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ASSESSMENT OF YOUTUBE VIDEOS AS A SOURCE OF INFORMATION ON MEDICATION USE IN PREGNANCY

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Abstract

Background—When making decisions about medication use in pregnancy, women consult many information sources, including the Internet. The aim of this study was to assess the content of publicly-accessible YouTube videos that discuss medication use in pregnancy.

Methods—Using 2,023 distinct combinations of search terms related to medications and pregnancy, we extracted metadata from YouTube videos using a YouTube video Application Programming Interface. Relevant videos were defined as those with a medication search term and a pregnancy-related search term in either the video title or description. We viewed relevant videos and abstracted content from each video into a database. We documented whether videos implied each medication to be 'safe' or 'unsafe' in pregnancy and compared that assessment with the medication's Teratogen Information System (TERIS) rating.

Results—After viewing 651 videos, 314 videos with information about medication use in pregnancy were available for the final analyses. The majority of videos were from law firms (67%), television segments (10%), or physicians (8%). Selective serotonin reuptake inhibitors (SSRIs) were the most common medication class named (225 videos, 72%), and 88% percent of videos about SSRIs indicated they were 'unsafe' for use in pregnancy. However, the TERIS ratings for medication products in this class range from 'unlikely' to 'minimal' teratogenic risk.

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Conclusion—For the majority of medications, current YouTube video content does not adequately reflect what is known about the safety of their use in pregnancy and should be interpreted cautiously. However, YouTube could serve as a valuable platform for communicating evidence-based medication safety information.

Keywords

YouTube; Medications; Pregnancy; Social Media; Drug Safety

INTRODUCTION

Medication use in pregnancy has increased over the past 30 years with the majority of pregnant women (90%) in the United States reporting use of at least one medication during pregnancy.[1] However, the safety of most commonly used medications in pregnancy is still unknown due to insufficient data.[2] In addition, accurate sources of information on the safety of medications in pregnancy can be challenging to find for both clinicians and pregnant women, which can impact the ability to make informed treatment decisions.

YouTube has become one of the largest social media platforms with an estimated one billion unique viewers per month and over six billion hours of video watched monthly.[3] Given the popularity of YouTube, several studies have assessed the quality of information in YouTube videos related to health conditions and behaviors, including immunizations,[4] prostate cancer,[5] the 2009 H1N1 influenza pandemic,[6] infantile spasms,[7] kidney stone disease,[8] cardiopulmonary resuscitation,[9] pediatric tumors,[10] inflammatory bowel disease,[11] burn first aid,[12] epilepsy,[13] and cardiac auscultation.[14]

A 2010 survey of women from 24 countries reported that over 80% of pregnant women used the Internet to inform decision-making in pregnancy.[15] With potentially many pregnant women searching the Internet for pregnancy information, it is important to evaluate the content of YouTube videos as sources of health information. The objective of our study was to assess information from systematically selected YouTube videos related to medication safety in pregnancy. We described video characteristics such as source and popularity, and assessed the accuracy of video content with respect to medication safety in pregnancy.

MATERIALS AND METHODS

Video Search Terms

To identify YouTube videos with content relevant to medication use in pregnancy, we assembled a list of the most common medication components taken in pregnancy from publications of self-reported medication use in the National Birth Defects Prevention Study and Slone Epidemiology Center Birth Defects Study[2] and the National Health and Nutrition Examination Survey (NHANES).[16] Based on the most frequently reported medication components, we compiled a list of 284 generic and brand name products (Supplemental eTable 1). We then added five general medication search terms (i.e. “SSRI”, “inhaler”, “bronchodilator”, “antibiotic”, and “antidepressant”) to mimic common terms a woman might use to search for video content. Each of these 289 medication search terms was then

paired with seven pregnancy-related terms (“pregnant”, “pregnancy”, “defect”, “congenital anomaly”, “congenital anomalies”, “birth defect”, and “birth anomalies”), generating a total of 2,023 distinct combinations of search terms.

Selection of Videos Using the Data Feed from YouTube’s Application Programming Interface (API)

Employing the list of search terms, we used a YouTube Application Programming Interface (API) video feed that searches video metadata to identify potential YouTube videos with medication and pregnancy-related content.[17] YouTube API video feed data elements include, but are not limited to: video uniform resource locator (URL), author, title, description, author-selected category (e.g., news, education, how-to, people, entertainment, tech), dates of publication and updates, duration, number of views, number of comments, and ratings. The data extraction from the YouTube API video feed was performed on June 9, 2014. To limit the sample of videos for viewing to those that would presumably be most relevant, we restricted the selection to those results with both a medication and pregnancy-related search term in the title or description fields (n=651). All videos that met this criterion were imported into a Microsoft (MS) Access database. Additional information on our method for data extraction is available in the online supplemental material.

Abstraction of Information from Reviewed Videos

Following the initial data extraction, three members of the research team (CL, VJG, APG) watched the videos. One reviewer watched 466 videos (72%), one watched 156 videos (24%) and one watched 29 videos (4%). Team members abstracted the following information from each video into the MS Access database: presenter (gender, estimated age), source of the video (“advertisement”, “government [Food and Drug Administration: FDA]”, “government [other]”, “legal [law firm]”, “not for profit organization”, “patient/family”, “physician”, “public health organization”, “TV clip”, or “university”), number of views, number of “thumbs up” or “thumbs down”, medications mentioned in the video, medication-associated adverse outcomes mentioned in the video, any FDA pregnancy category mentioned, and the safety of the medication(s) implied in the video. Regarding this last data element, if the video discussed any adverse effect on the mother or fetus associated with a particular medication, the rater assessed the video as implying that medication to be “unsafe”.

