

# Changes in the alcohol-specific disease burden during the COVID-19 pandemic in Germany: interrupted time series analyses

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**Background:** The coronavirus disease 2019 pandemic has been linked to changes in alcohol consumption, access to healthcare services and alcohol-attributable harm. In this contribution, we quantify changes in alcohol-specific mortality and hospitalizations at the onset of the COVID-19 pandemic in March 2020 in Germany. **Methods:** We obtained monthly counts of deaths and hospital discharges between January 2013 and December 2020 ( $n = 96$  months). Alcohol-specific (*International Classification of Diseases*, tenth revision codes: F10.X; G31.2, G62.1, G72.1, I42.6, K29.2, K70.X, K85.2, K86.0, Q86.0, T51.X) diagnoses were further split into codes reflective of acute vs. chronic harm from alcohol consumption. To quantify the change in alcohol-specific deaths and hospital discharges, we performed sex-stratified interrupted time series analyses using generalized additive mixed models for the population aged 45–74. Immediate (step) and cumulative (slope) changes were considered. **Results:** Following March 2020, we observed immediate increases in alcohol-specific mortality among women but not among men. Between the years of 2019 and 2020, we estimate that alcohol-specific mortality among women has increased by 10.8%. Hospital discharges were analyzed separately for acute and chronic conditions. The total number of hospital discharges fell by 21.4% and 25.1% for acute alcohol-specific conditions for women and men, respectively. The total number of hospital discharges for chronic alcohol-specific conditions fell by 7.4% and 8.1% for women and men, respectively. **Conclusions:** Increased consumption among people with heavy drinking patterns and reduced utilization of addiction-specific healthcare services during the pandemic might explain excess mortality. During times of public health crises, access to addiction-specific services needs to be ensured.

## Introduction

During the coronavirus disease 2019 (COVID-19) pandemic, the parallel trend of declining alcohol consumption and attributable health burden was interrupted in many European countries: alcohol sales and average population consumption declined,<sup>1</sup> while the number of people dying from alcohol-specific diseases (i.e. conditions that are 100% alcohol-attributable) increased, e.g. by 5% in Germany.<sup>2</sup>

The drop in alcohol sales coupled with an increase in alcohol-specific deaths has been described as a COVID-19 alcohol paradox.<sup>3</sup> To explain this phenomenon, two important developments may be relevant: First, although most drinkers have reduced their consumption in Europe in 2020,<sup>1,4</sup> those who had very high drinking levels prior to the pandemic, as well as those who were particularly burdened with financial and emotional pressures during COVID-19, actually increased their alcohol consumption.<sup>4,5</sup> Second, there have been significant changes in healthcare access. Studies on healthcare utilization during COVID-19 have shown that the pandemic has led to a significant decrease in the use of primary care health services, both overall and for people with alcohol-related care needs (see data from the UK<sup>6</sup>). While primary care for people with alcohol-related disorders could be partially substituted by expanded telemedicine offers,<sup>7</sup> some crucial healthcare services were disrupted (see e.g. for liver cancer<sup>8</sup>).

To summarize, both alcohol consumption and healthcare utilization have changed during the COVID-19 pandemic. Possibly, the interruptions and delays in routine medical care may have resulted in the undertreatment of people with chronic alcohol problems and thus increased morbidity and mortality in this population. Empirical evidence for this hypothesis comes from different European countries: trends in alcohol-specific hospital and emergency admissions suggest decreases during the first months of the pandemic in Germany<sup>9</sup> and the UK.<sup>10</sup> Data from the Netherlands indicate that the overall declines were likely driven by reductions in acute problems due to alcohol intoxication during the lockdowns when nightclubs were closed and social gatherings were restricted.<sup>11</sup> In contrast, chronic alcohol conditions, such as alcohol dependence and alcohol-related liver diseases, remained more stable or have even increased.<sup>10,12</sup>

Our current understanding of the COVID-19 alcohol paradox is limited by a lack of studies that have examined the role of healthcare access for alcohol-specific conditions. Specifically, no study to date has investigated how hospitalizations for acute and chronic alcohol-specific conditions have been impacted by the COVID-19 pandemic and whether these changes co-occur with changes in alcohol-specific mortality. Thus, this contribution aimed to quantify changes in alcohol-specific mortality and hospitalizations during the COVID-19 pandemic in Germany with interrupted time series analyses.

