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Health information-seeking on Reddit, by people who use opioids

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Abstract

Introduction. In the most recent year that data is available, 101,035 people died from drug overdoses in the United States. For people who use drugs, obtaining treatment remains a significant barrier due to issues of fear, stigmatisation, and illegality. Some people turn to the anonymous social media site, Reddit, for obtaining health and harm reduction information.

Method. In this study we analysed 2,748 health-related posts on the subreddit r/opiates over a three-month period.

Analysis. Using a thematic analysis grounded in social constructivism, we categorised the data to determine the most frequent types of health questions asked by people who use opioids. We then used the text analysis software Linguistic Inquiry and Word Count to determine the emotional content of the posts.

Results. Most of the posts were asking about harm reduction strategies and methods to reduce or quit opioid use.

Conclusion. The text analysis demonstrated evidence of Foucault's discourse theory. People who use opioids need more information on harm reduction strategies, and especially safely administering and withdrawing from them.

Introduction

Since the early 2000s, the United States has experienced an explosion of opiate-related deaths; we are in the midst of an opioid crisis. National trend data indicates that more lives have been lost due to opioid overdoses than individuals that have died in armed conflict (e.g. wars) since World War II (National Academies..., 2017). Opioid misuse has always been a concern, but the increased pressure and marketing from pharmaceutical companies resulted with over 10 million people misusing prescription opioids in 2018 (U.S. Department of Health and Human Services, 2021). In 2020, there were an estimated 2.7 million people 12 years and older that have an opioid use disorder. Provisional data released by the Centers for Disease Control and Prevention shows that 101,035 people died from drug overdoses in the United States in a 12-month period ending in October 2021 (National Vital Statistics System, 2021). More than 75,000 of those deaths are opiate-related drug overdose deaths (National Vital Statistics System, 2021). Furthermore, the COVID-19 pandemic has exacerbated the opioid crisis (Centers for Disease Control and Prevention, 2021). This is particularly evident in communities that are already dealing with health disparity issues, such as lack of access to quality healthcare and higher prevalence of chronic conditions. While there has been increased attention directed to opioid addiction, few studies have focused their efforts on health information needs from the perspective of people who use drugs.

For people who use drugs, obtaining treatment remains a significant barrier. One crucial element related to this barrier is stigmatisation. Prior work has shown that healthcare professionals commonly have a negative attitude and perception towards substance use disorders (Van Boekel et al., 2013). Consequently, this results in poor health services rendered for some of those individuals. People who use drugs already have limited interactions with healthcare services and many report experiences of feeling dehumanised when seeking services (Biancarelli et al., 2019). Recent research has highlighted the possible role of stigma negatively impacting individuals'

decision to seek healthcare services (Paquette et al., 2018). In addition to community-based organizations, social media platforms provide a space for drug users to seek health information, support, and harm reduction strategies (Biancarelli et al., 2019).

Social networking sites, or social media, have grown exponentially over the past decade with 90% of adults ages 18 to 29 reporting use of at least one social media site (Pew Research Center, 2019). Social media sites have been implemented for public health purposes, including identifying opioid-related trends, public health surveillance, and influencing health policy (Moorhead et al., 2013). This growth in popularity and extensive use is related to its ease of use and convenience to interact with others for social support. Social media are ideal platforms for individuals to gather and discuss topics related to opioids. Moreover, online data collection through social media can facilitate access to hard-to-reach groups that may be marginalised from research (James and Bushner, 2009). One popular social media platform that has been used for research purposes is Reddit (De Choudhury and De, 2014). Reddit is considered a forum-based social media platform where users post, vote, and comment on topics under subreddits or categories (e.g., r/opiates subreddit) grounded by community voting (Pandrekar et al., 2018). Reddit users ("Redditors") are young, with 22% of adult users between 18 and 29 years old (Ceci, 2024). Unlike other platforms like Facebook and Instagram, Reddit allows users to post candid information with more anonymity. Evidence shows instances of users seeking information about how to safely use opiates (Costello et al., 2017)

This research incorporates a social constructivist approach, in which the learner builds knowledge by interactions with others (Vygotsky, 1929). The basis for this theory is that learners are creating knowledge in relation to the environment around them, which we interpret to include other people using social media. It conceptualises learning as an active process, one in which the person is a deliberate information-seeker (Liu and Chen, 2010). Later interpretations of this approach regard some

knowledge as socially constructed, both in terms of the creation of knowledge objects (Rytilä, 2021) and knowledge organization, such as the Dewey Decimal System (Frohmann, 1994). Because Redditors are both active information-seekers, constructing knowledge within the site, and they are creating a knowledge object to be used by others, social constructivism is an appropriate framework through which to conduct this study.

