Sticking with Landlines? Citizens' Use and Perception of Social Media in Emergencies and Expectations Towards Emergency Services in Germany

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Abstract. Crisis informatics has examined the use, potentials and weaknesses of social media in emergencies across different events (e.g., man-made, natural or hybrid), countries and heterogeneous participants (e.g., citizens or emergency services) for almost two decades. While most research analyzes specific cases, few studies have focused on citizens' perceptions of different social media platforms in emergencies using a representative sample. Basing our questionnaire on a workshop with police officers, we present the results of a representative study on citizens' perception of social media in emergencies that we conducted in Germany. Our study suggests that when it comes to emergencies, socio-demographic differences are largely insignificant and no clear preferences for emergency services' social media strategies exist. Due to the widespread searching behavior on some platforms, emergency services can reach a wide audience by turning to certain channels but should account for groups with distinct preferences.

Keywords: Social Media, Emergency Management, Police Departments, Use and Expectations, Quantitative Research

1 Introduction

Social media interactions have become a relevant part of responding to crises including natural disasters, human-made attacks and political uprisings. They are used by volunteers and professional emergency services (ES) to coordinate action, express solidarity and exchange information [1]. However, social media use by state organizations is also controversial. Criticism concerns unequal access to digital infrastructure and resulting biases in resource distribution [2]. Indeed, we have a limited understanding of who does and does not use social media in emergencies, which platforms are used and with what intentions. In addition, we do not yet know what people's expectations are regarding ES' use of social media generally and in crises. The reactions of ES to social media and their use of it also varies greatly across countries, departments, social media platforms and different types of ES, employing different communication styles [3]. Although some works try to formulate social media guidelines of practical use for ES and citizens [4] or to generalize strategic

communication in social media [5], there is still uncertainty among ES on how to best use social media in different cases and for different audiences, leading to the following research questions:

- **RQ1**: Which patterns of social media use, perceptions and expectations are prevalent in the German population regarding their use in emergency situations? Do different socio-demographic groups show different use and expectation patterns?
- **RQ2**: Which implications and guidelines, also considering the change of social media use over time, can be deduced for the design of social media engagement strategies for effective analysis of data and communications for emergency services?

To answer these questions, we conducted a workshop with participants (N=15) from a German central federal police agency to explore which aspects are relevant to them. From this we developed a questionnaire that in addition also asked questions similar to some we had previously asked in smaller samples in 2015 and 2016 [6, 7]. We then conducted a representative national German survey (N = 1,219), asking about social media behavior, use and evaluation of different platforms, shared content, advantages and disadvantages of its use in emergencies, expectations towards ES' social media behavior and socio-demographic data (age, gender, education, federal state residency, urbanization of residence). In this paper, we first outline current research and research gaps (section 2). We then portray our data gathering and insights through workshop discussions (section 3.1) and describe the survey and used methods of analysis (section 3.2). We then analyse the survey, additionally comparing it to results from 2015 and 2016 (section 3.3). Lastly, we discuss our findings of both approaches and draw conclusions for ES' social media use in emergencies (section 4).

2   Literature Review

Crisis informatics examines the use of information and communication technologies (ICT) in crises, often focusing on social media [1, 8]. With few exceptions [9, 10], insights into ES' activities are fragmented and limited to specific locations [11] and specific crisis events such as earthquakes, hurricanes, riots, shootings or terrorist attacks [3, 12, 13]. Indeed, more progress has been made to understand and conceptualize the role of citizens, such as citizen-to-citizen and citizen-to-authority communication [14], and the public, which uses social media for self-coordination and collaborative ICT in crises, as opposed to the roles of state authorities, both in the real and virtual realm [1]. Yet how the general population views the use of social media in crisis situations, its use by emergency managers and reasons for not engaging with modern technology in crises [15] remain understudied.

2.1   Barriers and Potentials of Social Media Use and Communication

Research identifies different strategies and tactics for social media use by emergency managers [16, 17] such as information dissemination, data monitoring/analysis and conversations/coordinated action. However, analyses of social media engagement more broadly find that ES are using new tools in a way that is very similar to traditional media: mainly broadcasting information, with little back-and-forth engagement and building on pre-existing communication styles [18]. Considering the relevance of informal behavior and improvisation [19], it is unclear how the potential

informality, speed and transparency of social media will influence the perception of ES' work and efficiency. In this vein, [20] identifies risks that are associated with the new decentralized communication styles of agencies on social media, among them the risk of missing important information as well as the risk of damaging one's reputation online because of its use by untrained officers.

Despite a lack of skills and tailored tools for analyzing social media data, ES across Europe appear to see a need to get active on social media [21]. A survey with ES staff (N=761) outlines ES' intention to significantly increase social media use for sharing emergency-related information, establishing bidirectional communication and improving situational awareness based on situation updates, multimedia files and public mood [15]. While the previous survey largely reflected fire departments' points of view, the aims of police departments include avoiding other actors' filling that space, framing the online conversation and preventing users from taking unguided policing actions (e.g., publishing missing person reports), reaching a wide audience, nurturing trust and understanding online deviance [22, 23]. Instructive is an analysis of public information officers (PIOs), the public relations component of the US National Incident Management System, which finds that PIOs' roles are changing considerably [24]: Most PIOs use social media to ease their work by directly communicating with affected populations and directing them to online help resources. In this way, they are empowered through social media. However, PIOs also lose control over information because private individuals are taking part in reporting. This has also negative consequences for their relationship with traditional media, which has been sized down and relies more on private sources as well as "citizen journalism" [25]. Social media thus offer more independence from traditional media and control over delivering messages, while at the same time ES lose control over information to citizens who publish information on their matters online. Insights into citizens' attitudes and behavioral traits are thus important for refining social media communication strategies [26].