We attempted to categorize video sources as specifically as possible; hence, there was an inherent operational hierarchy to the categories. For example, “legal [law firm]” videos were classified as such if they were produced by a law firm with the intent of soliciting clients for a lawsuit, irrespective of where they might have been originally broadcast. Similarly, if a physician from a teaching hospital was speaking in an educational video aimed at patients, it was classified as “physician”, “university”. The more general terms of “TV clip” and “advertisement” were assigned to videos that did not clearly fit into one of the more source-specific categories. Videos categorized as “TV clip” tended to be excerpts from news programs or interviews originally aired on television.

If a video discussed more than one medication, the rater assessed the implied safety of each medication mentioned. If the reviewer felt that the video was not related to medication use in pregnancy, the reviewer could indicate that the video should be excluded and provide a reason for the exclusion. To check the accuracy of this abstraction process, 10% of the videos (n=67) were randomly selected and split between two additional members of the research team (ECA, SMG) to review. Of these videos, information from four videos (6%) was added or edited in the MS Access database.

For all medication products abstracted, we compared the safety of a medication's use in pregnancy suggested in the YouTube video with the magnitude of risk rating listed in the Teratogen Information System (TERIS). TERIS is a subscription database that rates both the teratogenic risk of specific medication exposures in pregnancy and the quality of the data on risk of use in pregnancy.[18]

Statistical Analyses

Descriptive statistics (percentages, mean, minimum and maximum) were used to characterize the information abstracted from the videos. No inferential statistics were performed. We calculated the total days of potential viewing since the video was uploaded by subtracting the video publication date from the date of the video data extraction. We calculated measures of popularity, such as the "mean number of views per month", by dividing the total number of views since uploading by the total days since uploading, and multiplying by 30. Similarly, for "thumbs-up" ratings, we divided the total "thumbs-up" since the video was uploaded by the total number of views since uploading, and multiplied by 1000 (e.g., mean "thumbs-up" per 1000 views).

All video feed extraction processes and statistical analyses were performed using SAS 9.4 (SAS Institute, Cary, NC). The PROC HTTP procedure was used to perform the API video feed extraction, and the XML file was then parsed into a data structure using a map generated in the SAS XML Mapper 9.4.

RESULTS

YouTube API Video Feed

Our 2,023 search terms captured 41,438 distinct videos (Figure 1) from an initial 97,480 videos from the multiple video feeds performed (e.g. there were duplicated videos captured by different search terms across the multiple video feeds). We excluded 40,787 videos in which the medication product and pregnancy-related search terms were not in the title or description of the video, leaving 651 videos with at least one medication product search term and at least one pregnancy-related search term in the title or description.

Characteristics of the Reviewed Videos

Of the 651 reviewed videos, 337 were excluded after viewing. Among the excluded videos, 244 were excluded because the reviewer deemed the content of the video to be unrelated to medication use in pregnancy. The most common medication product search term among these 244 excluded videos was "clomid", a treatment for infertility. Associated excluded

videos tended to chronicle women's attempts to become pregnant. An additional 70 videos were excluded because the video was an exact duplicate of another video included in the analysis. Because the title and/or descriptions were different, however, the duplication was not detected during data cleaning. Twenty-three additional videos were excluded for other reasons (Figure 1). This left 314 videos in the final analyses.

Of the 314 videos we analyzed, the most common medication product search terms (in combination with a pregnancy search term) in the title or description were "antidepressant", "SSRI", "Zoloft", and "Paxil" (Figure 2). The majority of videos were from a "legal" (67%), "TV clip" (9.9%) or "physician" (8.0%) source (Table 1). The 210 videos of "legal" origin were uploaded by 110 distinct authors (range: 1–16 videos per author). The "physician" category had the highest number of views per 30 days (332 views), followed by "not for profit organizations" (114 views). Videos from "not for profit organizations" had the highest mean number of thumbs-up (5.3 thumbs-up per 1000 views). Videos of "legal" origin were, on average, the shortest in duration (mean=1.4 minutes), and videos from "university" and "not for profit organizations" were the longest in duration (both ~13.7 minutes).

Medications Mentioned in the Videos

On average, three medications were mentioned per video (range: 1–15). Antidepressants were discussed in the majority of videos (249, 79%), of which 82% were of "legal" origin (Table 2). Selective serotonin reuptake inhibitors (SSRIs) were the most common medication class (225 videos) mentioned in the YouTube videos, and sertraline and paroxetine were the most commonly mentioned SSRIs, reported in 135 and 118 videos, respectively (Table 3). Serotonin-norepinephrine reuptake inhibitors (SNRIs) were the second most common medication class (41 videos), and venlafaxine was the most commonly mentioned drug in that class (37 videos). Other types of antidepressants, particularly bupropion, were also mentioned in 32 videos. There was low concordance between the safety suggested in YouTube videos and medication ratings in TERIS. Eighty-eight percent of videos discussing SSRIs, SNRIs, or other antidepressants deemed them to be 'unsafe' for use in pregnancy (Table 3). The majority of these videos were from "legal" videos. However, TERIS ratings for specific SSRIs and other antidepressants ranged from 'unlikely' to 'minimal' teratogenic risk and were 'undetermined' for many SNRIs.

