Sociodemographic characteristics of social media users in crisis and disaster situations: Results of a representative German online panel

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ABSTRACT

Communication via social media during crises and disasters plays an important role in the disaster management cycle. However, research from a sociodemographic perspective that describes and compares everyday use versus use during crises and disasters is scarce. Hence, we conducted a representative panel survey in Germany (N = 476 participants, 50.6% female; M_{age} = 37.8 years) to compare social media use and sociodemographic correlates in both contexts. The most consistently used platforms are WhatsApp, YouTube, Facebook, and Instagram, with younger age groups favoring image-based platforms. Information about weather conditions, family/friends, and traffic is primarily shared and sought in crisis and disaster situations. Only a small percentage shares information publicly, mostly in the age range of 22 to 48 years (M_{age} = 35.49 years, SD_{age} = 12.93 years). The analysis reveals that the use of social media during crises and disasters is not representative of the general population and may reflect a small group (whose information is publicly available). Nevertheless, social media are an important tool to capture acute reactions and communicate with the public due to their fast-paced and interactive communication processes. A closer look at actual users is recommended for big data analysis of social media data to identify potential biases.

Keywords social media usage, sociodemographic characteristics in social media, disasters, informative value, crisis management.

INTRODUCTION

According to the We are Social report (We Are Social Deutschland GmbH 2021), Germany had 70.90 million social media users in early 2023, representing 85.1% of the population (DataReportal 2023). The most commonly used platforms – WhatsApp, Facebook, and Instagram (DataReportal 2023) – are primarily used for communication with friends and family, news consumption, and leisure. As people post descriptions and visuals of their experiences on social media – also during crises and disasters – decision-makers can obtain data from the latter for crisis management. Geolocation data, for instance, can support rescue operations and emergency measures after disasters such as floods (Albuquerque et al. 2015; Fathi, Thom, et al. 2020). Nevertheless, challenges arise due to the interactive nature, data volume, variety, dissemination, processing speed, and data quality (credibility, validity, and veracity) of social media, addressed by various approaches, like crisis informatics (Z. Wang and Ye 2017; Reuter and Kaufhold 2017) and Virtual Operations Support Teams (VOST). VOST can enhance situational awareness and decision-making in crises by providing actionable information in a time-sensitive work context (Fathi and Fiedrich 2022; Singla and Agrawal 2022). Effective integration of social media data into crisis management is promising, but requires an understanding of population differences in usage.

Social media are mostly text- or image/video-based, web-based services that allow individuals to be connected through the consumption, creation, evaluation, and exchange of user-generated content in different formats (Acquisti and Gross 2006; Ellison and Boyd 2013; Joinson 2008; Sloan and Quan-Haase 2016). This study, therefore, categorizes platforms as image- or text-based (Swan 2019).

On social media, personal profiles represent individuals and their network connections (Boyd and Ellison 2010), whereas privacy settings influencing information visibility, creating scalable sociality (Miller et al. 2016; Rhee et al. 2021).

Crisis situations alter social media usage patterns, influenced by economic and social background. Understanding these variations is crucial for developing customized strategies for disaster management, from preparedness to long-term recovery, and enables adjustable appliances for various disaster scenarios, such as analyzing information in real time or communicating news and alerts (Luna and Pennock 2018). During the COVID-19 pandemic, for instance, research has shown increased social media usage among younger adults experiencing emotional loneliness (Bonsaksen et al. 2021). Furthermore, social media usage patterns and platform preferences change during crises and disasters (Müller et al. 2023), as people turn to these platforms to share and receive information (Landwehr and Carley 2014). Several studies have explored how individuals use platforms such as Twitter (renamed to X) for disaster-related information sharing (Abdullah et al. 2017), how citizens experience information via social media during natural disasters (Yates and Partridge 2015), and how social media is utilized during emergencies (Simon et al. 2015). However, these studies do not link frequent social media use during crises to everyday habits, even though habitual use of social networking sites may shape crisis information-gathering behaviors (Hirano et al. 2014).