In our analyses, we differentiate between acute and chronic alcohol-specific conditions because we assume that hospitalizations for chronic alcohol-specific conditions are more predictive for mortality than hospitalizations due to acute alcohol-specific conditions. Specifically, we hypothesized that increases in alcohol-specific mortality in 2020 have coincided with reduced uptake of specialized treatment for diseases that are caused by chronic heavy alcohol consumption.

## Methods

### Data sources

As cause-specific and monthly data on (i) hospital discharges and (ii) mortality in Germany are not publicly available, we gained access to the individual-level databases to prepare our aggregate statistics for the years 2013–20. For hospital discharges, this is the Federal Statistical Office of Germany (DESTATIS<sup>13</sup>), while for (federal) mortality data, the responsible entity is the Statistical Office of Saxony.<sup>14</sup> For this study, data on hospital admissions would be arguably more informative than data on hospital discharges because hospital discharges depend on the length of stay and may only capture changes in admissions with some lag time. However, as some hospital stays go beyond 31 December, the 2021 data would be required to derive complete, unbiased estimates for 2020. As data from 2021 were expected to become available in 2023 only, we decided to resort to hospital discharges for the present analyses.

The individual-level data on hospital admissions and mortality with potentially sensitive information remained with the statistical offices all the time. Aggregations were performed by the statistical offices by counting the number of hospital discharges/deaths by five stratifying variables (for details see below) while cases with missing values in any of these variables were removed before aggregation ( $n = 83$  cases with missing age or sex information across all years). The data owners provided Excel files containing the hospital admission/death counts and ensured anonymity in these data by checking that each cell contains at least three cases (e.g. at least three deaths from chronic alcohol consumption among women aged 60–74 in February 2016). This threshold also prohibited the performance of state-level analyses with the same level of detail. Given these strict procedures to protect sensitive data and ensure anonymity, we did not seek to obtain ethical approval (analyzing anonymous data in Germany does not require ethical or data protection approval, see Ref. 15).

To contextualize trends in alcohol-specific healthcare access and mortality with alcohol consumption, we obtained data on the volume of monthly beer sales from the Federal Statistical Office (monthly data on other beverages is not available<sup>16</sup>).

### Stratifying variables

The following variables were used to stratify the number of hospital discharges and death counts: year (2013–20), month (January to December), sex (men, women), age group (15–44, 45–59, 60–74, 75+) and diagnostic group. For the diagnoses, the following groups from the *International Classification of Diseases*, tenth revision (ICD-10)<sup>17</sup> were extracted: First, alcohol-specific deaths defined by ICD-10 codes that are 100% alcohol-attributable (F10.X; G31.2, G62.1, G72.1, I42.6, K29.2, K70.X, K85.2, K86.0, Q86.0, T51.X), which were further split into (i) harm from acute heavy alcohol use, such as acute intoxication (F10.0) and poisonings (T51) and (ii) harm from chronic heavy alcohol use, such as alcohol use disorders (F10.1–F10.9 but not F10.0) as well as somatic harms that occur after several years of heavy drinking, including but not limited to alcoholic liver disease (G31.2, G62.1, G72.1, I42.6, K29.2, K70, K85.2, K86.0, Q86.0). In addition to the alcohol-specific diagnoses, we considered an all-cause grouping, which included the above-mentioned alcohol-specific diagnoses, other diagnoses that are related but not

specific to alcohol (e.g. ischaemic heart diseases), as well as all other diagnoses that are not related to alcohol consumption.

### Statistical analyses

As trajectories of alcohol-specific deaths differ by sex and age group,<sup>2</sup> descriptive analyses were performed stratified by sex and all age groups (15–44, 45–59, 60–74, 75+).

To address the research aim, we performed interrupted time series models with generalized additive mixed models (GAMM; for details, see Ref. 18). Compared with traditional autoregressive integrated moving average models, GAMM allow a more flexible modelling of seasonality and control for external confounders. Accordingly, GAMM are increasingly used to evaluate the impact of the COVID-19 pandemic<sup>19</sup> or alcohol control policies.<sup>20</sup> The model selection is described in the [Supplementary material](#).

