Original Research

SAGE Open
April-June 2025: 1–17

DOI: 10.1177/21582440251334852
journals.sagepub.com/home/sgo
Sage

Exploring Campus Anti-Drug Activities Through Online News Reports: A Hybrid Manual and Automated Content Analysis Approach

Ching-Hao Chang[1], Chiu-Mieh Huang[2], Kah-Yew Lim[3], Fen-He Lin[4], Kuei-Yu Huang[5,6], and Jong-Long Guo[1]

Abstract

Illegal drug use is a major global problem that has increased significantly over the last decade. Since it is often initiated in adolescence, government programs have targeted this demographic to reduce drug use. To analyze the reach of such campaigns, the study presents a hybrid manual and automated content analysis approach to identify campus anti-drug news reports by applying keyword-based mining. The DiVoMiner automated text analysis engine was used to identify themes within reports addressing campus anti-drug news. The data sources were obtained from online news media, including newspaper media organizations, television media, Internet News, and news forwarding platforms in Taiwan between January 2019 and October 2021 ($N = 17,698$). Four major themes were identified: potential risk factors associated with illegal drug use, stakeholders involved, the content and strategies of anti-drug activities, and treatment goals and strategies for drug prevention. Curiosity (33.29%) emerged as the foremost risk factor for adolescent drug use, with family members (29.77%) being the most prevalent stakeholders. Regarding anti-drug activities, the most frequently discussed content was anti-drug and campus safety campaigns (43.27%), whereas tailored programs (23.17%) represented the prevailing strategy. The primary treatment goal of drug prevention was to facilitate adolescents' social rehabilitation (60.22%), which was frequently achieved through supportive relationships; encouraging statements (33.02%) were the most prevalent practice. This study provides insights from online news coverage of campus anti-drug activities for adolescents. It offers educators, researchers, and policymakers valuable information regarding the major themes emphasized in news narratives.

[1]Department of Health Promotion and Health Education, College of Education, National Taiwan Normal University, Taipei, Taiwan
[2]Institute of Clinical Nursing, College of Nursing, National Yang Ming Chiao Tung University, Taipei, Taiwan
[3]Department of Political Science, National Chengchi University, Taipei, Taiwan
[4]School of Nursing, College of Medicine, National Taiwan University, Taipei, Taiwan
[5]Institute of Traditional Medicine, National Yang Ming Chiao Tung University, Taipei, Taiwan
[6]Department of Chinese Medicine, Shin Kong Wu Ho Su Memorial Hospital, Taipei, Taiwan

Corresponding Authors:
Chiu-Mieh Huang, Institute of Clinical Nursing, College of Nursing, National Yang Ming Chiao Tung University, No. 155, Section 2, Linong Street, Taipei 112947, Taiwan.
Email: cmhuang2021@nycu.edu.tw

Jong-Long Guo, Department of Health Promotion and Health Education, College of Education, National Taiwan Normal University, No. 162, Section 1, He-ping East Road, Taipei 10610, Taiwan.
Email: jonglong@ntnu.edu.tw

Plain language summary

Exploring campus anti-drug activities through online news reports: an automated content analysis

Illegal drug use is a major global problem that has increased significantly over the last decade. To better understand government efforts to reduce drug use among young people, this study used a combination of manual and automated content analysis techniques to identify news reports related to campus anti-drug activities. The researchers focused on campus anti-drug news published by Taiwanese online media organizations between January 2019 and October 2021, totaling 17,698 articles. Using the computer-assisted platform, DiVoMiner, this study effectively organizes and categorizes extensive textual data and identifies four major themes within these news reports. This study sheds light on the major themes highlighted in online news coverage of campus anti-drug activities aimed at adolescents. Its findings provide valuable insights for educators, researchers, and policymakers regarding the major themes emphasized in news narratives, helping inform future strategies to address the issue of drug use among adolescents.

Keywords

students, adolescents, campus anti-drug, online news, automated content analysis, text mining

Introduction

The detrimental consequences of illegal drug use and its profound impact on health have placed a substantial burden on public health (Levitt et al., 2020; Lo et al., 2020; McHugh et al., 2015). According to the World Drug Report published by the United Nations Office on Drugs and Crime, approximately 275 million people worldwide used illegal drugs in 2020, a notable increase of 22% from 2010. Furthermore, an estimated 38.6 million individuals were afflicted with drug use disorders in 2020 (United Nations Office on Drugs and Crime, 2021). The use of illegal drugs adversely affects physical and mental health (Armoon et al., 2021; Saedder et al., 2014) and carries a heightened risk of lethal outcomes (Saedder et al., 2014; Vasylyeva et al., 2020). It is closely associated with increased incidents of accident injury (Hayes et al., 2020; Saedder et al., 2014), theft, violence (Evans et al., 2021; Hines & Douglas, 2012), and suicide (Armoon et al., 2021; Knorr et al., 2016).

Owing to public awareness of and concern about the abovementioned harms, government policy has long focused on addressing campus drug use practices, recognizing that drug use often occur during adolescence (Miech et al., 2015; Yilin et al., 2023). To effectively control adolescent use of illegal drugs, Taiwan's Ministry of Education and its affiliated agencies offer subsidies for school-based anti-drug programs. These initiatives incentivize schools to create and implement diverse intervention programs and provide educational and advocacy activities on campus. They aim to improve students' anti-drug awareness, use prevention, and treatment. Moreover, these activities seek to enhance public awareness on the harm of illegal drugs, in addition to the anti-drug strategies and methods available on campus.

Information on government-endorsed programs and activities for reducing the harm of illegal drug use on campuses is frequently disseminated through various news media. Pervasive and intense persuaders, the news media affect public perceptions, beliefs, and attitudes (Campbell & Jamieson, 2006). Their ability to influence public opinion is particularly crucial in issues and policies such as those related drug use (Chenault, 2012). Furthermore, the media significantly influences the public opinion regarding drugs and drug users (Habib et al., 2023). In today's environment, mass media plays a vital role, providing a unified platform for all public health communication, health education guidelines, and for retaining social ties while following social distancing measures (Anwar et al., 2020). The growing number of online news reports on this topic provides ample daily information on illegal drug use, allowing researchers to use such content to analyze program efficacy, reach, and related concerns.

Text mining is an effective and efficient method for processing massive amounts of data. It is an application of data technology whose primary purpose is to determine the implied meaning in a text and obtain potentially practical and understandable knowledge from it. Text mining analysis includes word segmentation, word frequency calculation, and keyword extraction (Ahadi et al., 2022). Research that used text mining methods on topics related to drug use has primarily focused on two areas: investigating research trends (L.-W. Chou et al., 2020; Sarker et al., 2020; Singh et al., 2018; S.-H. Wang et al., 2016), and exploring and analyzing web forum data concerning illegal drug use (Cameron et al., 2013; Lamy et al., 2017; T. Nasralah et al., 2020). One particular text mining investigation scrutinized English-language discussions about Synthetic Cannabinoid Receptor

Agonists (SCRA) across three drug-focused online forums. This study uncovered a growing trend in mentioning the adverse effects associated with SCRA in forum discussions. (Lamy et al., 2017). Another study extracted insights from social media content to discern public concerns surrounding the opioid crisis, highlighting the most prevalent opioids related topics on social platforms (T. Nasralah et al., 2020). Most of the aforementioned text mining studies predominantly sourced their textual data from forums or social media, few utilized online news reports. Additionally, the focus was not specifically on the adolescent population. Past research has primarily explored the perspectives of the public on the use of illegal drugs, analysis of how adolescent drug use or campus drug use prevention activities are represented in news reports is lacking. Therefore, this study intends to explore adolescent drug use and campus drug use prevention in the context of online news reports.

Literature Review

Adolescent drug use increases the likelihood of encountering mental, physical, and social challenges later in life. Young people who engage in recreational drug consumption are susceptible to mental health problems such as anxiety, concentration difficulties, aggression, hallucinations, and mental stress (Richert et al., 2020; Seddon, 2003). Moreover, drug use adversely impacts the cognitive functions of memory, learning, impulse control, and stress management (Squeglia & Gray, 2016). During adolescence, the prefrontal cortex is not fully developed and, under the influence of drugs, is prone to misjudgment, impulsiveness, emotional instability, and behavioral issues (Silveri et al., 2016). The U.S. Centers for Disease Control and Prevention reported that in 2019, approximately 15% of high school students used certain illegal drugs (Centers for Disease Control and Prevention, 2023). The National Institute on Drug Abuse's ("Monitoring the Future") long-term surveillance of illegal drug use among adolescents revealed that reported substance use decreased dramatically between 2020 and 2021, after the onset of the COVID-19 pandemic and related changes like school closures and social distancing. In 2023, 10.9% of 8th, 19.8% of 10th, and 31.2% of 12th graders reported using illegal drugs in the past year (Patrick et al., 2023). These results indicate that the prevalence of illegal drug use increases with age. In Taiwan in 2017, a national campus survey found that drug use among high school students was prevalent in 0.23% of juniors and 0.73% of seniors (Guo et al., 2017). Another study in Taipei found that the lifetime prevalence of illegal drug use in truant adolescents was 15.0% to 17.9%, with a corresponding estimate of 3.1% to 3.4% for adolescents without truancy (L. C. Chou et al., 2006).

Studies have demonstrated that peers and parents have the greatest influence on adolescents' substance use behavior (D'Amico et al., 2020; Trucco, 2020). Furthermore, the youth may be more vulnerable to drug use during the summer months, considering their increased free time or participation in social activities that could promote drug exposure (Palamar et al., 2020). A study analyzing the description of substance use in online news pointed out that legal-criminal aspects were the most frequent themes; nearly 60% of reports had pessimistic headlines and portrayed drug use or drug users negatively, and a quarter of articles used stigmatizing language (Ghosh et al., 2022).

