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Effects of the COVID-19 pandemic on suicide attempts in a rural region in Germany, a 5-year observational study

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ABSTRACT

Background: The COVID-19 pandemic and public life restrictions may have a negative impact on people's mental health. Therefore, we analyzed whether this condition affected the occurrence of suicide attempts (SA) over 20 months during the pandemic period.

Methods: We included patient records according to DSM-5 criteria for suicidal behavior disorders ($n = 825$) between Jan 1, 2017, and Dec 31, 2021. We applied interrupted time-series Poisson regression models to investigate the effect of the pandemic on SA occurrence, time trends, and seasonal patterns in the whole group of patients as well as stratified by age and gender.

Results: There was no significant effect of the pandemic on the occurrence of SA in the overall group. However, we observed a significant impact of the pandemic on the seasonal pattern of SA, also the variance differed significantly (pre-pandemic mean \pm variance: 13.33 ± 15.75 , pandemic: mean \pm variance: 13.86 ± 7.26), indicating less periodic variation in SA during the pandemic. Male patients and young adults mainly contributed to this overall effect. Subgroup analysis revealed a significant difference in SA trends during the pandemic in older adults (>55 years) compared with younger adults (18–35 years); SA numbers increased in older adults and decreased in younger adults as the pandemic progressed.

Limitations: A few patients may have received initial care in an emergency department after SA without being referred to psychiatry.

Conclusions: In general, the COVID-19 pandemic and related measures did not significantly affect the occurrence of SA but did significantly affect the dynamics. In addition, the pandemic appeared to affect suicidal behavior differently across age groups as it progressed. Particularly for the older adult group, negative long-term effects of the pandemic on suicidal behavior can be derived from the present results, indicating the need to strengthen suicide prevention for the elderly.

1. Introduction

The COVID-19 pandemic and associated containment measures such as lockdowns, social restrictions, school and business closures lead to social and financial burdens, which substantially perturb numerous people's mental health worldwide. For example, a recent study estimated an additional increase in depressive and anxiety disorders cases due to pandemics by 27.6 % and 25.6 %, respectively (Santomauro et al.,

2021). Furthermore, given the strong association between depressive disorders and suicidal ideations (SI) (Franklin et al., 2017), it is also conceivable that the COVID-19 pandemic increases SI and potentially suicidal behaviors (SB), including suicide attempts and suicides.

However, suicide and suicide attempts are complex and multifaceted behaviors. Thus, the transition from SI to suicidal acts depends on several trigger and risk factors. Regarding the temporal association with SB, the contributing factors have been classified as distal, e.g., genetic;

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intermediate, e.g., neurocognitive; and proximal or triggering factors (Sobanski et al., 2015; Turecki et al., 2019). Suicidal crisis usually occurs in the context of an intense negative mental state, considered a proximal factor. A Finnish study demonstrated that the majority (80 %) of suicide decedents had stressful life events within the last three months before their death (Heikkinen et al., 1994). Job loss, financial problems, and interpersonal difficulties, e.g., family conflicts and separations, were discussed to play essential roles in vulnerable individuals (Foster, 2011).

Past epidemics, such as severe acute respiratory syndrome (SARS) and economic crises, have been associated with negative mental health outcomes (Stuckler et al., 2011; Yip et al., 2010). Research has shown that during periods of rising unemployment or of significant economic uncertainty across Europe, suicide rates have increased across Europe (Stuckler et al., 2011). The number of suicides increased by 30 % in Hong Kong during SARS epidemics, especially among female elders (Chan et al., 2006). The common motives for suicide were associated with fears of being a burden to their families. This is an important observation because Thomas Joiner's highly influential "Interpersonal Theory of Suicidal Behavior" hypothesizes two factors as critical triggers for SB in vulnerable individuals, namely "thwarted affiliation" and "perceived burden" (Van Orden et al., 2010). "Thwarted Belongingness" describes the feeling of not being part of a valued group. "Perceived Burdensomeness" represents a thought or feeling that one's death would resemble a sense of relief to the environment. A recent study supported a significant relationship between the perceived burdens of the COVID-19 pandemic, both interpersonal factors, and increased suicide risk using an online survey (Gratz et al., 2020). Another online study reported an association between COVID-19-related experiences and past month SIs among adults in the United States (Ammerman et al., 2021). A meta-analysis of 54 studies showed increased event rates for SI and suicide attempts due to pandemics contrasting such rates from pre-pandemic studies (Dubé et al., 2021). However, all these studies were based on cross-sectional data limiting the understanding of the association between the pandemic and the occurrence of SI or SB. Previous two few longitudinal studies indicated a reduction in number of suicide attempts (Olie et al., 2021) and self-harm (Carr et al., 2021) accordingly in the early phase of the pandemic compared to 2019, without accounting for temporal trends.