The main analyses were restricted to the population aged 45–74 years, which was found to be affected mostly by increased alcohol-specific deaths in 2020.<sup>2</sup> In a sensitivity analysis, we estimated changes in healthcare access and mortality among 15- to 44-year-olds.

Data management and analyses were performed in R version 4.2.2.<sup>21</sup> Time series analyses were conducted with functions of the *mgcv* package.<sup>22</sup> All data analyzed (monthly counts of discharges and deaths and beer sale volume) including the corresponding R code are publicly shared.<sup>23</sup>

## Results

### Descriptives

Between 2013 and 2020, a total of 1 460 896 alcohol-specific hospital discharges and 114 355 deaths were registered. The average annual numbers for the total study period are summarized in [table 1](#).

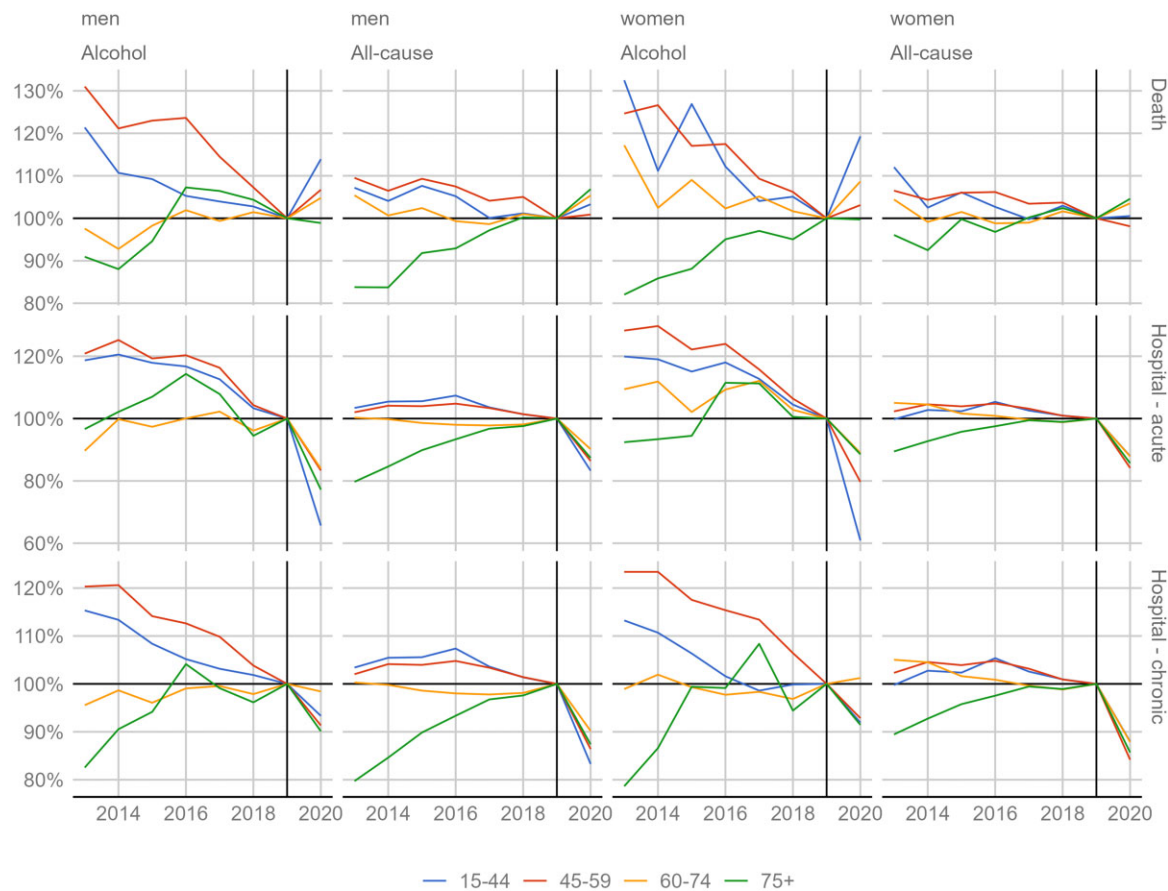
In contrast to hospital discharges, a stratification of alcohol-specific causes into acute and chronic conditions for mortality data was not feasible as nearly all registered alcohol-specific deaths were chronic conditions (for the year 2020: 13 941 out of 14 221 deaths; see [Supplementary table S1](#) for a breakup by sex and age). Accordingly, all mortality analyses were performed for *all* alcohol-specific conditions—keeping in mind that most of those deaths reflected harm from chronic heavy alcohol use. Hospital discharges were still subdivided into acute and chronic conditions, as the latter was expected to be more predictive of alcohol-specific mortality.