In addition, as information-seekers who are looking for information concerning, most often, illegal drug use or methods of abusing legally obtained opioids, this population may demonstrate evidence of discourse theory. Foucault's discourse theory is traditionally used to examine the way that language, spoken or written, is shaped by the structures of power in our society (Foucault, 1972). Discourse theory has also been applied in the study of how emotions enforce hierarchies in social dynamics, particularly in healthcare settings (Ajjawi, et al., 2022) and social media (Vaahensalo, 2021). People who use opioids may be information poor, lack helpful information sources and may be afraid of information-seeking due to negative ramifications. They use self-protective behaviour, such as secrecy, due to a mistrust of others and a fear of the consequences of their information need being exposed. This speaks to discourse theory in that it exposes an understanding of the power structures in society and the disadvantages that people who use opioids face in getting health information related to opioid use and harm-reduction because of them.

The objective of this study is twofold. First, we would like to determine what health and harm-reduction information people who use opioids need, based upon the questions asked by users of the subreddit r/opiates. While this may not be a generalisable study by which to extrapolate to a larger population, there has been research into the use of anonymous social media postings to establish the often-hidden information needs of stigmatised groups (Ammari, et al., 2014). Second, we want to ascertain the emotional content of the posts to determine if there are indicators of discourse theory. To do this we will use the text analysis

software Linguistic Inquiry and Word Count, further described in the methods. It is also of interest to the researchers to use this software to evaluate the emotional content of various types of posts in order to study how emotions manifest based upon the participants' information needs.

Health information seeking behaviour on social media among people who use drugs.

Several studies have focused their efforts on online communities in popular Reddit sub-threads. Balsamo et al., (2021) conducted a five-year analysis of Reddit threads pertaining to opioid usage with the goal of tracking interest in drug usage, building a common vocabulary of drug terms from the perspective of drug users, and collecting data on ways users administered opiates. Findings show a dramatic increase in fentanyl discussion occurring around 2016, a high frequency of heroin interest with one in three users posting it, and discussions about drug routes of administration based on the type of opiate: oral, intranasal, intravenous, and inhalation (smoking or snorting) (Balsamo et al., 2021).

Another study focused on online recovery groups in the r/methadone Reddit group to assess COVID-19's impact on access to methadone treatment (Nobles et al., 2021). Results found that more than half of the posts contained some mention of COVID-19's hindrance to receiving methadone treatment for recovery (Nobles et al., 2021). Meacham et al. (2022), explored an opiate-user subreddit as well as a recovery subreddit to examine the effects that cannabis usage had on the two groups. Results found marijuana was mentioned more frequently in the recovery subreddit as a coping mechanism for minimising the withdrawal effects from opiates. This growing body of evidence shows that social media, including Reddit, are a primary source for how drug users search for health information. To the authors' knowledge, there have been few studies that have used Reddit to explore the health and harm-reduction information needs of people who use opioids.

When seeking health information through traditional methods, formal healthcare services play a vital role with providing services people who use drugs. Such persons have more healthcare needs, however, they do not utilise many formal healthcare services that are available for them (Morgan, et al., 2015). Previous literature shows that the healthcare services of people who use drugs are more acceptable and available when there is a harm-reduction framework (Islam et al., 2012). Recent evidence shows that drug users are accessing the internet more frequently through the use of mobile devices (Ranjit et al., 2020). Evidence indicates that drug users with high levels of technical competence are willing to receive health messages to their mobile devices. However, additional study is needed to understand this community's health information-seeking behaviour in online social media spaces (Ranjit et al., 2020; Redpath et al., 2006). Previous work has supported the promise of social media platforms, like Reddit, as an effective platform for health promotion (Record et al., 2018). These platforms also allow for the shaping of social norms among people who use drugs and provide a space for harm-reduction strategies from peers who have shared experiences.

The anonymity of social media

Social media provide informal environments to discuss sensitive topics (Johnson and Ambrose, 2006) and allow users to generate content and promote two-way interaction between them (Moorhead et al., 2013). Social media have been used to analyse health behaviour of users with depression (Takashi et al., 2009), explore health information-seeking behaviour and self-care activities among diabetic patients (Jamal et al., 2015), understand the habits of young lesbian, gays, and bisexual people at suicidal risk (Silenzio et al., 2009), and monitor public concern and infectious activity disease for the influenza A virus H1N1 (Signorini, 2011). Moreover, several other studies (Lossio-Ventura et al., 2018; Kalyaman et al., 2017; Chan et al., 2015) have demonstrated the potential of social media to assess the behavioural process of opioid use and abuse, as well as understand users' sentiments. As a result, public health researchers and practitioners can leverage

social media to access hard-to-reach populations and collect data that would otherwise be difficult to collect through other research data collection methods (Capurro et al., 2014).