Sociodemographic determinants of social media use

Regarding active communication, a differential perspective allows crisis communication professionals to tailor their messages to their target groups. For example, young adults (≤ 29 years) primarily rely on online media for risk information and warnings, guiding emergency response agencies in tailoring strategies (Tomczyk et al. 2022). Since sociodemographic characteristics affect how individuals perceive, evaluate, and interpret problem contexts (Kiechle 2002), understanding these backgrounds is vital for converting social media data into decision-relevant knowledge in the context of passively gathering information by monitoring public activities (Luna and Pennock 2018).

Research demonstrates significant generational differences in social media usage (Fietkiewicz 2017), with younger individuals being more active than older adults (Chou et al. 2009) and engaging with platforms differently, experiencing varying levels of satisfaction (Jung 2018). Studies have consistently reported age-related differences in platform preferences (Penni 2015) and usage behaviors (Sultan 2021), particularly on visual platforms like Instagram (Seltzer et al. 2015). Younger generations prioritize social media for socializing, sharing interests, and showcasing talents (Wojdan et al. 2020). Additionally, visual content tends to have a stronger influence on women than men (Karatsoli and Nathanail 2020).

Research Gap and Research Questions

However, existing studies on social media user profiles predominantly focus on Twitter or analyze specific crisis- and disaster-related data (K. Wang et al. 2021; Zachlod et al. 2022; Zou et al. 2018; Kryvasheyeu et al. 2016; Takahashi et al. 2015). Previous research on motives and patterns of social media use in crisis and disaster situations often relies on small, non-representative, and/or biased samples, and use generic measures, such as overall usage frequency, without differentiating between platform (Gul et al. 2017; Chen et al. 2020). To date, few studies examine the demographic characteristics of users across different types of crises and disaster situations, and even fewer have analyzed publicly available user data (Bell et al. 2013; Correa et al. 2010). This study addresses these gaps by analyzing self-reported social media use in Germany, focusing on platform-specific sociodemographic profiles and motives for social media use in crisis and disaster situations. The results contribute to understanding the use of social media, taking into account the heterogeneity of users (Lee et al. 2016), improving strategies for processing publicly available data, and enhancing communication of health information and educational content to diverse populations (Seltzer et al. 2015). This article aims to answer the following research questions:

RQ1 How does the sociodemographic composition of German social media users vary across different platforms?

RQ2 How are social media platforms utilized during crises and disasters, and to what extent does publicly available information represent the broader population?

METHODS

The research questions were examined through statistical analysis of an online survey conducted in Germany with 500 panelists.

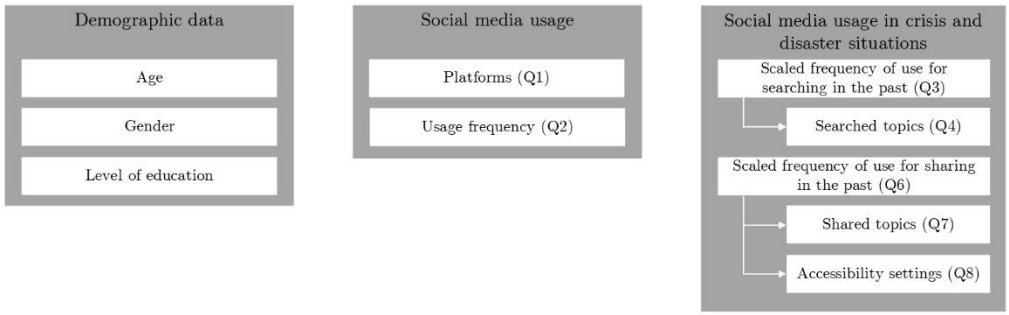

Figure 1. Question units for targeting the research questions.
Figure 1 visualizes the integrated survey questions for the analysis; the corresponding questions are referenced via the numbered Q and listed in the supplementary information.

