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Using Google trends to predict birth methods and place:**A retrospective analysis of data for Türkiye¹**

Gözde ÖZSEZER

RN, PhDc; Ege University Health Sciences Institute Department of Public Health Nursing, 35030, İzmir, Türkiye

E-mail: gozdeozsezer@hotmail.com

ORCID: 0000-0003-4352-1124

Arife GÜR BOZ²

RN, PhDc; Ege University Health Sciences Institute Department of Public Health Nursing, 35030, İzmir, Türkiye

E-mail: arifegur35@gmail.com

ORCID: 0000-0002-3103-0558

Gülelgül MERMER

RN, PhDc; Ege University Health Sciences Institute Department of Public Health Nursing, 35030, İzmir, Türkiye

E-mail: gulengul.s.mermer@ege.edu.tr

ORCID: 0000-0002-0566-5656

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The authors declare that there is no possible conflict of interest in this study.

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Similarity

This study was scanned in the iThenticate program. The final similarity rate is 11%.

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² Corresponding author

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Abstract

The aim of this research was to make a retrospective analysis of the Google Trends data related to birth methods and place according to the geographical regions of Türkiye. The Google Trends data were collected according to six different time series between 01 Jan 2004 - 31 Dec 2021. The data were collected on 26 Jul 2022 from the seven geographical regions of Türkiye and across Türkiye using the keywords “normal birth”, “cesarean section”, “vaginal birth”, “home birth”, and “water birth”, which are among the methods of delivery. Considering Türkiye, geographical regions, and time series, the data analysis was performed using percentages, Ethical permission was not required due to the nature of the study and due to the openness of the data. In all-time series, it was seen that the search for “normal birth” was popular in the sample cities selected from Türkiye and the seven geographical regions, and that the popularity, however, decreased over time. The Google searches of individuals for their birth preferences and place may vary depending on the cultural structure of the region they live in, cultural interaction, health policies during the COVID-19 pandemic, socioeconomic status, COVID-19 restrictions, fear of COVID-19, access to health services.

Keywords: “Internet searches, Google Trends, Birth, Birth methods “

EXTENDED ABSTRACT

Introduction

Birth is a unique experience for each individual, which is interpreted differently according to the individual’s own existential characteristics, cultural elements, and the structure of the society in which s/he lives. Birth is one of the most important services provided by the health system in any society. Monitoring global and regional changes in birth pattern preferences is important to improve the Millennium Development Goals projections. The aim of this research was to make retrospective analyzes of internet searches related to birth methods and place according to the geographical regions of Türkiye. In addition, the results of this study provided a perspective on the reflection of the data obtained from the use of technological tools in the field of health care.

Conceptual and Theoretical Framework

Concepts

Information epidemiology is one of the current public health approaches that analyzes the data collected from the Internet. Internet search data offers a unique and real-world perspective on how the perspective of individuals and communities changes and evolves as major health-related events unfold. Google is the most popular search engine among internet users globally.

Literature Review

Worldwide, 21.1% of women give birth by cesarean section. While the five countries with the lowest cesarean rate in the world are in Africa, the first five countries with the highest cesarean section rates are: Dominican Republic (58.1%), Brazil (55.7%), Cyprus (55.3%), Egypt (51.8%) and Türkiye. (50.8%) (Betran et al., 2021). Considering the inequalities between countries in the global context, evidence-based studies suitable for pregnancy and birth process gain importance (Betran et al., 2021). In Türkiye, the rate of birth at home has decreased from 40% to 1% in the last 25 years (Türkiye Demographic and Health Survey, 2021). It is seen that 53.5% of the births in the last five years were cesarean section and 46.5% were normal births, and that it differs according to the regions (Türkiye Demographic and Health Survey, 2021).

Methods

The Google Trends data were collected according to six different time series between 01 Jan 2004 - 31 Dec 2021. The data were collected on 26 Jul 2022 from the seven geographical regions of Türkiye and across Türkiye using

the keywords “normal birth”, “cesarean section”, “vaginal birth”, “home birth”, and “water birth”, which are among the methods of delivery. Considering Türkiye, geographical regions, and time series, the data analysis was performed using percentages, Ethical permission was not required due to the nature of the study and due to the openness of the data.