Reddit is an increasingly popular social media site. In fact, it is the sixth-most trafficked site in the United States (Alexa, n.d.). Part of Reddit's allure is the anonymous posting aspect (Silberman and Record, 2021). For people seeking information about illegal activities, such as injecting drugs, remaining anonymous on Reddit could be particularly appealing (Costello et al., 2017). While other social media conglomerates, such as Facebook and Twitter, require users to create accounts that include displaying personal information, Reddit refrains from this. Users are able to post anonymously with little fear of being tracked (Silberman & Record, 2021). Furthermore, Reddit sub-threads create specific communities where moderators and users post threads, upvote or downvote comments, and effectively build conversations online privately.

Methods

Data collection

It was determined that the subreddit r/opiates was the most appropriate for this study, as it is the forum for '*all things related to the narcotics known as opiates*', (r/opiates, n.d.). An exception to this, however, are posts related to sourcing or seeking drugs. A subreddit is a community forum that is specific to one interest or topic. Some examples may be r/gardening, r/sports, and r/askparents. At the time of writing, r/opiates has approximately 187,000 members and dozens of posts each day. The topic and activity level made r/opiates ideal for this study.

We utilised a mixed methods exploratory sequential design in which we first collected and cleaned the data, then analysed it qualitatively, then quantitatively (Cresswell, 2009). In this case, for data collection we used the open-source framework Scrapy (<https://scrapy.org>) to crawl the post and comment data from the r/opiates subreddit through the Pushshift Reddit API. The Pushshift Reddit API fetches various metadata fields for

Reddit posts in the format of JSON files. For the purpose of manual coding and subsequent analyses, we stored the data into two relational tables: one for original posts to r/opiates (posts), and the other for replies to the posts (replies). For the 'posts' table, we recorded, for each post, the post-id, title of the post, the text, author, the number of likes, the URL of the post, the timestamp of the post, and the number of replies to the post. For the 'replies' table, we recorded the id of the original post that the reply was in response to, the text comment, the author, the timestamp, and the number of likes to the reply. These were then merged into one Excel spreadsheet that displayed all post information for each post-id in one row.

For the purposes of this study, the time period of December 1st, 2020, to January 31st, 2021 was selected. There were several reasons for this. First, this was the height of the Covid-19 pandemic Delta variant, and it has been found that the pandemic increased health information-seeking (Zimmerman, 2021). Second, drug overdose deaths spike in the winter, and therefore, we theorised that there may be more harm-reduction-related information-seeking during these months of the year (Brown University, 2019).

The original Excel file contained 4,594 unique observations, with each detailing the data contained for as many posts. The data in this file were cleaned by a graduate assistant in a process in which they removed all posts with any of the following issues: missing data points for the title or content, titles or content cells where the text had been deleted, or duplicate postings. Posting on Reddit and then later deleting the content is a common practice for those who do not want such posts associated with their user account. Through this process, 367 posts were removed, leaving 4,227 posts remaining. From this point, the graduate assistant used Excel's find and filter functions to remove posts about common topics on the subreddit that were not relevant to this research, such as sex (non-health related), movies, music, the holidays, dating, drug laws, and drug-related policies. This left 3,984 posts remaining. The graduate assistant then read each post title and first comment, leaving any

post that was at all related to health or harm-reduction and in which the user was asking a question or implying a request for information. This eliminated 468 posts, with 3,516 unique posts remaining.

Qualitative analysis

A thematic analysis was conducted based upon the methods described by Braun and Clarke (2006). 'Thematic analysis is a method for identifying, analysing and reporting patterns (themes) within data', (p. 79). Braun and Clarke outlined a six-step process of conducting thematic analysis, including familiarising yourself with the data, coming up with initial codes, searching for themes, evaluating those themes, generating names for them, then producing the final analysis as a scholarly paper.

Using this process as a guide, members of the research team read the data and met to discuss it as a means of familiarising ourselves. Next, we came up with suggestions for codes based upon our initial understanding of what the data contained, trying to be as inclusive to as many possibilities as we could. We met to discuss the code, defining what, exactly, each code meant and how it should be applied to the dataset. Following this meeting, we each coded the same set of data, then checked for discrepancies in the application of the code. We went through this process, coding the same data, then checking against each other for discrepancies, several times. Once we were able to code the same data accurately to each other, we split up the dataset into two and each coded their own section. Next, to ensure accuracy, we traded datasets and checked each other's coding. Once this part of the process was complete, we had all 3,516 unique posts coded. In doing so, 768 posts were further eliminated as not relevant to the study, leaving 2,748 relevant coded posts.

At this phase of the process, we determined the most appropriate themes based upon how pieces of coded data fit together. We determined that the major themes were help with harm reduction, requests for others to share experiences related to drug use and health, questions related to side effects,

questions related to quitting, including withdrawal management, questions related to overdosing. These will be further discussed in the results section.

