

Cultural Differences in Emotions and Opinions on Painless Delivery: Comparison of Twitter and Weibo Posts

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Abstract: The decision-making process for the use of pharmaceutical interventions in health communication scenarios can be complex, often involving multiple influences. One salient health issue that a mother-to-be would encounter is the decision-making in using pain control during labor. This study focused on people's attitudes toward epidural analgesia (EA) in labor, comparing comments raised in Twitter and Weibo, in an attempt to delineate cultural differences in opinion pertaining to this issue. Sentiment and thematic content analyses were conducted over the course of one year. The results of these analyses suggest that, with the cultivation of policy and cultural discrepancies, the use of EA is a controversial and complicated topic over both platforms. Twitter users expressed a higher prevalence of negative emotions, while Weibo users were positive. Additionally, the narratives revealed the influence of perceptions of self-construal and female empowerment. Finally, the analyses highlighted the differing understandings of the concept of pain and medical intervention in different cultural contexts. The results indicate that the promotion of EA use for delivery remains a contentious issue that warrants further attention.

Keywords: Cross-cultural, social media, English, Chinese, childbirth, painless, epidural, sentiment analysis, thematic analysis

1. Introduction

Modern medicine provides us options to deal with pain, be it pharmaceuticals or medical procedures. However, the development of such technology does not necessarily imply full acceptance by the general public, and media, especially social media, play an important role in constructing the public opinion of such scientific advances (Gleeson et al., 2019). A good example of this would be the childbirth issue, which involves communication between various stakeholders including the medical professionals, mothers-to-be, and family, as evidenced by the fact that less than 4% of decisions for the method of birth are made solely by the patient herself (Bylund, 2005). In fact, deciding on how pain can be mitigated at childbirth may be directly influenced by popular attitude of the general public and how culture shapes such beliefs.

In modern society, the influence of Social Networking Sites (SNS) in personal decision making has been shown to have great impact on users, particularly for health-related decisions. For example, Wu and Li (2017) found social media predict risk perception stronger than traditional media exposure. Childbirth, in particular, due to it being a novel life event, may arouse anxiety in young women, propelling them to seek information from various sources, especially SNS, owing to its accessibility and great availability of information. However, the nature of the information on SNS may differ with culture. Compared to traditional media, SNS consists of more user-generated content. A large percentage of narratives on SNS are personal experiences and stories that are embedded with personal judgement and emotions, rather than factual information alone (Kim, 2022). When it comes to issues that are not on the agenda of mass media, people also turn to SNS for information (Gleeson et al., 2019; Lee & Oh, 2013). For this reason, the information available on SNS

will likely be culturally bound, dependent on the norms and values of the people who participate on a particular SNS platform, oftentimes differentiated by language.

Given that attitudes toward health issues can be affected by culture, we decided to focus on a childbirth issue, that of epidural analgesia (EA), an intervention method for painless delivery, to see if discussions differ on two major SNS platforms distinguished by language. We chose to analyze discussions on the English version of Twitter, comparing it with Weibo. While Weibo is exclusive to the Chinese language and can therefore be assumed to be a fairly accurate estimate of the attitudes of Chinese people, Twitter is very international. World Population Review (2024) reports that the top countries for Twitter usage are the United States (95.4 million users), Japan (67.5 million), India (27.3 million), Brazil (24.7 million), Indonesia (24 million), and United Kingdom (23.1 million). Twitter users can set their own language, hence, for example, Japanese users can participate in discussions offered in Japanese. In effect any user can participate in any language, but it is most likely that users choose to be in their own native language community. This is not to say that English discussions are limited to users in the USA, UK, Canada, Australia and other English-speaking countries, as there are likely to be bilinguals and those wishing to practice their second language skills. However, we placed our focus on a controversial medical issue, not an ordinary, everyday issue like politics, trusting that anyone participating in a discussion as scientifically complex as epidural analgesia would have native language ability to not only understand what it means, but also to keep up with the debate on the pros and cons of such a specialized topic. We, therefore, assumed that the English discussions on the matter were, by and large, exchanged by native speakers of English, and the sample comments on Twitter would be adequately representative of the intended cultural group, that of the Anglo-culture. Given this, the purpose of this study was to inquire into cultural differences in attitude toward epidural analgesia (EA) through a content analysis of Weibo versus Twitter.

Cultural differences in the adoption of EA are quite evident. EA consists of injecting anesthesia into the spine area and has been proven to be a safe and effective way to reduce labor pain (Anim-Somuah et al., 2018). However, a wide gap in its adoption can be seen between countries. According to Osterman and Martin (2011), over 60% of U.S. women adopt EA during delivery, whereas a study in China showed less than 1% of Chinese women opting for this (Fan et al., 2007). Perhaps this difference reflects how Chinese view medicinal cures. As holistic, herbal medicine is often referred to as “traditional Chinese medicine (TCM),” it is a popular preconception that Chinese prefer natural cures over chemical. Chuang et al. (2009) revealed that 33.6% and 87.7% of mothers used TCM during and after pregnancy in the Taiwan area of China, suggesting their trust and preference of natural means of health care, especially in the context of treating ailments of newborn or young children.

Furthermore, Chinese have been known to construe the childbirth experience as “one of the most severe type of pain” (Ngai & Xiao, 2021). To this, Callister et al. (2003) claim that labor pain is a culturally defined construct which contains both psychological and physiological experiences. Culture norms of people can, therefore, lead them to interpret the pain experience into a meaningful and necessary element of laboring. In actual fact, Chinese women have been found to perceive pain as an expected, severe, but essential element of childbirth (Ngai & Xiao, 2021). Traditional Chinese culture advocates the value of suffering, as one proverb contends: “One will be privileged only if he/she suffers more”. Western society also has actively debated labor pain and pain control. Religiously speaking, the Christian Bible, in Genesis 3:16, refers to labor pain as a part of natural birth, “In sorrow thou shalt bring forth children,” and midwives who dared to control the pain of the mother were even accused of being witches (Lurie, 2004). However, with Queen Victoria’s reliance on medical intervention for labor pain relief, as well as the first-wave feminist activities, medical and technological means of pain management started to become popularized amongst the general public. Indeed,

epidural analgesia was introduced in 1921, hence the use of pain relief in childbirth has over 150 years of history among Anglo-European populations (Skowronski, 2015).