Negative news, such as accidents, violence, and self-harm, tends to leave a more lasting impression on people regarding adolescent drug use. However, positive news reports in this context also exist. It is possible to explore the use of language in both positive and negative news reports through text mining techniques. Understanding how adolescent drug use is presented in news reports can help comprehend how the media influences public perceptions of youth drug use.

The earlier the onset of illegal drug use, the higher the susceptibility to addiction and subsequent health detriments; therefore, failing to undertake early detection and intervention can compound the challenges of rehabilitation. In addition to ensuring a safe and healthy learning environment, numerous countries have formulated policies and intervention programs for drug prevention in schools. For example, drug education has been widely implemented in schools and disseminated through the media in the United States, with Drug Abuse Resistance Education (DARE) and Project ALERT being the most commonly used drug prevention education programs (Rosenbaum & Hanson, 2017). Similarly, "Unplugged" is a European school-based prevention program that comprises 12 units taught by teachers to adolescents aged 12 to 14. The program has proven to be effective in reducing smoking, alcohol abuse, and short-term marijuana use in the European Drug Addiction Prevention trial (Vigna-Taglianti et al., 2014). A cluster randomized controlled trial on a Brazil school-based drug prevention program held over 12 classes called # Tamojunto 2.0 found that the program can reduce alcohol initiation among adolescents (Sanchez et al., 2021). Drug prevention policy and campus programs may be disseminated to the public through online news reports, revealing information about the government's efforts to combat drug use on campuses and achieving a promotional effect by making the public aware of these initiatives.

The Goal of This Study

Focusing on campus anti-drug news reports, this study aims to mine the relationship between such textual features using massive textual data analytics. Analyzing online news through text mining will enrich our understanding of the associated campus anti-drug practices. This study presents a hybrid manual and automated content analysis method (Chang et al., 2021) designed to identify illegal campus drug prevention practices by applying keyword-based mining.

Methods

Data Source

The data used for this study were online news media coverage of anti-drug activities on campus from January 2019 to October 2021, obtained from online news websites of hundreds of Taiwanese news media, including newspaper media (e.g., Liberty Times, China Times, and United Daily News), television media (e.g., TVBS, SET News, Formosa News, and EBC News), Internet News (e.g., ETtoday, Nownews, and Newtalk) and news forwarding platforms (e.g., Yahoo, Line, and PChome). The uMax Data database collects all news from the aforementioned news platforms daily and selects relevant news from the database using keywords based on the study objective.

A key step in data retrieval was identifying keywords related to campus and drug use. Our research team, consisting of drug use experts and data mining engineers, followed the process outlined by Hassan et al. (2014) to generate a list of relevant keyword (Hassan et al., 2014). First, drug use experts provided an initial list of seed keywords (e.g., "drug prevention," "anti-drug"). Using these, we employed an automated platform to retrieve news reports. We then reviewed and added any unclear or missing terms from the results to the seed list. Afterward, domain experts refined the list by removing irrelevant keywords. The same process was applied with seed terms like "campus," "Ministry of Education," and "Bureau of Education" to generate campus-related keywords. The final keyword queries are presented in Table 1.

Table 1. Keyword Queries.

Group	Keywords
Group 1 (drug-related terms)	Drug, anti-drug, drug awareness, drug rejection, laughing gas, illegal drug, drug use, drug abuse, drug prevention, drug use prevention, and drug abuse prevention
Group 2 (campus-related terms)	Campus, on-campus, Ministry of Education, Education Administration, K-12 Education Administration, Bureau of Education, Education Department, off-campus organizations, and off-campus guidance and counseling institutes

Team members manually reviewed and refined the seed keywords to enhance accuracy. News reports were collected based on the inclusion and exclusion criteria outlined in Table 2. If a news headline contained both "drug use-related" and "campus-related" keywords, the article was directly included. However, if the body text of the news contained these keywords, a manual re-evaluation was conducted. For instance, some news reports mentioned government officials visiting campuses for anti-drug activities, but the actual content pertained to COVID-19 prevention and vaccination efforts. Additionally, there are cases where news reports address computer antivirus efforts rather than drug prevention – due to the identical Chinese terms for "anti-drug" (反毒) and "antivirus" (反毒) – were noted. In total, 26,541 relevant news reports were collected, followed by data cleaning.

Analysis Tools and Process

Automated content analysis was conducted using the DiVoMiner platform (uMax Data Technology CO, LTD., Taiwan), an online tool for content analysis and data mining. DiVoMiner employs machine learning coding for content analysis, utilizing a word segmentation

Table 2. Examples of Inclusion and Exclusion Criteria for the Manual Verification.

Area	Type	ID	Criteria
Drug use	Inclusion	I1	Headlines contain related seed keywords
		I2	Body text contains related seed keywords
	Exclusion	E1	Not a news report
		E2	No campus-related keywords were mentioned
Campus	Inclusion	I1	Headlines contain related seed keywords
		I2	Body text contains related seed keywords
	Exclusion	E1	Not a news report
		E3	No drug-related keywords were mentioned

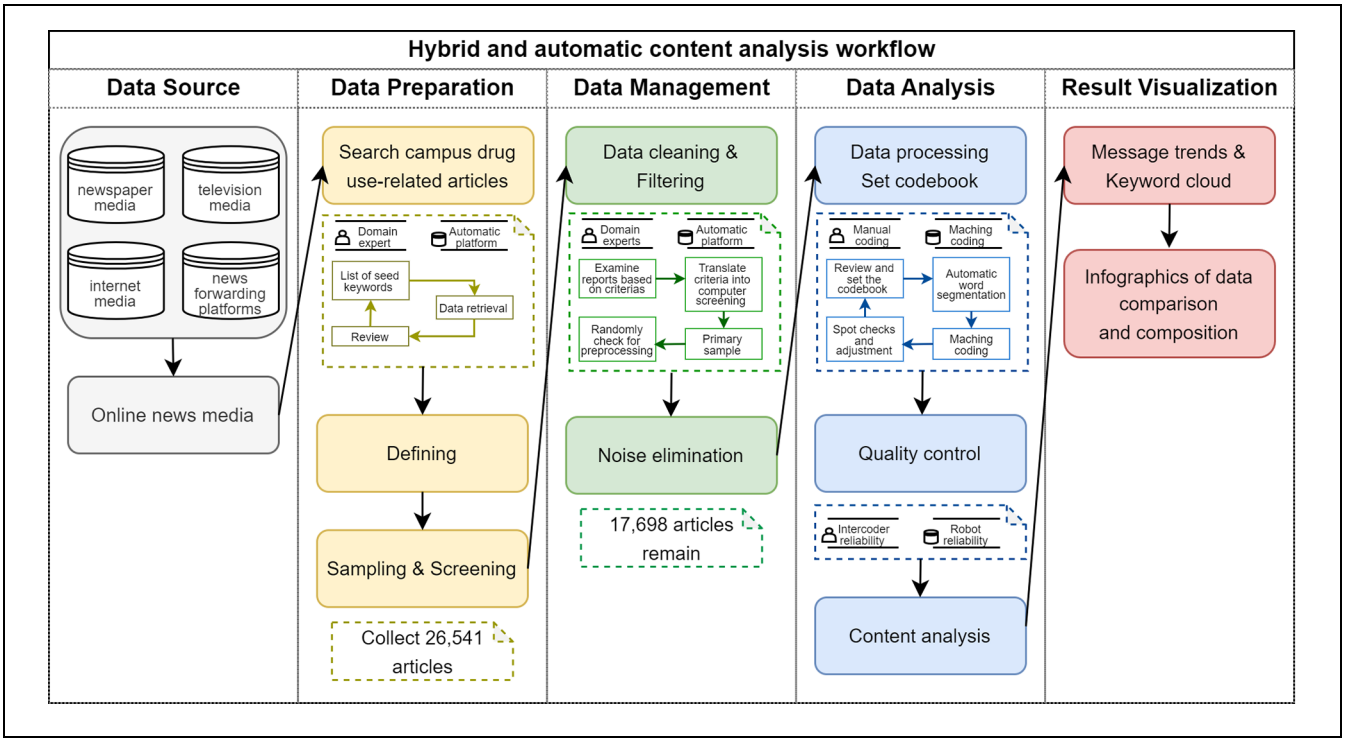

Figure 1. Hybrid and automatic content analysis workflow for DiVoMiner's computer-assisted classification.

algorithm trained on a comprehensive corpus of millions of industry-related words. It integrates a unique 10-year data set from China, Hong Kong, Macau, and Taiwan, using the Hidden Markov Model (HMM) for Chinese word segmentation (Zhang & Wen, 2020). The HMM-Ngram segmentation model was optimized with N-shortest path results for enhanced accuracy. To efficiently extract data related to campus drug use from unstructured texts, the model was trained to include semantic knowledge. To verify the model's feasibility and reliability, three coders randomly labeled 300 news reports, achieving over 99% classification accuracy, which was considered acceptable (Chang et al., 2020). Accuracy was calculated using the following formula:

A = belongs to category A and coded as A;
B = belongs to category A but coded as Not A;
C = belongs to category Not A but coded as A; and
D = belongs to category Not A and coded as Not A.

$$\text{Accuracy} = (\text{A} + \text{D})/(\text{A} + \text{B} + \text{C} + \text{D})$$

Figure 1 illustrates the manual and automated content analysis workflow for DiVoMiner's computer-assisted classification. The data analysis proceeded as follows:

(1) *Data Preparation*: The collected data were imported into the DiVoMiner platform. For each article, defining, sampling, and screening were conducted on keywords, phrases, or statements related to drugs and campus. A total of 26,541 news reports were initially gathered.
(2) *Data Management*: DiVoMiner's computational function explored the collected news data by storing, cleaning, filtering, and preprocessing. We adopted a hybrid approach to extract the desired data accurately, combining manual review and computational techniques. We manually examined specific news reports, identified criteria for inappropriate articles, and translated these criteria into computer screening commands for the batch selection of noise. This process was undertaken to avoid unnecessary noise data affecting the analysis. Subsequently, 17,698 reports were included as the primary sample. The titles, content, publications, and publication dates of the news articles were crawled and stored in Excel files. The research team randomly selected 1,000 news articles from the sample for preprocessing. Several terms were frequently reported in the news. For example, articles commonly reported that the reasons adolescents used illegal drugs were because

of curiosity or because they dropped out of school. These news items are often accompanied by terms, such as risk factors, influencing factors, underlying causes, and possible causes. Consequently, a theme of "potential risk factors associated with illegal drug use" was developed to collectively categorize "curiosity" and "dropping out of school."