Other medication types were less commonly mentioned in YouTube videos. After antidepressants, the next most common medication types mentioned included analgesics and antipyretics (26 videos, 8%), most of which were of "physician" or "TV clip" origin (46% and 27%, respectively), and hormones and synthetic substances (24 videos, 8%), most (42%) of which were from a "patient/family" source (Table 2). The majority of videos about analgesics and antipyretics focused specifically on acetaminophen (17 videos), with 29% of videos reporting it to be 'unsafe' during pregnancy despite the medication having a TERIS rating of 'minimal' teratogenic risk (Table 3). The majority of videos about hormones and synthetic substitutes focused specifically on antidiabetic medications (15 videos); the safety implied in the YouTube videos mostly agreed with the rating in TERIS for this medication type. Anticonvulsant, gastrointestinal, and antibacterial medication types were each mentioned in less than 25 videos (Table 2, Table 3). The timing of medication exposure in

pregnancy or the critical period of risk was not discussed in the majority of videos (233, 74%) and only 13 videos (4%) mentioned FDA pregnancy categories (data not shown).

Adverse Pregnancy Outcomes Mentioned in the Videos

The adverse outcomes reported in the reviewed videos consisted mainly of specific birth defects (175 videos, 56%), followed by persistent pulmonary hypertension of the newborn (83 videos, 26%), non-specific birth defects (56 videos, 18%), and behavioral or developmental disabilities (35 videos, 11%) (Table 4). Congenital heart defects were the most common birth defects mentioned (160 videos, 51%), followed by craniofacial defects (100 videos, 32%), and neural tube defects (67 videos, 21%) (Table 4). When looking at reported adverse outcomes by medication class, heart defects and craniofacial defects were most often reported to be associated with antidepressants; most of the videos reporting these associations were of ”legal” origin (Table 5).

DISCUSSION

In this study, we reviewed over 600 YouTube videos and abstracted information from 314 videos that provided information on the use of medications in pregnancy. Over two-thirds of reviewed videos were from law firms, and less than 10% of videos each were from other sources such as TV clips, physicians, universities, or government agencies. Antidepressants were the predominant medication type mentioned. Birth defects and heart defects, in particular, were the most common adverse pregnancy outcomes discussed. A comparison between a medication’s safety in pregnancy suggested in the YouTube video with the magnitude of risk rating listed in TERIS suggested that, for selected medications, such as SSRIs, the YouTube video content that we reviewed does not adequately reflect what is known about the medication’s teratogenic risk. People seeking information about the safety of medications in pregnancy from YouTube videos should be mindful of the information source when drawing conclusions about the teratogenic risk of specific medication products and consider the video content with caution. Our use of search terms such as “defect”, “congenital anomaly”, “congenital anomalies”, “birth defect”, and “birth anomalies” seemed to identify videos more likely to present medications as “unsafe” than “safe”.

In general, our findings are consistent with previous research that has found that the information related to the safety of medications in pregnancy on many websites is inconsistent and inadequate. For example, a 2013 study assessed information about the safety of medications in pregnancy and reported on content from 25 different websites and 245 medications listed as “safe for use during pregnancy”. Researchers found that about 40% of websites lacked sufficient data to support safety claims.[19] A recent multinational study used an anonymous Internet-based questionnaire to assess the extent to which pregnant women use multiple information sources and the consequences of conflicting information. Results showed that almost all of the women surveyed used multiple information sources when seeking information on medication safety in pregnancy. About 20% of the women surveyed reported that conflicting information led them to decide not to use a particular medication.[20] A 2014 French study investigated the quality and reliability of information on medications in pregnancy in conversations in online forums. Researchers

reported that nearly 20% of the advice given in these online conversations lacked sufficient evidence to support their conclusions.[21] For pregnant women this inconsistent information can lead to frustration and anxiety and may lead women to decide not to use a particular medication during pregnancy, even if the benefits of use outweigh the risks associated with medication exposure.

A strength of our study is the large set of empirically derived medication and pregnancy-related terms we utilized to search YouTube metadata. It would not have been feasible to conduct a manual search of the same magnitude within YouTube. Furthermore, we were able to identify and review over 600 videos, more than the number of videos reviewed in other studies investigating health-related information available via YouTube.

Our study is subject to several limitations. First, we searched for videos within the YouTube API and although this was an efficient method that allowed for automated data capture, it did not replicate the process an individual would go through when conducting a manual search within YouTube. Specifically, we were not able to consider the order in which videos from a manual search might appear, which could be an important factor for users searching YouTube and could influence the likelihood that an individual would ever see a video. Nonetheless, by first extracting data from the YouTube API, we were able to cast a broad net and capture all videos regardless of the order in which a video would appear on a results page during a manual search.

Second, we excluded from consideration videos that did not have at least one pregnancy-related and medication search term in either the title or description; this decision excluded over 40,000 videos from consideration. It is possible that some potentially relevant videos were not considered for review because of this exclusion rule.

