



# Determinants of Postponed Cancer Screening During the COVID-19 Pandemic: Evidence from the Nationally Representative COVID-19 Snapshot Monitoring in Germany (COSMO)

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**Purpose:** The COVID-19 pandemic is accompanied by various challenges for individual health and the health care system. However, preventive examinations such as cancer screenings should not be postponed during a pandemic. Because nationally representative studies describing postponed cancer screenings and identifying its determinants in Germany are lacking, our aim was to close this gap in knowledge.

**Materials and Methods:** We used cross-sectional data from the nationally representative online-survey “COVID-19 Snapshot Monitoring in Germany (COSMO)” (wave 17), which was conducted in July 2020. The analytical sample included 974 individuals (mean age was 45.9 years, SD: 16.5 years; 18 to 74 years). The outcome measure was whether cancer screening had been postponed since March 2020 due to the COVID-19 pandemic (no, attended as planned; yes, postponed).

**Results:** In total, slightly more than 10% of individuals stated to have postponed cancer screenings between March and July 2020 due to the COVID-19 pandemic, particularly women and individuals aged 30 to 49 years. The likelihood of postponed cancer screening was positively associated with higher affect regarding COVID-19 (OR: 1.65, 95% CI: 1.16–2.35), whereas it was negatively associated with younger age (eg, 18 to 29 years, OR: 0.17, 95% CI: 0.05–0.64, compared to individuals 30 to 49 years).

**Conclusion:** Study findings showed that one out of ten individuals postponed cancer screenings during the COVID-19 pandemic. We determined two correlates of them (age and affect regarding COVID-19). Individuals with an increased likelihood of postponed cancer screenings should be specifically addressed.

**Keywords:** cancer screening, corona-virus, COVID-19, delayed screening, postponed screening; SARS-CoV-2; access to health care; availability of medical care; health care use; health care utilization; health services research; postponed treatment

## Introduction

It is well known that globally cancer is a main driver of mortality.<sup>1</sup> Numerous types of cancer are positively associated with age. In high-income countries further demographic aging is expected and thereby cancer prevalence will increase.<sup>2</sup> However, on the contrary survival rates increase steadily by advancement in cancer treatment and prevention.<sup>3</sup>

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Three types of prevention exist. The aim of primary prevention is to decreasing incidence rates of diseases. Whereas secondary prevention focuses on early detection and immediate treatment of disease. For example, secondary prevention strategies for cancer include colorectal cancer screening, cervical cancer, and mammography screening. Moreover, tertiary prevention refers to preventing the progression of existing conditions.

Worldwide, the World Health Organization established guidelines and criteria for screening procedures.<sup>4</sup> Numerous countries reimburse cancer screenings if efficacy has been confirmed. In Germany, several voluntary population-based cancer screenings are paid for by statutory health insurances. For women, these screenings include, among other things, an annual genital examination (for those aged 20 years and over), and an annual breast examination (30 years and over). For men, these screenings include, among other things, the examination of the external genital organs and the palpation of the prostate and lymph nodes (for those aged 45 years and over). Further details are provided by the Federal Joint Committee (G-BA) in Germany<sup>5</sup> or by the Federal Ministry of Health in Germany.<sup>6</sup> Despite the opportunity to use these services free of charge, screenings are often underused.<sup>7</sup>

Previous studies analyzed determinants of cancer screening utilization. For instance, it has been shown that an increase of screening procedures was associated with higher age, higher educational level<sup>8</sup> and being female.<sup>7</sup> Additionally, health-related factors such as self-rated chronic health conditions<sup>9,10</sup> and psychological factors are linked to the use of cancer screenings.<sup>11</sup> Furthermore, previous studies have shown that socio-demographic factors such as country of birth (eg, born in a foreign country), unemployment or lower socioeconomic status are associated with an increased likelihood of dismissing cancer screenings.<sup>12,13</sup>

However, studies examining determinants of postponed cancer screenings are lacking in general - and in particular during the COVID-19 pandemic. The COVID-19 pandemic is accompanied by various challenges for the health and the health care system. However, it is important not to postpone preventive examinations such as cancer screenings during the

COVID-19 pandemic. The aim of this study was to clarify the frequency of postponed cancer screening due to the COVID-19 pandemic and to identify its correlates using cross-sectional data from a nationally representative survey. This knowledge might assist in identifying individuals at risk for postponed cancer screenings.

On the 16th of March 2020 corona-measures such as closing schools were implemented on a national level in Germany. On the 22nd of March additional travel ban and contact regulations followed, which lasted for several weeks. Restrictions were loosened on the 20th of April 2020. Schools gradually reopened in early May (4th May). In May additional measures were loosened (eg, playground reopened, and contact bans loosened). Further restrictions eased in June. However, a spike in COVID-19 cases could lead to a re-implementation of restrictions.