Results

In all time series, it was seen that the search for “normal birth” was popular in the sample cities selected from Türkiye and the seven geographical regions, and that the popularity, however, decreased over time. When the TS were examined, it was observed that the popularity of the “cesarean section” search increased. It was also observed that the search for “home birth” and “water birth” gained some popularity over time.

Conclusion and Recommendations

According to the results of the research, it was seen that the most popular search for birth type in the seven geographical regions of Türkiye between January 1, 2004, and December 31, 2021 was “normal birth”, despite the decrease in the time series. It was determined that the search for “cesarean section” increased over time. Using the results of this research, it can be suggested to conduct qualitative and quantitative research on the birth preferences of individuals from different cultures living in the seven geographical regions of Türkiye. Using GT results, data can be obtained on the interests of Google users in different subjects related to the birth process. Within the scope of community advocacy, health professionals can take an active role in directing individuals to reliable websites by having more data for the vulnerable group of women and children.

Popular Google searches can sometimes cause infodemic. However, since popular women’s magazines and websites often do not provide comprehensive and accurate information, there are concerns that they may adversely affect policies to reduce cesarean rates. In this context, it is important to create quality content about perinatal care and to support women’s decision processes through e-campaigns and e-interventions. With the increase in the use of the Internet, the use of social media is also increasing in direct proportion. Individuals follow influencers who provide information on health, birth, etc. The information given by influencers sometimes has an academic basis, whereas they may sometimes share information to receive advertisements and to earn income.

It is debatable how much people investigate the accuracy of the information given by those accounts they follow on social media. Therefore, a massive infodemic will also cause some misdirection in the future. In this study, it is estimated that access to sources becomes easier with the widespread use of the Internet over time, and that people may also be convinced of unnecessary cesarean section delivery due to infodemic.

Keywords: “Internet searches, Google Trends, Birth, Birth methods “

INTRODUCTION

Birth is a unique experience for each individual, which is interpreted differently according to the individual’s own existential characteristics, cultural elements, and the structure of the society in which s/he lives. Birth is one of the most important services provided by the health system in any society (Tunçalp et al., 2015). Vaginal birth is a natural and physiological process. Cesarean delivery is necessary when normal delivery is not safe for mother and baby, and has increased significantly over the past decade (O’Donovan & O’Donovan, 2018). Monitoring cesarean section data reveals important indicators of “improving newborn and maternal health”, which is one of the Millennium Development Goals (Zarifsanaiey et al., 2020).

Women's preferences and concerns should be at the center of the decision-making process in planning the mode of delivery (NICE, 2021). Today, in parallel with many developments in the pregnancy and birth process, women would like a birth that they can share with their spouses, cope with the stress of the process with their own skills and birth support, and be at the center of the process (Yılmaz Esencan, et al., 2018). Monitoring global and regional changes in birth pattern preferences is important to improve the Millennium Development Goals projections.

Since 1985, the international health community has considered the ideal rate for cesarean delivery to be between 10-15%. Since then, cesarean section has become increasingly common in both developed and developing countries. When medically necessary, cesarean section can effectively prevent maternal and neonatal deaths. It is stated that the number of maternal and neonatal deaths decreases when cesarean section rates increase to 10% in a population. When the rate rises above 10%, there is no evidence that death rates improve (WHO, 2015).

Worldwide, 21.1% of women give birth by cesarean section. While the five countries with the lowest cesarean rate in the world are in Africa, the first five countries with the highest cesarean section rates are: Dominican Republic (58.1%), Brazil (55.7%), Cyprus (55.3%), Egypt (51.8%) and Türkiye. (50.8%) (Betran et al., 2021). Considering the inequalities between countries in the global context, evidence-based studies suitable for pregnancy and birth process gain importance (Betran et al., 2021).