Given the above differences in traditions and propensities of Chinese versus Anglo-Europeans, we assumed that these differences would be reflected in the discussions within SNS communities. Of course, directly surveying potential mothers as to their preference of EA over Caesarean section would be a more direct inquiry into this. However, our study targeted the specific acts of communication within SNS regarding the issue, with the purpose of questioning the differences in the content of discussion pertaining to EA. Therefore, our study focuses on cultural differences in health communication between laypersons engaging in English versus Chinese SNS discussions.

One concern with searching for cultural differences on SNS would be the young generation of users, and the likelihood of whether they would abide by traditions or be swayed by modernization. With the advent of the internet, the vast availability of information may give prospective mothers a better picture of their options for childbirth, hence they may be less reliant on tradition. Exposure to media, in particular, SNS, may be an influential factor regarding potential use of EA. However, even with this influence, we contend that there would still be differences between Chinese and English discussions. The reason behind our surmise is based on Markus and Kitayama's (1991) self-construal theory. For the Chinese, who are characterized with high interdependent self-construal, important decisions on personal matters are likely to be shared with significant others, such as spouse and family. In contrast, most Anglo-European cultures are considered to be high on independent self-construal, valuing self-agency in making decisions pertaining to their own self.

Women who are bearing a child may actively refer to SNS to seek information and bonding with social capital (Gleeson et al., 2019). SNS provides women with instrumental and emotional support through active usage (Strange et al., 2016), while serving as a supplement or even replacement for health professionals for women's information needs, particularly since many women perceive the traditional patient-doctor relationship to be patriarchal (Bessett, 2010). For these reasons, the sentiment surrounding this topic is crucial to women, clearly warranting extensive discussion. Sentiment analysis is the weapon of choice for measuring this impact. Past studies have found the sentiments in the post not only could increase the number of retweets, but can draw people's attention, evoking higher levels of cognitive involvement, and strengthening social ties within one's community (Bayer et al., 2012; Berger & Milkman, 2012; Rellecke et al., 2012). In the area of childbirth, Bylund (2005) noted that a mother's decision on choosing painkillers during birth was correlated with the tone of words they used. As a platform to present people's opinions and experience, SNS is most likely to help us understand current public opinions and attitudes towards EA use, hence we intend to utilize sentiment analysis in our study.

Few studies have examined the general sentiment and attitude pertaining to this issue on SNS (Aydin et al., 2022). A better understanding of EA narrative is important for a clearer conceptualization of the role of social networking sites (SNS) in mediating health-related support and could provide us updated insight on general attitudes toward childbirth decisions.

Given the above, our study aims to explore how Chinese SNS users as well as English-speaking users perceive EA cognitively and emotionally through content analysis, and probe into psychological factors influencing the adoption of EA. We chose to feature Twitter and Weibo, as these SNS discussion platforms are the most widely used in their respective languages. By comparing the differences in sentiments expressed in discussions between Weibo and Twitter, we aim to seek for cultural differences pertaining to the issue of EA usage. The following research questions were raised:

RQ1. What are the differences in sentiments, emotions and opinions between Weibo users and Twitter users on the topic of EA?

RQ2. Is there a dominant narrative surrounding EA regardless of platform?

H1. Weibo discussions have greater content pertaining to the opinions of significant others (family, friends).

2. Method

Text analyses of posts from Twitter and Weibo, which are the major SNS platforms in the West and in China respectively, were conducted. For Twitter, we collected posts via the search query [(“painless” OR “spinal” OR “epidural”) AND (“delivery” OR “labor” OR “birth” OR “pregnant”)], through its own scraping tool named Twint. Twint is a widely used open-source tool designed for efficiently extracting a large volume of data from Twitter. Instead of screen scraping, it performs web scraping to gather data directly from Twitter’s front-end. Twint was adopted for the current study because it offers a comprehensive data collection method compared to other tools like GetOldTweets3. It also is relatively effective in bypassing the Twitter API’s limitations (for example, rate limits and the capability to be used anonymously without sign-up). For Weibo, we developed an original scraping python script, which generated the results under the search query [(“无痛” OR “硬膜外” OR “腰麻”) AND (“分娩” OR “生育” OR “生产” OR “产妇”)]. The data range for both topics covered entries from 1 May 2021 to 1 May 2022, and all the data were collected during 1 July and 6 July 2022. To exclude the influence of bot-like posts, we removed duplicate posts by retaining the earliest posted and discarding copies, and consequently, 12,813 Twitter posts, and 12,512 Weibo posts were retrieved for analyses. We adopted the Linguistic Inquiry Word Count Analyzer (LIWC) 2015 to process the above-mentioned data. LIWC is a software based on dictionaries to help analyze emotions and thinking styles embedded within context (Tausczik & Pennebaker, 2010). Our study adopted LIWC for its highly reputable nature, as it was developed collaboratively by experts in psycholinguistics, and has been widely used in sentiment analysis (Pennebaker et al., 2007). Both the original English version, and the simplified Chinese version have demonstrated high validity and reliability (Bantum & Owen, 2009; Gao et al., 2013). We selected some factors for a refined analysis, including *family*, *friends*, *work*, *money*, *health*, *death*, *rewards*, *risk* and *power*. Sentiment factors included *positive emotion*, *negative emotion*, *anxiety*, *anger*, *sad*, and *profanities*. Each factor designated count words from the dictionary of LIWC. For example, the factor of *family* counted words related to members of family or any other words related to the concept of family, and we recorded 118 count words via LIWC 2015 version. Examples of count words in this case were: *father*, *ma*, *marry*, and more are shown in Table 1. Each score indicates the percentage a certain category of words takes up out of the whole post content. For example, if the score for the factor of *negative emotion* is 2.5, that means 2.5% of the content in the posts is identified as pertaining to negative affect.

Table 1. Example of Count Words for LIWC Measurement.