Third, for some videos, it was challenging to discretely categorize the video source into a single category. The decision to categorize a video's source when it was unclear or when it could fall into more than one category (e.g. distinction between "not for profit" and "university") was made by the reviewer, which may have introduced a degree of information bias if reviewers were not consistent in their decision-making. For most videos, however, the origin was obvious.

Fourth, our assessment of whether the video noted the medication to be "safe" or "unsafe" was somewhat subjective and relied on the reviewer's interpretation of the information presented in the video. However, based on the pre-established protocol for data abstraction, if the video discussed any adverse effect on the mother or fetus, raters uniformly assessed the video as noting that medication to be "unsafe". There was insufficient information to have a more nuanced assessment of the video's safety assessment. In addition, the terms of our search were selected to identify videos that discussed teratogenic effects of medication use in pregnancy. By including the pregnancy related search terms of "defect", "congenital anomaly", "congenital anomalies", "birth defect", and "birth anomalies", we were, by design, seeking to identify videos that discussed these effects. It is important to note that broader search terms such as "preterm", "low birth weight", "complications", "stillbirth" and "miscarriage" were not included. Therefore, we acknowledge that not all videos

discussing these broader adverse outcomes associated with medication use in pregnancy were captured in our analyses. Hence our results may be an underestimation of the incorrect information portrayed in YouTube videos.

Fifth, when videos discussed broad medication classes rather than a specific medication product, we could not compare the video's safety assessment to a corresponding TERIS rating.

Lastly, grouping reported adverse outcomes was challenging, especially when videos were vague in the outcomes mentioned or reported multiple outcomes. Several videos needed to be re-reviewed during data analysis to clarify some of the health effects abstracted (e.g. when "jittery" was noted as an effect of a medication used in pregnancy, the video needed to be re-reviewed to determine whether that effect referred to the mother or the baby).

CONCLUSION

To our knowledge, this is the first assessment of the content of YouTube videos about medication use in pregnancy. For selected medications, such as SSRIs, the YouTube video content that we reviewed does not adequately reflect what is known about the safety of their use in pregnancy and video content should be interpreted with caution. Given the high utilization of the Internet for health information, YouTube could serve as a valuable platform for communicating evidence-based medication safety information in pregnancy. Credible sources, such as FDA, physicians, and CDC, should consider using YouTube as a platform for disseminating factual, reliable content on medication safety. Information communicated in YouTube videos can encourage women to discuss their treatment questions with their healthcare providers and can provide women with information to inform these conversations.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Key Points

- YouTube video content can be searched systematically to extract videos related to safety of medication use in pregnancy.
- The majority of YouTube videos reviewed were related to litigation.
- Antidepressants were the most commonly discussed medications in YouTube videos reviewed.
- For the majority of medications, current YouTube video content does not adequately reflect what is known about the safety of their use in pregnancy.