Although cesarean delivery provides better outcomes for both maternal and neonatal safety under certain circumstances, there is no evidence that cesarean deliveries provide better outcomes overall (Kim et al., 2016). However, cesarean delivery carries an overall increased risk of short-term and long-term complications for both mother and baby compared to vaginal delivery (Eide & Bærøe, 2021). It has adverse effects on patients, including increased maternal mortality, postpartum complications, and infant death (Kim et al., 2016). Therefore, all options should be carefully considered when deciding on the mode of delivery. In addition to all these, the lack of access to cesarean delivery in some parts of the world or the fact that this access is due to some restrictive factors has devastating consequences (Boerma et al., 2018).

In Türkiye, the rate of birth at home has decreased from 40% to 1% in the last 25 years (Türkiye Demographic and Health Survey, 2021). It is seen that 53.5% of the births in the last five years were cesarean section and 46.5% were normal births, and that it differs according to the regions (Türkiye Demographic and Health Survey, 2021). Caesarean section is more common among women living in cities (52%) than rural areas (36%) (Türkiye Demographic and Health Survey, 2013). In the Health Statistics Yearbook prepared by the Ministry of Health of the Republic of

Türkiye (2021) with the data for the year 2020, it is stated that the rate of cesarean section surgeries in live births is 57.3% and that the rate of primary cesarean section among live births is 28.8%. In the same report, when the regional distribution of cesarean deliveries is examined, the highest rate is in the Mediterranean Region (67%), followed by the Western Black Sea Region (65.7%), the Aegean Region (65.3%), the Eastern Black Sea (63.8%), and the West Marmara (62.8%), respectively. The regions where the cesarean rate is relatively low are Northeast Anatolia (40.1%), Middle East Anatolia (43.5%), and Southeastern Anatolia (46.4%).

Fertility in Türkiye by region is affected by many cultural, socio-economic and demographic dynamics. This interaction is a collection of variables such as: women's education, social status, income level, customs and beliefs, age at marriage, accessibility to family planning services, level of technology use, perspective on birth, expectation from the child, family system changes, migration, ethno-cultural differences, traditional-cultural norms, religion, social status of the household, the preference of the household over the gender of the child to be born, and the economic cost of the child (Aydın et al., 2018). Factors affecting the choice of cesarean section in Türkiye can be listed as follows: fear of labor pain, guidance of the doctor, nurse and midwife around the expectant mother, the thought that it will be healthier for the baby, the psychological state of the mother-to-be, the desire to have the birth done by the doctor, knowing the date of birth in advance, the circle of friends, and social media (Aydın et al., 2018; Sönmez & Sivaslioglu, 2019). Many dynamics have been determined for women to prefer normal birth. Mother-baby health is the primary reason for preferring normal birth in Türkiye (Sönmez & Sivaslioglu, 2019). Faster recovery in normal birth and the mother's ability to pay more attention to her baby are also effective in this regard (Aktaş & Yılar, 2018). In a study, the reasons for preferring normal birth in England consisted of factors such as low anxiety level, past positive normal birth experience, mother and baby safety, fear of anesthesia, and rapid recovery after birth (Black et al., 2005). In a qualitative study conducted in Brazil, it was revealed that rapid recovery after delivery was effective on the preference for normal birth, and that the absence of pain in the choice of cesarean section was also effective (Kasai et al., 2010).

Internet search data offers a unique and real-world perspective on how the perspective of individuals and communities changes and evolves as major health-related events unfold (Cheng, Fisher, & Nicholson, 2022). The Internet is among many factors that affect birth-related decisions (Betran, et al., 2018). Most pregnant women search for information about the birth process on the Internet, trying to find help in the process. At this point, there are doubts that the quality of internet content and the lack of up-to-date information may prevent the user

from making the right decisions about the birth process (Fioretti et al., 2015). Information epidemiology is one of the current public health approaches that analyzes the data collected from the Internet (Eysenbach, 2011). Google is the most popular search engine among internet users globally (Kamiński et al., 2020).