Across 8 years, alcohol-specific causes made up 1.1% of all hospital discharges and 1.5% of all recorded deaths. For hospital discharges, the largest share of alcohol-specific cases was recorded in people younger than 60 (76%), whereas the opposite was true for deaths (15–59: 44%). Compared with all-cause hospitalizations (41% younger than 60) and deaths (8% younger than 60), those with alcohol-specific cases were considerably younger. By stratifying alcohol-specific hospitalizations by acute and chronic conditions, we found that younger populations were more likely to be admitted for acute and older populations for chronic alcohol conditions (see also [Supplementary figure S1](#)).

[Figure 1](#) shows how the annual number of hospital discharges and deaths attributable to alcohol or all causes have changed in comparison to 2019 (for a visualization of the absolute monthly number of cases, see [Supplementary figure S2](#)). Relative to the pre-pandemic year, we observed fewer alcohol-specific deaths among younger but not older (75+) adults. During the pandemic, both alcohol-specific and all-cause death tolls have risen across all age groups but the trend reversal (i.e. from decreasing to increasing) was only observed in adults younger than 75 years of age. Moreover, trends in hospitalizations largely mirrored the mortality trends: up until 2019, the number of discharges for alcohol-specific and all-cause conditions decreased among younger populations (15–59) and was stable (60–74) or increased (75+) for older adults. During the pandemic, however, stark declines in the number of discharges were observed for

**Table 1** Average number of alcohol-specific deaths and hospital discharges by sex and age group between 2013 and 2020 and separately for 2019 and 2020

Outcome	Sex	Age group (years)	Average over all years	Total in 2019	Total in 2020	Change between 2019 and 2020 (%)
Deaths	Men	15–44	740.4	683	778	+13.9
		45–59	4159.9	3589	3830	+6.7
		60–74	4344.9	4366	4576	+4.8
		75+	1428.9	1446	1430	–1.1
	Women	15–44	224.4	197	235	+19.3
		45–59	1274.1	1127	1162	+3.1
		60–74	1465.4	1385	1505	+8.7
		75+	656.5	707	705	–0.3
Hospital discharges	Total	15+	14 294.4	13 500	14 221	+5.3
		15–44	50 249.5	47 276	35 561	–24.8
	Men	45–59	51 286.9	46 698	41 340	–11.5
		60–74	26 381.1	27 036	25 492	–5.7
		75+	5198.3	5411	4684	–13.4
		Total	20 788.4	19 719	13 492	–31.6
	Women	45–59	16 958.4	15 124	13 352	–11.7
		60–74	9406.8	9343	9158	–2.0
		75+	2342.8	2431	2196	–9.7
		Total	15+	182 612.0	173 038	145 275