Sample

Between 12 and 19 August 2022, 500 German internet users (49.8% female; age ≥ 18 years, M_{age} = 37.74 years, SD_{age} = ± 14.01 years) completed the questionnaire distributed by an external panel provider (mo'web). After a quality check to exclude speedsters (Thielsch and Hirschfeld 2021), the net sample consisted of 476 participants (50.6% female; M_{age} = 37.8 years). Representativeness was ensured through quota sampling based on the marginal distribution of age and gender, followed by post-stratification weighting according to Sand and Kunz (2020), which was based on the cross-distribution according to the We are Social report (We Are Social Deutschland GmbH 2021).

Instruments

Overall, the participants reported their demographic characteristics, general social media use, and use in crisis and disaster situations. The survey questions, available in the appendix, were pretested with twenty participants and ten structured interviews to ensure comprehensibility and clarity. The survey was conducted on LimeSurvey (version 5.6.11+230320) (Limesurvey: An Open Source survey tool n.d.), with rewards in monetary points within the panel system.

Statistical analysis

Statistical analysis was performed with IBM SPSS Statistics 29/28. To answer RQ1, the Mann-Whitney U test, the Welch-ANOVA/Games-Howell post-hoc analysis, and the Kruskal-Wallis test/Dunn-Bonferroni test were used. For RQ2, point-biserial correlation and Somer's d were examined. The Pearson correlation coefficient according to Cohen (1988) was used to measure effect size, with $|r| > 0.1$ weak, $|r| > 0.3$ moderate, and $|r| > 0.5$ strong correlation.

RESULTS

WhatsApp is the most used platform according to respondents, followed by YouTube, Facebook, each exceeding 60% usage, as shown in the Tables 1 and 2.

	Facebook	*LinkedIn*	*reddit*	*Telegram*	*Twitter*	*WhatsApp*	*Xing*
proportion of sample	60.53%	26.78%	22.75%	31.98%	36.82%	84.55%	20.33%
gender							
female	51.05%	67.55%	66.47%	61.45%	61.79%	49.80%	57.83%
male	48.95%	32.45%	33.53%	38.55%	38.21%	50.20%	42.17%
age							
mean	38.76	34.74	33.17	35.68	36.02	38.35	35.41
18-24	10.78%	11.78%	17.08%	11.52%	13.36%	18.35%	9.92%
25-34	35.68%	46.28%	49.10%	46.56%	43.55%	30.59%	43.77%
35-44	25.94%	30.84%	26.43%	25.82%	24.25%	21.82%	34.21%
45-54	14.66%	9.06%	5.78%	9.05%	11.47%	13.84%	10.32%
55-64	10.04%	2.04%	1.60%	5.89%	6.35%	10.66%	1.78%
65+	2.90%	0.00%	0.00%	1.16%	1.01%	4.75%	0.00%
educational level							
primary	6.35%	6.08%	4.47%	6.29%	6.58%	6.25%	4.66%
secondary	42.29%	24.16%	25.99%	31.49%	31.87%	44.88%	22.61%
tertiary	51.36%	69.75%	69.55%	62.22%	60.83%	48.33%	72.73%
correlation of usage frequency and age							
$\chi^2(5)$	46.70[a]	52.84[a]	46.11[a]	46.21[a]	42.02[a]	5.57	37.01[a]
φ/*Cramer's V*	0.31[a]	0.33[a]	0.31[a]	0.31[a]	0.30[a]	0.11	0.28[a]

[a] significant at the $p < .001$ level.

Table 1. Sociodemographic characteristics and relative frequencies of participants who stated that they use different social media platforms at least weekly (i.e., WhatsApp, Twitter, etc.) (complete case dataset; N = 476). This table corresponds to Table 2, which presents data on image-based platforms.