	English	Mandarin (English Translation)
positive emotion	considerate, brilliant, brave	伟大, 信任, 信心 (greatness, trust, faith)
negative emotion	hurt, defeat, denial	伤, 侵犯, 压抑 (wound, violate, repression)
anxiety	worried, doubt, discomfort	内疚, 动摇, 压力 (guilt, shakiness, stress)
anger	hate, dumb, goddamn	公愤, 厌烦, 反感 (public outrage, boredom, disgust)
sad	crying, heartbreak, homesick	可怜, 叹气 (pity, sigh)

profanity	idiot, jackass, shit	妈的, 吃屎, 呸 (shit, eat shit, yuck)
family	papa, ma, marry	手足, 父母, 未婚夫 (brother/sister, parents, fiancé)
friend	buddy, partner, roommate	伙伴, 玩伴, 社团 (buddy, playmates, community)
power	bully, rule, royal	会长, 伟大, 任命 (president, great, appointment)
money	purchase, price, owe	保险, 乞丐, 买主 (insurance, beggar, buyer)
health	pill, sick, sore	住院, 不孕, 临床 (hospitalized, infertility, clinical)
death	kill, tomb, corpse	遗书, 阵亡, 默哀 (posthumous, killed in action, moment of silence)
reward	taken, win, success	赚得, 超越, 达到 (earn, exceed, attain)
risk	hazard, loss, dangerous	缺点, 衰退, 警告 (drawbacks, decline, warning)

Thematic analysis was done for RQ2, using Latent Dirichlet Allocation (LDA), a topic modeling method with a generative statistical model (Jelodar et al., 2019). LDA's effectiveness is influenced by text preprocessing and the number of topics specified, so interpreting the topics required subjective judgment, which can induce bias. For this reason, we conducted a coherence score check to determine the optimal number of topics. Additionally, we implemented rigorous preprocessing steps and validated results through independent review by multiple researchers. LDA automatically clusters words by their latent semantic structure of the content, and categorizes them into a few numbers of themes, decided by the score of topic model coherence. As shown in Figure 1, Twitter posts reached highest topic coherence at eight topics, while Figure 2 suggested Weibo was highest at seven. Topic model coherence is known as a common approach to identifying the connection among keywords representing each topic and measures the semantic similarity of a group of posts. By gathering posts into a smaller number of themes, LDA simplifies our understanding of the topics people are talking about regarding EA.

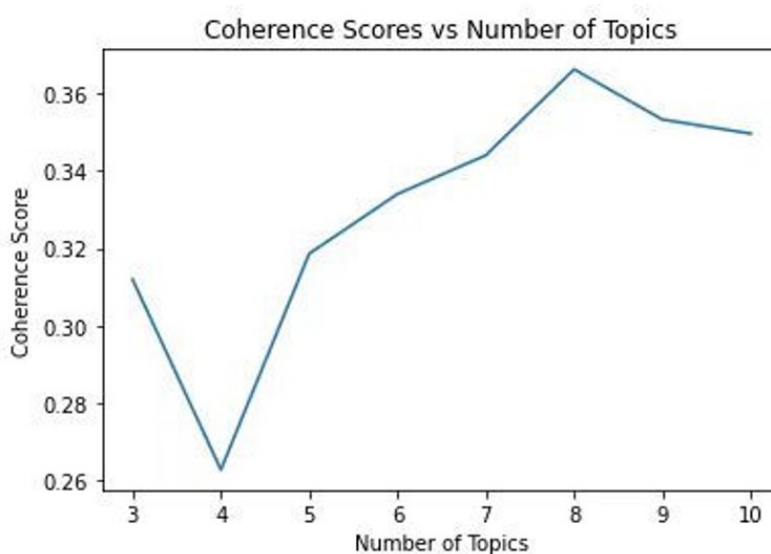


Figure 1. Coherence Score of Thematic Analysis Twitter.

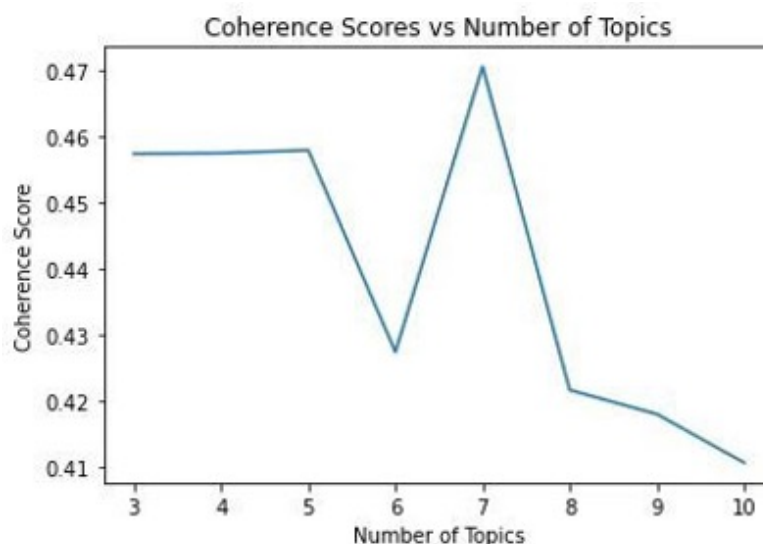


Figure 2. Coherence Score of Thematic Analysis Weibo.

3. Results

To inquire into RQ1, which questioned the sentiment and opinions of Weibo and Twitter users on the topic of EA, LIWC analysis was performed to derive percentages and standard deviations. Previous studies showed that, statistically, if a sample size is larger than 30, a z -test would be more robust than a t -test when comparing means from two populations (Pandis, 2015). Since the sample size was relatively large, two-sample z -tests were conducted to compare the means of LIWC scores of Twitter and Weibo posts. Table 2 shows these results. Means represent the average LIWC score, which is the average proportion of each category of words occupying the whole post content.

Some differences were noted: first, significant differences were found between the emotions on Twitter posts versus Weibo. Weibo showed more *positive emotion* than Twitter $z(25323) = 76.74, p < 0.001$. For *positive emotion*, the LIWC dictionary emulated words like *amazing*, *care*, *thank*, for Twitter, and “仔细” (*attentive*), “卓越” (*extraordinary*), and “信心” (*confidence*) for Weibo. Weibo also had more negative emotion content than Twitter $z = 40.99, p < 0.001$. *Negative emotions* contained words like *lame*, *guilty*, and *pissed off* for Twitter, and “危险” (*danger*), “受苦” (*suffer*) and “叫喊” (*yell*) for Weibo. These negative emotions were further subcategorized to give more detail to their content, including *anger*, *anxiety* and *sad*. Weibo contained a great percentage of *anger* ($z = 33.07, p < 0.001$) and *sad* ($z = 44.46, p < 0.001$) compared to Twitter. Examples of words fitting the subcategory of anger were *fight*, *jerk*, and *offence* in Twitter, and “残忍” (*cruel*), “愚蠢” (*foolish*), and “打扰” (*disturbing*) for Weibo. For the subcategory of *sad*, English count words included *helpless*, *miss*, and *ruin*, while Chinese consisted of “泪” (*tear*), “绝望” (*desperate*), and “自责” (*self-blame*). Weibo contained more words pertaining to *anxiety* than Twitter ($z = 11.96, p < 0.001$). Words considered *anxiety* included *panic*, *shake*, and *fear*, along with “压力” (*pressure*), “尴尬” (*awkward*), and “惊慌” (*panic*). In reference to RQ1, it would appear that Weibo participants have more of both *positive* and *negative* emotions and opinions regarding EA than Twitter.