(3) *Data Analysis*: Both manual assistance and algorithm coding were used for data processing, including pilot coding, subsequent revision, and double coding. Coders manually reviewed news reports and, based on their domain knowledge and research objectives, developed a codebook with keywords for each coding category. After setting the keywords, the platform's corpus performed automatic word segmentation, followed by algorithmic coding to classify the content. Manual spot checks were then conducted to review the machine coding results, with continuous adjustments made to incorrect keywords to enhance accuracy. For instance, when reviewing news articles, we found the phrase "teenagers are exposed to drugs because they join gangs," indicating gang involvement as a risk factor for teenage drug use. The keyword "gangs" was selected, and the DiVoMiner platform classified all articles mentioning this term as addressing the gang-related risk factor for drug exposure.

(4) *Result Visualization*: After the machine coding was completed, we obtained automated message trends and keyword cloud for comprehensive data and further visualized the analysis results on the platform.

Hybrid Reliability Test

To ensure the validity and reliability of the machine analysis, a manual technique was used to enhance the reliability of the computational process for extracting output text, including frequent terms, classification, and topics (Zamith & Lewis, 2015). The research team retrieved and reviewed the results during a data inspection meeting. Texts with thematic errors, such as news reports unrelated to campuses, were also identified. Subsequently, the identified texts were handed over to three coders with a background in data mining for manual review to increase intercoder reliability. To ensure the coders understood the content and standards of the coding framework, the research team provided them with coding framework explanations and instructions. Before starting formal reliability testing, the coders coded at least 50 data texts for different variables and then recorded and discussed coding process problems with the research team members. Consequently, the research team members confirmed that the coding accuracy was above 95% before proceeding with manual encoding.

This study used the Holsti (1969) method, a variation on percentage agreement, as the primary method for intercoder internal reliability. An agreement level of 80% or greater amongst coders has been proposed as acceptable in previous research (Lombard et al., 2010). The Holsti method formula (W. Wang, 2011) is as follows:

PA = The percentage of agreement between three coders
A = The number of two coders' consensus judgments
$N1$, $N2$, $N3$ = The number of decisions made by each coder

$$PA = 3A/(N1 + N2 + N3)$$

In this study, the variables encoded through both manual and computer methods included potential risk factors for illegal drug use, stakeholders involved, the content and strategies of anti-drug activities, and drug prevention treatment goals and strategies. Coders extracted news reports to compare the consistency between human and machine interpretations. For errors in machine coding, manual adjustments were made on the platform. Additionally, we applied the Holsti method to calculate internal reliability, with reliability coefficients for the coding variables ranging from 0.82 to 0.90, indicating significant intercoder reliability.

Content Analysis

Content analysis is a widely used method to scrutinize news coverage content (Cheng & Edwards, 2019; Semetko & Valkenburg, 2000) and is a suitable approach for capturing the portrayal of campus anti-drug news reports. Therefore, a content analysis method was adopted to code the collection of 17,698 news reports and convert the text content into quantifiable data. The developed codebook was checked and discussed by the research team multiple times to improve its appropriateness.

Results

Keyword Cloud and Distribution Trend

Figure 2 shows the keyword cloud used to visualize the distribution of the collected keywords. The larger the keyword, the more frequently it appears. The most used terms were "illegal drugs," "anti-drug," "campus," "activities," "students," "adolescents," "advocacy,"

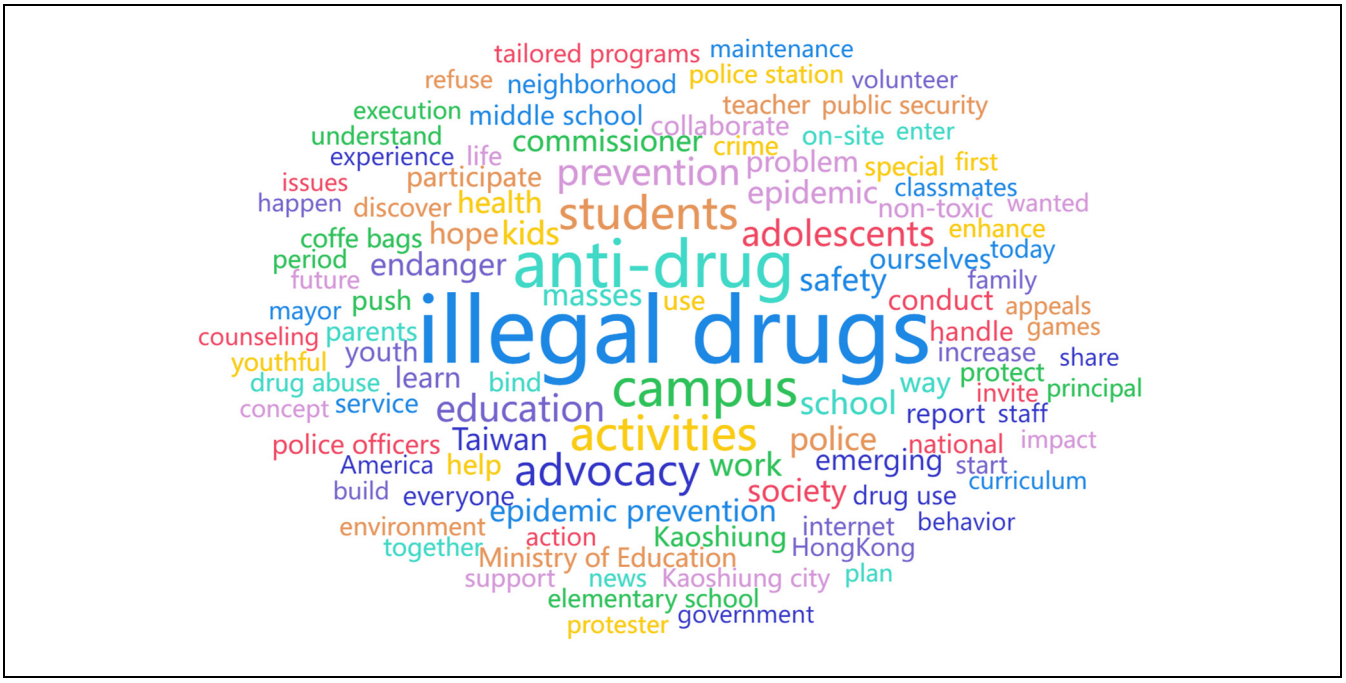

Figure 2. Keyword cloud.

"education," "safety," and "epidemic prevention." Figure 3 shows the distribution frequencies of campus anti-drug-related news articles. November had the highest number of campus anti-drug news reports, followed by a second peak of news reports around the summer vacation period between late June and August.

Four Major Themes

Four major themes were identified from the analysis: potential risk factors associated with illegal drug use, stakeholders involved, content and strategies of anti-drug activities, and treatment goals and strategies for drug prevention. The results were based on the educational system segmentation in Taiwan, which is categorized as follows: elementary school (6–12 years), middle school (13–15 years), high school (16–18 years), and college (19 years and above).

Figure 4a shows the primary potential factors contributing to the highest proportion of risk factors for drug use among students, which were "curiosity" (33.29%) and "curiosity combined with external factors" (29.95%), both under the category of individual factors. Numerous external factors involve drug dealers disguising new psychoactive substances as products, such as beverages (e.g., coffee bags) or snacks (e.g., jelly and gummy candies), and employing marketing strategies to entice adolescents to try them. Furthermore, middle school students appear to be most susceptible to the influence of interpersonal factors, such as peers and off-campus gangs. Regarding elementary school students, pressure factors seem to have the least impact on them.

As shown in Figure 4b, the top three stakeholders involved were "family," "teachers," and "classmates." Regarding content, Figure 4c shows that the most frequently used were "anti-drug and campus safety campaigns." Regarding anti-drug educational and advocacy strategies, the most common were "tailored programs" and "campus safety activities" as shown in Figure 4d. Moreover, as illustrated in Figure 4e, the primary treatment goal for illegal drug prevention in adolescents was "social rehabilitation." Regarding treatment strategies, the top three items with the highest proportions were "encouraging statement," "caring," and "nonjudgmental support," as shown in Figure 4f.