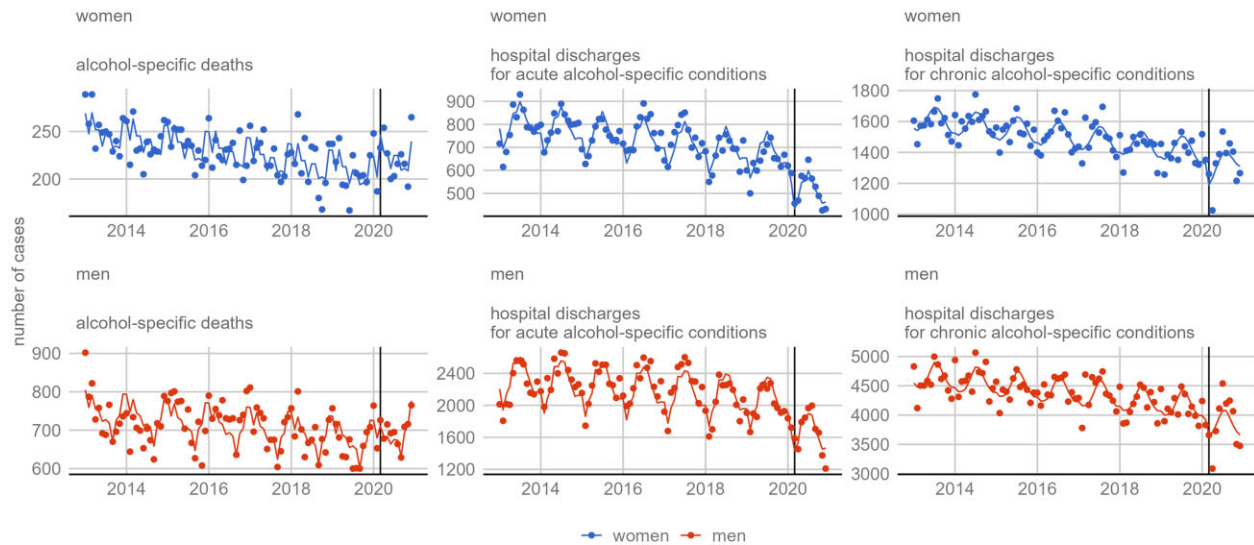


**Figure 1** Changes of deaths and hospital discharges relative to 2019 (reference value, vertical lines). Shown are (i) all-cause or (ii) alcohol-specific condition (columns, further stratified by acute vs. chronic condition for hospital data) by sex (also column) and age group. Horizontal lines indicate 100% (2019 reference value)

all-cause, as well as alcohol-specific causes for all age groups. Only hospital discharges for chronic alcohol conditions among 60- to 74-year-olds (orange line in figure 2) remained stable throughout 2020. In general, declines in hospital discharges for acute conditions appear to be more pronounced than for chronic conditions, and the greatest reduction can be observed for acute alcohol-specific conditions among 15- to 44-year-olds.

*Time series analyses quantifying pandemic-related changes in alcohol-specific mortality and hospitalizations*

The pandemic-related changes in alcohol-specific mortality and hospitalizations were quantified among 45- to 74-year-olds. The results of the time series models are summarized in table 2 and illustrated in figure 2. For five out of six analyzed time series, an abrupt and



**Figure 2** Sex-stratified monthly number of alcohol-specific deaths and hospital discharges reflective of acute and chronic heavy alcohol use between January 2013 and December 2020 among 45- to 74-year-olds. Dots indicate the observed values and the lines are fitted values obtained from interrupted time series models summarized in [table 2](#)

significant (level and/or slope) change in the number of alcohol-specific cases could be observed. Only the alcohol-specific deaths among men did not immediately change following the onset of the COVID-19 pandemic in March 2020.

According to the results of the interrupted time series analyses, the number of monthly alcohol-specific deaths among 45- to 74-year-old women has increased abruptly by about 22 following the onset of the pandemic in March 2020, controlling for the linear trend since 2013 and seasonal patterns. In contrast to the counterfactual scenario of no pandemic impact, we estimate that alcohol-specific mortality among women has increased by 10.8% between 2019 and 2020. For men, no abrupt changes were observed; however, the best-fitting model is suggestive of a continuous increase in the number of monthly deaths by seven additional deaths per month (slope change significant at  $\alpha = 10\%$ ), offsetting the observed long-term declines ( $-1$  death per month, significant at  $\alpha = 10\%$ ). According to this model, alcohol-specific mortality among men was 4.7% higher than expected if no pandemic had impacted their lives. Comparing the changes in alcohol-specific mortality to the changes in all-cause mortality gives some important context: between March and December, the number of all-cause deaths among 45- to 74-year-olds was 4.3% higher in 2020 ( $N = 219\,967$ ) than in 2019 ( $N = 210\,892$ ).

For hospital discharges stratified for acute and chronic heavy alcohol consumption, significant and abrupt declines were observed for both women and men. In comparison to the counterfactual scenario of no pandemic, the total number of hospital discharges for acute alcohol-specific conditions was 21.4% and 25.1% lower for women and men, respectively. For chronic alcohol-specific conditions, we estimate reductions of 7.4% and 8.1% for women and men, respectively. Again, changes in all-cause discharges provide important context: between March and December, the number of all-cause hospital discharges among 45- to 74-year-olds was 14.9% lower in 2020 ( $N = 5\,432\,325$ ) than in 2019 ( $N = 6\,382\,977$ ).