Sociodemographic variables of social media platform users (RQ1)

The sociodemographic composition of German social media users varies significantly across different platforms. Figure 2 indicates that platforms such as Xing, LinkedIn, Pinterest, Telegram, reddit, and Twitter are predominantly used by those aged 25-44. In contrast, more than 65% of respondents aged 25 to 54 reported frequent Facebook use, while over 80% across all age groups used WhatsApp. Tables 1 and 2 detail the demographic characteristics of frequent users across selected platforms.

Notably, social media use declines significantly after the age of 40 (U = 21628.50, $p \leq 0.001$). Younger users favor image-based platforms such as Pinterest and YouTube (Spearman's $\rho \geq .182$, $p \leq 0.001$), while Instagram, Snapchat and TikTok are unpopular among older users (Spearman's ρ = .474 (Instagram), .472 (Snapchat), .399 (TikTok), $p \leq 0.001$). Snapchat has the youngest user base (29.37 years, SD_{age} = ± 8.56 years), whereas Facebook has the oldest (37.85 years, SD_{age} = ± 11.85 years). Frequent use of social media is generally associated with younger users, except for WhatsApp, where usage is consistent across age groups; see Tables 1 and 2.

Age has a notable influence on platform choice, with small effects observed for YouTube, Pinterest, Twitter, and Xing and medium effects for reddit, Telegram, Facebook, LinkedIn, and TikTok. The most significant effects of age on platform use are seen with Snapchat and Instagram; see Table 2. Platform choice is significantly influenced by age, with younger users favoring Snapchat over older platforms such as Facebook, LinkedIn, Twitter, Telegram, Xing, WhatsApp, and YouTube. In contrast, WhatsApp and Facebook have older user bases than Instagram and TikTok, although these differences have low to medium effect sizes (r = [.085; .37]).

Finally, 48.5% of the respondents frequently used more than four platforms. A strong positive correlation exists between the frequent use of platforms like Instagram, Pinterest, Snapchat, TikTok, and YouTube and the total number of social media platforms frequently used, with correlations ranging from r = .559 (YouTube) to .725 (TikTok), $p \leq 0.001$.

	Instagram	*Pinterest*	*Snapchat*	*TikTok*	*YouTube*	*Other*	*German Internet users*[b]
proportion of sample	60.68%	31.52%	37.81%	44.00%	64.59%	22.51%	-
gender							
female	51.07%	49.66%	55.13%	53.19%	54.65%	61.80%	49%
male	48.93%	50.34%	44.87%	46.81%	45.35%	38.20%	51%
age							
mean	33.70	35.50	30.35	33.19	36.86	33.62	-
18-24	25.13%	15.70%	34.25%	26.32%	18.87%	17.64%	21,93%
25-34	36.84%	43.61%	40.21%	38.59%	33.37%	46.80%	29,91%
35-44	22.15%	25.58%	19.17%	21.91%	24.27%	24.89%	20,15%
45-54	10.68%	6.65%	5.20%	9.36%	12.64%	5.88%	14,27%
55-64	5.00%	6.48%	1.18%	1.84%	7.93%	3.63%	9,23%
65+	0.21%	1.99%	0.00%	1.98%	2.91%	1.16%	4,51%
educational level							
primary	6.15%	4.04%	5.06%	6.38%	5.41%	8.54%	-
secondary	39.84%	36.53%	35.70%	38.53%	42.10%	29.84%	
tertiary	54.01%	58.59%	59.24%	55.09%	52.08%	61.62%	-
correlation of usage frequency and age							
$X^2(5)$	99.52[a]	34.59[a]	110.55[a]	67.19[a]	24.78[a]	34.18[a]	-
φ/Cramer's V	0.46[a]	0.27[a]	0.48[a]	0.38[a]	0.23[a]	0.27[a]	-

[a] significant at the $p < .001$ level.
[b] according to [34]

Table 2. Sociodemographic characteristics and relative frequencies of participants who stated that they use various primarily image-based social media platforms (i.e., Instagram, Snapchat, etc.) at least weekly (complete case dataset; N = 476).