With regard to RQ2, which sought for dominant narratives within each platform, we looked at several topic categories. The category of *health* contained words like *sick*, *Tylenol*, and *epidemic*, “肿瘤” (*tumor*), “腹泻” (*diarrhea*), and “药片” (*tablets*), with Weibo having a significantly higher frequency ($z = 15.543, p < 0.001$). While Twitter posts feebly mentioned the category of *reward* (*luck*, *positive*, *win*), Weibo was more likely to raise the rewards of EA,

including “好处” (*benefits*), and “运气” (*luck*) $z = 42.261, p < 0.001$. The category of *risk* was characterized by words such as *bad*, *lacking*, and *prevent* in Twitter, while Weibo had “冒险” (*risk*), “忍耐” (*endure*), and “回避” (*avoidance*), the latter being greater in frequency $z = 10.860, p < 0.001$. Weibo posts contained more context on *religion*, $z = -2.619, p < 0.001$, subsuming words like *God*, *Christmas*, *hell* in Twitter versus “地狱” (*hell*), “上帝” (*God*), and “天堂” (*heaven*) in Weibo. Finally, the category of *power* showed similar words for both platforms, such as *law*, *ignorant*, *fame*, and *doctor*; Weibo added additional words including “妈妈” (*mama*), “家长” (*parent*), having a much greater mention than Twitter $z = 96.740, p < 0.001$. Furthermore, the category of *money* contained words like *discount*, *tax*, and *cost* in English, and similarly, “富裕” (*rich*), “穷人” (*the poor*), and “工资” (*salary*) in Chinese, with the latter being more frequent $z = 19.024, p < 0.001$. It should be noted that Weibo and Twitter showed no difference for the category of *death*, $z = 1.362, ns$.

Hypothesis 1 predicted that there would be greater mention of *family* and *friends* on Weibo, due to its participants likely having an interdependent self. The category of *family* contained the common words of “妻子” (*wife*), “婆婆” (*mother-in-law*) and “亲戚” (*relatives*) while the category of *friends* contained “约会对象” (*date*), “邻居” (*neighbor*), and “室友” (*roommate*). Weibo showed a significantly higher score on both categories (*family*: $z = 25.746, p < 0.001$, *friends*: $z = 10.997, p < 0.001$) as predicted, supporting H1. A list of mean, standard deviation and Z score of comparison is given in Table 2.

Table 2. Mean, Standard Deviation and Z score of Sentiment and Socio-psychological Factors.

	Twitter		Weibo		z
	Mean	SD	Mean	SD	
power	0.638	1.54	4.910	4.70	96.740 ***
family	1.378	2.36	2.303	3.28	25.746 ***
friend	0.066	0.55	0.166	0.86	10.997 ***
money	0.227	1.029	0.569	1.73	19.024 ***
health	3.428	3.85	4.325	5.22	15.543 ***
death	0.137	0.69	0.124	0.77	-1.362
reward	0.060	0.44	0.897	2.17	42.261 ***
risk	0.890	1.74	1.151	2.08	10.860 ***
positive	2.536	3.69	4.097	4.88	76.744 ***
negative	2.796	3.13	3.663	3.99	40.988 ***
anxiety	0.206	0.87	0.365	1.22	11.961 ***
anger	0.066	0.46	0.498	1.39	33.070 ***
sad	0.088	0.53	0.669	1.61	44.457 ***
profanity	0.479	1.51	0.157	0.78	-21.431 ***
religion	0.209	1.03	0.249	1.33	-2.619 ***

*** $p < 0.001$.

For further analysis, we conducted correlation analysis for both Weibo and Twitter posts to investigate the potential inner connections between variables. Weibo posts showed significant positive correlations between *positive emotion* and *family* ($r(15210) = 0.107, p < 0.001$), and *friends* ($r(15210) = 0.134, p < 0.001$), while multiple regression uncovered *negative emotion* being predicted by *power*-related words ($\beta = 0.210, p < 0.001$). Conversely, for Twitter, *power* predicted *negative emotions* ($\beta = 0.129, p < 0.001$). Two-tailed Pearson’s correlation were calculated separately by platform. Correlation matrices of all the categories are shown in Tables 3 and 4. The shades of color represent the coefficient score, deeper shades indicating a stronger correlation. Red indicates positive correlation while blue indicates

negative. The correlations denote close relationships between emotions and social factors. Emotion-related words were linked with more categories in Weibo posts. Meanwhile, *risk*, *anxiety* and *health* were associated with *negative emotion* in Twitter, indicating the general negativity toward EA use by Twitter users, linked to issues of side effects and potential risk. Correspondingly, Weibo showed correlations of *anxiety*, *anger* and *sad* with *negative emotion*, all at equally high degrees. Given that compared to other countries, EA use is not yet prevalent in China (Jing Wu et al., 2020), negative emotion could be attributed to the Chinese' lack of knowledge and experience with EA. Another noticeable difference between the two platforms was the influence of *family* and *friend*. *Friend* was positively correlated with *positive emotion*, and negatively correlated with *negative emotion* on Weibo, suggesting the influence of friends is positive. In contrast, *family* positively correlated with both *positive* and *negative emotions*. Twitter, on the other hand, did not show *friend* significantly correlating with emotion, and *family* was only negatively correlated with negative emotion, which suggest that the more mention of family in Twitter posts, the less negative emotion expression would occur.

While correlations indicated the co-existence level of words, it is difficult to tell a category's effect when other factors were removed. Two stepwise regressions were conducted to answer this query. Stepwise regression is a linear regression that tests a model with better explanation of variance of dependent variable (Henderson & Denison, 1989). General emotion expression (sum of *positive emotion* and *negative emotion*) was added as a dependent variable, while socio-psychological factors listed in Table 2 were entered as independent variable. The model with best variance was kept. For Weibo posts, approximately 30.4% of the variance for *emotion* was predicted. For Twitter posts, 19.9% of the variance was predicted.