Discussion

Text mining enables the automatic analysis of large text datasets, significantly reducing time compared to labor-intensive manual coding (Nasralah et al., 2020). While it offers higher accuracy and consistency, it lacks certain contextual understanding, which can be supplemented by expert manual analysis (L.-W. Chou et al., 2020). Text mining has been widely applied to process large volumes of social media data (Kumar et al., 2021; Sandu et al., 2024); however, to the best of our knowledge, few studies have focused on online news related to campus drug use issues. A text mining study on Brazilian syphilis news highlighted the media's crucial role in public health

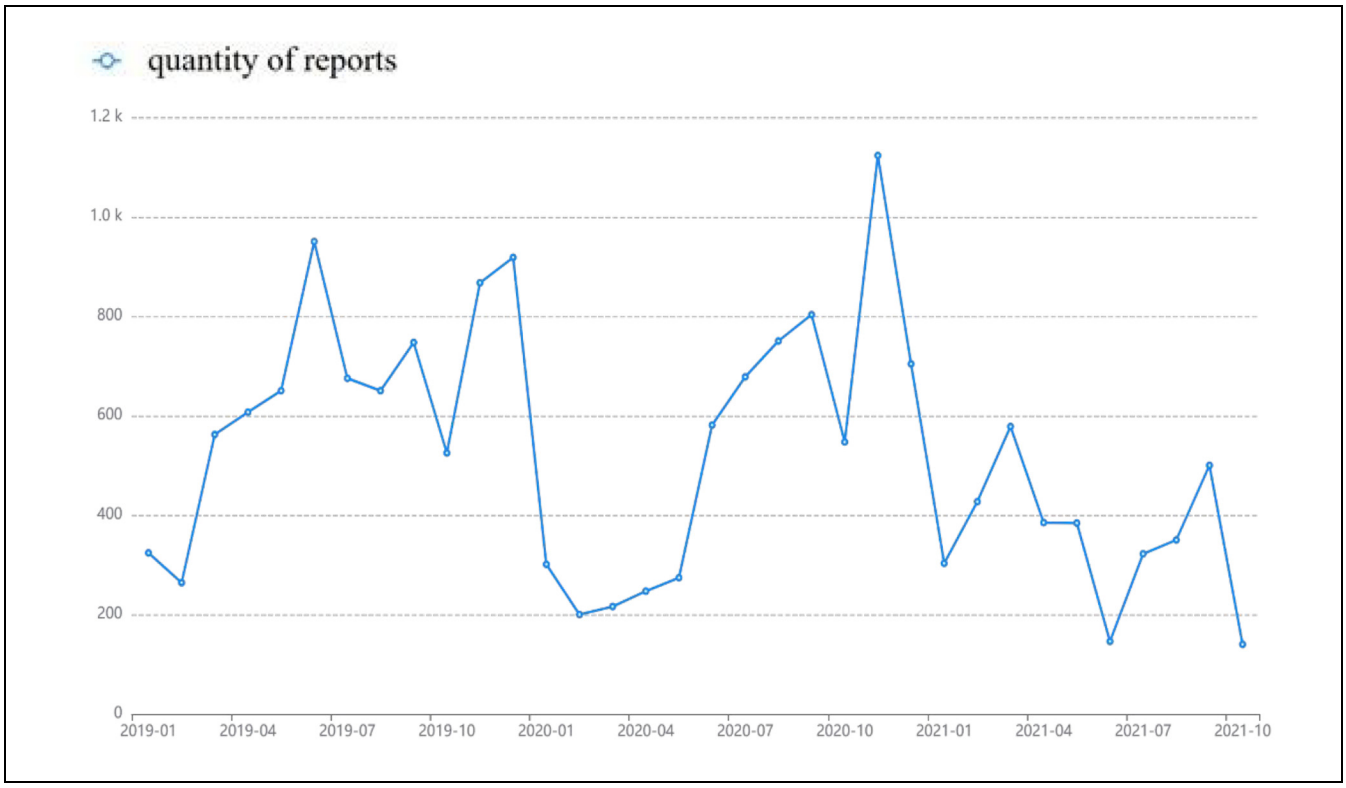

Figure 3. Publication distribution trend (by month).

communication (Pinto et al., 2023). This study utilizes a hybrid approach, combining manual and automated content analysis, to efficiently manage large datasets and structure information. It provides comprehensive insights into issue development through visual representation, highlighting how the media portrays campus drug use.

Using a data mining approach, we delved deeper into campus anti-drug efforts through online news reports. While past research highlights sensation seeking as a key risk factor for adolescent drug use (Wasserman et al., 2020), our findings identified curiosity as a major factor. Additionally, we found that external influences, such as the marketing and packaging of emerging drugs, have amplified teenagers' curiosity. We also expanded the key stakeholders influencing adolescent drug use to include teachers and principals, whereas previous studies primarily focused on family and peers (Woodward et al., 2023). Campus anti-drug programs are crucial for preventing student drug use, and our findings underscore comprehensive safety initiatives tailored to students at different educational stages, aligning with current research and practical trends (Lin et al., 2021; Tahlil & Aiyub, 2021). In summary, this study this study enhances understanding of campus drug use, offering valuable insights for health professionals, researchers, government officials, and educators.

In the context of campus anti-drug news reports, the findings derived from the keyword cloud analysis indicate that keywords associated with campus anti-drug efforts were intertwined with the critical goal of ensuring student safety. Notably, the timeframe during which the online news reports were examined coincided with the COVID-19 pandemic, resulting in the prominence of the word "safety" as one of the most frequently occurring terms. Another critical finding emerged when "epidemic prevention" appeared as a significant keyword. This finding is particularly noteworthy as it establishes a meaningful link between campus anti-drug initiatives, safety concerns, and the imperative efforts of epidemic prevention.

The heightened frequency of illegal drug use may be associated with seasonal effects. When analyzing the observed trends in the months when news coverage of campus drug use was published, we found a peak in related news coverage around November. Studies have indicated that substance use among adolescents increases during the summer months of June and July (Palamar et al., 2020). The second peak of news reports aligns with this finding. A study funded by the National Institute on Drug Abuse indicated the influence of seasonal effects on initial drug use (Palamar et al., 2020). Another study revealed that specific seasonal periods might render students more susceptible to drug use initiation, as

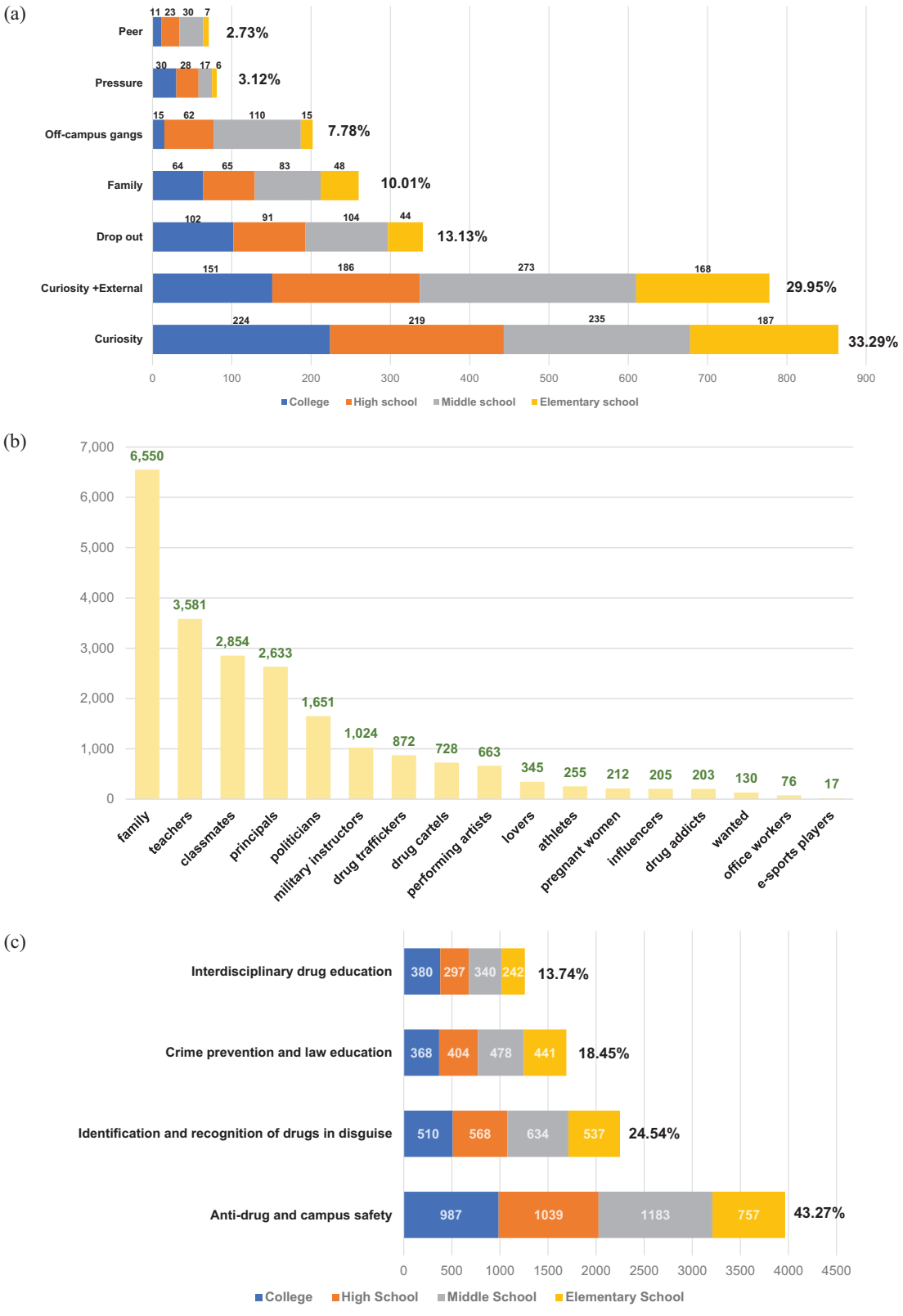

Figure 4. (continued)