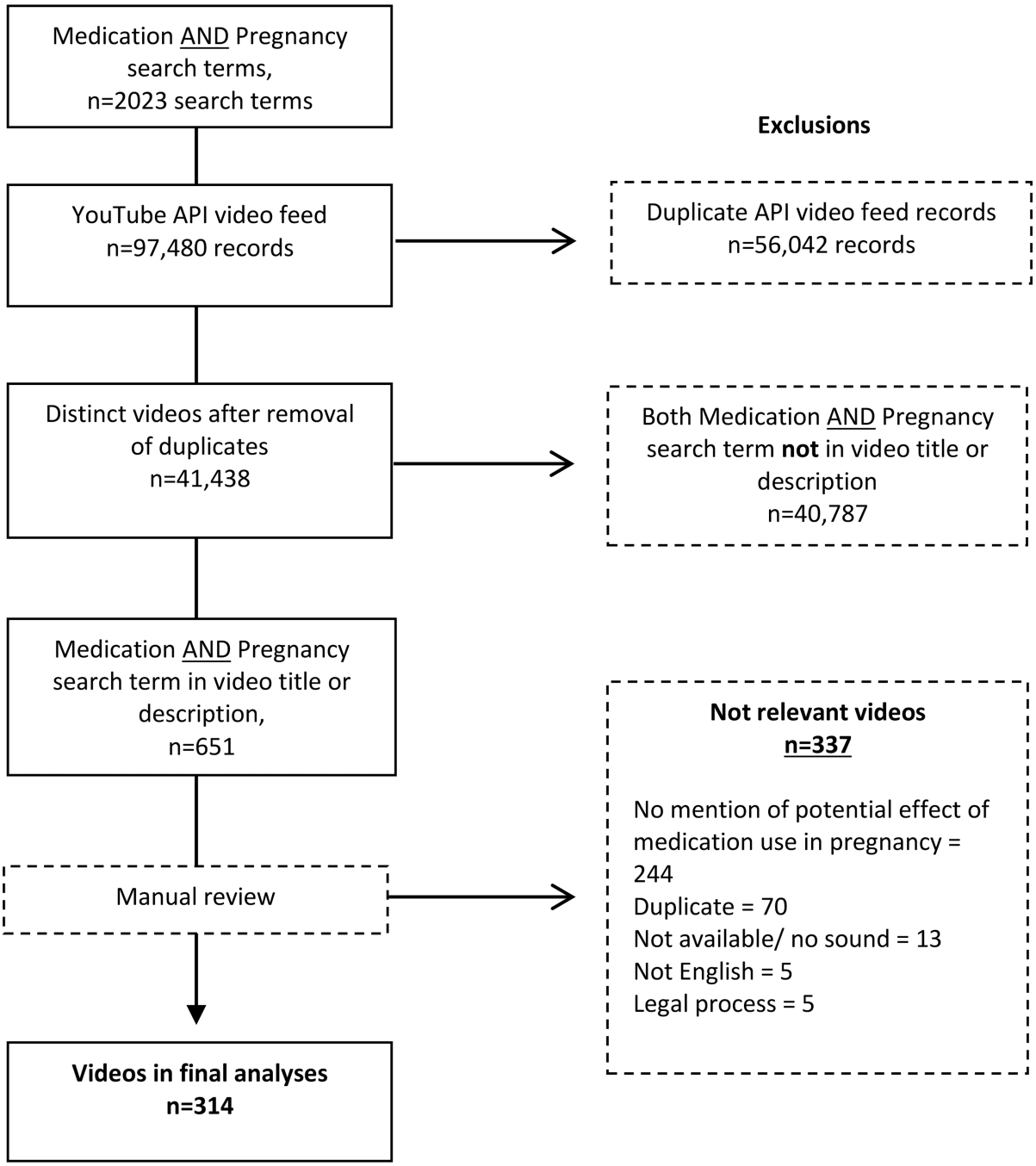

FIGURE 1.
Schematic overview of the video selection process.

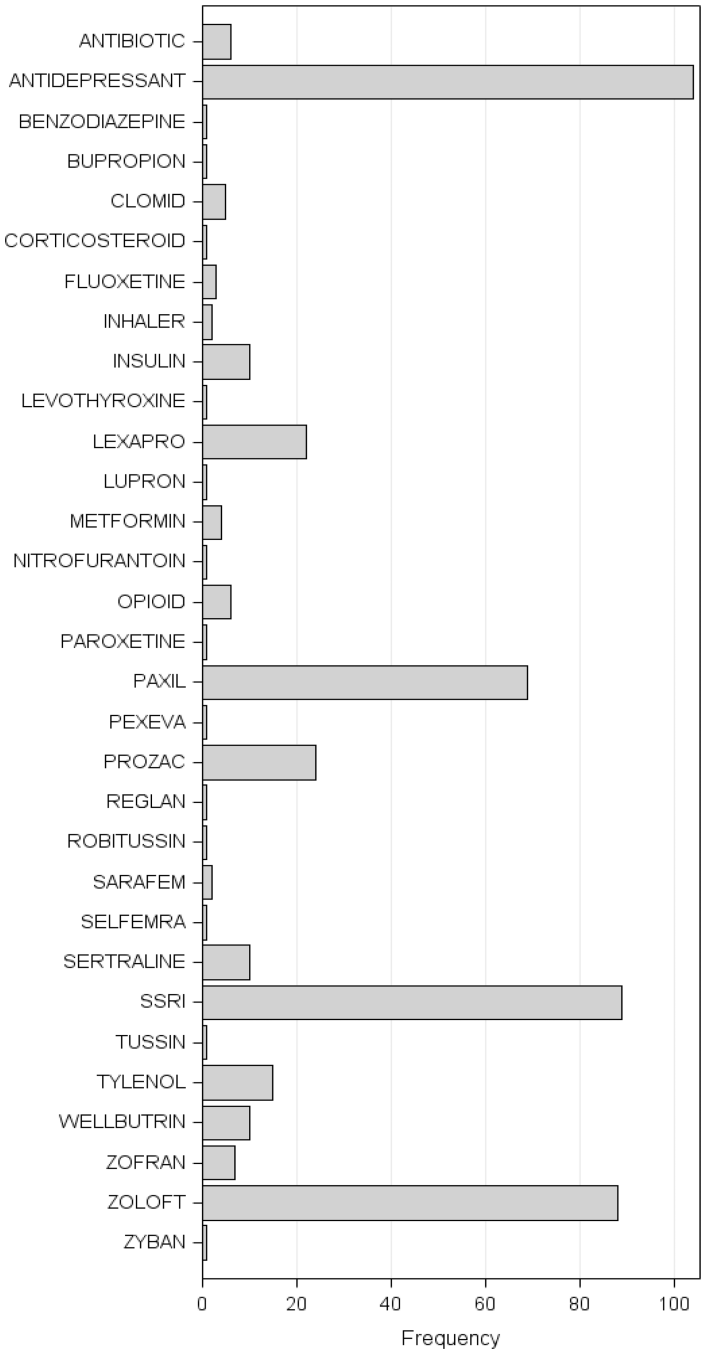

FIGURE 2.

Distribution of medication search terms appearing in the title or description of included videos (n=314). Note: Videos can be double-counted when multiple medications appear in the title or description.