Table 5 depicts the results of the regressions. Standardized coefficients indicated the predictive power of each variable on general emotion expression in the posts. The top five categories that predict emotion expression varied in two platforms. For Twitter, factors with significant causal effects were: *risk*, *profanity*, *power*, *religion* and *work*. For Weibo, *health*, *reward*, *religion*, *work* and *power* were significant predictors of emotion expression. These results suggested that socio-psychological factors have a stronger effect towards emotion expression in Weibo than in Twitter.

Thematic analysis was used to probe for RQ2. LDA automatically clustered words by their latent semantic structure of the content, and categorized them into several themes, decided by topic model coherence. Topic model coherence is a common approach to identifying the connection among keywords representing each topic. Figure 1 shows that Twitter posts had high coherence with eight topics, while Weibo had for seven. Example posts for topics on Twitter and Weibo are depicted respectively in Tables 6 and 7. Since Weibo content is in Simplified Chinese, Table 7b is the translated version of Table 7a.

For both Twitter and Weibo, the use of EA raised controversial discussions, as all kinds of attitudes ranging from positive to negative had been equally expressed, while much experience-sharing was also evident across platforms. Experience-sharing was often related to keywords dealing with numbers; for example, topic 6 in Weibo and topic 3 in Twitter were mostly about personal experiences and personal storytelling. Yet, the narrative was largely different across the two platforms.

Table 3. Correlation Matrixes for Factors (Twitter).

	Positive	Negative	Anxiety	Anger	Sad	Profanity	Power	Family	Friend	Work	Money	Religion	Health	Death	Reward
positive	1														
negative	-0.081 **	1													
anxiety	-0.035 **	0.241 **	1												
anger	-0.011	0.144 **	-0.008	1											
sad	-0.040 **	0.177 **	0.038 **	0.020 *	1										
profanity	-0.001	0.029 **	0.015	0.056 **	0.021 *	1									
power	0.016	0.129 **	-0.027 **	0.039 **	0.004	-0.006	1								
family	-0.008	-0.053 **	-0.009	0.002	-0.01	-0.033 **	0.002	1							
friend	0.007	-0.015	-0.002	-0.007	-0.003	0.037 **	-0.016	0.002	1						
work	0.056 **	0.063 **	-0.025 **	-0.011	0.008	-0.044 **	0.025 **	-0.085 **	-0.016	1					
money	0.009	-0.041 **	-0.025 **	-0.018 *	-0.018 *	-0.019 *	0.029 **	-0.019 *	-0.005	0.023 **	1				
religion	0.146 **	-0.024 **	-0.019 *	-0.003	-0.016	0.105 **	0.021 *	0.013	0.003	-0.003	-0.020 *	1			
health	-0.056 **	0.237 **	-0.003	-0.013	-0.006	-0.041 **	-0.006	0.103 **	-0.009	-0.026 **	-0.044 **	-0.031 **	1		
death	-0.023 **	0.082 **	0.003	0	-0.008	-0.017	0.111 **	0.021 *	-0.013	-0.037 **	-0.011	-0.004	0.017	1	
reward	0.088 **	-0.006	-0.011	-0.001	-0.003	-0.006	0.002	-0.007	-0.001	0.020 *	0.030 **	-0.013	-0.008	-0.015	1
risk	0.052 **	0.409 **	0	-0.005	0.001	-0.034 **	0.003	-0.028 **	-0.013	0.015	0.014	0.023 *	0.288 **	0.004	0.007

* $p < 0.05$, ** $p < 0.01$.

Table 4. Correlation Matrixes for Factors (Weibo).

	Positive	Negative	Anxiety	Anger	Sad	Profanity	Power	Family	Friend	Work	Money	Religion	Health	Death	Reward
positive	1														
negative	-0.039 **	1													
anxiety	-0.051 **	0.317 **	1												
anger	0.060 **	0.347 **	0.026 **	1											
sad	0.064 **	0.394 **	0.100 **	0.474 **	1										
profanity	-0.043 **	0.009	-0.023 *	0.072 **	-0.038 **	1									
power	0.076 **	0.210 **	-0.007	0.087 **	0.069 **	-0.011	1								
family	0.107 **	0.038 **	-0.017	0.037 **	0.046 **	-0.031 **	0.356 **	1							
friend	0.134 **	-0.026 **	-0.005	0.018 *	0.001	-0.013	0.002	0.104 **	1						
work	-0.077 **	-0.070 **	-0.023 *	-0.039 **	-0.053 **	0.021 *	0.237 **	-0.116 **	-0.011	1					
money	0.052 **	-0.047 **	-0.022 *	-0.004	-0.031 **	0.003	0.029 **	-0.039 **	0.001	0.160 **	1				
religion	0.104 **	0.020 *	-0.009	-0.016	0.006	-0.018 *	-0.045 **	-0.055 **	0.003	-0.048 **	-0.025 **	1			
health	0.067 **	0.183 **	0.022 *	0.086 **	0.201 **	-0.063 **	0.120 **	-0.042 **	0.003	0.007	-0.098 **	0.057 **	1		
death	0.008	0.124 **	0.013	0.053 **	0.011	-0.003	-0.022 *	-0.024 **	0.009	-0.017	-0.009	0.211 **	0.018 *	1	
reward	0.311 **	-0.049 **	0.004	-0.005	-0.020 *	-0.004	-0.050 **	-0.059 **	-0.006	0.042 **	0.070 **	-0.013	-0.009	-0.005	1
risk	0.034 **	0.252 **	0.310 **	0.062 **	0.086 **	-0.011	0.028 **	-0.005	-0.026 **	0.002	0.018 *	0.034 **	-0.01	0.107 **	-0.023 *

* $p < 0.05$, ** $p < 0.01$.

Table 5. Stepwise Regression Result for Twitter and Weibo.