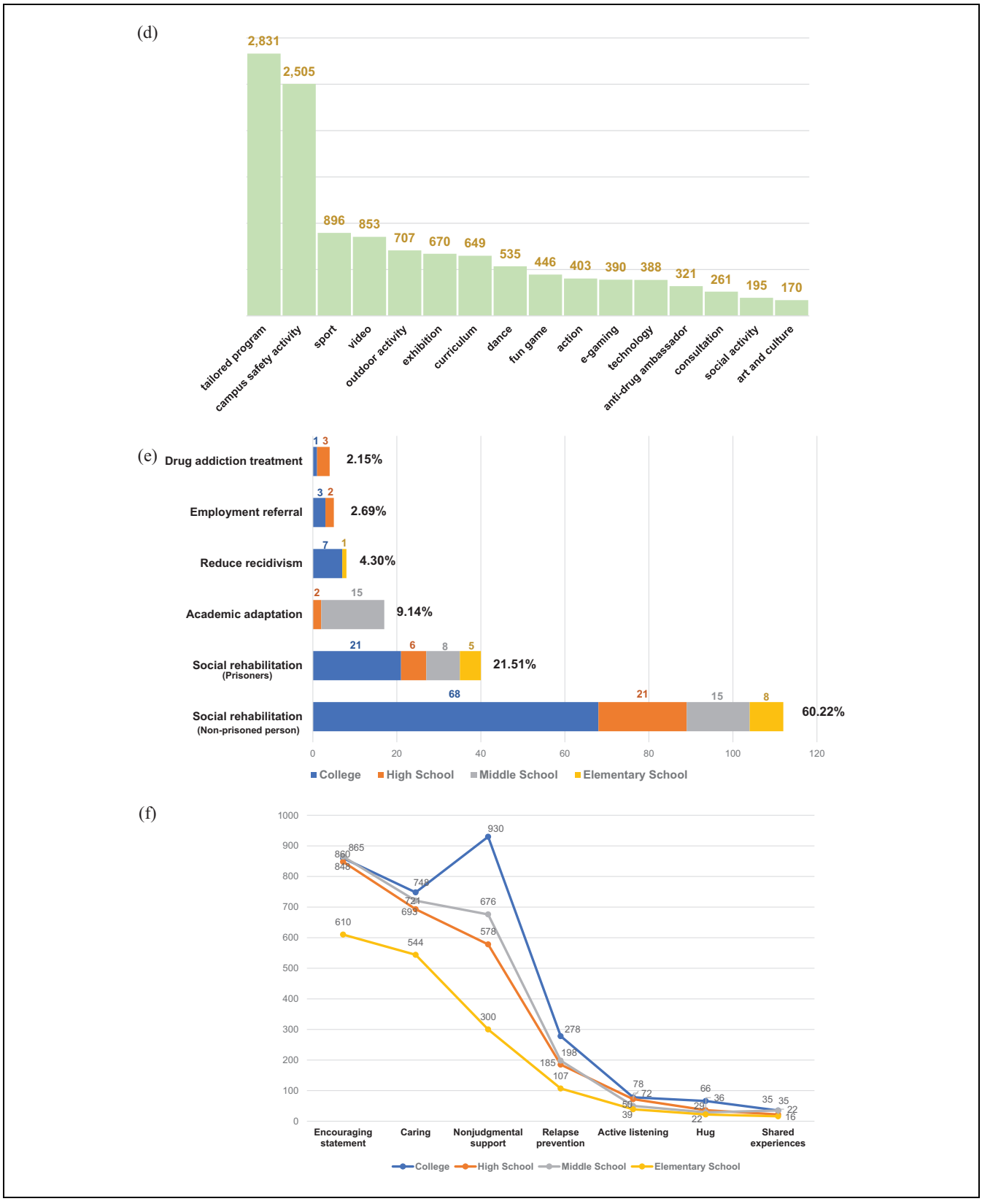

Figure 4. Four major themes emerged from the content analysis results (n = news reported numbers). *Theme 1*: (a) potential risk factors associated with illegal drug use; *Theme 2*: (b) stakeholders involved; *Theme 3*: (c) content of anti-drug activities and (d) anti-drug activity strategies; *Theme 4*: (e) drug prevention treatment goals and (f) drug prevention treatment strategies.

evidenced by the trends in November and December (Lipari, 2015). For example, previous research suggests that cold weather increases the risk of substance use and even death due to drug-use parties celebrating the Christmas holidays or cold weather causing sensory numbness and drug overdose (Goedel et al., 2019; Ventura-Cots et al., 2019). These findings are consistent with those of the present study's peak months of adolescent drug use in the news.

The study also found that in the news, curiosity is considered the highest potential risk factor for adolescents' illegal drug use, consistent with a national survey conducted in Taiwan which indicated "curiosity" as a prevalent initial factor for drug use among adolescents (Food and Drug Administration, 2019). The finding also aligns with a prior study that found a significant association between curiosity, use intentions, and substance use (Silveira et al., 2020; Wade et al., 2021). Multiple studies have also identified sensation seeking as a risk factor and predictor for substance use (Caqueo-Urizar et al., 2022; Mirnics et al., 2021). The curiosity construct encompasses two dimensions: exploration (reflecting the desire to seek novel experiences and knowledge) and absorption (indicating deep engagement and absorption in such activities). Curiosity exhibits a dual nature associated with adaptive and harmful behaviors. Thus, several studies have incorporated sensation seeking into the curiosity construct (Kashdan et al., 2004). Intertwining sensation seeking with curiosity has added depth to our understanding of the psychological mechanisms of drug use.

This study revealed that family members had the highest level of involvement in adolescents' drug-related news, followed by peers. This is consistent with previous research that emphasized the significant association between family and adolescent drug use (Aschengrau et al., 2021; Bray et al., 2022). A study from the European School Survey Project on Alcohol and Other Drugs found that adolescent drug use is closely associated with lower socioeconomic status and lower parental education (Gerra et al., 2020). Moreover, peer-influence interventions have shown effectiveness in predicting and preventing adolescent drug use (Mason et al., 2017). Therefore, integrated prevention programs should encompass family and peer levels to address adolescent drug use effectively.

Categorizing the content of anti-drug efforts revealed that they include anti-drug and campus safety campaigns, identification, and recognition of drugs in disguise, crime prevention and law education, and interdisciplinary drug education. This is because drug use in Taiwan is not only a problematic behavior but also a criminal act, and illegal drugs are divided into four categories with different penalties. From the educational system's perspective, the anti-drug activity content in elementary schools is more focused on law education and identifying and recognizing drugs in disguise, while colleges present the most interdisciplinary content. It is recommended that responsive strategies be adopted based on the age and needs of the target students, which is consistent with the International Standards on Drug Use Prevention (United Nations Office on Drugs and Crime, 2020). A study also noted that adopting an adolescent-centered model to implement the intervention would have a more significant effect (Huang, 2022).

Moreover, the results indicate that new forms of drugs are frequently disguised as snacks and drinks, easily deceiving adolescents who mistakenly consume them. Such packaging reduces adolescent awareness of illegal drugs and encourages their use. This finding is consistent with a national report indicating that new forms of disguised drugs are used mainly by adolescents, presenting a critical concern (Food and Drug Administration, 2019). Drugs disguised as candies and other items are usually a mix of various drugs, which can cause unexpected harm due to unknown ingredients. Compared to adults, the central nervous system of children and adolescents may be more susceptible to the effects of such drugs in disguise (Orsolini et al., 2019). Monitoring the Future (MTF) in America demonstrated that essential attitudes and beliefs regarding drug use are critical determinants of consumption patterns, particularly the perceived level of risk to the user associated with specific drugs and disapproval of their use for adolescents (Miech et al., 2021). Thus, it is suggested that the severe harm of disguised drugs should be emphasized in school-based intervention programs (Zamengo et al., 2019).

Our results indicate that the two most frequent strategies for anti-drug educational activities on campus are tailored programs and campus safety activities. This is because Taiwan's Ministry of Education provides an annual subsidy for developing a tailored campus anti-drug program based on its own needs assessment. In addition, since campus anti-drug efforts are under the purview of the School Safety Division of the Ministry of Education (Ministry of Education, 2012), anti-drug education and advocacy activities are often linked to safety activities and are reported in online news reports. Past studies also pointed to the three aspects of school culture, policy, and curriculum when designing evidence-based campus substance use intervention programs (Sloboda & Ringwalt, 2019).

From the big data of anti-drug activities, the characteristics of diversified categories were identified, such as sports (e.g., baseball, basketball), videos (e.g., self-media, short film), outdoor activities (e.g., camp, hiking), exhibitions, curriculum, dance (e.g., street dance), fun games (e.g., escape room, flash mob activities), transfer (e.g., mobile bus), e-games and technology (e.g., AR, VR, AI

module), consultation, social activities (e.g., school fair), and arts and culture (e.g., drama, singing competition). A meta-analysis of school-based substance use prevention programs suggests that health education and social learning models exhibit significant effectiveness, particularly when combined with oral, written, and audiovisual forms of support (Espada et al., 2015). The alignment of these anti-drug activities with the existing evidence is precise. They not only resonate with student interests but also amplify interactivity, consequently fostering heightened student engagement. Therefore, these meticulously crafted strategies and methodologies have emerged as pivotal tools for developing campus anti-drug efforts (Cuijpers, 2002; Soole et al., 2008).