The aim of this research was to make retrospective analyzes of internet searches related to birth methods and place according to the geographical regions of Türkiye. In addition, the results of this study provided a perspective on the reflection of the data obtained from the use of technological tools in the field of health care.

METHODS

The research is a retrospective study. The Google Trends (GT) data were obtained according to 6 different time series (TS) with equal intervals (3 years) between 01 Jan 2004- 31 Dec 2021. Trend extrapolation is frequently used in TS analysis (Akgül, 1994). Six equally spaced time series and date ranges are as in Table 1:

Table 1. Time series and date ranges

Time series	Data ranges
1	01 Jan 2004 – 31 Dec 2006
2	01 Jan 2007 – 31 Dec 2009
3	01 Jan 2010 – 31 Dec 2012
4	01 Jan 2013 – 31 Dec 2015
5	01 Jan 2016 – 31 Dec 2018
6	01 Jan 2019 – 31 Dec 2021

The data were collected on 26 Jul 2022 from the seven geographical regions of Türkiye and across Türkiye using the keywords “normal birth”, “cesarean section”, “vaginal birth”, “home birth”, and “water birth”, which are among the methods of delivery. The sample cities used in the geographical regions consist of metropolitan cities (The Marmara Region: Istanbul; The Aegean Region: Izmir; The Mediterranean Region: Antalya; The Central Anatolia Region: Ankara; The Black Sea Region: Samsun; The Eastern Anatolia Region: Erzurum; and The Southeastern Anatolia Region: Diyarbakir), and were chosen based on their representation of

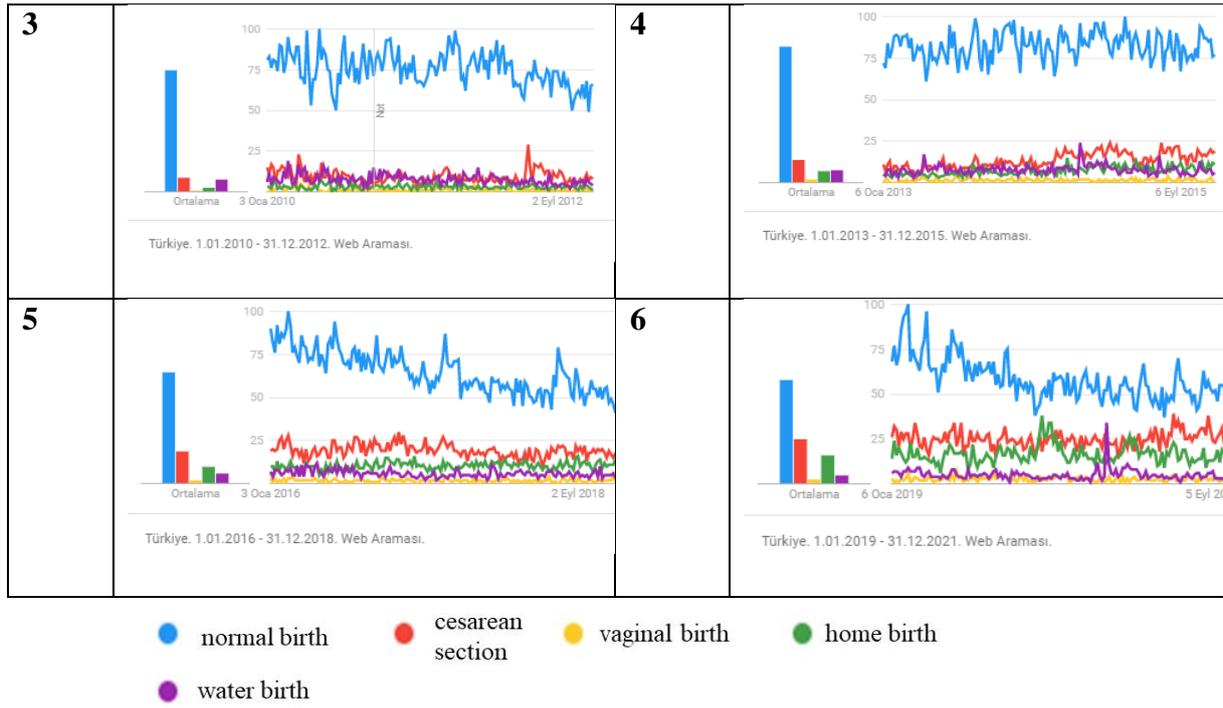
the region and on the data from Google Trends. GT is a tool used in the Google search engine (<https://trends.google.com/trends/>) to generate the search term's relative search volume (RSV). RSV is a search volume index adjusted for the number of Google users in a given geographic area. RSV ranges from 0 to 100. A value of 100 corresponds to the peak of popularity at a particular time and place, and a value of 0 to complete indifference. GT allows a selected word/term to be compared for a selected region since January 1, 2004 – the date when the first trend data was published. GT allows up to five terms to be compared simultaneously. In such a case, RSV =100 represents the highest popularity of one of the selected phrases. The data analysis was performed by using percentages through the consideration of the geographical regions of Türkiye and TS. Due to the type of research and the openness of the data, it did not require ethical permission. The strengths of this study include the rapid and real-time assessment of the birth patterns people are interested in, the ability to compare geographic regions, and the anonymity of the data.