Notes: SSRI = selective serotonin reuptake inhibitor

Table 1

Characteristics of YouTube videos about medication use in pregnancy reviewed (n=314), by source of video

Video source	Videos	Distinct author uploaders	Total days since uploading[1]	Total views since uploading	Mean views since uploading[2]	Total thumbs-up since uploading	Mean thumbs-up since uploading[3]	Duration (minutes)	Comments per video
	n (%)	n (max videos per author)	n	n	(per 30 days)	n	(per 1000 views)	Mean (min, max)	Mean (min, max)
Legal	210 (66.88)	110 (16)	178,145	220,529	37.1	827	3.75	1.43 (0.17, 9.77)	43 (0, 855)
TV Clip	31 (9.87)	25 (5)	23,969	30,246	37.9	79	2.61	2.27 (0.42, 11.43)	18 (0, 201)
Physician	25 (7.96)	18 (3)	24,097	266,248	331.5	80	0.30	2.91 (0.67, 12.83)	45 (0, 658)
Patient/Family	21 (6.69)	20 (2)	14,530	48,326	99.8	189	3.91	7.99 (1.02, 20.82)	30 (0, 322)
University	9 (2.87)	6 (4)	4919	7043	43.0	8	1.14	13.69 (0.50, 59.63)	1 (0, 4)
Not for Profit Organization	5 (1.59)	5 (1)	3505	13,276	113.6	70	5.27	13.59 (0.60, 54.68)	66 (0, 248)
Advertisement	8 (2.55)	7 (2)	3835	880	6.9	0	0.00	1.93 (0.15, 3.32)	22 (0, 155)
Government [FDA]	1 (0.32)	1 (1)	936	4	0.1	0	0.00	2.50 (2.50, 2.50)	0 (0, 0)
Unknown	4 (1.27)	4 (1)	2490	1014	12.2	1	0.10	1.90 (0.48, 6.00)	86 (3, 307)

FDA = Food and Drug Administration

[1] Sum (across all videos in that category) of the number of days between the upload date and YouTube API data extraction date.

[2] (Total views since uploading/total days since uploading) × 30 (as an estimate of month).

[3] (Total thumbs up since uploading/total views since uploading) × 1000.

Table 2

Number of reviewed YouTube videos (n=314) about medication use in pregnancy, by source of video and medication type

Video source	Antidepressants n (%)	Analgesics and antipyretics n (%)	Hormones and synthetic substitutes n (%)	Anticonvulsants n (%)	Antibacterials n (%)	Gastrointestinal agents n (%)	Other n (%)
Total	**249**	**26**	**24**	**21**	**9**	**10**	**10**
Legal	204 (81.9)	0	2 (8.3)	19 (90.5)	0	1 (10.0)	0
TV Clip	19 (7.6)	7 (26.9)	1 (4.2)	1 (4.8)	3 (33.3)	3 (30.0)	2 (20.0)
Physician	7 (2.8)	12 (46.2)	3 (12.5)	1 (4.8)	2 (22.2)	2 (20.0)	4 (40.0)
Patient/Family	5 (2.0)	4 (15.4)	10 (41.7)	0	3 (33.3)	4 (4.0)	1 (10.0)
University	2 (0.8)	2 (7.7)	4 (16.7)	0	0	0	2 (20.0)
Not for Profit Organization	4 (1.6)	0	1 (4.2)	0	1 (11.1)	0	0
Advertisement	4 (1.6)	0	3 (12.5)	0	0	0	1 (10.0)
Government [FDA]	1 (0.4)	0	0	0	0	0	0
Unknown	3 (1.2)	1 (3.8)	0	0	0	0	0

FDA=Food and Drug Administration

Table 3

Number of YouTube videos reviewed (n=314) about medication use in pregnancy, by medication type, class, generic drug name, Teratogen Information System (TERIS) ratings, and safety assessment in YouTube video

Medication Type	**n**[1]	**Percent**	**TERIS ratings**		**Reported as unsafe in YouTube video**	
Medication Class						
Generic Drug Name			**Teratogenic risk rating**	**Data quality/quantity rating**	**n**	**%**
Antidepressants	**249**	**79.3**			**218**	**87.5**
SSRI	***225***	***90.4***			***198***	***88.0***
Sertraline hydrochloride	135	60.0	Unlikely	Fair	120	88.8
Paroxetine hydrochloride	118	52.4	Minimal	Fair to Good	105	89.0
Fluoxetine hydrochloride	79	35.1	Unlikely	Fair	68	86.1
Escitalopram oxalate	59	26.2	Unlikely	Fair	53	89.8
Citalopram hydrobromide	43	19.1	Unlikely	Fair	38	88.4
Fluvoxamine maleate	12	5.3	Undetermined	Limited	9	75.0
Combination olanzapine and fluoxetine hydrochloride	4	1.8			4	100.0
SSRIs NOS	29	12.9			22	75.9
SNRI	***41***	***16.5***			***36***	***87.8***
Venlafaxine	37	90.2	None to Minimal	Limited to Fair	32	86.5
Desvenlafaxine	10	24.4	Undetermined	None	10	100.0
Duloxetine hydrochloride	3	7.3	Undetermined	Limited	3	100.0
Milnacipran hydrochloride	1	2.4	Undetermined	Very Limited	1	100.0
Other antidepressants	***32***	***12.8***			***28***	***87.5***
Bupropion hydrochloride	32	100.0	Unlikely	Limited to Fair	28	87.5
Mirtazapine	1	3.1	Unlikely	Limited to Fair	1	100.0
Antidepressants NOS	***18***	***7.2***			***10***	***55.6***
Analgesics and antipyretics	**26**	**8.3**			**12**	**46.2**
Acetaminophen	***17***	***65.4***	**Minimal**	**Good**	***5***	***29.4***
Opioids	***8***	***30.8***			***4***	***50.0***
Methadone	6	75.0	Unlikely	Limited to Fair	1	16.7
Buprenorphine hydrochloride	5	62.5			1	20.0