Twitter	Standardized Coefficients Beta	Weibo	Standardized Coefficients Beta
(Constant)		(Constant)	
risk	0.293 ***	health	0.384 ***
profanity	0.279 ***	reward	0.225 ***
power	0.089 ***	religion	0.146 ***
religion	0.094 ***	work	−0.169 ***
work	0.078 ***	power	0.140 ***
reward	0.060 ***	risk	0.132 ***
health	0.033 ***	friend	0.083 ***
family	−0.029 ***	death	0.061 ***
death	0.028 ***	family	0.035 ***

*** $p < 0.001$.

Twitter users talk more about their personal experiences and attitudes, from widely different perspectives. Many posts from topic 1 and 6 discussed users' perceived side effects and experience after birth with or without EA. For instance, one post in topic 6 mentioned: "Without an epidural, labor/birth went way faster and healing was a million times easier. I tore bad with my first and didn't at all with my second". Another instance of topic 1 was: "Epidural made my labor SO easy but damn this back pain is not it." These posts reflect concerns of health risks, as did topic 7, which described risk concerns at a personal level, but unlike those of topic 3 of experience-sharing, they pertained to surgical and medical issues. Twitter posts were also likely to contain scientific findings, often dealing with highly medical terminology, suggesting discussion among medical professionals. For instance, topic 4 had a post mentioning: "Association Between Hyperbaric Bupivacaine Dose and Maternal Hypotension: Retrospective Database Study of 8226 Women Undergoing Cesarean Delivery Under Spinal Anesthesia #OBAnes".

Twitter posts also frequently discussed issues of health locus of control, especially topic 2. There were many posts stating preference for natural birth (without medical intervention), claiming that natural birth made them feel they were in control, and the pain during labor was tolerable and normal. An example post was: "Depends on the situation. I've experienced both a drugged-up birth (epidural, emergency C section) and a drug free one, and assuming intervention was not medically necessary I would take drug free birth every time. Definitely liked feeling more in control and in tune with my body". A similar discussion arguing about natural birth was seen in topic 8: "On the other side, some mothers prefer not to have an epidural. Giving birth is painful and screaming is part of the adrenaline rush. Mine were both natural births and screaming during the process is natural as well. Stop assigning blame to everything." Natural birth without pain control use were forwarded also in religious posts: "Great work, but normal labor is supposed to be painful as was decreed by God Almighty! Will it be normal labor anymore if it is painless?" Posts like these demonstrated that the definition of what is "normal" in childbirth varies widely, with self-agency and religious beliefs, which can guide people to interpret the meaning of labor pain differently.

On Weibo, personal experience was also commonly shared. Topic 1 and 6 were both about personal experiences. In particular, topic 6 was similar to topic 3 in Twitter, which described experience in timeline and their feelings with/without EA. However, topic 1 described experiences dealing with social relationships, which is quite different from Twitter narratives. These relationships mainly were doctor-patient relationship, and relationships between

patient and family or relatives. For instance, for topic 1, some posts were: “I used EA and my husband signed the papers, although my mother-in-law was not in favor of it”; “The woman in labor next to me was crying and wailing, begging the midwife to contact her family, but they just wouldn’t sign. Apparently, her mother was strongly against signing to allow EA.” Such posts revealed that Chinese are characterized with health locus of control dependent on significant others and experts, rather than on themselves.

Another difference with Twitter was that the fertility issue seemed to be a trendy topic, owing to media coverage, and discussions brought up by influencers and opinion leaders. Topic 5 dealt with media coverage of an incident in which a woman in a rural area was found to be locked up in a room, and forced to give birth to eight children. This news went viral, sparking much discussion. Likewise, topics 2 and 3 dealt with media coverage of photos of the childbirth process, as well as on the recent national policy that encourages people to have three children. The photo coverage elicited emotional responses, while the policy raised debates arguing both pro and con for having three children. These lead onto discussion about social warfare and female rights, exemplified by: “Viagra and test tubes are covered by health insurance, but no one cares about postnatal depression and painless labor, so let’s make the fertility rate negative!” and “#How to increase the willingness to give birth to three children# is very simple. First, we should take good care of women’s health during childbirth to ensure that women are not affected by hormones and can become a parent painlessly just like men do”.

Media agenda also raised discussions on fertility, as seen in topic 4, which consisted mainly of discussion generated from TV shows and interviews of celebrities, arguing for the rights of women in childbirth, and celebrating motherhood. For example: “#Reza is grateful to have painless delivery. Some pains are not necessary, the greatness of motherhood does not need to be questioned”.

Perhaps due to the low adoption rate of EA with Chinese, Weibo posts compared to Twitter, debated significantly less about the health risks and personal effects of EA use, as well as comments related to the medical profession. Weibo posts contained more discussion on women’s rights and choices, and access to EA adoption. This suggests that gender issues are a hot topic on Chinese SNS. Much of the narrative on Weibo reflects stringent adherence to social norms as well as power discrepancies in society and having the right to decide on one’s own health-related issues was a reflection of empowerment. For a better illustration of LDA topic modeling, we generated two word-cloud figures for Twitter and Weibo contents as Figures 3 and 4.

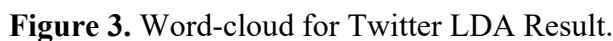
Table 6. Thematic Analysis for Twitter.

Keywords		Example Post
1	got, pain, time, didn't, back, get, hour	I didn't have any meds or epidural. and I had all back labor and coupling contractions it was horrible.. I couldn't dilate past 1.5. so they did cervidil.. and then I dilated to a 5–6 in 4 h and then went to an 8.5 then 10 finally after 14hrs. Next time I wanna wait to go in
2	control, easy, pregnancy, vaccine, normal, safe, men	That happens with every vaccine and every medicine for that matter. Sometimes the epidural doesn't work for women giving birth. No one claims this stuff is 100% effective.
3	hour, minute, 2, pushed, 12, hr, min, 24	It's been 12 weeks almost to the minute since I gave birth. Good news: my baby continues to be adorable and healthy! Less great news: a large part of my right leg continues to remain completely numb from labor/epidural/something.
4	anesthesia, analgesia, via, study, rate, cesarean	I have really looked for a natural birth podcast but I have to say that I find a LOT of podcasts that shame moms who end up having a cesarean, a hospital birth, using pain medications or get an epidural ?? and that's just not OK for me.
5	within, fetus, nicu, space, fire, ultrasound, associated, column, muscular, patient	Did he talk about parents who have make the horrible decision to terminate a pregnancy b/c a fetus has no spinal cord, or not brain stem, or terminal heart defects? No one ever talks about this. They act like women use abortion as birth control.
6	im, get, like, dont, give, without, pain	Now that I've given birth without any medication/ an epidural, I am ready to run for president
7	cord, baby, injury, defect, brain, year, surgery	My brain is hurting too now. Does this translate in carrying on trying to steer pregnant w/ ppl away from having an epidural? The normal birth/hypnobirth way?
8	pain, baby, woman, one, would, natural	Was 1 cm dilated late on the 25th and gave birth late at night on the 27th. Vaginal birth/no epidural. Didn't feel contractions until about maybe... 40 min before baby arrived. Couple pushes and baby was out in less than 15 min

Table 7. (a) Thematic Analysis for Weibo; (b) Thematic Analysis for Weibo (English translation).