2.2 Research gap

While such mainly qualitative works have made great contributions to understanding the varied ways in which social media are used in different crises [1], they often focus on a single platform, especially Twitter. Research that provides insights into general attitudes and usage patterns across various platforms, their change over time and how they are influenced by socio-demographic characteristics, is still limited. Currently only a few works deal with some of these aspects [27, 28]. There are some quantitative surveys, however, they are not based on representative samples [15]. A representative survey on social media use in Germany was conducted in the EmerGent [29] project but it is based on one point of enquiry, not allowing a trend analysis and missing important details about social media platforms and citizens' preferences [6]. To this end, our study is motivated by a workshop with practitioners and contributes generalizable findings from a representative survey of the German population with 1,219 participants. It covers all relevant social media platforms, privacy and security attitudes, and socio-demographic data to test assumptions about user groups and usage patterns on specific platforms. Apart from enabling generalizations, such research sheds light on those people who do not turn to social media in crises and who are often overlooked by studies of use patterns.

3 Empirical Study: Representative Survey of the German Population

3.1 Survey Design

On February 13, 2019 we conducted a workshop at a German central federal police agency which focused on the use of social media in emergencies, comprised police officers (N=15) and lasted 1,5 hours. At the start we introduced the procedure for conducting a representative survey and the aim of this workshop to generate a questionnaire with a short presentation. Examples of closed and open-ended questions were introduced. After the presentation, the workshop was based on three phases: In the **reflection phase** (10 minutes), based on their individual creativity, participants were instructed to note their ideas or questions on moderation tasks. In the **presentation phase** (20 minutes), participants presented their ideas and we subsequently arranged them thematically on a flip chart. The participants were encouraged to write down further ideas during the presentation phase. Finally, in the **discussion phase** (60 minutes), based on the group's collective creativity, participants discussed existing moderation cards, generated new ones and reflected upon their thematic grouping. Through open coding the three dimensions of *use*, *perception* and *expectation* emerged from the data, which were subsequently also reflected in the survey design.

- **Citizen's *Use* of Social Media in Everyday Life and Emergencies.** Police officers were interested in both how citizens use social media in emergencies and which platforms are used, as this could impact the depth and breadth of their analysis and communication strategies. Thus, we designed three questions to address use of media in emergencies (Q1), evaluation of information sources (Q2), as well as types of content shared in crises (Q3).
- ***Perceived* Benefits and Barriers of Social Media in Emergencies.** Officers were interested in the perceived benefits (e.g., easy, fast and detailed emergency information) of and barriers (e.g., data privacy, fake news and rumors) to using social media. A more detailed picture on motivations and fears would help them to feasibly adapt their communication strategy. Thus, we designed two questions to ask for benefits of (Q4) and barriers to (Q5) social media use in emergencies.
- **Citizens' *Expectations* Towards the Use of Social Media by Emergency Services.** Lastly, to further improve their analysis and communication strategies, police officers were interested in citizens' expectations towards social media use by ES, especially in terms of their monitoring behavior, the desired number of social media channels and language style. All interests are reflected in our last survey question (Q6).

In an **integration phase** the workshop results were combined with a published questionnaire [6, 7], whereof some existing questions were extended by new items (Q1, Q5, Q6) for additional insights (in conjunction with Q2 which was added as a new question) and some were re-integrated (Q3, Q4) to allow a temporal comparison of two datasets on how use, perceptions and expectations of citizens changed. While the previously published questionnaires were developed in the EmerGent [29] project whose consortium comprises fire departments and rescue services, the workshop with police officers allowed us to enrich the questionnaire with their perspective. Then, the first draft of a questionnaire was sent to the central federal police agency for two rounds of feedback.

3.2 Data Collection and Analysis

The finalized questionnaire was self-hosted through LimeSurvey, then sent to the commercial and ISO-certified panel provider GapFish in May 2019. The **survey** covered the dimensions of use, perception and expectation towards social media in emergencies, which was translated into six closed questions (see Ch. 3.1). Definitions were given before relevant items. Emergencies were defined as unforeseeable events (such as epidemics, earthquakes, fires, big accidents or floods) that impact several people and require immediate action to minimize negative consequences. Social media were defined along with the German dictionary as social networks through which users can connect with each other, communicate, have exchanges and generate content. For all generated items we followed guidelines for valid item design, including phrasing positively, clearly, short, concisely and understandably, limited to one statement per item and avoiding leading questions [30]. Though items should be related to the present [31] due to the infrequent nature of emergencies, we resorted to previous experiences, so potential effects of remembering should be taken into account in interpreting the results. Questions are either on a 5-point interval Likert scale or categorical. With regard to **participants**, the sample was adapted to represent the German population in age, gender, geography, urbanization and education [32]. These criteria ensure that we can infer the German usage patterns with minimal biases, avoiding the selection biases inherent in surveys, depending on where participants are recruited, typically favoring groups with more time.