Medication Type	n[1]	Percent	TERIS ratings		Reported as unsafe in YouTube video	
Medication Class						
Generic Drug Name			**Teratogenic risk rating**	**Data quality/quantity rating**	**n**	**%**
Diacetylmorphine	3	37.5	Unlikely	Fair	3	100.0
Codeine	1	12.5	Unlikely	Fair to Good	0	0
Nalbuphine hydrochloride	1	12.5	Undetermined	None	1	100.0
Combination buprenorphine and naloxone	1	12.5			0	0
Opioids NOS	4	50.0			3	75.0
NSAIDs	***4***	***15.4***			***3***	***75.0***
Aspirin	2	50.0	Minimal	Good	2	100.0
Ibuprofen	2	50.0	Minimal	Fair to Good	2	100.0
Naproxen sodium	2	50.0	Minimal	Limited to Fair	1	50.0
NSAIDs NOS	1	25.0			1	100.0
Other	***3***	***11.5***			***1***	***33.3***
Combination acetaminophen and aspirin	1	33.3			1	100.0
Combination aspirin, butalbital, caffeine	1	33.3			0	0
Pain relief, NOS	1	33.3			0	0
Hormones and synthetic substitutes	**24**	**7.6**			**6**	**25.0**
Antidiabetics	***15***	***62.5***			***1***	***6.7***
Insulins	9	60.0	Unlikely	Fair	0	0
Aspart	1	11.1	Unlikely	Fair	0	0
Detemir	1	11.1			0	0
Glargine	1	11.1	Unlikely	Fair	0	0
Human isophane	1	11.1	Unlikely	Fair	0	0
Insulin NOS	8	88.9			0	0
Biguanides: Metformin	6	40.0	Unlikely	Fair	0	0
Sulfonylureas: Glyburide	4	26.7	Unlikely	Limited to Fair	0	0
Thiazolidinediones: Rosiglitazone	1	6.7	Undetermined	Very Limited	1	100.0
Antidiabetics NOS	1	6.7			0	0
Estrogen agonists/antagonists	***7***	***29.2***			***5***	***71.4***

Medication Type	n[1]	Percent	TERIS ratings		Reported as unsafe in YouTube video	
Medication Class						
Generic Drug Name			**Teratogenic risk rating**	**Data quality/quantity rating**	**n**	**%**
Clomiphene citrate	6	85.7	Undetermined	Limited to Fair	4	66.7
Synthetic estrogen NOS	1	14.3			1	100.0
Gonadrotropins	***2***	***8.3***			***1***	***50.0***
Leuprolide acetate	1	50.0	Undetermined	Limited to Fair	0	0
Gonadrotropins NOS	1	50.0			1	100.0
Adrenals: Corticosteroids	***1***	***4.2***			***0***	***0***
Progestins: Progesterone	***1***	***4.2***	**Unlikely**	**Good**	***0***	***0***
Thyroid: Levothyroxine sodium	***1***	***4.2***	**Unlikely**	**Fair**	***0***	***0***
Anticonvulsants	**21**	**6.7**			**20**	**95.2**
Divalproex sodium	15	71.4	Undetermined	None	15	100.0
Topiramate	12	57.1	Small to Moderate	Fair	11	91.7
Carbamazepine	2	9.5	Small to Moderate	Fair to Good	2	100.0
Phenytoin	1	4.8	Small to Moderate	Fair to Good	1	100.0
Anticonvulsants NOS	1	4.8			1	100.0
Gastrointestinal agents	**10**	**3.2**			**1**	**10.0**
Antiemetics: Ondansetron	7	70.0	Unlikely	Limited to Fair	0	0
Antidiarrheal: Loperamide hydrochloride	1	10.0	Undetermined	Limited	0	0
Cathartics and laxatives: Polyethylene glycol 3350	1	10.0	Undetermined	Very Limited	0	0
Prokinetic agents: Metoclopramide	1	10.0	None	Fair to Good	1	100.0
Antacids NOS	1	10.0			0	0
Antibacterials	**9**	**2.9**			**1**	**11.1**
Azithromycin	1	11.1	Unlikely	Limited to Fair	0	0
Ceftriaxone sodium	1	11.1			0	0
Clindamycin	1	11.1	Undetermined	Limited	0	0
Colistin sulfate	1	11.1	Undetermined	Limited	0	0
Nitrofurantoin	3	33.3	Unlikely	Fair to Good	0	0

