the internet to find information on complementary medicine. *Complement Ther Med* 2017; 33: 78–84.
 31. StatCounter. Search Engine Market Share Australia - Jan 2020 - Jan 2021 2021 [cited 2021 March 1]. Available from: <https://gs.statcounter.com/search-engine-market-share/all/australia>.
 32. Nuti SV, Wayda B, Ranasinghe I, et al. The use of Google trends in health care research: a systematic review. *PLoS One* 2014; 9: e109583.
 33. Tran US, Andel R, Niederkrotenthaler T, et al. Low validity of Google trends for behavioral forecasting of national suicide rates. *PLoS One* 2017; 12: e0183149.
-