Previous studies, which investigated the effect of the COVID-19 pandemic on the number of suicides, reported inhomogeneous results. Whereas Osaki et al. (2021) observed an increase in suicide rates during the second pandemic wave in Japan, especially in females, Leske et al. (2021) did not find any change in suicide rates compared to the pre-pandemic period by analyzing real-time suicide data in Queensland, Australia, from Feb 1 to Aug 31, 2020. Also, Radeloff et al. (2021) showed stable suicide rates during the COVID-19 pandemic in Leipzig, Germany, compared to previous years. Deisenhammer and Kemmler (2021) reported decreased suicide numbers for the state of Tyrol, Austria during the first 6 months of the COVID-19 pandemic in a preliminary analysis. Tanaka and Okamoto (2021) identified a more complex association between the pandemic, associated measures, and monthly suicide rates, showing an initial decline and subsequent increase in suicides during the second wave. More interesting, the authors observed a larger increase in suicides in females as well as in children and adolescents, indicating differential adverse impact of the pandemic on potentially vulnerable subgroups. A recent study analyzing suicide data from 21 countries found either a decrease or unchanged suicide rates in the early months of the pandemic in high-income and upper-middle-income countries (Pirkis et al., 2021). Unfortunately, the data could not be stratified by age or gender. Furthermore, most of these previous studies investigated the short-term impact of COVID-19 pandemic, but negative long-term effects could also be expected.

Systematic research on the short- and long-term consequences of the pandemic on mental health and suicidal behavior is fundamental for developing suicide-preventive measures adapted to the current situation. Therefore, further longitudinal studies are needed to clarify the

association between the pandemic and suicidal behavior in general and vulnerable subgroups. As mentioned above, there is some evidence (Chan et al., 2006; Tanaka and Okamoto, 2021) that the effect of pandemic may have a stronger impact on suicidal behavior in elderly adults or in females.

In the present longitudinal study, we examined the impact of the COVID-19 pandemic on the number of suicide attempts as defined according to DSM-5 criteria of suicidal behavior disorder (SBD). Since the ratio of suicide to suicide attempt is of the order of 1 for 20–50 (Jollant et al., 2022), we expected to be more sensitive in detecting potentially negative effects of the pandemic on suicidal behavior. This data was systematically assessed over a period of 5 years from a large psychiatric hospital in Thuringia, Germany, before and after the COVID-19 outbreak (period from Jan 1, 2017, to Dec 31, 2021) to account for the underlying temporal trends. We additionally examined changes in the number of suicide attempts and trends in specific subgroups, i.e. males and females as well as in specific age groups. We expected to find a negative effect on the number of suicide attempts in the pandemic, particularly in females and elderly adults.

2. Methods

2.1. Study design

The government introduced significant measures in Germany (Bundesregierung) and Thuringia (Freistaat Thüringen, Landkreis Hildburghausen) to contain the COVID-19 pandemic with strict restrictions starting in March/April 2020, strongly affecting social and public life. As a result, people reduced their private contacts substantially to a minimum. Educational facilities, kindergarten, cultural facilities, sports and leisure facilities, hotels, gastronomic establishments, and most shops were closed. Therefore, we used this defined period starting from Mar 9, 2020, comparing the occurrence and time trends of SA before and during the COVID-19 pandemic. This study accumulated data on adult patients with recent SA ($n = 825$) admitted to the Department of Psychiatry and Psychotherapy, Helios Fachkliniken Hildburghausen, from Jan 1, 2017, to Dec 31, 2021.