For our **data analysis** we eliminated incomplete answers, resulting in N=1,219 reliable answers. Due to the sample size an approximation of normal distribution of the data can be assumed [33]. Depending on the scale of the dependent and independent variables, we used Chi Square tests, Person's Phi, Cramer's V, Kendall's tau-b, ANOVA and Pearson's r for our analysis. For the categorical variable "gender" we applied the t-test for independent samples, paying attention to the assumption of homogeneity of variance through a Levene test. We judge effect sizes of Pearson's r of $|0.10|$ as a small, of $|0.30|$ as a moderate, and of $|0.50|$ as a strong correlation [34]. For the statistical analysis we use IBM SPSS Statistics 26. For each analysis we chose the test that is most robust and allows for the most fine-grained scale. An exception is made when testing for non-linear correlations, for which data are recoded into categories to test group effects, such as binary categories for those under 25, over 45 and those over 60-years old. In addition, we recode the categorical variables that capture the use types of various social media platforms in emergencies into ordinal variables to represent social media engagement. This we derived from answers to whether and how people used social media in emergencies (*not used, just to search, just to share, to search and share*) and interpret it such that searching is a less intense engagement than sharing, while doing both signifies most intense engagement. To perform tests of this assumption and group effects, we also code social media use as a bivariate variable that delineates any type of use of a platform ("1") from no use of that platform ("0"), and various combined user or non-user groups. We test city size and age for collinearity and find no multicollinearity (VIF = 1).

We furthermore compare the studies of 2015 (N=1,034), 2016 (N=1,069) and 2019 to see if and how social media behavior and expectations have changed over recent time. The comparison data come from a 2015 snowball survey conducted in several countries and a 2016 representative survey conducted in Germany [6, 7]. Since social media is a fast-developing field, these three years of difference between surveys can yield interesting insights. However, in part items varied slightly between these surveys. Thus, newer and more fine-grained questions on the use of social media

platforms of the most recent study were merged to capture the same dimensions found in the other studies concerning any use of social media in emergencies. In addition, what respondents think about when reporting on "social media" might also have changed over time. While we explicitly include WhatsApp as a social media platform in this survey, in 2015 and 2016 this platform may not have appeared to all respondents as such [6, 7]. Thus, we exclude WhatsApp in the survey comparison.

3.3   Results

Widespread Use but Limited Helpfulness of Social Media Platforms (Q1 and Q2). Almost two thirds of respondents (63%) seek out information by reading social media messages in emergencies (see Fig. 1). About half of all respondents made posts on social media sites, equally aiming to obtain information, to share information, or both. Two thirds of respondents used their smartphone in an emergency, 13% used it only to broadcast, 27% only to share information and another 27% to both share and search. When it comes to specific platforms, people have mainly used WhatsApp, which is also the platform through which most people share information (55%). In its use, WhatsApp is followed by Facebook, YouTube and Instagram. Twitter, Snapchat and Periscope were used by less than 25%. YouTube is particularly popular for searching information. On all platforms, it is uncommon to only post information and to not use it also retrieve information. In Germany, WhatsApp and Facebook are the only platforms on which widespread sharing behavior is taking place in emergencies. 26% use none of the social media platforms we asked about, 24% use no other platforms apart from Facebook and WhatsApp, 10% use exclusively WhatsApp, and 73% use a combination of social media that includes Facebook or WhatsApp.

Engagement on all platforms correlates significantly (p<0.001) with all other platforms. Kendall's tau-b for ordinal variables shows effect sizes of between 0.33 and 0.74. However, the correlation between WhatsApp and other social media platforms is the smallest (ranging between 0.14 (Periscope) and 0.4 (Facebook)), followed by Facebook (0.33 to 0.44). In contrast, use of less common social media platforms (YouTube, Twitter, Instagram, Periscope and Snapchat) correlates strongly with effect sizes between 0.5 to 0.74. This indicates that while Facebook and WhatsApp are more frequently used independently from other platforms, high engagement on the more peripheral social media channels is strongly linked to engagement on more platforms.
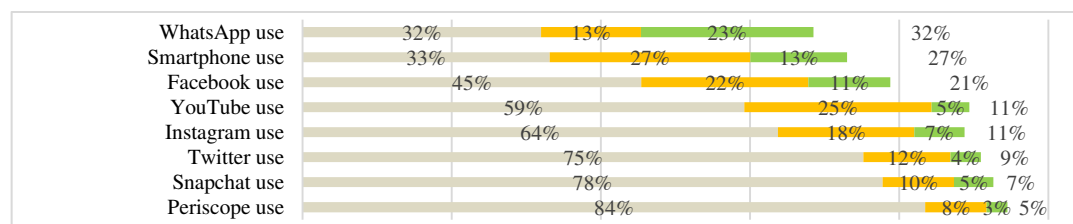

Figure 1. Q1: Please indicate the extent to which you have used the following social media in an emergency situation affecting you (not used, to search information, to share information, to search and share).

