

Time-series analysis of undetermined death rates compared to suicide death rates in Germany: Considerations for evaluating anti-suicide interventions

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Introduction

Evaluation of suicide prevention campaigns can reveal their effectiveness. A common outcome for assessing anti-suicide activities is the rate of completed suicides. However, suicide deaths are often misclassified as deaths of undetermined cause¹, masking the effects of anti-suicide interventions. Our aim was to compare the rates of suicide deaths (SD) to undetermined deaths (UD) in Germany to understand how they are related.

Methodology

Sample: Death registration data for German inhabitants, aged 15 years and older, were obtained from the Federal Health Monitoring² website for the period of 1991 to 2020.

Analyses: Age-standardized rates (SDR, per 100 000) were calculated for SDs and UD. Rate ratios were found by dividing the UD rate by the SD rate. A time-series analysis was then applied to detect structural changes utilizing the methodology described by Gusmão et al. (2021)³. Analyses were completed using RStudio software (Version 1.4.1106).

¹Värnik, P., et al. Forensic Science International, 2010. **202**(1-3): p. 86-92.

²Gesundheitsberichterstattung des Bundes. <https://www.gbe-bund.de/gbe/>

Results

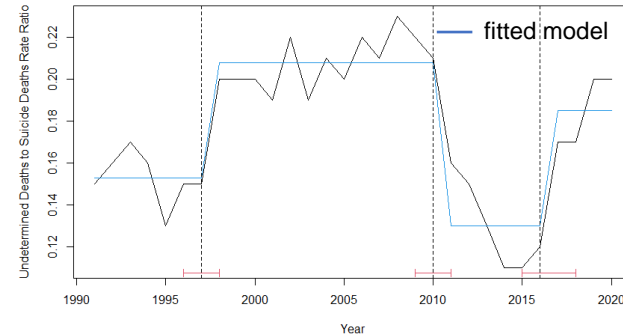


Figure 1. Ratio of undetermined death (UD) rate to suicide death (SD) rate for both sexes ($F = 9.2742$, $p\text{-value} = 0.039$). Breakpoints = 1997, 2010, 2016.

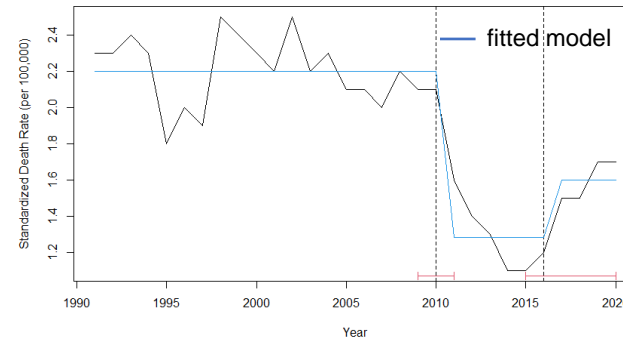


Figure 3. Undetermined cause death (UD) rates for both sexes ($F = 101.39$, $p\text{-value} < 2.2e-16$). Breakpoints = 2010, 2016.

Results



Figure 2. Suicide death (SD) rates for both sexes ($F = 84.181$, $p\text{-value} < 2.2e-16$). Breakpoints = 1994, 1998, 2004, 2016.

Time Window	Breakpoint (95% CI)	Rate Ratio Mean (Standard Deviation)
Both Sexes		
1991-1997	1997 (1996; 1998)	0.15 (0.013)
1998-2010	2010 (2009; 2011)	0.21 (0.012)
2011-2016	2016 (2015; 2018)	0.13 (0.020)
2017-2020	n/a	0.18 (0.015)
Males		
1991-1997	1997 (1996; 1999)	0.15 (0.013)
1998-2005	2005 (2004; 2007)	0.18 (0.010)
2006-2010	2010 (2009; 2011)	0.20 (0.006)
2011-2016	2016 (2015; 2018)	0.12 (0.017)
2017-2020	n/a	0.17 (0.014)
Females		
1991-1997	1997 (1996; 1998)	0.16 (0.013)
1998-2011	2011 (2010; 2012)	0.26 (0.019)
2012-2016	2016 (2015; 2018)	0.15 (0.026)
2017-2020	n/a	0.22 (0.029)

Table 1. Mean rate ratio for each time window between breakpoints (by sex).

Discussion

- The 1997 breakpoint aligns with the 1998 adoption of the International Classification of Diseases (Tenth Revision), which impacted death registration procedures.
- Decline in the rate ratio observed in 2010 (Figure 1) corresponds to changes in the SD rate (Figure 2) and UD rate (Figure 3). The decrease in rate ratio suggests fewer SDs were “masked”.
- The 2010 breakpoint corresponds to the 2009 suicide of a famous German footballer. The publicity surrounding his death may have led to reduced stigma and increased recognition of SDs.
- Similar results were found when rate ratios for males and females were separated (Table 1).

Conclusion

- Due to the common misclassification of SDs as UDs, calculating the rate ratio of the two measures will provide a more accurate picture of suicide statistics.
- Researchers should consider using this measure when evaluating suicide prevention activities.