2.2. Settings

The Helios Fachkliniken Hildburghausen is the central provider of mental health care in a region with 295,000 residents in 3051 km² (population density 97.69 inhabitants per km²). The care region is rural, with 18 % of people living in communities of <500 residents, 29 % in communities of 500 to 5000 residents, 13 % in cities of up to 10,000 residents, and 41 % in cities of up to 35,000 residents. Population numbers remained nearly stable over the study period, with a 1.2 % decrease in population between 2017 and 2021. The average age of the population in the study region is 47.9 years, which is descriptively higher than the national average (44.5 years, 2019) (Thüringer Landesamt für Statistik, Statistisches Bundesamt). During the study period, 14,502 patients were admitted as inpatients. 91.8 % of patients live in the primary care region, 6.8 % in adjacent areas, and 1.8 % outside the study region. The median length of stay for patients was 27.01 days, with 9.6 % of patients staying in the hospital for only a monitoring period of up to 24 h.

The COVID-19 mortality rates were twice as high as those in other areas of Germany. Infection rates with a range of 13.7 to 20.31 per 100,000 people were near twice as high as national rates, i.e., 9.62 per 100,000 people. Mortality rates were between 2.50 % and 3.23 % and were thus significantly higher than the German average of 1.45 % (Robert Koch Institut, RKI).

The local ethics committee of the State Chamber of Physicians of Thuringia, Germany, approved the study (22,319/2021/147). This study was part of a suicide prevention project ("Network for Suicide Prevention in Thuringia"), funded by the Federal Ministry of Health

(BMG) and Helios Kliniken GmbH.

2.3. Participants

As illustrated in Table 1, 825 adult females and males were admitted to inpatient psychiatric care after a suicide attempt within the past four weeks. An SA was defined based on the DSM-5 (American Psychiatric, 2013) criteria for the current SBD: “A self-initiated sequence of behaviors by an individual who, at the time of initiation, expected that the set of actions would lead to his or her death.” Exclusion criteria were suicidal ideation or preparation of a suicide attempt without action, self-harm behavior in an altered mental state such as delirium or confusion, or if the act was ideologically motivated. The current diagnosis of SBD was also clearly delineated from “non-suicidal self-injury” (NSSI), another condition that is further explored in the DSM-5.

2.4. Statistical methods

2.4.1. Modeling interrupted time-series

To model changes in SA occurrence before and during the COVID-19 pandemic, we applied two interrupted time-series Poisson regression models, first modeling the impact of a pandemic, time trend, and the interaction of both factors and in the second model periodic pattern of seasonality and its interaction with the pandemic. This method is widely used for modeling the count time series (Islam et al., 2020; Leske et al., 2021). For modeling the seasonality, the Fourier series was applied with sin and cos with the interval of four seasons in each year on a monthly fixed interval from Jan 1, 2017, till the end of Dec 31, 2021. Before the statistical analyses, we examined the autocorrelation and partial autocorrelation of the count time series. As a result, we observed that the monthly SA occurrence across years is non-random but follows a seasonal pattern (supplementary Figs. S1), a frequently observed finding (Coimbra et al., 2016). In addition, considering potential overdispersion, the quasi-Poisson regression model was also applied. The Poisson regression and quasi-Poisson regression models produced similar results; therefore, we report the findings of the Poisson regression.

We further modeled separate Poisson regressions for gender and for the three defined age groups (Petry, 2002) to examine the impact of the pandemic on SA within specific subgroups of patients: young adults (aged 18 to 35 years), middle-aged adults (aged 35 to 55 years), and older adults (aged over 55 years). We performed all analyses in this study using R version 4.1.0, and in the package stats version 3.6.2, codes are available upon request.

Table 1
Demographic and clinical characteristics of the investigated sample.