Analyzing the effect of city size on social media engagement (see Ch. 3.2) on the different platforms, we find no significant connection between the two variables. To control for non-linear effects in different age groups, we analyze groups of 1) under 25-year-olds, 2) over 45-year-olds

and 3) over 60-year-olds separately as binary variables with a Mann-Whitney-U-test for two independent samples and ordinal dependent variables. Surprisingly, the results show that when it comes to activity in emergencies, there are no significant differences related to age groups. To ensure that this finding does not result from the recoding of categorical social media use to ordinal social media engagement, we again recode social media use as a binary variable for any use on a particular platform in an emergency. We then perform logistic regressions over the binary variables of social media platform use and the continuous variable age and find no significant influence.

People's strong use of WhatsApp is in line with respondents' opinions on the usefulness of information sources (see Fig. 2), where contact with professional ES or personal contacts such as family and friends are regarded as the most helpful sources (with both deemed quite or very useful by 70% of respondents). Social media get the same positive evaluation only from 50%.
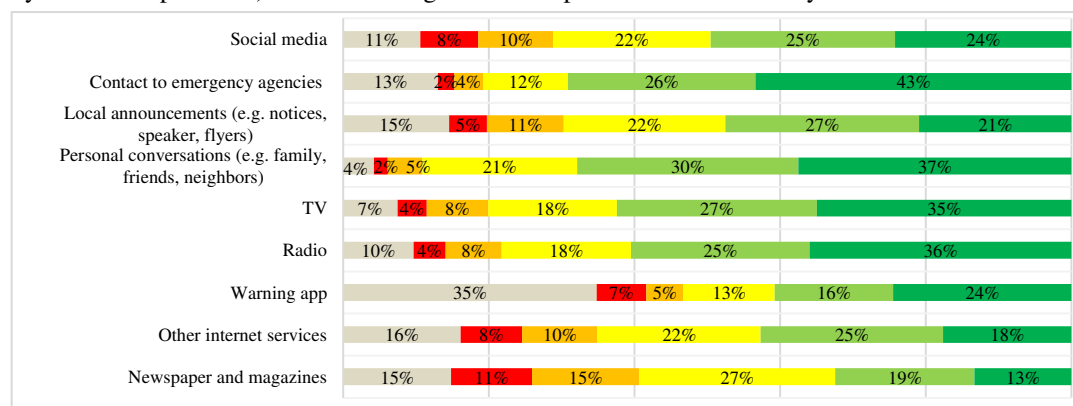

Figure 2. Q2: Please indicate how helpful you perceived the following sources of information in an emergency situation affecting you (not used; not, not very, moderately, quite, very helpful).

Looking only at those who did use emergency service contact or social media respectively in an emergency, positive evaluation lies even at 80% with ES and 55% with social media. For those 64% that had been in an emergency situation before (N=827) to judge the helpfulness of sources, there are moderate to strong positive correlations between all sources (for all $p < 0.001$, see Table 1). We can distinguish between different groups: First, social media users do not necessarily support all things digital in emergencies: Despite a strong connection with other internet sources, warning apps lag behind in this group. They are moderate supporters of TV, radio and local announcements. However, they appreciate newspapers, personal conversations and telephone conversations somewhat less. This indicates that social media use is indeed not equivalent to using technology for different types of technologically enhanced exchanges with ES, friends or family. In contrast, those who appreciate contact with ES appear to also favor more direct forms of exchange through personal conversations and authoritative information through local announcements and warning apps. A third group whose members prefer more traditional sources such as newspapers, TV and radio can be identified.

Table 1. Correlation of Helpfulness of Information Sources, $p < 0.001$

	Social media	Contact to emergency	Local announce-	Personal conver-	TV	Radio	Warning app	Other internet	Newspaper

Pearson's r	(SM)	services (ES)	ments	sations				services	
SM	1	0,206	**0,316**	**0,188**	0,296	**0,309**	0,27	**0,494**	**0,19**
Contact to ES	0,206	1	**0,447**	**0,318**	0,26	0,297	**0,393**	0,225	**0,156**
Newspaper	**0,190**	**0,156**	0,281	0,2	**0,465**	**0,424**	**0,14**	0,237	1

Only for the evaluation of social media we find no significant influence of gender (p= 0.097). Despite this, females evaluate all other sources more positively. Though gender is significant here, effect sized are very small to negligible (e.g., helpfulness of contact with ES: Cramer's V= 0.107, p= 0.003). Gender is thus not relevant for the perception of helpfulness of social media in emergencies and its influence on the evaluation of other sources is negligible.