FINDINGS

It was seen that the most popular search in the sample cities selected from the seven geographical regions of Türkiye in all TS was “normal birth”. When the TS were examined, it was observed that the popularity of the “normal birth” search decreased and that the popularity of the “cesarean section” search increased. It was also observed that the search for “home birth” and “water birth” gained some popularity over time (Table 2).

Table 2. Relative search volumes by time series

Time series	Graphics	Time series	Graphics
1	<p>Türkiye. 1.01.2004 - 31.12.2006. Web Araması.</p>	2	<p>Türkiye. 1.01.2007 - 31.12.2009. Web Araması.</p>

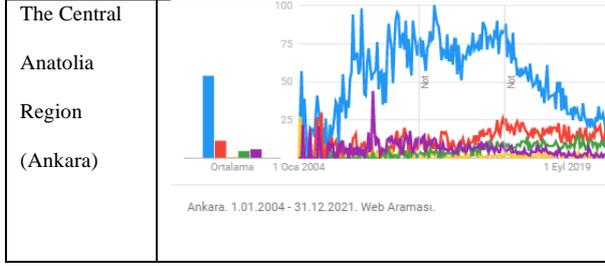


The RSV changes of the birth type searches over time according to the seven geographical regions of Türkiye were examined. When the cities represented in the regions were examined one by one in the first and sixth TS range, it was seen that the search for “normal birth” decreased and that the search for “cesarean section” and “home birth” increased in the Marmara Region. Similarly, it was determined that the search for “normal birth” decreased and that the search for “cesarean section” and “home birth” increased in the Aegean, Mediterranean, Central Anatolia, Black Sea, and Southeastern Anatolia Regions. In the Eastern Anatolia Region, it was observed that the search for “normal birth” decreased, that the search for “cesarean section” increased, and that the search for “home birth” was not made at all. It was observed that the Eastern Anatolia Region was the region with the highest number of searches for “normal birth” (Table 3).

When the RSV graphs were analyzed by geographical regions, it was observed that the search for “normal birth” was popular in all regions and that its popularity, however, decreased over time, while the popularity of the “cesarean section” search increased (Table 4).

Table 3. Relative search volume change according to time series of birth type searches by geographical regions (%)