Screening facilities have been closed in several European countries for some time during the COVID-19 pandemic.<sup>14–18</sup> Moreover, it should be emphasized that elective surgery in hospitals was postponed since March 2020 in Germany.<sup>19</sup> Additionally, a recently published scoping review determined that studies are missing identifying why outpatient appointments were cancelled during the COVID-19 pandemic in Germany. Nevertheless, a previous study based on nationally representative data demonstrated that perceived access to healthcare was quite good.<sup>20</sup>

## Materials and Methods

### Sample

Data were collected from the COVID-19 Snapshot Monitoring (COSMO),<sup>21</sup> wave 17 (analytical sample, n=974, aged 18 to 74 years). Individuals answered questions about postponed cancer screenings solely in wave 17. The COSMO study started in March (3rd and 4th March, wave 1) with weekly follow-up waves until the 26th of May. Subsequently, the survey continued in a 14-day interval. Wave 17 was conducted from the 21st to 22nd of July 2020.

The market research company Respondi recruited participants based on an online-panel matching distribution of gender, age and federal state within German population.<sup>22</sup>

## Dependent Variables

In concordance to other large cohort studies (like the German Ageing Survey) individuals were initially asked whether they had postponed a cancer screening since March 2020 due to the COVID-19 pandemic (1 “Yes” 2 “No, attended as planned” 3 “No examination pending” 4 “No, other reasons”). Thus, they answered whether they postponed a cancer screening due to the COVID-19 pandemic from March 2020 to late July 2020. We dichotomized the outcome measure (0 = no, attended as planned; 1 = yes, postponed). A pretest (n=14 individuals) confirmed high face validity of dependent variables.

## Independent Variables

Several explanatory variables were included in multiple logistic regression analysis: age group (dividing between: 18 to 29 years; 30 to 49 years; 50 to 64 years; 65 years and over), sex (women; men), married/in a relationship (no; yes), living status (living alone;  $\geq 2$  individuals in household), self-employment (no; yes), educational level ( $\leq 9$  years;  $\geq 10$  years, but without general qualification for university entrance;  $\geq 10$  years, including general qualification for university entrance), town size (municipality/small town (1–20.000 inhabitants); medium sized town (20.001–100.000 inhabitants); small city (100.001–500.000 inhabitants); big city ( $> 500.000$  inhabitants)), region (East Germany; West Germany), the COVID-19 cases/100,000 population in the federal state of the participant (at the time of data collection: below median; above median), and the presence of at least one chronic condition (no; yes).

Moreover, affect regarding to the COVID-19 disease was assessed, consisting of seven items. For example, items were: “For me, the new type of corona virus is ... ” “Spreading slowly” (1) to “spreading quickly” (7) or “inflated in media” (1) to “not given enough attention in media” (7). The score was computed by averaging items. In our study, Cronbach’s alpha was 0.78. Furthermore, the presumed severity of COVID-19 disease was quantified (“How do you assess an infection with the novel corona virus for yourself?” (from 1 = completely harmless to 7 = extremely dangerous)).

## Statistical Analysis

Sample characteristics for our analytical sample were computed stratified by status of postponement of cancer screenings. Subsequently, we performed multiple logistic regressions to determine associated factors of postponed cancer screenings due to the COVID-19 pandemic. Statistical significance was established at  $p < 0.05$ . Statistical analyses were conducted using Stata 16.0 (Stata Corp., College Station, Texas).

We also checked for multicollinearity. Since the highest variance inflation factor (VIF) was 1.72 (mean VIF was 1.34), it can be concluded that multicollinearity is not a threat.

## Results

### Sample Characteristics

Sample characteristics (analytical sample with n=974 individuals, average age=45.9 years, SD: 16.5 years, 18 to 74 years; 51.1% female) are shown in [Table 1](#). Bivariate analysis showed that the dependent variable was associated with gender, age group, chronic diseases, affect regarding COVID-19, and presumed severity of COVID-19. Further details are displayed in [Table 1](#).

[Figure 1](#) shows the frequency of postponed cancer screenings. In summary, 11.3% of individuals postponed cancer screenings between March and July 2020 due to the COVID-19 pandemic. Whereas 88.7% of participants did not report postponed screenings (“no, attended as planned”: 13.2%; “no, examining pending”: 71.7%; “no, other reasons”: 3.8%).

### Regression Analysis

Multiple logistic regressions with postponed cancer screenings since March 2020 due to the COVID-19 pandemic as outcome measure (0= no, attended as planned, 1 = postponed) are depicted in [Table 2](#). Regressions revealed that the likelihood of postponed cancer screening was positively associated with higher affect regarding COVID-19 (OR: 1.65, 95% CI: 1.16–2.35), whereas it was negatively associated with younger age (eg, 18 to 29 years, OR: 0.17, 95% CI: 0.05–0.64, compared to individuals 30 to 49 years).