Increase in Sharing of Content (Q1 and Q3). Comparing those who are concerned with their privacy and data safety with those less concerned in regard to their sharing behavior on social media in emergencies, using logistic regression we find no significant differences in their sharing of types of information. Looking at the data of 2016 and 2019 (see Fig. 3), there is a noticeable decrease of citizens who never shared information in emergencies (56% to 37%). Especially the number of citizens who searched and shared information increased (19% to 36%), which could be affected by the recent increase of man-made disasters, such as the 2016 Munich Shooting and the 2016 Berlin truck attack on a Christmas market, that were extensively covered across German media.
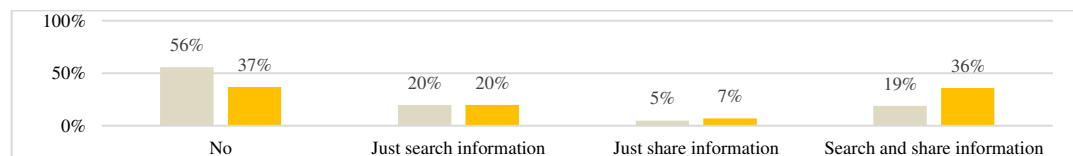
Figure 3. Q1: Please indicate the extent to which you have used social media in an emergency situation affecting you (2016 vs. 2019) (For 2019: all platforms merged except WhatsApp).

Participants shared on average two types of content, 85% having shared between one and three types. About one in four people shared photos, videos or testimonies as eyewitnesses (see Fig. 4). Among those who became active as eyewitnesses, a significant but slight negative correlation with age appears ($\tau b = -0.15$, $p < 0.001$), but none with any particular social media platform or city size. Of those 68% that had been in an emergency, weather information and road/traffic warnings were most often shared, followed by measures taken for one's safety, one's location, feelings and emotions about the event, while 18% did not share any information. Gender plays a significant but only small role: Women are more likely to share feeling on social media ($X(2) = 24.907$, $p < 0.001$; $\phi = 0.174$). In contrast, men were more likely to share their location ($X(2) = 10.36$, $p = 0.006$; $\phi = 0.112$), videos ($X(2) = 16.23$, $p < 0.001$; $\phi = 0.14$) and witness accounts ($X(2) = 6.928$, $p < 0.001$; $\phi = 0.088$). Similarly small significant differences can be found in relation to age: People under the age of 25 are more likely to share feelings on social media ($X(1) = 31.097$, $p < 0.001$; $\phi = 0.194$) as well as videos ($X(1) = 4.612$, $p = 0.032$; $\phi = 0.075$). In addition, they are less likely to not have shared any type of content ($X(2) = 10.012$, $p = 0.002$; $\phi = -0.11$). In contrast, those over 45 years old were less likely to share most types of content or any content at all ($X(2) = 13.222$, $p < 0.001$; $\phi = 0.127$).
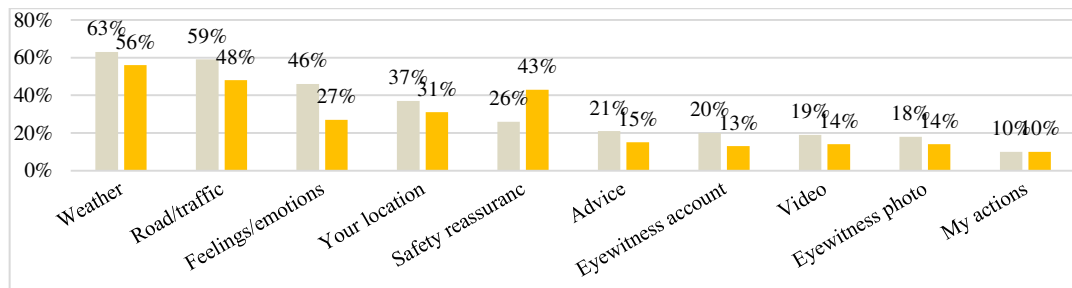
Figure 4. Q3: Please indicate the types of information you have shared in social media in emergency situations affecting you (2016 vs. 2019).

Despite the overall increase of shared information from 2016 to 2019, the amount of different information types decreased except for safety reassurance (26% to 43%) making it the third most shared information type after weather (56%) and road/traffic conditions (48%). The increase for safety reassurance may be linked to the use of Facebook Safety Check, which appears to have become more widely used during the abovementioned events. Furthermore, there is a significant drop of citizens sharing feelings or emotional content in social media (46% vs. 27%). Further research should investigate this phenomenon, which may be caused by a habituation effect due to the increasing number of large-scale emergencies that are heavily covered by media.

Preference for Emergency Hotline Despite Speed of Social Media (Q4, Q5). Regarding advantages of social media in contrast to traditional sources, respondents particularly value the speed with which information is available (61%) and its easy accessibility (60%). On the other hand, less than 30% regard social media as more accurate, trustworthy and reliable than traditional media. A significant majority (71%) states that it is better to call an emergency number. Many are also concerned with rumors (64%) und false news (56%), as well as an excess of information (53%). Half of the respondents also regard data security and privacy as a disadvantage (50%) as well as the possibility that social media might be inaccessible in an emergency (54%). While social media is granted with providing accessible and speedy information, only a minority of between 8% and 20% disagrees with the limitations of and concerns about social media, painting a picture of social media users who appear unenthusiastic about relying on social media in emergencies.