The research team then went back to our dataset and ensured that our initial themes formed 'a coherent pattern', and 'accurately represented the data as a whole', (Braun and Clarke, 2006, p. 91). Satisfied that our themes were coherent, accurate, and reflective of the dataset as a whole, we concluded the thematic analysis process by beginning to work on this manuscript.

Quantitative analysis

There were several steps of quantitative analysis. First, we attempted to assign emotional codes to the texts of the Reddit posts. This was done by following a similar text analysis method described in an award-winning paper by Ruthven, Buchanan, and Jardine (2018), in which they coded and analysed the social media posts of young mothers using Linguistic Inquiry and Word Count (LIWC) (<https://www.liwc.app>) software. This is a tested and validated text analysis program that categorises words into psychologically meaningful categories, such as positive and negative emotions, anger, anxiety, and many others (Tausczik and Pennebaker, 2010). It then counts the occurrences of those words within a text. People tend to use words related to their state of mind in meaningful clusters. So, if a person is sad, they are likely to use several words that would be categorised as 'sad' together in their natural language patterns (Boyd, 2017). The LIWC dictionary was, 'developed using established, standard psychometric approaches such as validation on external psychological data, as well as techniques that ensure high internal reliability from a statistical perspective' (p. 165).

The software also has four algorithmic summary measures: analytical thinking, clout, authenticity, and emotional tone. For the purposes of this research, we analysed the data using the clout and emotional tone variables. Clout, which is measured as a percentage, refers to the person's feeling of their relative

social status within society and their general confidence (Fox and Stafford, 2021). It is different from the category of power, which was also to be used in this study, and which LIWC categorises as a reflection of a person's relative social status in a social setting.

The emotional tone variable measures both positive and negative emotions. The higher the number, the more positive the emotional tone. Anything below 50 (out of 100) is considered to reflect negative emotions. In addition, LIWC was assessed against many large corpora to give sample test results that broadly represent each variable's and summary measure's representation in everyday life (Boyd et al., 2022). Examples of these are randomly selected texts from Twitter, blogs, transcribed natural conversations, movie transcripts, etc.

The software was run on the dataset as a whole, then on the data after they had been grouped into specific themes. The purpose was to examine the emotional tone of each theme of health questions, both on their own and relative to the rest of the dataset. For the purposes of examining evidence of discourse theory, the LIWC output variables power and achievement and the summary variable of clout were studied. In the interests of examining the overall emotions expressed by the posters, the summary variable emotional tone and the individual variables of positive and negative emotion will be evaluated.

Results

Most commonly expressed information needs

The most commonly found themes were related to harm-reduction, requests for others to share experiences related to drug use and health, questions related to side effects, questions related to quitting, including withdrawal management, and questions related to overdosing. We also found the themes of comparisons between drugs, mental health, and pain medication management, but these were less frequent. Table 1 shows the numeric breakdown of how often each of such posts appeared in the data.

| Information need themes | Frequency |
|-------------------------|-------------|
| Harm reduction | 1095 |
| Experience requests | 427 |
| Side effects | 367 |
| Quitting | 241 |
| Overdose | 122 |
| Drug comparisons | 105 |
| Mental health | 75 |
| Pain medication issues | 69 |
| Other | 247 |
| <i>Total</i> | <i>2748</i> |

Table 1. Theme frequency

The theme of harm-reduction breaks down into further sub-categories. These included safe drug consumption questions about determining drug purity (n=146), proper dosing of drugs (n=282), drug contraindications (n=232), and safe routes of administration for consumption (n=359). We also listed medicated withdrawal management (n=76), or the administration of drugs to avoid getting dope sick, under the harm-reduction umbrella, as many of the questions were about proper dosing for safe practices. The category of *other* contains a wide variety of requests for information, such as how to communicate with doctors to get them to prescribe opioids, questions about filling medication prescriptions, open questions about addiction, website references requests, and so on. Most of these were in some way related to the inclusion criteria of the study, but not frequent enough within the data to warrant being grouped into a theme.

LIWC analysis of each theme and subtheme

In this analysis, we will discuss the LIWC output of the most frequent themes of harm reduction, requests for others to share experiences related to drug use and health, questions related to side effects, questions related to quitting, including withdrawal management, and questions related to overdosing. We did not run the analysis on the less frequent themes. While the theme of overdosing is only slightly more frequent than drug comparisons, we included it in the LIWC analysis and further

discussion because the actual questions were so significant.