In the context of schools' three-tiered prevention model (Department of Student Affairs and Special Education, 2021) for adolescent drug use, primary prevention focuses on raising awareness and educating the entire school community. Secondary prevention involves early screening for high-risk students and tailored counseling, while tertiary prevention refers to students engaged in drug treatment (Tobin & Sugai, 2005). An integrated intervention strategy, known as positive behavior support (PBS), could be employed, including all three prevention levels and emphasizing individual support to address problematic behaviors (Bambara & Kern, 2021). According to the Campus Substance Use Counseling Reference Manual issued by Taiwan's Ministry of Education (Ministry of Education, 2016), motivational interviewing is the most commonly used counseling intervention model in Taiwan. Studies have explored applying motivational interviewing to adolescent substance use counseling (Li et al., 2016). This study found that "encouraging statements," "caring," and "nonjudgmental support" were the top three strategies in adolescents' drug treatment, which are consistent with the principles of motivational interviewing emphasizing rapport building, resisting the righting reflex, understanding the patient's motivations, and listening with empathy (Hall et al., 2012). Establishing a positive and caring atmosphere on campus can aid high-risk students in reducing drug use by enhancing their social connections and protective factors (Nawi et al., 2021).

Implications

This study illustrates the potential of a manual and automated hybrid approach for content analysis with text mining of online news reports to identify campus anti-drug activities. Regarding theoretical implications, this study enhances our understanding of adolescent illegal drug use within the context of news reporting. It introduces a theoretical framework to analyze how adolescent drug use and campus anti-drug initiatives are depicted in news reports, thereby enriching our understanding of how the news media shape public perceptions. Regarding practical implications, the substantial increase in online news reports has led to an overwhelming amount of textual data. The proposed method offers a practical approach for extracting insights more efficiently than manual analysis when faced with these vast data volumes. Educators can benefit from the insights obtained from this study into prevalent risk factors, stakeholders, and effective strategies for anti-drug activities in tailoring their programs to meet specific needs. This study revealed that the highest potential risk factor for drug use is curiosity, and family and peers are the most common stakeholders, which can be included as a reference for educators in formulating drug use prevention programs. Moreover, the most discussed drug use education plans in the news are tailored programs that are diverse in activity forms, highly interactive, and suitable for students' ages and needs, with positive behavior support and motivational interviews being frequently mentioned strategies in campus anti-drug news.

As for the regulatory implications, regulatory agencies can use this study's findings to evaluate the effectiveness of existing anti-drug campaigns and consider adjustments to better align with established themes and prevalent strategies. Policymakers can consider the higher incidence of school drug use news towards the end of the year and during summer, which correlates with seasonal and school holiday patterns, and devise regulations aimed at preventing new forms of disguised drugs to which adolescents are easily exposed. Future studies may apply this method to identify prospective categories and investigate issues of interest. Compared with manual or traditional content analysis research, this method aids in conducting in-depth analysis, offering a rapid and inexpensive alternative to acquiring an overview of big data in written texts.

Limitations

This study had several limitations. First, in textual analysis, the researcher crawls and filters the data to extract relevant information on the topic of interest. However, this approach might exclude potentially valuable insights. Moreover, the scope of this study did not extend to anti-drug-related activities within campus settings that are not covered by online news reports. Finally, the findings might not fully represent the entire campus's anti-drug news reports because the study did not include news reports on social media. Future research should address these issues to improve the quality of the research methods.

Conclusions

This study investigated adolescent drug use and campus drug use prevention in the context of online news reports, identifying the portrayal of adolescent drug use and campus anti-drug initiatives in news reports. This study used a hybrid manual and automated content analysis approach to identify adolescent drug use and campus drug use prevention from Taiwanese online media. We identified four major themes in news coverage: potential risk factors associated with illegal drug use, stakeholders involved, the content and strategies of anti-drug activities, and treatment goals and strategies for drug prevention. Our study provides insights from online reports coverage on adolescent drug use and campus anti-drug news for adolescents. Future research could follow the methodology of this study, substituting campus-related keywords with those related to the family, to explore how families are represented in news reports on adolescent drug use, as families are one of the critical stakeholders.

Acknowledgments

This article was subsidized by the National Taiwan Normal University (NTNU), Taiwan, Republic of China. We thank the authors of this research's selected news reports and the reviewers and editors for their valuable comments.

ORCID iDs

Ching-Hao Chang https://orcid.org/0009-0005-3932-5026
Chiu-Mieh Huang https://orcid.org/0000-0001-9143-9972
Kah-Yew Lim https://orcid.org/0009-0008-1083-5913
Fen-He Lin https://orcid.org/0000-0002-7300-4622
Kuei-Yu Huang https://orcid.org/0000-0002-6296-0061
Jong-Long Guo https://orcid.org/0000-0002-3120-014X

Ethical Approval

Human Research Ethics Committee of National Taiwan Normal University approved this study (Ref. NO. 202304HM024).

Author Contributions

JLG, CMH, and KYL conceived and designed the study. CHC, CMH, KYL, FHL, KYH, and JLG provided administrative, technical, and material support. KYL, CMH and CHC performed data management and statistical analysis. All authors were responsible for the drafting of the manuscript. All authors have read and approved the final version of the manuscript.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by a grant from the Taiwan Food and Drug Administration (Grant #112TFDA-N-004).

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data Availability Statement

The datasets generated or analyzed during this study are available from the corresponding author upon reasonable request.

Guarantor

Chiu-Mieh Huang and Jong-Long Guo.

Supplemental Material

Supplemental material for this article is available online.

References

Ahadi, A., Singh, A., Bower, M., & Garrett, M. (2022). Text mining in education—A bibliometrics-based systematic review. *Education Sciences*, *12*(3), 210. https://www.mdpi.com/2227-7102/12/3/210

Anwar, A., Malik, M., Raees, V., & Anwar, A. (2020). Role of mass media and public health communications in the COVID-19 pandemic. *Cureus*, *12*(9), e10453. https://doi.org/10.7759/cureus.10453

Armoon, B., SoleimanvandiAzar, N., Fleury, M.-J., Noroozi, A., Bayat, A.-H., Mohammadi, R., Ahounbar, E., & Fattah Moghaddam, L. (2021). Prevalence, sociodemographic variables, mental health condition, and type of drug use associated with suicide behaviors among people with substance use disorders: A systematic review and meta-analysis. *Journal of Addictive Diseases*, *39*(4), 550–569. https://doi.org/10.1080/10550887.2021.1912572

Aschengrau, A., Grippo, A., & Winter, M. R. (2021). Influence of family and community socioeconomic status on the risk of adolescent drug use. *Substance Use & Misuse*, *56*(5), 577–587. https://doi.org/10.1080/10826084.2021.1883660

Bambara, L. M., & Kern, L. (2021). *Individualized supports for students with problem behaviors: Designing positive behavior plans*. Guilford Publications.

Bray, J. H., Gallegos, M. I., Cain, M. K., & Zaring-Hinkle, B. (2022). Parental monitoring, family conflict, and adolescent alcohol use: A longitudinal latent class analysis. *Journal of Family Psychology*, *36*(7), 1154–1160. https://doi.org/10.1037/fam0001019

Cameron, D., Smith, G. A., Daniulaityte, R., Sheth, A. P., Dave, D., Chen, L., Anand, G., Carlson, R., Watkins, K. Z., & Falck, R. (2013). PREDOSE: A semantic web platform for drug abuse epidemiology using social media. *Journal of Biomedical Informatics*, *46*(6), 985–997. https://doi.org/10.1016/j.jbi.2013.07.007

Campbell, K. K., & Jamieson, K. H. (2006). *The interplay of influence: News, advertising, politics, and the internet*. Thomson Wadsworth.

Caqueo-Urizar, A., Atencio-Quevedo, D., Urzua, A., Flores, J., & Irarrazaval, M. (2022). The mediating role of contextual problems and sensation seeking in the association between substance use and mental health in adolescents from northern Chile. *International Journal of Environmental Research and Public Health*, *19*(4), 2262. https://doi.org/10.3390/ijerph19042262

Centers for Disease Control and Prevention. (2023, April 27). *Youth risk behavior survey data summary & trends report*, 2011–2021 U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Office of Infectious Diseases, NCHHSTP. Retrieved August 30, from https://www.cdc.gov/healthyyouth/data/yrbs/yrbs_data_summary_and_trends.htm

Chang, A., Schulz, P. J., Jiao, W., & Liu, M. T. (2021). Obesity-related communication in digital Chinese news from Mainland China, Hong Kong, and Taiwan: Automated content analysis. *JMIR Public Health and Surveillance*, *7*(11), e26660. https://doi.org/10.2196/26660

Chang, A., Schulz, P. J., Tu, S., & Liu, M. T. (2020). Communicative blame in online communication of the COVID-19 pandemic: Computational approach of stigmatizing cues and negative sentiment gauged with automated analytic techniques. *Journal of Medical Internet Research*, *22*(11), e21504. https://doi.org/10.2196/21504

Chenault, S. P. (2012). The new ice age? A content analysis of methamphetamine coverage in a Midwestern newspaper. *JIJIS Journal*, *12*, 15.

Cheng, M., & Edwards, D. (2019). A comparative automated content analysis approach on the review of the sharing economy discourse in tourism and hospitality. *Current Issues in Tourism*, *22*(1), 35–49.