Analyzing judgements about social media advantages and disadvantages shows that all advantages correlate significantly and moderately to strongly (p = 0.001, 0.32 < r < 0.83) among themselves, as do disadvantages (p = 0.001, 0.27 < r < 0.83). Especially accuracy, trustworthiness and reliability occur together (r = 0.8-0.83), while trustworthiness and speed of availability show the smallest correlation (r = 0.27). Regarding the disadvantages, people who prefer to call an emergency hotline are also highly concerned with rumors on social media (r = 0.83), and security and privacy concerns occur especially in conjunction with concerns over false news (r = 0.71). The data also shows that respondents differentiate between rumors and fake news (r = 0.57). How can the attitude towards calling emergency numbers be explained? Again, there is no correlation between age or gender and a favorable opinion of emergency hotlines. Nor do we find significant correlations between people's favoring of phone calls and their expectations towards ES' social

media use, such as their capacity to monitor the platforms or their expected response time. A t-test for independent samples, comparing those with and without emergency experience, shows no significant differences. Thus, emergency experience has no effect on social media perceptions.
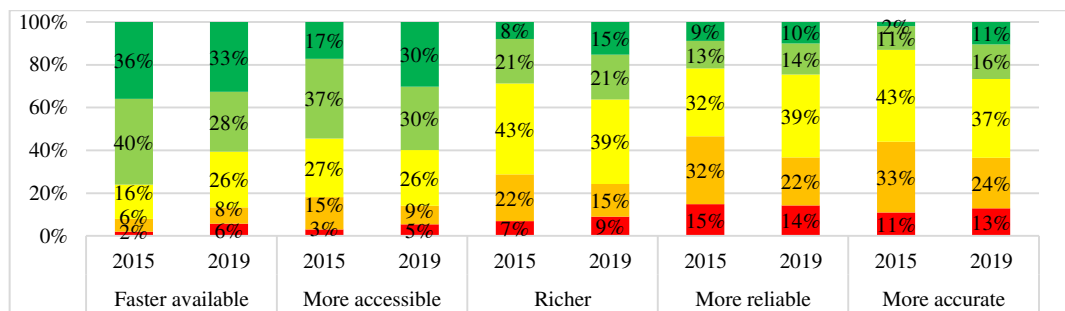

Figure 5. Q4: Which advantages do you assume for social media compared to other information sources (e.g., television, radio or traditional website) (strongly disagree, disagree, neutral, agree, strongly agree)?

Looking at our datasets from 2015 and 2019 (see Fig. 5), the perceived accessibility (54% to 60%), richness (29% to 36%), reliability (22% to 24%) and accuracy (13% to 27%) of information increased noticeably. Although the perceived faster availability of information dropped (76% to 61%) together with accessibility, these characteristics are still most dominant in comparison to traditional media. Despite the increase in richness, reliability and accuracy, social media is still perceived worse in these characteristics compared to traditional media (see Fig. 6). Compared to 2016, social media were perceived as less disadvantageous: the survey participants showed less skepticism with regard to false rumors (74% to 64%), data privacy (62% vs. 50%), malfunction in emergencies (60% to 54%) and missing reliability (65% to 38%). Still, except for reliability, at least half of participants were skeptical with regard to dangers emanating from social media. Interestingly, while the preference of emergency calls over social media was balanced in 2016, in this survey 71% preferred an emergency hotline over using social media in emergencies.
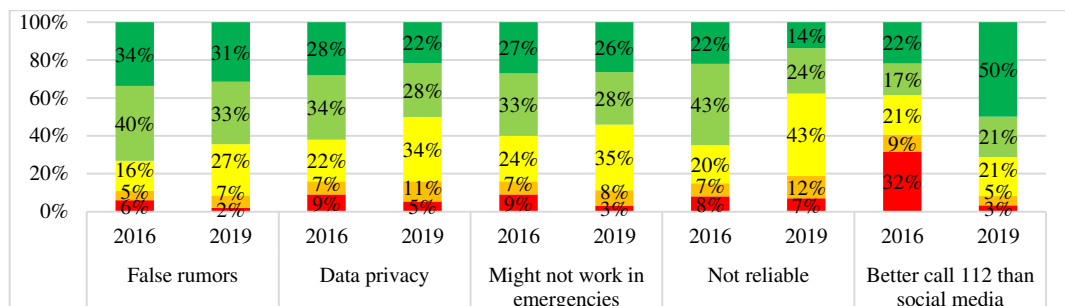

Figure 6. Q5: Which disadvantages do you assume when using social media during an emergency situation (strongly disagree, disagree, neutral, agree, strongly agree)?

High Expectations, High Understanding (Q6). With regard to ES' activities on social media, many respondents do not have clear expectations (see Fig. 7). On the one hand, people expect that

ES should continuously monitor their social media channels (58%) and almost 40% expect that a post (including one asking for help) should be responded to within one hour, although this idea is also rejected by a large portion of respondents (27%). 46% expect that in emergencies ES will be too busy to analyze social media. While 40% regard the current extent of ES' social media presence as sufficient, 47% wish to find news about ES' day-to-day activities on social media. In our survey, a tendency exists to favor a variety of regionally and thematically differentiated social media channels. 44% of respondents would welcome direct messages (e.g., through social media chats) by ES in case of emergencies, while 22% were against such direct contact.