First, according to the LIWC website, the clout summary measure is a reflection of the post author's feelings of social status which ranges from 0-100. In the tables below, the clout measure is displayed for each theme and the harm reduction sub-themes. In their report on the development of the psychometric properties of LIWC, Boyd (et al., 2022) found that typical clout measures of corpora from everyday life ranged very close to 50. Twitter, for example, produced a clout score of 49.10. Captured conversations produced clout scores of 61.01. Of all corpora that were evaluated, which included over 31 million words, blogs produced the lowest clout scores of 29.99. However, the clout scores for the Reddit data were 14.39 for the entire set, with the scores for the most frequent themes ranging from 10.46 to 17.49.

The summary measure of emotional tone ranks from 0 to 100, with anything below 50 suggesting a more negative tone. The average emotion tone score from our dataset was 35.07. However, the individual themes for overdose and side effects were 24.83 and 27.71, respectively. These are considerably lower than the typical LIWC corpus score of 46.24.

Finally, the Reddit dataset variable scores of achieve, power, and positive emotions were all substantially lower than the typical LIWC corpus scores. Negative emotions were much higher in the Reddit data set than the LIWC

corpus. Table 2 below has the breakdown of each theme and sub theme LIWC scores for all variables, the LIWC scores for the entire Reddit

dataset, and the LIWC corpus scores for comparison. In the next section we will analyse these for statistical significance.

| Themes/ *Subthemes | Clout | Emo. Tone | Achieve | Power | (+) Emo. | (-) Emo. |
|-------------------------------|--------------|--------------|-------------|-------------|-------------|-------------|
| Harm Reduction (all combined) | 13.67 | 37.99 | 0.95 | 0.32 | 0.54 | 0.47 |
| *Medicated Withdrawal | 10.46 | 34.44 | 0.97 | 0.20 | 0.41 | 0.90 |
| *Drug Purity | 15.24 | 33.11 | 0.70 | 0.30 | 0.34 | 0.40 |
| *Drug Contraindications | 12.64 | 34.81 | 0.53 | 0.31 | 0.44 | 0.59 |
| *Dosing Recommendations | 12.21 | 42.31 | 0.84 | 0.25 | 0.76 | 0.47 |
| *Consumption Methods | 15.53 | 39.39 | 1.42 | 0.42 | 0.55 | 0.34 |
| Side Effects | 14.17 | 27.71 | 0.70 | 0.21 | 0.47 | 1.20 |
| Experience Requests | 13.73 | 34.40 | 0.89 | 0.42 | 0.72 | 1.02 |
| Quitting | 12.77 | 35.60 | 1.26 | 0.38 | 0.58 | 1.02 |
| Overdose | 17.49 | 24.83 | 0.29 | 0.52 | 0.37 | 1.15 |
| <i>All posts from Reddit</i> | <i>14.39</i> | <i>35.07</i> | <i>0.89</i> | <i>0.42</i> | <i>0.58</i> | <i>0.83</i> |
| <i>LIWC Corpus Score</i> | <i>49.99</i> | <i>46.24</i> | <i>1.27</i> | <i>1.27</i> | <i>1.03</i> | <i>0.67</i> |

Table 2. LIWC output for most frequent themes

Statistical analysis of the LIWC output

The output of each theme and sub-theme was compared to both the average of the entire dataset and the LIWC corpus score using simple single-sample T-tests. The purpose of the analysis between individual themes and the LIWC dataset was to determine if posts demonstrated significant emotional differences from what would be typical in common communication. The purpose in comparing the individual themes against the entire dataset was to see if there were differences in the emotional content of the posts from one topic to another. Below in Table 3, while the clout statistic is significantly low for the entire dataset, there is not a significant difference between the individual themes. However, the emotional tone summary variable is significantly lower for the overall data coded as harm-reduction, and specifically those posts seeking dosing recommendations and inquiring about consumption methods. Side effects and overdose posts also scored lower to a statistically significant degree.

Next, moving away from the LIWC summary variables, the achieved variable captured

themes that were both significantly lower and higher. Posts in which the author was inquiring about quitting or asking about consumption methods were actually higher in the achieve variable than the rest of the dataset. Posts in which the author was looking for drug contraindications, side effects, and overdose were lower. The power variable, however, was found to be statistically significant only in posts that demonstrated lower power scores than the rest of the dataset. These were the overall theme of harm-reduction, and specifically medicated withdrawal, dosing recommendations, and side effects. The variables of positive emotions found statistical significance with lowered positive emotions for drug purity, drug contraindications, and overdose. The variable of negative emotions found statistically significant relationships with each of the harm-reduction sub themes except medicated withdrawal. The relationships with each demonstrates that there are fewer negative emotion words present in the data. The opposite is true for the relationship between side effects and negative emotions.