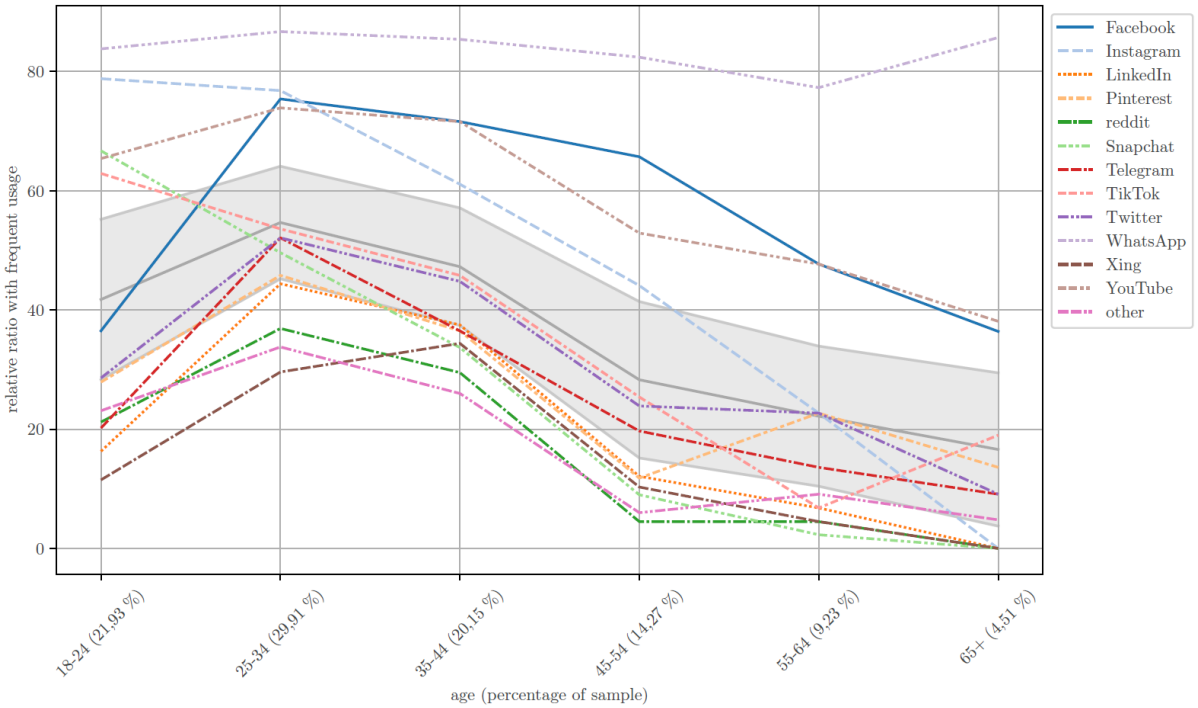

Figure 2. The use of social media platforms to share information publicly by age.
Figure 2 shows the relative proportions of frequent social media users per age group, broken down by platform. Age was divided into six classes. Frequent use means using the platform at least several times a week. The mean and 95% confidence interval are shown by the gray line and light gray area, respectively. Single-choice matrix question: Q1

Social media usage in crisis and disaster situations (RQ2)

During crises and disasters, social media is primarily used for both information seeking and public sharing, but the extent of this usage varies among different demographic groups. While 65.1% occasionally use Facebook, Twitter or Instagram for crisis information, 38.1% do so frequently. If affected by a crisis today, 75.4% would likely turn to social media. Public sharing is less common: 57.4% share information occasionally, but only 30.2% do so frequently. Looking forward, 71.9% estimated a 50-50 chance of using social media for public sharing in future crises, although only 16.4% considered it very likely. Weather conditions/warnings, family and friends' status, and road/traffic conditions are the most frequently shared topics. However, information is more likely to be searched than shared - 28.7% seek eyewitness content, but only 16.8% share it (see Figure 3).