	Prepandemic (N = 520)	Pandemic (N = 305)	Overall (N = 825)
Age			
Mean (SD)	45.8 (19.5)	47.1 (20.1)	46.2 (19.7)
Median	44.2	43.5	44.2
Gender			
F	247 (47.5 %)	133 (43.6 %)	380 (46.1 %)
M	273 (52.5 %)	172 (56.4 %)	445 (53.9 %)
ICD-10 diagnoses			
F0	16 (3.1 %)	19 (6.2 %)	35 (4.2 %)
F1	76 (14.6 %)	44 (14.4 %)	120 (14.5 %)
F2	35 (6.7 %)	26 (8.5 %)	61 (7.4 %)
F3	319 (61.3 %)	172 (56.4 %)	491 (59.5 %)
F4	69 (13.3 %)	38 (12.5 %)	107 (13.0 %)
F6	5 (1.0 %)	0 (0 %)	5 (0.6 %)
F7	0 (0 %)	3 (1.0 %)	3 (0.4 %)
n.a.	0 (0 %)	3 (1.0 %)	3 (0.4 %)
Age categories			
<35	197 (37.9 %)	105 (34.4 %)	302 (36.6 %)
35–55	158 (30.4 %)	88 (28.9 %)	246 (29.8 %)
>55	165 (31.7 %)	112 (36.7 %)	277 (33.6 %)

3. Results

In total, 825 suicide attempts were registered with the mean age of 46.2 ± 19.7 , including 380 (46.1 %) females and 445 (53.9 %) males (Table 1). The average number of SA per month was 13.52 with a variance of 12.58. As presented in Table 2, the average number of SA per month before and during the pandemic are nearly identical (before: mean \pm variance: 13.33 ± 15.75 , after: mean \pm variance: 13.86 ± 7.26), but the variances significantly differed indicating diminished monthly fluctuations in SA during the pandemic (Levene's test; F-value: 4.16, p-value: 0.046).

3.1. Results of the Poisson regression

We did not observe any significant impact of the pandemic on the occurrence of SA in the whole group, both unadjusted and adjusted for the seasonality in the Poisson regression models. We also did not find a significant trend regarding SA numbers nor a significant interaction between pandemic and the trend (Fig. 1 and Table S1). However, as presented in Table S1, a significant impact of the pandemic on the seasonal pattern was observed, indicating less periodic variation in SA during the pandemic (z-value = -2.239 , p-value = 0.025). As depicted in Fig. 1, before the COVID-19 pandemic, SA peaked around October/November, but this pattern changed significantly during the pandemic.

3.2. Subgroup analyses

3.2.1. Effects of the COVID-19 pandemic on specific age groups

Regarding the impact of the pandemic on the age groups, there were no significant effects of the pandemic on SA occurrence in all three age groups unadjusted and adjusted for the seasonality. Neither significant trends nor significant interactions could be observed for older and middle-aged adults (Tables S2 and S4), even if in older adults there was a more substantial increase in the number of SA during the pandemic than before pandemic, as seen in Fig. 2.

In younger adults (Table S3), the time trend indicated a significant overall decrease in SA (z-value = -2.189 , p-value = 0.029), as well as, a significant effect of the pandemic on seasonality (z-value = -2.022 , p-value = 0.043).

As indicated in Fig. 2, comparing time trends between older and younger adults, we observed a significant interaction between both ages groups and the time trend (Table S5; z-value = 2.934, p-value = 0.003) showing increasing SA numbers in older adults and decreasing number in younger adults as pandemic proceeded.

3.2.2. Effects of the COVID-19 pandemic on males and females

We did not find any significant impact of the COVID-19 pandemic on SA occurrence in males and females, on trends in both groups, and on seasonality patterns in females (Tables S6 and S7).

But, a significant effect of the COVID-19 pandemic on the seasonality pattern of SA was observed in male patients (z-value = -2.411 , p-value = 0.016), which showed similar significant pandemic related effect on seasonality patterns as the whole group and younger adults (Fig. 1B and supplementary Table S6).

Table 2
Averaged number and variance of monthly suicide attempts before and during the pandemic.