| Themes/Subthemes | Clout | Emo. Tone | Achieve | Power | (+) Emo. | (-) Emo. |
|-------------------------|--------|-----------|----------|----------|----------|----------|
| Harm Reduction, All | 0.2820 | 0.0014 | 0.1874 | 0.0002 | 0.2854 | < .00100 |
| *Medicated Withdrawal | 0.1022 | 0.8518 | 0.6249 | 0.0014 | 0.0891 | 0.6859 |
| *Drug Purity | 0.6154 | 0.4119 | 0.0576 | 0.1067 | 0.0029 | < .00001 |
| *Drug Contraindications | 0.1956 | 0.8880 | 0.0000 | 0.0259 | 0.0266 | 0.0011 |
| *Dosing Recommendations | 0.0805 | 0.0001 | 0.5476 | 0.0006 | 0.0488 | < .00001 |
| *Consumption Methods | 0.3808 | 0.0074 | < .00001 | 0.9312 | 0.5628 | < .00001 |
| Side Effects | 0.8865 | < .00001 | 0.0019 | < .00001 | 0.0544 | 0.0001 |
| Experience Requests | 0.5566 | 0.6372 | 0.9585 | 0.9057 | 0.0324 | 0.0244 |
| Quitting | 0.2499 | 0.8319 | 0.0008 | 0.4563 | 0.9985 | 0.0230 |
| Overdose | 0.1935 | 0.0001 | < .00001 | 0.3781 | .00086 | 0.0447 |

*Statistically significant results are highlighted

Table 3. P-value results from single sample T-test of each theme/subtheme against the entire dataset

Finally, below Table 4 shows the results of each theme and subtheme compared against the larger LIWC corpus scores for each variable. Here, it is clear that there is statistical significance between each theme and subtheme against the larger corpus for nearly every variable. The few exceptions are not highlighted. In each instance, with the single

exception of medicated withdrawal and negative emotions, the data from our research shows a lowered emotional state from the LIWC corpus. This means that in every coded category, the posts reflect lowered clout, more negative emotional tone, low achievement, decreased power, fewer positive emotions, and increased negative emotions.

| Themes/Subthemes | Clout | Emo. Tone | Achieve | Power | (+) Emo. | (-) Emo. |
|------------------------|----------|-----------|----------|----------|----------|----------|
| Harm Reduction | < .00001 | < .00001 | < .00001 | < .00001 | < .00001 | < .00001 |
| Medicated withdrawal | < .00001 | 0.0007 | 0.0505 | < .00001 | < .00001 | 0.1688 |
| Drug purity | < .00001 | < .00001 | < .00001 | < .00001 | < .00001 | 0.0014 |
| Drug contraindications | < .00001 | < .00001 | < .00001 | < .00001 | < .00001 | 0.2580 |
| Dosing recommendations | < .00001 | 0.0357 | < .00001 | < .00001 | 0.0044 | 0.0007 |
| Consumption methods | < .00001 | 0.0000 | 0.1435 | < .00001 | < .00001 | < .00001 |
| Side Effects | < .00001 | < .00001 | < .00001 | < .00001 | < .00001 | < .00001 |
| Experience Requests | < .00001 | < .00001 | < .00001 | < .00001 | < .00001 | 0.0001 |
| Quitting | < .00001 | < .00001 | 0.9612 | < .00001 | < .00001 | 0.0001 |
| Overdose | < .00001 | < .00001 | < .00001 | < .00001 | < .00001 | 0.0030 |

*Statistically significant results are highlighted

Table 4. P-value results from single sample T-test of each theme/subtheme against the LIWC corpora

Discussion

This study explored the themes of health-related information that people who use drugs searched for on Reddit and how their posts reflected their emotional state. In this section we will give examples of posts from the five categories analysed above and discuss the LIWC output and if there are indications of discourse theory.

Harm reduction

Over one-third of the questions in our dataset were related to harm-reduction. The most frequent sub-topic that occurred were users requesting information about safe routes of administration, or ways to take opioids. In asking these questions, Redditors were concerned with both safety and obtaining the highest bioavailability. Examples of this are, 'how many times can I shoot up in the same spot?', 'Is there reduced risk of overdose with an IM injection as opposed to an IV?', 'Need help boofing heroin', or 'I've never injected before, but this year has just been shit, and the holidays really got me down. How would one safely cook a dilly 8, would i overdose? Should i do more? Im on 80mg methadone daily. Is this something i can do once and get over? Thank you folks. Merry Christmas'.

Many other posts showed users asking more nuanced questions that combined route of administration concerns with determining the purity of the drug before they administer it; 'How can I get the cut out of my stuff?' or 'How to use H safely with no tolerance assuming it has fentanyl?'. More direct drug purity questions were posed, such as 'H I just bought looks different than usual. Unsure about it. :(Under the sub-category of drug purity, users frequently asked for advice on a process called cold water extraction in which they separated the acetaminophen from the opioids contained in pills such as hydrocodone. This is done to reduce harm to the person's liver. Similarly, there were many posts related to drug contraindications, such as 'Mixing benzos with perc's', 'Norco after H?', and 'Tramadol after cocaine. How long should I wait to be safe?' The sub-theme of dosing was full of questions related to taking enough of the drug, but not too much: 'Shoot as much as I snort?' and 'How much in MG

of morphine to take for a medium recreational high with no tolerance?'