Chou, L.-W., Chang, K.-M., & Puspitasari, I. (2020). Drug abuse research trend investigation with text mining. *Computational and Mathematical Methods in Medicine*, *1*, 1030815. https://doi.org/10.1155/2020/1030815

Chou, L. C., Ho, C. Y., Chen, C. Y., & Chen, W. J. (2006). Truancy and illicit drug use among adolescents surveyed via street outreach. *Addictive Behaviors*, *31*(1), 149–154. https://doi.org/10.1016/j.addbeh.2005.04.011

Cuijpers, P. (2002). Effective ingredients of school-based drug prevention programs. A systematic review. *Addictive Behaviors*, *27*(6), 1009–1023. https://doi.org/10.1016/s0306-4603(02)00295-2

D'Amico, E. J., Rodriguez, A., Tucker, J. S., Dunbar, M. S., Pedersen, E. R., Shih, R. A., Davis, J. P., & Seelam, R. (2020). Early and late adolescent factors that predict co-use of cannabis with alcohol and tobacco in young adulthood. *Prevention Science*, *21*(4), 530–544. https://doi.org/10.1007/s11121-020-01086-7

Department of Student Affairs and Special Education. (2021). *Implementation plan for preventing student drug abuse*. Retrieved August 30, from https://depart.moe.edu.tw/ed2800/News.aspx?n = B4093BE3E7599FBB&sms = C4199356E3388C7E

Espada, J. P., Gonzálvez, M. T., Orgilés, M., Lloret, D., & Guillén-Riquelme, A. (2015). Meta-analysis of the effectiveness of school substance abuse prevention programs in Spain. *Psicothema*, *27*(1), 5–12. https://doi.org/10.7334/psicothema2014.106

Evans, C. B. R., Stalker, K. C., & Brown, M. E. (2021). A systematic review of crime/violence and substance use prevention programs. *Aggression and Violent Behavior*, *56*, 101513. https://doi.org/https://doi.org/10.1016/j.avb.2020.101513

Food and Drug Administration. (2019). *National survey report of illegal drug use in Taiwan 2018*. Retrieved August 30, from https://www.fda.gov.tw/tc/includes/GetFile.ashx?id = f637616988367725887&type = 3&iid = 11814

Gerra, G., Benedetti, E., Resce, G., Potente, R., Cutilli, A., & Molinaro, S. (2020). Socioeconomic status, parental education, school connectedness and individual socio-cultural resources in vulnerability for drug use among students. *International Journal of Environmental Research and Public Health*, *17*(4), 1306. https://www.mdpi.com/1660-4601/17/4/1306

Ghosh, A., Naskar, C., Sharma, N., Fazl, E. R., Choudhury, S., Basu, A., Pillai, R. R., Basu, D., & Mattoo, S. K. (2022). Does online newsmedia portrayal of substance use and persons with substance misuse endorse stigma? A qualitative study from India. *International Journal of Mental Health and Addiction*, *20*(6), 3460–3478. https://doi.org/10.1007/s11469-022-00859-1

Goedel, W. C., Marshall, B. D. L., Spangler, K. R., Alexander-Scott, N., Green, T. C., Wellenius, G. A., & Weinberger, K. R. (2019). Increased risk of opioid overdose death following cold weather: A case-crossover study. *Epidemiology*, *30*(5), 637–641. https://doi.org/10.1097/ede.0000000000001041

Guo, J. L., Huang, C. M., & Lee, T. C. (2017). *National web-based survey of illegal drug use among adolescents*. Ministry of Education.

Habib, D. R. S., Giorgi, S., & Curtis, B. L. (2023). Role of the media in promoting the dehumanization of people who use drugs. *The American Journal of Drug and Alcohol Abuse*, *49*, 371–380.

Hall, K., Gibbie, T., & Lubman, D. I. (2012). Motivational interviewing techniques – Facilitating behaviour change in the general practice setting. *Australian Family Physician*, *41*(9), 660–667.

Hassan, S.-U., Haddawy, P., & Zhu, J. (2014). A bibliometric study of the world's research activity in sustainable development and its sub-areas using scientific literature. *Scientometrics*, *99*(2), 549–579. https://doi.org/10.1007/s11192-013-1193-3

Hayes, C. J., Krebs, E. E., Hudson, T., Brown, J., Li, C., & Martin, B. C. (2020). Impact of opioid dose escalation on the development of substance use disorders, accidents, self-inflicted injuries, opioid overdoses and alcohol and non-opioid drug-related overdoses: a retrospective cohort study. *Addiction*, *115*(6), 1098–1112. https://doi.org/https://doi.org/10.1111/add.14940

Hines, D. A., & Douglas, E. M. (2012). Alcohol and drug abuse in men who sustain intimate partner violence. *Aggressive Behavior*, *38*(1), 31–46.

Holsti, O. R. (1969). Content analysis for the social sciences and humanities. *Addison-Wesley (content analysis)*.

Huang, L. (2022). Practitioners' perspectives on family-based intervention for illicit drug-using adolescents in Taiwan: A qualitative study. *Substance Abuse Treatment, Prevention, and Policy*, *17*(1), 30. https://doi.org/10.1186/s13011-022-00460-8

Kashdan, T. B., Rose, P., & Fincham, F. D. (2004). Curiosity and exploration: Facilitating positive subjective experiences and personal growth opportunities. *Journal of Personality Assessment*, *82*(3), 291–305. https://doi.org/10.1207/s15327752jpa8203_05

Knorr, A. C., Tull, M. T., Anestis, M. D., Dixon-Gordon, K. L., Bennett, M. F., & Gratz, K. L. (2016). The interactive effect of major depression and nonsuicidal self-injury on current suicide risk and lifetime suicide attempts. *Archives of Suicide Research*, *20*(4), 539–552.

Kumar, S., Kar, A. K., & Ilavarasan, P. V. (2021). Applications of text mining in services management: A systematic literature review. *International Journal of Information Management Data Insights*, *1*(1), 100008. https://doi.org/https://doi.org/10.1016/j.jjimei.2021.100008

Lamy, F. R., Daniulaityte, R., Nahhas, R. W., Barratt, M. J., Smith, A. G., Sheth, A., Martins, S. S., Boyer, E. W., & Carlson, R. G. (2017). Increases in synthetic cannabinoids-related harms: Results from a longitudinal web-based content analysis. *International Journal of Drug Policy*, *44*, 121–129. https://doi.org/10.1016/j.drugpo.2017.05.007

Levitt, A., Mermin, J., Jones, C. M., See, I., & Butler, J. C. (2020). Infectious diseases and injection drug use: Public health burden and response. *The Journal of Infectious Diseases*, *222*(Suppl. 5), S213–S217.

Li, L., Zhu, S., Tse, N., Tse, S., & Wong, P. W.-C. (2016). Effectiveness of motivational interviewing to reduce illicit drug use in adolescents: A systematic review and meta-analysis. *Addiction*, *111*(5), 795–805.

Lin, L.-C., Huang, C.-M., Hsu, H.-P., Liao, J.-Y., Lin, C.-Y., & Guo, J.-L. (2021). Integrating health literacy into a theory-based drug-use prevention program: A quasi-experimental study among junior high students in Taiwan. *BMC Public Health*, *21*(1), 1768. https://doi.org/10.1186/s12889-021-11830-5

Lipari, R. N. (2015). *Monthly variation in substance use initiation among full-time college students* (The CBHSQ Report: Review from Substance Abuse and Mental Health Services Administration (USA), Rockville, MD)

Lo, T. W., Yeung, J. W. K., & Tam, C. H. L. (2020). Substance abuse and public health: A multilevel perspective and multiple responses. *International Journal of Environmental Research and Public Health*, *17*(7), 2414. https://doi.org/10.3390/ijerph17072610

Lombard, M., Snyder-Duch, J., & Bracken, C. C. (2010). *Practical resources for assessing and reporting intercoder reliability in content analysis research projects* (Intercoder Reliability in Content Analysis Report; pp. 1–18)

Mason, M. J., Zaharakis, N. M., Rusby, J. C., Westling, E., Light, J. M., Mennis, J., & Flay, B. R. (2017). A longitudinal study predicting adolescent tobacco, alcohol, and cannabis use by behavioral characteristics of close friends. *Psychology of Addictive Behaviors*, *31*(6), 712–720. https://doi.org/10.1037/adb0000299

McHugh, R. K., Nielsen, S., & Weiss, R. D. (2015). Prescription drug abuse: from epidemiology to public policy. *Journal of Substance Abuse Treatment*, *48*(1), 1–7. https://doi.org/10.1016/j.jsat.2014.08.004

Miech, R. A., Johnston, L. D., O'malley, P. M., Bachman, J. G., & Schulenberg, J. E. (2015). *Monitoring the future national survey results on drug use, 1975–2014. Volume 1, secondary school students*. Institute for Social Research.

Miech, R. A., Johnston, L. D., O'Malley, P. M., Bachman, J. G., Schulenberg, J. E., & Patrick, M. E. (2021). *Monitoring the future national survey results on drug use, 1975–2020. Volume I, secondary school students*. Institute for Social Research.

Ministry of Education. (2012). *Department of student affairs and special education brief introduction*. Retrieved August 30, from https://english.moe.gov.tw/cp-4-15161-82FDB-1.html

Ministry of Education. (2016). *Campus substance use counseling reference manual*. Retrieved September 5, from https://www.guide.edu.tw/publications/counseling-series/7f74ea41-0680-444d-b234-ff88ed4df63e

Mirnics, Z., Kovi, Z., Tanyi, Z., & Grezsa, F. (2021). Adolescent drug use, relational variables and personality factors. *Psychiatria Danubina*, *33*, S656–S665. https://doi.org/WOS:000717549900038

Nasralah, T., El-Gayar, O., & Wang, Y. (2020). Social media text mining framework for drug abuse: Development and validation study with an opioid crisis case analysis. *Journal of Medical Internet Research*, *22*(8), e18350. https://doi.org/10.2196/18350

Nawi, A. M., Ismail, R., Ibrahim, F., Hassan, M. R., Manaf, M. R. A., Amit, N., Ibrahim, N., & Shafurdin, N. S. (2021). Risk and protective factors of drug abuse among adolescents: a systematic review. *BMC Public Health*, *21*(1), 2088. https://doi.org/10.1186/s12889-021-11906-2

Orsolini, L., Chiappini, S., Corkery, J. M., Guirguis, A., Papanti, D., & Schifano, F. (2019). The use of new psychoactive substances (NPS) in young people and their role in mental health care: A systematic review. *Expert Review of Neurotherapeutics*, *19*(12), 1253–1264. https://doi.org/10.1080/14737175.2019.1666712

Palamar, J. J., Rutherford, C., & Keyes, K. M. (2020). Summer as a risk factor for drug initiation. *Journal of General Internal Medicine*, *35*, 947–949. https://doi.org/10.1007/s11606-019-05176-3

Patrick, M. E., Miech, R. A., Johnston, L. D., & O'Malley, P. M. (2023). *Monitoring the future panel study annual report: National data on substance use among adults ages 19 to 60*, 1976–2022. Institute for Social Research.