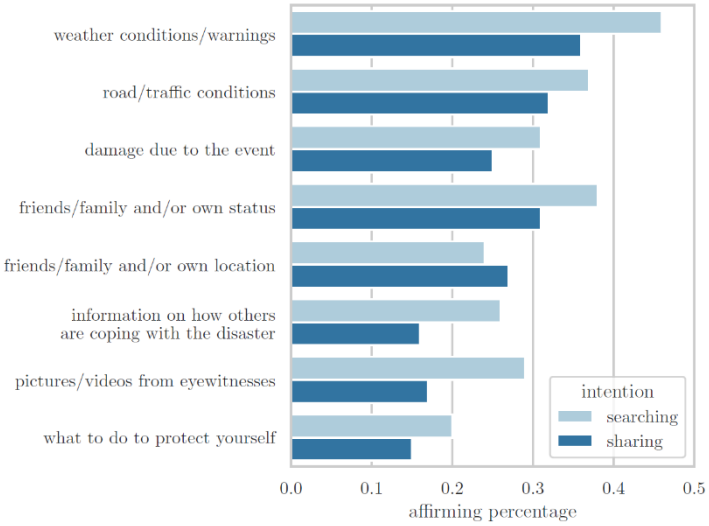

Figure 3. Shared and searched topics in social media during crisis and disaster situations (complete case dataset; N = 475)
Figure 3 visualizes the comparison of the relative proportions for sharing and searching for specific topics in social media during crises and disasters. Multiple-choice radio button-questions: Q4 and Q7

Only a small percentage of respondents (35.3%) share crisis-related content publicly - defined as posts visible to all or in public groups. Weather conditions and warnings (18.3% of all respondents), road/traffic conditions (17.9%), and damage caused by the event (15.3%) are the most common shared topics. Notably, only 13.0% share their status, and 10.7% share their location publicly. Figure 4 reveals that those who publicly share information during crises differ significantly from the broader population, with women and individuals aged 45-54 being particularly underrepresented. Additionally, regular social media users are more likely to share during crises, indicating that habitual use influences behavior during emergencies.

Overall, while social media is a vital tool for information during crises, public sharing remains selective and may not fully represent the broader population.

DISCUSSION

This study examines social media use in everyday life and during crises and disasters among a representative German sample of Internet users. The findings indicate that social media usage skews toward younger age groups, especially on image-based platforms such as Instagram. Additionally, the social media content shared reflects only a small segment of the population, with women and individuals over 45 being notably underrepresented. Older users also expressed greater data privacy concerns, which can reduce their likelihood of sharing information (Baruh et al. 2017).

In general, sharing behavior is influenced by motives like a need for social belonging and connectedness, whereas information searching is driven by a need for knowledge acquisition or reducing uncertainty (Ham et al. 2018). Thus, persons with larger social networks might be more likely to share information, which could exacerbate the vulnerability of people without strong social support during crises and disasters that do not share on social media and might be overlooked. The study also reveals that Twitter, a key platform for crisis data analysis in the literature, is used publicly by only a small segment of the sample, primarily individuals aged 23 to 48 years (M_{age} = 35.49 years, SD_{age} = ± 12.93 years). This highlights biases in social media data for crisis management, as

certain demographics are overrepresented. Some vulnerable groups (e.g., younger and older people) are underrepresented.