	Months	SA (n)	Mean	Variance	Min	Max
Overall	61	825	13.53	12.59	3	21
Prepandemic	39	520	13.333	15.75	3	21
Pandemic	22	305	13.86	7.266	5	18

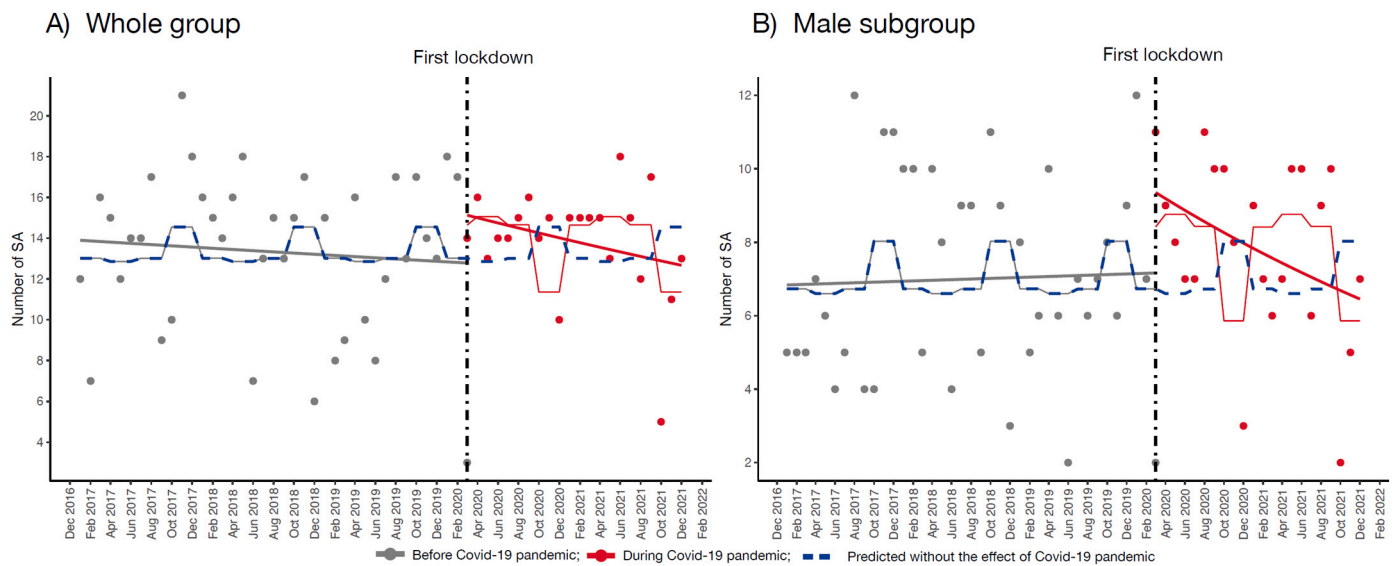


Fig. 1. In the Fig. 1A, the grey points indicate the number of suicide attempts per month before Covid-19 pandemic in the whole group of patients, and the red points show the number of suicide attempts during pandemic. In the Fig. 1B, the grey points indicate the number of suicide attempts per month before Covid-19 pandemic in male patients only, and the red points show the number of suicide attempts during pandemic. The solid grey line shows the Poisson trend line before and the solid red line after the first lockdown. The curvy grey solid line depicts the modeled seasonality pattern, and the curvy red solid line shows the seasonality pattern after the first lockdown. The dashed blue line shows the Poisson regression predicted based on data before COVID-19 lockdown. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