Finally, the sub-category of medicated withdrawal was primarily people trying to figure out how to taper their usage with other substances in order to not experience withdrawals. Examples of this are,

All night if been flinching, idk how to explain it but it sucks. I've been sniffing heroin / fent on and off for 6 years. With lots of opiate pills in between. I'm 25. I'm trying to stop permanently. I have kratom in capsules and 6 Xanax left. What's the best course of action?'

I know it's a stupid question but I'm looking for any type of help. Withdrawing off heavy heroin and benzo use, and

Does anyone else use Cushing drugs? I been using molly to try to stay off Fenty. I'm not addicted to molly, I can only do so much until it loses its effect (3 days in a row?) I don't know if it's helping today I wanted Fenty so bad!

It was often difficult to determine which category a post should be placed under, as the questions related to harm-reduction were nuanced and frequently touched on several aspects of drug usage, including administration route, purity, dosing, and contraindications. This demonstrated that the information needs of the user are more complex than what could be offered by a non-interactive information exchange platform.

Experience requests

Many posters requested others to share their experiences pertaining to a broad range of topics, with a particular emphasis on those pertaining to their health and seeing if others had experienced similar side effects or adverse health outcomes. One example of this is where a poster asked, 'Does anyone else get opiate-induced insomnia?' This example may be a rather non-urgent, exploratory question, while many other posts we found there to be examples where a poster requested time-sensitive information, either shortly before seeking or in lieu of seeking out immediate

medical attention. For example, one post by a user states,

I'm on my way to the ER to get this abscess looked at. I was just wondering if anyone had any advice about things to say to the doc or do, etc.? Pretty worried, but it's definitely time I did this.

While in this instance the user has already decided to receive medical care, they still seem to request the opinion of other posters in the subreddit as a first resort for navigating social interactions in a medical setting. Furthermore, in another instance a poster asks, 'Do I need to go to hospital? Just did a shot and hand is swelling'. In yet another: 'I can't tell if I'm overreacting or I've given myself a blood infection. Any insights or advice? I'm debating going to the Urgent care just to be safe but I don't want to unless I have to'. Some of these experience requests were more philosophical in nature but brought up by the user in an attempt to make decisions about how to move forward. Examples of this are: 'Need Some Advice on my fuck ups' and, 'Honestly, has anyone gotten off opiates after a very long habit that started off extremely young and been able to be happy?' Many of these posts are essentially attempts to get support through a community of understanding people, such as, 'Wish me luck and some words of encouragement, tips, or success stories would be great to hear right now I'm a bit stressed'.

Side effects

On the topic of side effects, a common concern raised was about withdrawal symptoms and how to potentially dampen the effects. One user asked, 'Day 4 withdrawal, stomach feels tortured, when does it get better?' Another asked, 'Does the intensity of wd's always correlate with your tolerance?' Users were also highly concerned with side effects related to general use. Questions posed to the forum were, 'Does testicular degeneration reverse after withdrawal?',

I wake up from a little nap and im SO COLD and shaking so mf hard I can't even stop for the life of me. Like muscles just contracting i deadass thought I was about to die, felt like I had tetanus (I assume) It went away after

maybe 10 minutes of hardcore shaking under a blanket.. WTF?

or 'is it normal to shake rapidly when waking up from a nod?? i'm scared i'm going to have a seizure or something awful'. Abscesses and issues with injection sites were common areas of concern. 'Injected a shot that was dark with blood but I missed. How long before I would notice an infection?' and

I have a very worrisome problem going on otopop an injection site I fuked up and used way to many times (I do know I should've went somewhere else but at the time it was the only place I could get to register and I admittedly got what was coming to me) could anyone message me if you think you're able to tell me what is going on I'll send pics upon request I just wanna know if I'm gonna die if I don't see a doctor.

While there are many websites that list the common symptoms experienced by those in withdrawal, the exhaustive lists may induce information-overload in the user. These questions show the benefit of a platform for a user to ask these questions directly to other users, furthering the importance of Reddit in this context.