Medication Type *Medication Class* Generic Drug Name	n[1]	Percent	TERIS ratings Teratogenic risk rating	 Data quality/quantity rating	Reported as unsafe in YouTube video n	 %
Sulfamethoxazole and trimethoprim	1	11.1			0	0
Antibacterial NOS	5	55.6			1	20.0
Benzodiazepines	**4**	**1.3**			**1**	**25.0**
Alprazolam	1	25.0	Unlikely	Fair to Good	0	0
Diazepam	1	25.0	Minimal	Good	0	0
Estazolam	1	25.0	Undetermined	None	1	100.0
Benzodiazepines NOS	1	25.0			0	0
Antihistamine	**2**	**0.6**			**0**	**0**
Dimenhydrinate	1	50.0	Unlikely	Fair to Good	0	0
Diphenhydramine hydrochloride	1	50.0	Unlikely	Fair	0	0
Antihistamine NOS	1	50.0			0	0
Anxiolytics, sedatives, and hypnotics	**1**	**0.3**			**1**	**100.0**
Eszopiclone	1	100.0	None to Minimal	Limited to Fair	1	100.0
Zaleplon	1	100.0	Undetermined	None	1	100.0
Zolpidem tartrate	1	100.0	Unlikely	Limited to Fair	0	0
Dermatologic	**1**	**0.3**			**1**	**100.0**
Etretinate	1	100.0	High	Fair	1	100.0
Isotretinoin	1	100.0	High	Excellent	1	100.0
Other	**6**	**1.9**			**2**	**33.3**
Autonomic: nicotine	1	16.7	Minimal to Small	Good	1	100.0
Herbal and natural products: probiotics	1	16.7			0	0
Oxytocics: mifepristone	1	16.7	Undetermined	Limited	1	100.0
Vitamins: levomefolate calcium	1	16.7	None	Excellent	0	0
Other NOS[2]	2	33.3			0	0

NOS=not otherwise specified; NSAIDs=non-steroidal anti-inflammatory drugs; SNRI=serotonin-norepinephrine reuptake inhibitor; SSRI=selective serotonin reuptake inhibitor

[1] Some videos discussed more than one medication type (i.e., they might be represented more than once in this column); therefore, the sum of videos within each medication class will not equal the number of videos for each medication type.

[2] Cold medications, inhaler, nasal decongestant spray.

Table 4

Number of YouTube videos reviewed (n=314) about medication use in pregnancy, by adverse outcome mentioned[1]

Adverse Outcome	n[2]	%
Specific birth defects	**175**	**55.7**
Heart defects	160	51.0
Craniofacial defects	100	32.0
Neural tube defects	67	21.3
Abdominal defects	53	17.0
Club feet	53	17.0
Lung defects	51	16.2
Limb defects	27	8.6
Anal defects	12	3.8
Muscular/skeletal defects	6	1.9
Brain defects	6	1.9
Genital defects	4	1.3
Chromosomal abnormalities	2	0.6
Nonspecific birth defects[3]	**56**	**17.8**
PPHN	**83**	**26.4**
Behavioral/developmental disabilities[4]	**35**	**11.2**
Non-birth defect complications in the infant	**21**	**6.7**
Neonatal abstinence syndrome	**12**	**3.8**
Death	**5**	**1.6**
Outcomes related to the mother	**28**	**8.9**
Birth related complications[5]	**19**	**6.1**
None	**7**	**2.2**
Missing	**53**	**16.9**

Notes: PPHN=Persistent pulmonary hypertension of the newborn

[1] All groups are indicators (i.e., videos could report more than one effect for every medication discussed and are therefore counted in each group indicated); exception to this is nonspecific birth defects when a birth defect by location was also given (see note below).

[2] Some videos discussed more than one effect (i.e., they might be represent more than once in this column), therefore, the sum of videos within each effect type will not equal the number of videos for each effect type.

[3] Only includes videos in which no specific birth defects were mentioned.

[4] Includes autism, developmental disabilities not otherwise specified, and behavioral problems not otherwise specified.

[5] Includes preterm birth, miscarriage, low birth weight, and general birth complications.

Table 5

Number of reviewed YouTube videos (n=314) about medication use in pregnancy, by medication type, adverse outcome mentioned, and source of video

Medication Type Outcomes[1]	N	Percent	% overall (n=314)	Source[2]	n	Percent
Antidepressants	**249**					
Heart defects	156	62.7	49.7	Legal	146	93.6
Craniofacial defects	95	38.2	30.3	Legal	91	95.8
Analgesics and antipyretics	**26**		**8.0**			
Behavioral/developmental	10	38.5	3.2	Physician	3	30.0
				TV Clip	5	50.0
Related to mother	7	26.9	2.2	Physician	6	85.7
NAS	5	19.2	1.6	University	1	20.0
				Physician	2	40.0
				TV Clip	1	20.0
Hormones and synthetic substitutes	**24**		**7.6**			
Related to mother	4	16.7	1.3	Advertisement	1	25.0
				University	2	50.0
Anticonvulsants	**21**		**6.7**			
Heart defects	15	71.4	4.8	Legal	15	100
Craniofacial defects	15	71.4	4.8	Legal	15	100
Neural tube defects	12	57.1	3.8	Legal	11	91.7
Gastrointestinal agents	**10**		**3.2**			
Related to mother	3	30.0	1.0	Patient/Family	3	100
Antibacterials	**9**		**2.9**			
Related to mother	2	22.2	0.6	Physician	1	50.0
				TV Clip	1	50.0

Notes: PPHN=Persistent pulmonary hypertension of the newborn

[1] Over 10% prevalence among outcomes.

[2] Over 20% prevalence among crosstab in medications.