(a)		
	Keywords	Example Post
1	孩子, 一个, 收起, 医生, 手术, 检查, 医院, 患者, 产妇	我当时无痛我老公果断签字,虽然婆婆也是不大赞成。另一个产妇在我旁边一直鬼哭狼嚎不断哀求助产士叫家属,可是他们就是不签。问了才知道是产妇的妈妈不让签
2	生育, 女性, HagaseAnna, 女人, 婚姻, 一个, 评论, 男性	#如何提高三孩生育意愿#很简单啊, 1. 先做好女性生育时的健康管理,保证女性在生育时不受激素等等的影响,能像男性一样无痛当妈. 2. 解决女性就业 歧视,推行男性产假政策. 3. 取消离婚冷静期,保障女性生育,哺乳,育儿期间的权益...
3	医院, 医疗, 服务, 医保, 中心, 兴趣, 动图, 切开, 健康	无痛分娩在很多国家已经普及了几十年,而我们还在争议能不能使用,科普之路任重道远,以及如果列入医保范围会有很大帮助。
4	微博, 视频, 妈妈, 选择, 母亲, 孩子, 感谢, 女性	伊能静在《上班啦!妈妈》提到女性自主选择生育方式的问题,现在一些思想比较保守的人对无痛分娩有偏见,尤其是长辈不能接受无痛分娩,伊能静表示只有 母亲 最有 权利 选择 当 母亲 的方式。据悉,自然分娩的产痛 仅次于 烧伤,而 无痛分娩可以很好地减轻生育带来的痛苦,大家认为#女性是否要选择无痛分娩#呢?
5	生育, 生育率, 女子, 丰县, 八孩, 情况, 政策, 孩子, 事件, 人口	#官方通报徐州丰县生育八孩女子情况#今日迷惑发言,真的是迷惑,就这个家庭那个母亲生孩子的时候可能打麻药跟无痛针吗?他难道有选择的权利吗?没有,他只能不停的生下这些孩子,承受分娩的痛苦,到头来,却让男性觉得你是活该的
6	顺产, 真的, 医生, 宫缩, 感觉, 小时, 产房, 侧切	#女性是否要选择无痛分娩#无痛简直是产妇之光啊!!!从阵痛到开两公分一共9个小时,鬼知道是怎么过来的打了无痛呆在分娩室整个世界都美好了现在看到这个话题,回想当时的经过,所有的一切在看到宝宝的那一刻,都值了
7	疼痛, 孩子, 产妇, 麻醉, 镇痛, 医生, 视频	#昌平动态#【准妈妈们不再“痛”迎宝宝!昌平这家医院全面开展无痛分娩技术】昌平区中医医院产科近日与麻醉科联合开展了无痛分娩技术。无痛分娩技术的成功开展体现了产科“科学化、亲情化、人性化”的服务理念,使准妈妈们感受“快乐产房,舒适分娩”。无痛分娩技术是采用连续硬膜外麻醉方式,麻药浓度极低,既可为产妇提供满意的镇痛效果,又不延长产程,起效快,作用可靠,对新生儿无不良影响。
(b)		
1	child, one, put away, doctor, surgery, examination, hospital, patient, maternity	I used EA and my husband signed the papers, although my mother-in-law was not in favor of it. The other woman was crying and wailing next to me, begging the midwife to contact her family, but they just wouldn't sign. When I asked, I learnt that it was the mother of her who did not allow to sign.

- | | | |
|---|---|---|
| 2 | fertility, female, HagaseAnna,
woman, marriage, one, comment,
male | #How to increase the willingness to give birth to three children# is very simple, 1. Firstly, we should take good care of women's health during childbirth to ensure that women are not affected by hormones and can become parent painlessly just like men could 2. Solve the problem of discrimination against women in employment, and implement a policy of maternity leave for men. 3. Abolish the cooling-off period for divorce, and protect women's rights and interests during childbirth, breastfeeding and childcare... |
| 3 | hospitals, medical, services, health
insurance, center, interest, gif, cut,
health | Painless childbirth has been popular in many countries for decades, while we are still disputing whether it can be used, the road of popularization has a long way to go, also, if it is included in the health insurance, it will be of great help. |
| 4 | Weibo, video, mama, choice,
mother, child, grateful, women | "Go to Work! Mum" mentioned the issue of women choosing their own way of giving birth, and that some people who are more conservative are prejudiced against painless delivery, especially some elders who cannot accept it, but Ino said that only mothers have the most right to choose the way of becoming a mother. It is learnt that the pain of natural childbirth is second only to burns, and painless childbirth can well reduce the pain of childbirth, do you think that #women should choose painless childbirth#? |
| 5 | fertility, fertility rate, women,
fengxian, 8 children, situation, child,
issue, population | #Official report on Xuzhou Fengxian woman who gave birth to eight children #Today's confusing statement, really confusing, is it possible for this mother to give birth while receiving painless injection? Does she have the right to choose? No, she can only keep giving birth to these children, bear the pain of childbirth, in the end, yet still let the men think you deserve it! |
| 6 | Nature delivery, really, doctor,
contractions, feel, hour, delivery
room, side cuts | #should women choose painless labour #Painless is simply the light of maternity!!! It took 9 h total from the start of pain to open two centimetres, hell knows how I get through that, after getting the painless injection, I laid in the delivery room, and the whole world became beautiful. Now seeing this topic, I think back to the processes and everything are all worth it after you see the baby! |
| 7 | Pain, child, maternity, anesthesia,
analgesia, doctor, video | #Changping News#[Mothers-to-be no longer welcome the baby in pain! this hospital comprehensively carry out painless delivery technology] Changping District Hospital of Chinese Medicine Obstetrics and Anaesthesia Department recently jointly carried out painless delivery technology. The successful implementation of painless delivery technology reflects the obstetrics department's service concept of "scientific, affectionate and humane", and enables mothers-to-be to feel "happy delivery room, comfortable delivery". The painless delivery technique adopts continuous epidural anaesthesia with very low concentration of anaesthetics, which can provide satisfactory analgesia for mothers without prolonging the process of labour, and is fast-acting, reliable and has no adverse effect on newborn babies. |





4. Discussion

RQ1, questioning the sentiments and opinions on the topic of EA, uncovered that for both Twitter and Weibo platforms, negative emotions were prevalent, indicating use of words with a link to negative emotions. In addition, we observed high mention of risk, health, as well as death in the contents. Furthermore, EA use in labor has been viewed and discussed cautiously as a new technological intervention. When we traced back to the actual posts, we found that some expressed concern towards the potential side effects and risks of EA as a medically induced intervention. However, what should be noticed is that the expression of negative emotion was not essentially towards the use of EA. A large amount of negative emotion was associated with labor pain. There are also some negative tones expressed towards the low rate of the use of EA, suggesting that the process of childbirth, either with or without EA, poses heavy mental and physical burden.