Pinto, R., Lacerda, J., Silva, L., Araújo, A. C., Fontes, R., Lima, T. S., Miranda, A. E., Sanjuán, L., Gonçalo Oliveira, H., & Atun, R. (2023). Text mining analysis to understand the impact of online news on public health response: Case

of syphilis epidemic in Brazil. *Frontiers in Public Health*, *11*, 1248121.

Richert, T., Anderberg, M., & Dahlberg, M. (2020). Mental health problems among young people in substance abuse treatment in Sweden. *Substance Abuse Treatment, Prevention, and Policy*, *15*(1), 43. https://doi.org/10.1186/s13011-020-00282-6

Rosenbaum, D. P., & Hanson, G. S. (2017). Assessing the effects of school-based drug education: A six-year multilevel analysis of project DARE. In D. P. Rosenbaum, & G. S. Hanson (Eds.), *Drug abuse: Prevention and treatment* (pp. 157–188). Routledge.

Saedder, E. A., Brock, B., Nielsen, L. P., Bonnerup, D. K., & Lisby, M. (2014). Identifying high-risk medication: A systematic literature review. *European Journal of Clinical Pharmacology*, *70*, 637–645.

Sanchez, Z. M., Valente, J. Y., Galvão, P. P., Gubert, F. A., Melo, M. H. S., Caetano, S. C., Mari, J. J., & Cogo-Moreira, H. (2021). A cluster randomized controlled trial evaluating the effectiveness of the school-based drug prevention program #Tamojunto2.0. *Addiction*, *116*(6), 1580–1592. https://doi.org/https://doi.org/10.1111/add.15358

Sandu, A., Cotfas, L.-A., Stănescu, A., & Delcea, C. (2024). A bibliometric analysis of text mining: exploring the use of natural language processing in social media research. *Applied Sciences*, *14*(8), 3144. https://www.mdpi.com/2076-3417/14/8/3144

Sarker, A., DeRoos, A., & Perrone, J. (2020). Mining social media for prescription medication abuse monitoring: A review and proposal for a data-centric framework. *Journal of the American Medical Informatics Association*, *27*(2), 315–329. https://doi.org/10.1093/jamia/ocz162

Seddon, C. (2003). *Adolescent health* (0 7279 1846 X). https://www.researchgate.net/publication/281282828_Adolescent_Health_BMA_2003

Semetko, H. A., & Valkenburg, P. M. (2000). Framing European politics: A content analysis of press and television news. *Journal of Communication*, *50*(2), 93–109.

Silveira, M. L., Conway, K. P., Everard, C. D., Sim, H. Y., Kimmel, H. L., & Compton, W. M. (2020). Longitudinal associations between susceptibility to tobacco use and the onset of other substances among US youth. *Preventive Medicine*, *135*, 106074. https://doi.org/10.1016/j.ypmed.2020.106074

Silveri, M. M., Dager, A. D., Cohen-Gilbert, J. E., & Sneider, J. T. (2016). Neurobiological signatures associated with alcohol and drug use in the human adolescent brain. *Neuroscience & Biobehavioral Reviews*, *70*, 244–259.

Singh, S. P., Karkare, S. S., Baswan, S. M., & Singh, V. P. (2018). The application of text mining algorithms in summarizing trends in anti-epileptic drug research. *bioRxiv*.

Sloboda, Z., & Ringwalt, C. L. (2019). The school: A setting for evidence-based prevention interventions and policies. In Z. Sloboda, H. Petras, E. Robertson, & R. Hingson (Eds.), *Prevention of substance use* (pp. 147–163). Springer. https://doi.org/10.1007/978-3-030-00627-3_9

Soole, D. W., Mazerolle, L., & Rombouts, S. (2008). School-based drug prevention programs: A review of what works. *Australian & New Zealand Journal of Criminology*, *41*(2), 259–286. https://doi.org/10.1375/acri.41.2.259

Squeglia, L. M., & Gray, K. M. (2016). Alcohol and drug use and the developing brain. *Current Psychiatry Reports*, *18*, 1–10.

Tahlil, T., & Aiyub, A. (2021). Ex-drug users' and health professionals' perspectives about school-based drug use prevention programs: A qualitative study. *Frontiers in Public Health*, *9*, e631212.

Tobin, T., & Sugai, G. (2005). Preventing problem behaviors: Primary, secondary, and tertiary level prevention interventions for young children. *Journal of Early and Intensive Behavior Intervention*, *2*, 125. https://doi.org/10.1037/h0100309

Trucco, E. M. (2020). A review of psychosocial factors linked to adolescent substance use. *Pharmacology Biochemistry and Behavior*, *196*, 172969. https://doi.org/https://doi.org/10.1016/j.pbb.2020.172969

United Nations Office on Drugs and Crime. (2020). *UNODC/WHO international standards on drug use prevention*. Retrieved February 29, from https://www.unodc.org/unodc/en/prevention/prevention-standards.html

United Nations Office on Drugs and Crime. (2021). *World drug report 2021*. Retrieved August 30, from https://www.unodc.org/unodc/en/data-and-analysis/wdr2021.html

Vasylyeva, T. I., Smyrnov, P., Strathdee, S., & Friedman, S. R. (2020). Challenges posed by COVID-19 to people who inject drugs and lessons from other outbreaks. *Journal of the International AIDS Society*, *23*(7), e25583. https://doi.org/https://doi.org/10.1002/jia2.25583

Ventura-Cots, M., Watts, A. E., Cruz-Lemini, M., Shah, N. D., Ndugga, N., McCann, P., Barritt, A. S., Jain, A., Ravi, S., Fernandez-Carrillo, C., Abraldes, J. G., Altamirano, J., & Bataller, R. (2019). Colder weather and fewer sunlight hours increase alcohol consumption and alcoholic cirrhosis worldwide. *Hepatology*, *69*(5), 1916–1930. https://doi.org/10.1002/hep.30315

Vigna-Taglianti, F. D., Galanti, M. R., Burkhart, G., Caria, M. P., Vadrucci, S., & Faggiano, F. (2014). "Unplugged," a European school-based program for substance use prevention among adolescents: Overview of results from the EU-Dap trial. *New Directions for Youth Development*, *2014*(141), 67–82. https://doi.org/https://doi.org/10.1002/yd.20087

Wade, N. E., Palmer, C. E., Gonzalez, M. R., Wallace, A. L., Infante, M. A., Tapert, S. F., Jacobus, J., & Bagot, K. S. (2021). Risk factors associated with curiosity about alcohol use in the ABCD cohort. *Alcohol*, *92*, 11–19. https://doi.org/10.1016/j.alcohol.2021.01.002

Wang, S.-H., Ding, Y., Zhao, W., Huang, Y.-H., Perkins, R., Zou, W., & Chen, J. J. (2016). Text mining for identifying topics in the literatures about adolescent substance use and depression. *BMC Public Health*, *16*(1), 279. https://doi.org/10.1186/s12889-016-2932-1

Wang, W. (2011). *A content analysis of reliability in advertising content analysis studies* [PhD thesis, East Tennessee State University].

Wasserman, A. M., Mathias, C. W., Hill-Kapturczak, N., Karns-Wright, T. E., & Dougherty, D. M. (2020). The development of impulsivity and sensation seeking: Associations with substance use among at-risk adolescents. *Journal of Research on Adolescence*, *30*(4), 1051–1066. https://doi.org/https://doi.org/10.1111/jora.12579

Woodward, T., Smith, M. L., Mann, M. J., Kristjansson, A. L., & Morehouse, H. (2023). Risk & protective factors for youth substance use across family, peers, school, & leisure domains. *Children and Youth Services Review*, *151*, 107027.

Yilin, D., Bellerose, M., Borbely, C., & Rowell-Cunsolo, T. L. (2023). Assessing the relationship between drug use initiation age and racial characteristics. *Journal of Ethnicity in Substance Abuse*. Advance online publication. https://doi.org/10.1080/15332640.2023.2271871

Zamengo, L., Frison, G., & Zwitser, G. (2019). Understanding and managing the new psychoactive substances phenomenon: A holistic approach. *Journal of Public Health Policy*, *40*(2), 217–235. https://doi.org/10.1057/s41271-018-0156-6

Zamith, R., & Lewis, S. C. (2015). Content analysis and the algorithmic coder: What computational social science means for traditional modes of media analysis. *The ANNALS of the American Academy of Political and Social Science*, *659*(1), 307–318. https://doi.org/10.1177/0002716215570576

Zhang, H., & Wen, B. (2020, August). Construction of word segmentation model based on HMM + BI-LSTM. In *International Conference of Pioneering Computer Scientists, Engineers and Educators* (pp. 47–61). Springer Singapore.