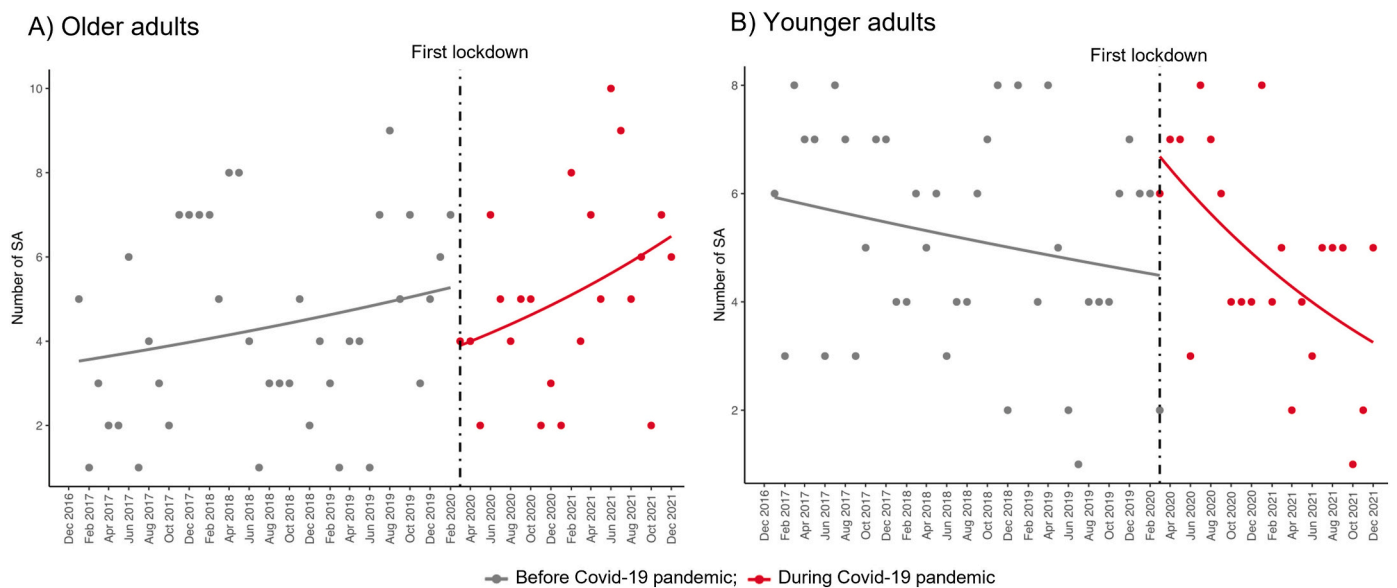


Fig. 2. In the Fig. 2A, the grey points indicate the number of suicide attempts before Covid-19 pandemic in patients with age > 55 years, and the red points show the number of suicide attempts during pandemic. In the Fig. 2B, the grey points indicate the number of suicide attempts before Covid-19 pandemic in patients with age between 18 and 35 years, and the red points show the number of suicide attempts during pandemic. The solid grey line shows the Poisson trend line before the first lockdown, and the solid red line shows the Poisson trend line after the first lockdown. Comparing time trends, there was a significant interaction between both ages groups and the time trends during pandemic. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

4. Discussion

After the COVID-19 pandemic outbreak in mid-March 2020 and the implementation of extensive contact reduction programs in Germany and Thuringia, we expected to find its significant effect on the number of suicide attempts. To investigate this, we selected patients admitted after a suicide attempt to a large psychiatric hospital in a rural area in Germany over five years (2017–2021). However, in contrast to our hypothesis, the Poisson regression analysis did not reveal any significant

differences in the overall SA occurrence or trends during the pandemic compared to the pre-pandemic years. Although there was an initial increase in the monthly numbers of suicide attempts in the whole group after the first lockdown, a potential regression toward the mean occurred within the first months of the pandemic. The normalization in the numbers of SA might be also related to the introduced extensive governmental support measures. However, we found differences in seasonal patterns and trends in individual subgroups.

Looking at the group as a whole, the results of the present study are

in agreement with previous studies (Leske et al., 2021; Olie et al., 2021; Pirkis et al., 2021; Radeloff et al., 2021) and extend them by the observation of nonsignificant negative long-term effects of the COVID-19 pandemic and associated measures on suicidal behavior. Suicide and suicide attempts are complex and multifaceted behaviors. In addition, the transition from suicidal ideas to suicidal acts relies on several trigger and risk factors. Although the current pandemic has been shown to increase suicidal ideas (Ammerman et al., 2021), it appears that it is not sufficient to be a promoter for suicidal behavior, at least over the two years of the pandemic.

However, our analysis showed distinct and significantly different trends regarding the SA occurrence in older and younger adults. Whereas in the latter group, a decreasing SA occurrence was observed during the pandemic, an opposite effect was revealed in older adults, suggesting an increasing number of SA (although non-significant) with the persistence of the pandemic.