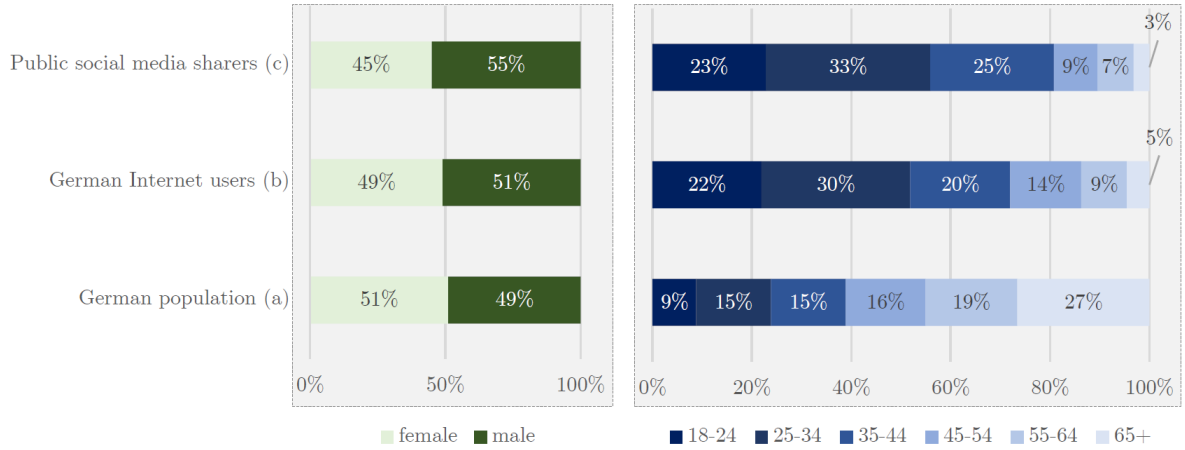

Figure 4. Comparison of sociodemographic variables between the German population, German internet users, and those sharing on social media publicly according to the survey conducted.
[a] Data on the population as of December 31, 2021, transmitted by Destatis in December 2022.
[b] According to the We are Social report (We Are Social Deutschland GmbH 2021).
[c] According to the survey conducted.

Consistent with previous research, platforms show distinct demographic and social characteristics (Bell e al. 2013; Blank and Lutz 2017; Correa et al. 2010). Age significantly influences platform use, with this study finding a strong correlation between younger users and Instagram, contrary to earlier British findings (Blank and Lutz 2017). Reuter, Kaufhold, Spielhofer, et al. similarly reported a negative correlation between age and Facebook use in their study 2017. While their study focused on Twitter, Facebook, and other platforms, the present study provides additional insights into image-based platforms. A comparison of the two studies reveals an increase in social media use from 2017 to 2022, both in daily life and crises. According to Reuter's study, 63% of respondents used Facebook, 16% used Twitter, and 57% used other platforms weekly. In crisis situations, 44% used social media, but only 5% shared content, whereas 72% shared information at least occasionally. This study extends their work by analyzing sharing settings, revealing that only 35.29% shared content publicly.

Both studies confirm that weather, warnings, and road/traffic conditions are the most common topics shared. While Reuter et al. focused on predefined content, the present study distinguished between past and future social media use during crises, considering different visibility settings. As with prior research (Blank and Lutz 2017; Al-Saggaf and Simmons 2015), findings confirm that no single platform represents the German population, and platform use varies by demographics, intent, and purpose.

In the future, to complement survey-based inquiry of user-reported preferences and behaviors, integrating social media metadata into the analysis and in emergency response efforts could enhance targeting and channel selection for specific audiences (Seltzer et al. 2015). This study's overview can assist crisis communication officials in choosing platforms that effectively reach their intended audiences based on reported preferences. While Twitter allows metadata extraction, not all platforms provide this capability, necessitating a mixed-methods approach to understand user demographics and cross-platform correlations.

Given evolving platform popularity and usage patterns during different crises and disasters (e. g., preparation-focused tweets for hurricanes vs. real-time/recovery tweets for tornadoes and floods) (Müller et al. 2023; Niles et al. 2019), event-specific data collection is essential for accuracy and relevance. Despite sample and timing differences, this study and prior research (Reuter and Kaufhold 2017; Reuter, Kaufhold, Spielhofer, et al. 2017; Blank and Lutz 2017; Bell et al. 2013; Correa et al. 2010; Tommasel et al. 2021; Seltzer et al. 2015; Tomczyk et al. 2022), stress the importance to further inspect the sociodemographic profiles of social media users across platforms and different crises and disasters to effectively tailor crisis communication and harness the potential for digital crisis management.