The pattern of increasing mortality and decreasing healthcare access was also confirmed for the age group of 15- to 44-year-olds. For both sexes, mortality from alcohol-specific conditions increased by 20–34% while hospital discharges for acute alcohol-specific conditions decreased by 23–40%. Again, less pronounced but significant reductions in hospital discharges for chronic alcohol-specific conditions (5–6%) were observed (see [Supplementary figure S3](#) and [table S2](#)).

Lastly, we examined how the trend in alcohol-specific deaths and hospitalizations compares to beer sales. As shown in [Supplementary](#)

[figure S4](#), beer sales show a very similar seasonal pattern as hospitalizations. Between 2019 (92.2 million litres) and 2020 (87.2 million litres), a 5.5% reduction in beer sales was registered.

## Discussion

Among 45- to 74-year-olds, we found increased alcohol-specific mortality among women and decreased hospitalizations from both acute and chronic conditions among both women and men following the onset of the COVID-19 pandemic. The same pattern could be observed among 15- to 44-year-olds; however, the relative mortality increases were larger in this age group and seen in both men and women. Thus, we confirm our hypothesis and highlight that health-care utilization may be one explanatory pathway of the COVID-19 alcohol paradox.

## Limitations

Our analyses were restricted to the data that only marks the beginning of the COVID-19 crisis. In Germany, in winter 2020/21, the pandemic burden on hospitals due to rising caseloads exceeded that of spring 2020. Future studies should examine whether the observed patterns are restricted to the first months of the pandemic (sometimes referred to as ‘pandemic shock’) or persist in later years, as well. Annual data from 2021 suggest that the diverging trend of alcohol-specific hospitalizations (absolute number of discharges: 299 894 in 2020, 291 858 in 2021<sup>24</sup>) and deaths (absolute: 14 218 in 2020, 14 385 in 2021; age-standardized rate per 100 000: 16.4 in 2020, 16.7 in 2021<sup>25</sup>) has continued in Germany.

Further, analyzing retrospective data from healthcare registries does not allow us to draw causal inferences on the drivers of the observed changes. Also, we cannot differentiate between reduced availability vs. reduced demand for treatment. Lastly, using clinical data from diagnoses of alcohol-specific conditions is prone to uncertainty given the inconsistency in coding (for an assessment of so-called garbage codes in cardiovascular disease in Germany, see [Ref. 26](#)), as well as the high stigmatization of alcohol use disorders.<sup>27</sup> This could lead not only to suboptimal care of people with alcohol use disorders<sup>28</sup> but also to underreporting of alcohol-specific diseases.<sup>29</sup> Thus, the presented numbers should be considered underestimates of the true alcohol-specific burden. To understand the entire alcohol-attributable burden, the contribution of alcohol to other diseases (e.g. cancer) and injuries needs to be considered.

**Table 2** Results of the interrupted time series analyses on alcohol-specific mortality and hospital discharges among 45- to 74-year-olds