Results on previous pandemics such as SARS (Chan et al., 2006; Yip et al., 2010) have already shown that older people are more affected by the pandemic, leading to an increased number of suicides (Conwell et al., 2002). The protective measures associated with the COVID-19 pandemic and the health care system's focus on managing many infections affected access to the medical assistance system. During the early phases of the pandemic, in particular, patients across all age groups sought less help (Carr et al., 2021). However, we suppose that younger people used other support systems or had better coping skills, whereas older people tended to isolate themselves socially and used fewer alternative psychosocial support systems.

Moreover, studies examining Joiner's interpersonal factors suggest that distress related to the perception of being a burden to others and detracting from others accounts for significant variance in suicidal ideation among older adults (Cukrowicz et al., 2013). Especially at the beginning of the pandemic, the massive restrictions were justified by the need to protect vulnerable groups, especially the elderly. Observations showed a significantly higher risk of dying from SARS-CoV-2 infection and the resulting COVID-19. For example, nearly 50 % of people who died from COVID-19 in Germany lived in elderly care facilities (Kricheldorf, 2020), and the mortality rate of COVID-19 patients aged 55 years and older exceeded 15 % (RKI). This is consistent with international studies that have observed that long-term care facilities had high rates of serious illness and hospitalization as well as accounted for >35 % of deaths in the United States (Bankole, 2022).

In addition to more severe complications and higher mortality risk, the older adult group was also thought to have more severe negative effects of the pandemic. There were concerns about access to care, difficulties adapting to technologies such as telemedicine, and fears that isolation would exacerbate existing mental illnesses (Vahia et al., 2020). In addition, it was suggested that the fear of contagion and the simultaneous feeling of being a burden to the younger generation because of being severely limited socially had a pessimistic influence on individuals' thoughts about their future and may have reinforced thoughts of death. Some studies found that there is a higher prevalence of anxiety, depression, and loneliness in older adults when compared with pre-pandemic levels (Bankole, 2022; Jin et al., 2022).

We therefore suspect that the initially observed higher resilience of older people was not only based on individually better protection against mental illness, but rather on higher levels of prosocial behavior, increased empathy, or stronger emotion regulation. These skills may have been particularly fundamental in the first phase of the pandemic, while worries about the future, feelings of being a burden on others, fear of the disease, loneliness, and isolation became more important as the pandemic progressed.

In contrast to older adults, only the early phase of the pandemic appeared to have played an essential role for SA in younger adults. On the one hand, the decline throughout the pandemic could be due to the better adaptation of this group, which may have developed new skills and abilities to cope with the pandemic (Kimhi et al., 2020). In addition,

we assume that the government's extensive financial support may have helped reduce initial threats of existential financial burdens.

On the other hand, the decrease could also be artificial and related to reduced help-seeking behavior after a suicide attempt. A study by Jollant et al. (2021) in a French population found that 39.3 % of respondents reported not having been hospitalized after their last suicide attempt even before the pandemic. There is reason to believe that prompting for home isolation and fear of infection in emergency departments and clinics may have amplified this effect of reduced help-seeking and provided another explanation for the decline in the younger group. Results from France and England on patients with self-injurious behavior and other mental illnesses seem to confirm this assumption (Carr et al., 2021; Jollant et al., 2021). There is a need to learn more about whether there is a change in the utilization of other services as well. Most importantly, this effect needs to be observed over a more extended period.

A further and new finding in the present study was a significant effect on seasonal fluctuation and periodic variability of SA during the pandemic, particularly in males and younger adults. The seasonality of suicides has long been the focus of suicide research (Christodoulou et al., 2012; Vyssoki et al., 2014). To our knowledge, few studies have examined the seasonality of suicide attempts (Coimbra et al., 2016); most data refer to the frequency of suicides from death registers in specific regions. Although the exact cause for seasonal peaks is unknown, former epidemiological studies point toward a specific suicide-triggering effect of meteorological factors, explaining more variance in suicide incidence than socioeconomic factors (Vyssoki et al., 2014).

Thus, findings of the present study suggest that the impact of the COVID-19 pandemic and related measures on suicide attempts were superior to potential meteorological variables, such as seasonal sunshine duration, leading to a reduction of the seasonal variability of suicide attempts before the pandemic.