Weibo users expressed more positive, as well as negative comments toward EA than Twitter, suggesting that the issue may have been more polarized in the former. The higher incidence of positive emotion in the narrative of EA use could be due to perception bias of EA as well as cultural biases. On one hand, although the use of EA in labor already has a history of over 150 years, and has been introduced in China, the popularization of this technology has been slow. In fact, EA for delivery was first performed in 1963 in China, and the government had not officially promoted it nationwide until 2018; consequently, the EA adoption rate remained low for many years (Jing Wu et al., 2020). Thus, the knowledge people have of EA is mainly from media rather than their embodied experience or that of surrounding people. Many users discussed EA as a way out of labor pain, partially neglecting side effects due to the lack of shared drawbacks. Our regression results also supported this assumption, since *reward* contributed to emotion expression significantly in Weibo. On the other hand, past studies have attested that Chinese people hold a more positive view toward risky situations compared to other cultures (Ji et al., 2004).

SNS users tend to be younger in age, and perhaps the youthful generation of Weibo users were caught between their own individualistic wishes versus those of significant others. Since many parties are involved in the decision-making process regarding the use of EA, Weibo discussants may have more mixed emotions, being torn between their own preferences versus friends and family. As for Twitter, negative emotions were mentioned more often than positive, albeit slightly. In particular, anxiety and profanity were significantly more likely to be mentioned than anger or sadness, and some posts expressed apprehension towards the adoption of new and untested medical technology, as well as arguments over their risk.

H1 predicted that Weibo users would involve family and friends more in their discussion. Consistently with Markus and Kitayama's (1991) theory of cultural self-construal, the Chinese tend to have an interdependent self-construal, which induces them to have concern about what their significant others think about their own decisions. Weibo posts, as expected, weighed more heavily on mention of friends and family, suggesting that collectivistic social norms are important in the Chinese culture. Both correlations and regressions showed significant relationships between family and emotion expressions on Weibo. Yoshino's (2006) study on Chinese social values found that *family* garnered the highest degree of importance in one's daily life. Given this, it would stand to reason that childbirth is not an issue of an individual, but a health-related issue of the whole family, including the parents, and in some cases, the grandparents of the child bearer. As dominantly having interdependent self-construal, Chinese value the opinions of their family members, and family could induce negative emotion and refusal of EA, even if the mother-to-be herself had been inclined to use it. Aside from the evidence mentioned in thematic analysis results, the significant relationship between *power* and *family* also suggested the significant impact from family members.

From the thematic analysis, we addressed RQ2, as can be seen in Tables 5 and 6, which depict huge differences in the narrative of EA across the two platforms. Weibo posts were divided into seven topics, consisting of four themes: topic 1 and 6 were about *self-experience sharing*; 1 focused on *decision making*; 6 focused on the actual *laboring process*; and 2 and 3 discussed *policies* regarding EA use. Further, topic 2 discussed *female rights*, while 3 pertained to *facilities* and *medical resources*. In addition, topics 4 and 5 mentioned social issues and trending topics in China, 4 talked about positive issues, while 5 engaged in negative issues, and 7 dealt with informative and educational issues regarding EA use.

Twitter posts were divided into eight topics, with themes not as clearly distinguished as Weibo. Topics 1, 3, 6, 7 and 8 were about experience-sharing, while most of the rest expressed concerns about EA use, including comparing risks with other methods of childbirth. (Ajzen & Fishbein, 1980)

Our thematic analysis made it apparent that the discussion about EA use in Weibo is something that goes beyond ordinary daily life, compared to Twitter. Weibo posts often discussed the use of EA from a more macro-level perspective, that of culture and society, while Twitter tended to discuss it on a personal level, with emphasis on risks to the mother. Thus, it was quite obvious that Twitter users perceive EA use differently than Weibo, and that the latter are more likely to see this new medical technology as positive scientific progress.

5. Conclusions and Limitations

Through sentiment and thematic analyses, our study explored the general attitudes toward EA use over the SNS platforms of Twitter and Weibo. We found that EA was considered controversial over both platforms, and how people viewed and discussed it differed dramatically. SNS is an influential source of information, especially for the younger generation, including potential mothers. Medical issues like the one raised in this study would elicit much discussion, and we sought out differences between cultures. The results of our

comparison of Weibo versus Twitter revealed that the discussion on the topic of EA use in labor is under the influence of social and cultural values and norms.

The advent of SNSs have largely reshaped the information exchange and health decision-making process in pregnancy. The narratives on SNSs not only reflect the general attitude and agenda pertaining to the issue, but also exert an impact on people cognitively and emotionally, which might eventually influence their actual behavior. We chose to look at the contents of the discussion surrounding a topic dealing with a personal health decision. Our focus was on cultural differences, but rather than directly surveying young people in China and in Western culture, we decidedly chose to look at differences in SNS discussion between these two cultures, to explore whether they are in accord with the predictions of cross-cultural theories. Indeed, we found that Weibo and Twitter do differ in the values expressed, and these differences were consistent with the theoretical framework of cultural self-construal.

One of the limitations of the current study was that it only covered existing posts during a one-year duration; to what degree this data can represent general public opinion is unknown. Certain events in a particular culture can temporarily impact the way people think and communicate about a topic. Had major media, such as national TV, covered the topic on hand, the opinions may have been greatly swayed. Secondly, Twitter posts were automatically downloaded if they were identified as English Tweets, and demographic information including country, user age, etc., were not available for analysis. Downloading data which can identify such crucial information should be considered. Finally, LIWC employs a bag-of-words model, which may not fully capture the context in which words are used. This limitation can affect the accuracy of sentiment analysis, particularly in nuanced social media text. LDA may be a more suitable approach for longer texts, and it may struggle with the shorter, fragmented social media posts.

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