Variable	Deaths: any alcohol-specific conditions				Hospital discharges: acute alcohol-specific conditions				Hospital discharges: chronic alcohol-specific conditions			
	Women		Men		Women		Men		Women		Men	
	Estimate (95% CI)	P value	Estimate (95% CI)	P value	Estimate (95% CI)	P value	Estimate (95% CI)	P value	Estimate (95% CI)	P value	Estimate (95% CI)	P value
Intercept	251.71 (245.11 to 258.31)	<0.001	751.78 (722.19 to 781.37)	<0.001	807.47 (777.43 to 837.50)	<0.001	2333.06 (2219.75 to 2446.37)	<0.001	1619.13 (1593.00 to 1645.26)	<0.001	4674.45 (4601.01 to 4747.89)	<0.001
Linear trend	-0.54 (-0.68 to -0.41)	<0.001	-0.95 (-1.53 to -0.37)	0.002	-1.79 (-2.39 to -1.19)	<0.001	-3.47 (-5.67 to -1.27)	0.003	-2.59 (-3.12 to -2.05)	<0.001	-6.63 (-8.12 to -5.14)	<0.001
Level change	21.82 (9.60 to 34.04)	0.001	-	-	-149.43 (-196.57 to -102.29)	<0.001	-409.65 (-555.04 to -264.26)	<0.001	-152.07 (-231.39 to -72.75)	<0.001	-258.38 (-393.77 to -122.98)	<0.001
Slope change	-	-	6.93 (-1.14 to 15.00)	0.096	-	-	-	-	16.89 (2.85 to 30.93)	0.020	-	-
% Change	+10.8%	-	+4.7%	-	-22.7%	-	-19.8%	-	-5.4%	-	-6.3%	-
AR/MA	None	-	AR1/MA2	-	AR1/MA1	-	AR1/MA1	-	AR2/MA2	-	AR2/MA2	-
Adjusted R <sup>2</sup>	0.580	-	0.531	-	0.852	-	0.837	-	0.661	-	0.647	-

Notes. All results are obtained from GAMM with smoothing terms using cubic splines to represent the annual seasonality (repeating pattern every 12 months). Autoregressive and moving average terms were introduced in the correlation structure to account for autocorrelation in the residuals. For deaths among women, no autocorrelation was present, thus generalized additive models without the addition of AR or MA terms were conducted. Level change denotes an abrupt change in March 2020. Slope change denotes a continuous change in the linear (long-term) trend following March 2020. -, not included in the final model; AR, autoregressive term; CI, confidence interval; MA, moving average terms.

## Implications

In Germany, sales-based per capita consumption of pure alcohol has marginally decreased from 11.0 l in 2019 to 10.7 l in 2020 (unpublished data from the World Health Organization), paralleling the presented trend in beer sales. Consistent with these trends, we found that the number of hospitalizations for chronic and acute alcohol-specific conditions has decreased. In contrast to these trends, we found an increased number of deaths from alcohol-specific conditions. As outlined in the 'Introduction', the divergent trends of hospitalizations and deaths during a period of slightly decreasing per capita alcohol consumption can be explained first with differential changes in consumption and second with changes in healthcare access. In the following, we describe the implications and limitations of both explanations.

For the first explanation, it should be considered that people with low- and medium-drinking risk have on average decreased their alcohol use, while people with high-risk drinking levels have on average increased their alcohol use with the onset of the pandemic (see findings from European countries including Germany<sup>5</sup>). People with chronic heavy drinking patterns accumulate somatic harms over decades and reduce their survival chances. Given the non-linear risk relation between alcohol intake and many adverse outcomes, such as liver cirrhosis,<sup>30</sup> drinking one or two additional drinks will have a more detrimental effect for people who are already drinking hazardously (e.g. five drinks a day) as compared with people with low-risk drinking patterns (e.g. one drink a day). Thus, the changes in drinking patterns might explain increased mortality. At first sight, the divergent trends in consumption seen during the COVID-19 pandemic appear to be in contrast to Skog's theory of collectivity of drinking cultures.<sup>31</sup> This theory postulates that changes in alcohol consumption are very similar across various groups within a society. Specifically, Skog states that 'changes in drinking behaviour will typically be a group phenomenon'.<sup>31</sup> Given that society is a social network in which everyone is influenced by others and that these influences are synchronized, every member is affected by mean changes in consumption. However, the theory also acknowledges that the cultural susceptibility is larger for people with low-risk rather than for those with high-risk drinking patterns, while people who drink the most (e.g. 99% percentile) are 'practically immune' to changes in the general consumption level in their culture'.<sup>31</sup> Interpreting the divergent trends in hospitalizations and mortality as partially driven by differential changes in consumption, our findings may add to Skog's theory that there may be determinants for alcohol consumption that may not synchronize throughout society so rapidly. The COVID-19 pandemic constitutes an unprecedented public crisis that has affected members of society very differently. Restrictions to contain the virus have affected disadvantaged populations disproportionately.<sup>32</sup> Using the terminology of Skog, a synchronization of drinking culture may have been slowed down or even interrupted during periods of physical and social distancing and severe psychological and financial strains. It will require further studies with longer follow-up intervals for a comprehensive evaluation of the COVID-19 pandemic on alcohol consumption and harm.