Region	Time series (%)																													
	1 (01 Jan 2004 – 31 Dec 2006)					2 (01 Jan 2007 – 31 Dec 2009)					3 (01 Jan 2010 – 31 Dec 2012)					4 (01 Jan 2013 – 31 Dec 2015)					5 (01 Jan 2016 – 31 Dec 2018)					6 (01 Jan 2019 – 31 Dec 2021)				
	N	C	V	H	W	N	C	V	H	W	N	C	V	H	W	N	C	V	H	W	N	C	V	H	W	N	C	V	H	W
	B	S	B	B	B	B	S	B	B	B	B	S	B	B	B	B	S	B	B	B	B	S	B	B	B	B	S	B	B	B
The Marmara Region (İstanbul)	71	12	2	1	4	78	9	<1	2	1	82	8	1	3	6	77	10	1	6	6	69	15	1	9	6	59	19	2	1	5
The Aegean Region (İzmir)	75	18	-	1	6	81	8	-	1	1	70	16	-	4	8	73	13	-	7	7	60	11	-	1	7	52	24	-	1	5
The Mediterranean Region (Antalya)	75	12	-	-	13	80	7	-	<1	13	78	9	-	3	10	73	12	-	7	8	62	11	-	1	6	56	24	-	1	6
The Central Anatolia Region (Ankara)	72	13	1	1	13	78	8	1	1	12	77	10	1	3	9	75	13	1	5	6	66	19	1	9	5	48	28	3	1	4
The Black Sea Region	91	9	-	-	-	87	5	-	2	6	82	8	-	3	7	78	7	-	6	9	64	18	-	1	2	57	24	-	1	3



DISCUSSION

It was seen that the search for “normal birth” was popular in the sample cities selected from Türkiye and seven geographical regions in all TS; however, the popularity decreased over time. This result is different from the results of a study examining the search volumes of birth patterns (Kamiński et al., 2020). In this study, it was observed that the popularity of the search for “cesarean section” in TS increased. It is similar to the results of the study of Kamiński et al. (2020). Popular Google searches can sometimes cause infodemic (Fioretti et al., 2015). However, since popular women’s magazines and websites often do not provide comprehensive and accurate information, there are concerns that they may adversely affect policies to reduce cesarean rates (Boerma et al., 2018). In this context, it is important to create quality content about perinatal care and to support women’s decision processes through e-campaigns and e-interventions (Shorten et al., 2015). Cesarean section rates in Türkiye are increasing over the years (Türkiye Demographic and Health Survey, 2013; Türkiye Demographic and Health Survey, 2018). With the increase in the use of the Internet, the use of social media is also increasing in direct proportion. Individuals follow influencers who provide information on health, birth, etc. The information given by influencers sometimes has an academic basis, whereas they may sometimes share information to receive advertisements and to earn income.

It is debatable how much people investigate the accuracy of the information given by those accounts they follow on social media. Therefore, a massive infodemic will also cause some misdirection in the future. In this study, it is estimated that access to sources becomes easier with the widespread use of the Internet over time, and that people may also be convinced of unnecessary cesarean section delivery due to infodemic.

It is also thought that one of the reasons for the parallel increase in the rate of the “cesarean section” search in RSV, which is increasing in popularity, may be health policies. With the Health Transformation Program (HTP) implemented within the scope of the Ministry of Health in Türkiye, the economic benefit of cesarean section for health service providers has become preferred over normal delivery and recommended for those who will give birth, as it is advantageous in terms of both physicians and hospitals (Erol & Özdemir, 2019). While the rate of cesarean deliveries in all deliveries before the HTP (2003) was 21%, this rate increased to 57.3% in 2020 after the HTP. While the rate of cesarean section is 38.7% in inpatient treatment institutions affiliated to the Ministry of Health in 2017, it is 69.7% in private health institutions (Republic of Türkiye Ministry of Health, 2021). Recently, due to the increase in malpractice

cases and performance practice, health professionals have started to prefer cesarean delivery. In addition, cesarean section is preferred because it is covered by insurance (Filiz, 2020).