Relatively strong opposition is found with regards to the question of whether to use more colloquial language on social media, with only 27% in favor and 36% rejecting the proposal. Of those firmly in opposition, only about half used Facebook in emergencies and only less than 20% used Twitter. The Mann-Whitney-U-test and an analysis of variance (ANOVA) show that neither age, gender nor education play a role. Comparing the datasets of 2016 and 2019, there is a decrease in the perception that ES should monitor social media (67% to 58%) and participants increasingly think that ES are too busy to monitor social media during emergencies (43% to 56%). While both of these developments seem to point in the same direction, the expectation that ES should respond within one hour to social media posts increased (47% to 53%).
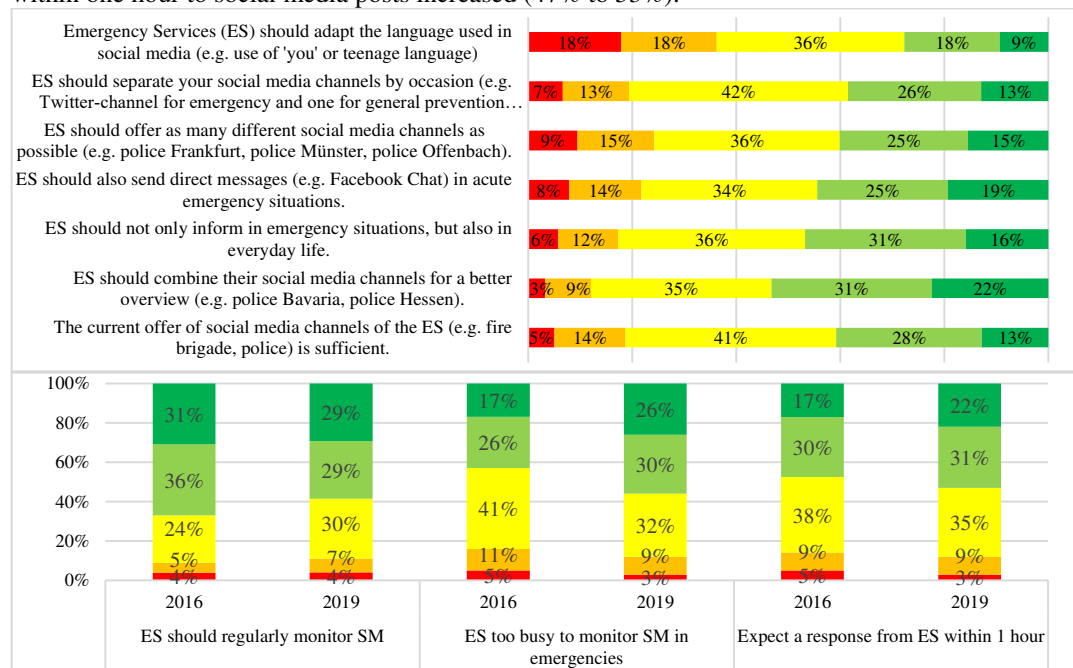

Figure 7. Q6: Emergency Services (e.g., fire brigades, ambulance services or police) also use social media in emergency situations (strongly disagree, disagree, neutral, agree, strongly agree).

4   Discussion

4.1   Contribution and Policy Implications

With regard to use of social media in emergencies (**RQ1**), one of the unique contributions of this paper is the differentiation of platforms, which shows that WhatsApp and Facebook dominate and are together used by over 70% of respondents. Only on these platforms sharing is widespread, while YouTube is popular for searching information. The predominant use of social media for searching information fits with many ES' strategy of using social media to broadcast information und supports previous findings [6]. Despite Twitter's importance for many ES for fast updates, YouTube has so far been more relevant to people in emergencies. This suggests that for a majority virtually "returning" [35] may be more relevant than factual updates. People's sharing behavior on WhatsApp and Facebook may be explained by the still more private nature of social media's chat tools [36] and the growth in personal safety assurance. A new finding is also that while the perceptions of helpfulness of sources all positively correlate some clusters can be found, showing that consumers of traditional information sources and those seeking personal and authorities' information are less likely to respond well to social media information. This may mean that ES' spreading of information through social media may not have to be prioritized at this point, or that it is not fulfilling users' demands: Those favoring social media evaluated contact with ES as comparatively less helpful; instead, they value other online content, likely generated by peers and online journalists. In contrast, those who find contact with ES helpful do not find social media very helpful in emergencies.

Our survey supports findings on age and gender as partly relevant [37] but mainly taking on only a small to negligible role, while education and urbanization are not central for social media use in emergencies. While the study design is biased towards people who negotiate the online realm, the finding may also suggest that in cases of emergencies, people diversify their strategies: Those who normally use social media less may explore new channels for seeking out information and for reaching out, while people may also be drawn to less frequently used but familiar ways of communication that are perceived as reliable, such as placing an emergency call. Despite the frequent use of social media, traditional emergency phone calls find strong support among respondents. Those favoring such calls are particularly skeptical of the trustworthiness, accuracy and reliability of social media. While those who are concerned with data security and privacy do not show different sharing and use patterns in emergencies, they are strongly concerned with the existence of fake news and whether social media channels are reliable in crises.