For the second explanation, we argue that underutilization of addiction-specific services among people with heavy drinking patterns might add to the observed excess mortality. According to our findings, the all-cause number of hospital discharges in 2020 was about 15% lower than in 2019, which may indicate a prioritization of hospital capacities for COVID-19 cases and undertreatment of certain populations. Previous studies have linked the pandemic to several detrimental consequences, such as reduced cancer screening and increased cancer deaths.<sup>33</sup> Similarly, it is plausible to assume that reduced access to specialized interventions for people with heavy drinking patterns, such as withdrawal treatment, is more likely to be responsible for the observed excess mortality. Of note, this holds particularly true for chronic alcohol-specific conditions, which usually develop over a longer period and for which screenings are critical

for treatment success. In contrast, the more pronounced decline in acute alcohol-specific conditions may be primarily driven by the decline in heavy episodic drinking episodes observed in the early months of the pandemic.<sup>1</sup>

While this explanation is generally plausible, the question arises of whether we should observe an immediate increase in alcohol-specific mortality among both women and men because of this. One reason for the women-specific step increase could be that women were particularly affected by the pandemic, as they continue to be responsible for most of the unpaid labour (i.e. childcare, domestic work). School closures and home office obligations imposed a unique strain on women,<sup>34</sup> resulting in a high mental health burden.<sup>35</sup> It is worth noting, however, that we did not observe significant sex differences in self-reported relative changes in alcohol consumption during the pandemic in Germany.<sup>36,37</sup> If similar relative changes translate into similar absolute changes in alcohol consumption among women and men (such data are not available for Germany), this could have contributed to the immediate increase we observed among women. Specifically, women experience more severe consequences than men with the same level of alcohol consumption (see, for example, risk relations for liver damage<sup>30</sup>). Another relevant aspect could be the lower treatment rates in qualified withdrawal treatment, outpatient addiction care and rehabilitation treatment among women with alcohol use disorders compared with men.<sup>38</sup> Given a higher pandemic-related burden on women, the difference in treatment utilization might have been widened during the pandemic due to, for example, a lack of time or personal capacity. Lower treatment utilization in turn may have contributed to the immediate increase in alcohol-specific mortality among women.

Lastly, it should be noted that we found an age gradient in the relative increase of alcohol-specific mortality, with larger changes observed in younger age groups. Importantly, the risk of dying from COVID-19 was elevated for older adults while high-risk alcohol consumption has been linked to increased infection risk.<sup>39</sup> Thus, the observed age gradient could be explained by the fact that COVID-19 has replaced some alcohol-specific deaths in older adults. In other words, a greater number of people with alcohol use disorders may have died following the onset of the pandemic than estimated in our analysis.

## Conclusions

The onset of the COVID-19 pandemic has coincided with increased alcohol-specific mortality and a decrease in alcohol-specific hospitalizations in Germany. Increased consumption among people with heavy drinking patterns and reduced healthcare utilization during the pandemic might explain excess mortality. In times of public health crises, access to addiction-specific services needs to be maintained and utilization of professional psychosocial and medical support should be encouraged.

## Supplementary data

Supplementary data are available at *EURPUB* online.

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## Author contributions

Jakob Manthey (Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Software, Validation, Visualization, Writing—original draft, Writing—review & editing), Carolin Kilian (Validation, Writing—

review & editing), Ingo Schäfer (Writing—review & editing), Marielle Wirth (Data curation, Software, Validation) and Bernd Schulte (Funding acquisition, Project administration, Writing—review & editing)

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**Conflicts of interest:** J.M. and C.K. have worked as consultants for various public health agencies. The other authors declare no conflicts of interest.

## Data availability

The data analyzed and the corresponding R codes are publicly available: 10.6084/m9.figshare.22093286.

### Key points

- In Germany, alcohol-specific mortality increased while alcohol-specific hospitalizations decreased with the onset of the coronavirus disease 2019 pandemic in 2020.
- Changes in alcohol use among people with chronic heavy drinking patterns in conjunction with an underutilization of addiction-specific services are possible explanations.
- In times of public health crises, access to specialized healthcare services for vulnerable populations such as people with alcohol use disorders should be maintained.

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