Interestingly, males and younger adults were more affected in periodic fluctuations than females, indicating gender and age specificity regarding experienced stressors, differential resilience, or adaptive capacity. Other studies have shown differences in more significant psychosocial stress among women during the COVID-19 pandemic (Kimhi et al., 2020). Present results could also not confirm the observation of larger increase in suicides in females during pandemic in Japan (Osaki et al., 2021; Tanaka and Okamoto, 2021), which could be explained by the cultural differences. Women were more challenged in caring for children, family, or elders, and the feeling of being needed could be a suicide-preventive factor. However, it is crucial to continue to observe how the increased psychosocial stress experienced will affect women's mental health after the pandemic has subsided. Regional characteristics, such as the availability of public family support services, need to be more fully considered in the future studies.

Findings of present study have to be seen in light of strengths and some limitations. Strengths of this study include real-time data over a period of 5 years, a systematic evaluation of all suspected suicide attempts by at least two investigators to exclude non-suicidal behaviors or other self-injury according to DSM-5 criteria and a data stratification by age and gender. In addition, because of legal requirements, patients after a suicide attempt living in the care region are admitted exclusively to Helios Fachkliniken Hildburghausen; therefore, we believe that from the available data, we can draw concrete conclusions about how the COVID-19 pandemic may have influenced the occurrence of suicide attempts in that defined rural area.

However, we were unable to include individuals who did not contact the help system despite a severe suicidal crisis due to pandemic restrictions or fear of contagion. The inpatient admission numbers of patients after a suicide attempt alone cannot represent the entire impact of the pandemic on acute suicidality. In addition, we still know little about the extent to which outpatient support systems or counseling centers instead cared for patients in acute suicidal crises or whether patients received initial care in an emergency department after a suicide attempt

without being referred to psychiatry for further treatment.

Both of these assumptions would be in marked contrast to the pre-pandemic experience, where it was common for almost every patient to be referred to a psychiatric hospital for further evaluation of suicide risk. However, because of the tight care situation for COVID-19 patients, especially in the first phase of the pandemic, our clinical observation was that non-infected patients were discharged significantly earlier, without appropriate further treatment. Reports from crisis counseling centers in Austria suggest an increase in contacts, especially from 2021 onwards, particularly with regard to an increase in counseling on sleep disorders, excessive demands, or suicidal ideation (Sagerschnig et al., 2021).

Further studies are needed, investigating the generalizability to other and urban regions in Germany and the world. Future studies with greater power are also required for subgroup analyses, especially for the elderly, to examine further the effect of pandemics and associated containment measures on suicidal behavior.

In summary, pandemic containment measures that were primarily planned to protect vulnerable groups may also have unexpected negative effects. Therefore, we recommend that suicide prevention efforts, especially for the elderly, be further strengthened to reverse the observed negative trend and effectively address new risks in the post-pandemic period.

Targeted training, especially for the elderly, in the use of available new digital technologies and low-tech strategies such as letter writing or telephone contact could lead to reduced social isolation (Bankole, 2022). Structural changes, including providing more resources to vulnerable older adults and their families, are needed. In addition, policy makers and mental health providers should incorporate lessons learned into future infection prevention and pandemic planning.

CRedit authorship contribution statement

UWK and GW conceptualized the study, contributed to its design, and drafted the manuscript. UWK, DS, JA, TS did literature search and review, UWK, JA, TS and SWF were responsible for data collection, managing, cleaning, and assessing. JN and GW were involved in the statistical analysis, primary responsibility for applying analytical methods, designing and coding figures and tables. UWK, GW and MW were involved in funding acquisition. All authors critically reviewed the manuscript and approved the final version. Members of the research team had full access to the underlying data used to generate estimates presented in this article.

Conflict of Interest

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

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Ethical standards

The local ethics committee of the State Chamber of Physicians of Thuringia, Germany, approved the study (22319/2021/147). The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional

committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2013.

Data sharing

Raw data and programming code for replication in R or other statistical software used in this study are available from the corresponding author on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jad.2022.09.022>.

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