In the study, which conducted a GT search on birth and delivery patterns from 2004 to 2019, the topics with the highest popularity globally were identified as: birth, cesarean section, vaginal birth, preterm birth, home birth, and water birth. In the study, the Relative Search Volume of cesarean section was found to be associated with regional cesarean section rates (Kamiński et al., 2020). In Türkiye, cesarean section is more common among women living in cities (52%) than in rural areas (36%) (Türkiye Demographic and Health Survey, 2013). The highest cesarean rate is in the Mediterranean region with 67%, while the lowest cesarean rate is in Northeast Anatolia with 40.1% (Republic of Türkiye Ministry of Health, 2021). In the findings of this study, among the regions, the popularity of the search for “cesarean section” was the lowest in the Eastern Anatolia Region in the first and second time series, while it was similar to the other regions in the third and fourth time series and outstripped other regions in the fifth and sixth time series. In the same study, it was seen that the search volume for “normal birth” in developing countries was higher than in developed countries (Kamiński et al., 2020). In this study, the search volume for “normal birth” was found to be higher in the Eastern Anatolia, Southeastern Anatolia, and Black Sea Regions compared to the Aegean, Marmara, and Mediterranean Regions throughout the time series. It is thought that this result may be related to the cultural diversity and economic situation among the regions of Türkiye. Health in all cultures is affected by religions that are a part of culture (Tanriverdi, 2021). The north and east of Türkiye are the regions where the patriarchal family structure is seen the most. Therefore, in these cultures, women can access health services only if their family elders and men allow it (Taşçı Duran, 2020). In a phenomenological study of women’s home birth experiences in eastern Türkiye, it was emphasized that pregnant women could not access health services due to their spouses, were affected by those who gave birth in their family and surroundings, and were influenced by religious and cultural phenomena. This is one of the reasons for preferring normal and home birth (Çalış and Özsoy, 2021).

In the findings of our study, when the first and sixth TS range were examined one by one, it was determined that the search for “home birth” increased in all regions except the Eastern Anatolia Region, and that the search for “home birth” was never made in the Eastern Anatolia Region. In a study, it was seen that the interest for “home birth” and “water birth” decreased (Kamiński et al., 2020). In the literature, it was determined that women used social media tools to get information about their birth patterns (Küçükali et al., 2019). Women’s search for information through social networks is a process where women can hide their true identities

and express their curiosity in a free and natural environment and are affected by their decisions (Ay et al., 2019). According to the findings of a research, the most views in messages asking for information and help are on “fear of childbirth” (Ay et al., 2019). Pain control becomes important when it comes to fear of childbirth. The birth, which is called “Princess birth” because it provides a comfortable birth process with pain control with epidural analgesia, is popular in social media (Ulas et al., 2016). On the other hand, the social media sharing of home birth or water birth by social media accounts with a large number of followers and their sharing of home birth or water birth on social media are effective on women (Serbest, 2020). Especially in the social media posts of western women, water birth and home birth draw attention (Kızılkaya, 2021). As seen in these research findings, it is thought that this is related to the fact that searches for “home birth” and “water birth” gained popularity over time.

Another study with the time series generated from the beginning of the COVID-19 pandemic was conducted regionally for the term home birth in a GT search between March 11, 2019, and February 21, 2021 (Cheng et al., 2022). After the World Health Organization declared the COVID-19 pandemic, it was observed that the search for home birth reached a maximum with a sharp increase until the week of March 29, 2020, and then gradually decreased (Cheng et al., 2022). The results of this study, which showed that interest in home birth increased significantly following the declaration of the COVID-19 pandemic, is consistent with an online survey conducted in April 2020. The results of the survey showed that American women preferred home and birth center births more (Gildner & Thayer, 2020). The Google searches of individuals for their birth preferences and place may vary depending on the cultural structure of the region they live in, cultural interaction, health policies in the COVID-19 pandemic, socioeconomic status, COVID-19 restrictions, fear of COVID-19, and access to health services.

CONCLUSION

According to the results of the research, it was seen that the most popular search for birth type in the seven geographical regions of Türkiye between January 1, 2004, and December 31, 2021 was “normal birth”, despite the decrease in the time series. It was determined that the search for “cesarean section” increased over time. Using the results of this research, it can be suggested to conduct qualitative and quantitative research on the birth preferences of individuals from different cultures living in the seven geographical regions of Türkiye. Using GT results, data can be obtained on the interests of Google users in different subjects related to the birth process. Within the scope of community advocacy, health professionals can take an active role in

directing individuals to reliable websites by having more data for the vulnerable group of women and children.

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