Regarding the adoption of casual language in social media channels, strong resistance is voiced. Of those concerned, however, a large proportion did not use social media in emergencies, while those who are active on Facebook appear to be largely indifferent. Turning to wishes regarding social media accounts run by ES, there are no strong preferences to be found overall and no big differences between those having used social media in emergencies. This suggests that no clear preferences have emerged within the German population and a variety of strategies can be successful. This supports the findings that a diverse set of social media strategies can be relatively successful within ES [16].

With a view to recommendations for ES' social media strategies (**RQ2**), we can derive preliminary suggestions: Most respondents see advantages in social media and many have used it in situations of uncertainty. However, people are also aware of the downsides of social media and its

uncertain reliability in crises. This suggests that the use of hybrid strategies [20, 24], incorporating elements of social media while maintaining traditional channels of communication, is recommendable. Although it is likely to increase burdens on ES, our survey also finds that respondents are understanding those challenges particularly in stressful situations, suggesting that people may be prepared to use offline modes of communication in case social media remains unanswered. However, this flexibility may also be required due to social media not fulfilling all expectations. This would have to be explored further by future qualitative research. It also appears that social media communication in emergencies is not and perhaps does not need to be tailored to specific socio-demographic groups, since their experiences and evaluations are similar. Since there are so far no clear preferences for how to implement social media strategies, this should be ever more closely surveyed among the population, as opinions may only form while making experiences with different modes.

Changes over time indicate an overall increase of people who have been using social media in emergencies, especially those who both searched for and actively shared information despite decreasing diversity of different content types. While the increase of safety assurance may be connected to the use of Facebook Safety Check, the noticeable decrease of emotional content requires further research to identify its cause. We observed an increase of perceived social media potentials but citizens still rate the quality of other media, except for accessibility and speed, higher and the 2015 survey is based on a snowball sample which limits the comparability of results. In terms of disadvantages, there is a noticeable decrease, but most barriers are still perceived as a problem by more than 50% of participants. Further inquiries are necessary to identify long-term trends. Despite the fact that a larger number of participants expect ES to be too busy to monitor social media, interestingly, more of them demanded an answer on their posting within one hour, indicating a widening gap between perceived reality and desired state.

The comparison of this survey with data from 2015 and 2016 also shows the strong fluctuation of opinions. Considering the strong changes also seen in the development of social media channels, e.g., the emergence of chat features in Facebook, as well as the emergence of large groups on WhatsApp, continuing surveillance of changes appears necessary to adjust strategies in due time. It seems likely that this will challenge more rigid styles of organizational communication. For now, a focus on Facebook and WhatsApp as the dominant communication channels appears to reach a vast group of people. They are also the best sources to attain information through citizens' content. For broadcasting information, ES may consider including YouTube. Since mobile phones are generally wide-spread, further exploration of warning apps appears to be a promising avenue [38].

4.2   Limitations and Future Work

This paper is subject to limitations: The biggest challenge is that online surveys are biased towards people who engage online. Although the survey provides representative results according to the criteria of age, gender, geography, urbanization and education, it excludes those people who are most resistant to using technology. A normalizing effect may also be incurred by remembering events in the past. In addition, it is unclear when the emergencies took place that respondents were referring to, which may influence the channels used at that point in time. Since several social media platforms consist of components that can be used as a public forum or private messaging tools, it is not completely clear whether "posting" or "reading" on social media exclusively refers to the public creation and recreation of content, or also to private communication. In future research it

seems fruitful to differentiate between such more private use of social media directed at acquaintances or towards bigger circles of strangers and public institutions, especially as behavior might be relevant for communication about emergencies and with ES. Further research should thus explore how people interact with technologically enhanced means of communication in the private and public realms, as well as regarding how, when and why they turn to both the public realm and state institutions.

Regarding urbanization truly rural areas and very big cities that might have specific needs in emergencies may not be sufficiently visible, since our categories start at 5,000 inhabitants and end at 100,000. More refined categories could test the lack of differences found in this study between people living in highly urbanized or rural areas and their particular challenges. A caveat results from not differentiating between different types of ES. Furthermore, respondents' lack of decisiveness regarding their preferences for ES' social media strategies may be a result of limited experience with different online communication modes and will likely yield more opinionated results in the future. Finally, the paper focuses on practical and policy implications, lacking an underlying theory guiding the questionnaire design and an explanatory framework. Therefore, future qualitative research should explore social media use, perceptions and expectations from a theoretical lens, i.e., using the framework of risk cultures, which differentiates the framing of incidents, trust towards authorities and targets of blaming if emergency response is not successful [36, 39].

5   Conclusion

In this paper, we examined the use, perceptions and expectations of German citizens towards social media in emergencies. Our survey of a representative sample (N=1,219) of the German population was informed by a workshop with a German central federal police agency. We found a widespread use of WhatsApp, Facebook and YouTube in emergencies, which increased in the last three years. Despite social media being perceived as faster and more accessible, citizens appraise traditional media as more accurate and reliable information sources, which is supplemented by the fear of false rumors and issues of data privacy in social media. Furthermore, many citizens expect emergency services to monitor social media, establish bidirectional communication, publish information not only in emergency situations but also in everyday life, and provide both regional and federal social media presences. Finally, those valuing social media in emergencies also favor other online sources, but not necessarily apps, contact with ES or personal conversations.

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