Quitting

Under the topic of quitting, users asked questions that ranged broadly, with common sub-themes being asking if they may be addicted to a particular substance, seeking information to assist with discontinuation of use, withdrawal management and avoidance in the process of discontinuation, and a few instances of support group-related inquiries. Withdrawal management was a pervading theme, with one user asking how to limit their body shaking during the withdrawal they anticipate occurring during the upcoming work week. Another poster stated that they were nearing the end of tapering down their consumption yet were severely bothered by the anxiety symptoms they were experiencing and asked, 'how long does this stage last?' And another person simply asked, 'Your first aid bag for getting clean of heroin?' while another inquired, 'Can shrooms help me get off opiates?' In this category, there were many posts titled

things such as, 'I need help', 'end of the rope', 'struggling to stay clean', and 'How bad is my situation ? I can't really stop...'. These posts reflect the person's need to connect with other people in similar situations that could possibly help. They also demonstrate the benefit of an anonymous community in which they could ask about these issues without judgment. 'My life is completely normal and no one knows about this.' 'I'm really scared, some advice to get through this would be nice.' 'I just don't know what's wrong with me. I wish I was normal.'

Overdose

Overdose-related questions are of particular importance to address due to the long-lasting, or permanent, effects a user could experience if they make decisions based on bad information. Most of the overdose posts were asking how to prevent it. One post was titled, 'Using Adderall to prevent overdoses?', where the user proceeded to ask whether the effects of snorting Adderall would act as a deterrent to an overdose if they had taken too much fentanyl. Another wrote to help a potentially overdosing girlfriend.

Girlfriend in really fucken bad withdrawals that started over a week after her last big line of fentanyl, cant speak, can barely move pulse fluctuating between under 60 bpm to 90 bpm, extreme muscle spasms, hands and feet cold to the touch, slightly warm on the forehead, she is responsive albeit slow to nod or shake her head, cant hold down much fluid, what can i readily do to ease her suffering. And should i let her fall asleep and if so for how long.

Other posters were trying to determine if they were overdosing. For example,

My pupils are extremely small, my fingernails are purple and my fingers and toes are cold but my body is warm, I feel like I am in a dream and also I feel very unusually tired, I need to run on a treadmill to stay awake. I am switching from cold to warm extremely fast,

and,

My vision is prelurry, typing this is extremely difficult, itchy as fuck, I'm pretty much on the verge of passing out, nodding hard and getting mild tactile/audio hallucinations. Should I worry too much about respiratory depression if I let myself sleep?

or, 'Feeling a tightness in my chest. Feel like I'm maybe breathing 50-60% of my lung capacity'.

Finally, a few posters seemed to be trying to induce suicide, which is against the rules of the subreddit. Posts like this were shut down, by both the moderators and the community. When the community responded, it was with offers of help and support. Examples of these questions are, 'Is it difficult to commit suicide using a large amount of morphine?', 'Would 9 bars, some alcohol, and a couple fent presses kill me? I also have like 19 perc 10s left over and some codeine. Would this be lethal?', 'If someone were to od from smoking fent would it be just about instant? Or take some time?', and simply, 'Would 30mg Vicodin and 16mg alprazolam be fatal?'

Evidence of discourse theory

Finally, a word on Foucault. It is the authors' belief that this dataset demonstrates evidence in support of discourse theory. Many of the posts in this dataset requested information on potentially illegal activities. Much of the harm reduction information, such as safe routes of drug consumption, safe dosing, how to use opioids in a way that mitigates side effects, such as abscesses, how to prevent overdose, and even how to quit by tapering usage, all inquire about illegal drug use. This supports the authors' expectation that the posters may be afraid of seeking information due to negative ramifications, and therefore engaging in secretive information-seeking.

While this sort of small-world insider perspective is typically associated with Chatman (1999), it is the authors' belief that the illegality of the information sought speaks to an understanding of the societal power structures at play in discourse theory. The posters are not engaging in information-seeking in their own community or family. They cannot, out of fear, be recognised as being part of the insider group. Instead, they post anonymously on

Reddit to evade the ramifications of their actions, which may include both legal consequences and stigma. This supposition is further supported by the LIWC output which found that these posts lacked power and achievement while demonstrating negative emotional tone. Further, the posts had significantly low clout in every category. These negative emotions, coupled with the secrecy of the posters' behaviour, are indicative of an acknowledgement of the hierarchical social dynamics that affect their health and harm-reduction information-seeking. This is an admission of the power structures of society and confirmation of the theoretical mechanisms of Foucault's discourse theory.

Conclusion

The research was a massive undertaking that produced far too much information to include

here. The most important results indicate that people who use drugs use Reddit to obtain health information that they are unable to or afraid to get from other sources. Much of this information is related to harm reduction and throughout the dataset there was very frequent evidence that the posters wanted to stop using but could not figure out how. The reasons for this generally were related to symptoms of withdrawals and the illegality of their use. There was also constant evidence of feelings of shame and fear of getting caught, whether it be by law enforcement or loved ones. In agreement with this, the results demonstrate evidence of discourse theory.

More importantly, the words of the people posting on Reddit show the intense suffering and desperation of people who use drugs, and hopefully can be used to illuminate paths to provide them with help and kindness.

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