To the authors' knowledge, this study is the first detailed analysis of German social media usage, focusing on sociodemographic user groups. It aims to aid tailored risk communication (e.g., targeting youth on image- based platforms) and improve bias correction through approaches like Robust Post-stratification, as developed by Giorgi

et al. (2022). Furthermore, the research supports disaster management decision-makers by highlighting underrepresented groups in social media data and guiding communication efforts during crises. However, limitations exist, including potential biases arising from the panel provider's recruitment process and platform selection algorithms. Consequently, the sample restricted to online users, may not fully reflect the general population, despite post-stratification weighting (We Are Social Deutschland GmbH 2021). In addition, the exclusive focus on Germany limits the generalizability of the findings to other cultural and infrastructural contexts. Other potential limitations include sampling frame shortcomings, non-response effects, and measurement errors, which may have influenced the results (Armoogum et al. 2018). As the study is based on self-reported data, biases such as memory recall and social desirability cannot be fully ruled out. To help mitigate these effects, responses were collected anonymously to encourage honest reporting and reduce response bias.

Moreover, as data were collected form a single country, cross-national comparisons, as seen in studies such as Reuter, Kaufhold, Schmid, et al. (2019), remain limited. Within Germany, the sample size of 476 participants may not be sufficient to capture regional differences in social media use. However, due to limited statistical power at the regional level, additional regional differentiation would not have provided meaningful insights and was therefore not pursued. To more accurately understand how well social media data reflect the general population, future research should consider both the inclusion of "lurkers" — users who observe content without engaging — and a larger, more diverse sample to improve representativeness and the ability to conduct meaningful subgroup analyses.

And while the study explored correlations between sharing behavior and specific public settings, as well as published topics, these were not examined in a contingent manner. Future studies should investigate specific forms of communication by combining topics with visibility settings for more detailed insights.

Furthermore, the study did not differentiate between the stages of the disaster management cycle - preparedness, response, and recovery - despite likely variations in social media usage across these phases (Hirano et al. 2014; Müller et al. 2023; Tomczyk et al. 2022; Yates and Partridge 2015). Investigating these differences could provide a more nuanced understanding of participation by sociodemographic groups. Additionally, the research could be enriched by exploring additional variables, such as geographic differences—examining whether communities in vulnerable environments exhibit distinct social media usage patterns compared to those in more stable regions or income-based usage cultures. While these aspects fall beyond the scope of the current study, they offer fruitful avenues for future research and discussion, enhancing the understanding of social media dynamics in crisis management. Finally, using a more comprehensive set of additional data, such as para-data, including actual content shared during events, would enhance understanding. Detailed multimethod comparisons and analyses will be necessary for future studies to deepen our understanding of these dynamics.

CONCLUSION

User-generated data on social media can be valuable for early detection of unusual events through systematic big data analysis, which identifies deviations from the norm (Thom et al. 2016). However, findings suggest that social media data in crisis and disaster situations are primarily useful for micro-level insights, offering information without any claim to representativeness. On a macro level, such as understanding the behavior of the general population, social media can only serve as a supplementary source, particularly for detecting trends in events. While social media data can enhance situational awareness, it is important to recognize its limitations when attempting to derive information about larger populations. To accurately interpret macroscopic trends, it is essential to account for the demographic composition of the data or apply corrections, such as demographic inference and bias correction (Z. Wang, Hale, et al. 2019).

ACKNOWLEDGMENTS

This research project was funded by the Federal Office of Civil Protection and Disaster Assistance within the framework of the announcement "Analysis of Social Media Regarding the Psychosocial Needs of the Population in Crises and Disasters" (Number 0013). Specifically, it was part of the project "Systematic Analysis of Social Media Communication for the Creation of Psychosocial Situation Reports in Crises and Disasters (#sosmap)." We sincerely thank the Federal Office for its financial and conceptual support, which has made this work possible.

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