In a supplementary analysis ([Supplementary Table 1](#)), we used multinomial logistic regressions with the base outcome “Yes, postponed cancer screenings”. Overall,

**Table I** Sample Characteristics (Wave 17, with n=974 Individuals)

	Postponed Cancer Screenings				p-value
	Yes, Postponed Cancer Screenings	No, Attended as Planned	No Examining Pending	No, Other Reasons	
	Mean (SD)/n (%)	Mean (SD)/n (%)	Mean (SD)/n (%)	Mean (SD)/n (%)	
Sex					0.03
Male	40 (8.4%)	62 (13.0%)	358 (75.2%)	16 (3.4%)	
Female	70 (14.1%)	67 (13.4%)	340 (68.3%)	21 (4.2%)	
Age category					<0.001
18 to 29 years	4 (2.1%)	16 (8.5%)	168 (88.9%)	1 (0.5%)	
30 to 49 years	54 (15.4%)	38 (10.9%)	242 (69.1%)	16 (4.6%)	
50 to 64 years	35 (13.0%)	40 (14.8%)	182 (67.4%)	13 (4.8%)	
65 years and over	17 (10.3%)	35 (21.2%)	106 (64.3%)	7 (4.2%)	
Children under 18 years:					0.51
No	75 (10.4%)	96 (13.3%)	523 (72.4%)	28 (3.9%)	
Yes	35 (13.9%)	33 (13.1%)	175 (69.4%)	9 (3.6%)	
Education					0.24
up to 9 years/10 years and more (without general qualification for university entrance)	59 (13.3%)	61 (13.8%)	305 (68.8%)	18 (4.1%)	
10 years and more (with general qualification for university entrance)	51 (9.6%)	68 (12.8%)	393 (74.0%)	19 (3.6%)	
Town size					0.48
Municipality/small town (1–20.000)	45 (11.2%)	57 (14.2%)	282 (70.1%)	18 (4.5%)	
Medium sized town (20.001–100.000)	23 (9.6%)	32 (13.3%)	180 (75.0%)	5 (2.1%)	
Small city (100.001–500.000)	21 (14.8%)	12 (8.5%)	102 (71.8%)	7 (4.9%)	
Big city (> 500.000)	21 (11.1%)	28 (14.7%)	134 (70.5%)	7 (3.7%)	
Region					0.50
Western Germany	90 (11.0%)	110 (13.5%)	583 (71.4%)	34 (4.1%)	
Eastern Germany	20 (12.7%)	19 (12.1%)	115 (73.3%)	3 (1.9%)	
Cases/100,000 population					0.44
Below median	54 (11.5%)	54 (11.5%)	340 (72.7%)	20 (4.3%)	
Above median	56 (11.1%)	75 (14.8%)	358 (70.7%)	17 (3.4%)	
Relationship/Marriage					0.69
No	34 (10.1%)	41 (12.2%)	249 (73.9%)	13 (3.9%)	
Yes	76 (11.9%)	88 (13.8%)	449 (70.5%)	24 (3.8%)	
Living situation					0.89
Living alone	30 (11.9%)	31 (12.3%)	181 (71.5%)	11 (4.3%)	
At least 2 individuals in the same household	80 (11.1%)	98 (13.6%)	517 (71.7%)	26 (3.6%)	
Migration background:					0.93
No	94 (11.4%)	110 (13.4%)	589 (71.6%)	30 (3.6%)	
Yes	16 (10.6%)	19 (12.6%)	109 (72.2%)	7 (4.6%)	

(Continued)

**Table 1** (Continued).

	Postponed Cancer Screenings				p-value
	Yes, Postponed Cancer Screenings	No, Attended as Planned	No Examining Pending	No, Other Reasons	
Self-employment					0.55
No	97 (11.0%)	116 (13.1%)	638 (72.3%)	32 (3.6%)	
Yes	13 (14.3%)	13 (14.3%)	60 (65.9%)	5 (5.5%)	
Chronic disease					<0.01
No	61 (10.0%)	70 (11.5%)	461 (75.7%)	17 (2.8%)	
Yes	49 (13.4%)	59 (16.2%)	237 (64.9%)	20 (5.5%)	
Affect regarding COVID-19 (higher values correspond to higher affect regarding COVID-19)	4.5 (1.1)	4.0 (0.9)	4.1 (1.0)	4.2 (1.2)	<0.001
Presumed severity of COVID-19 disease (from 1 to 7; higher values correspond to higher severity)	4.7 (1.4)	4.4 (1.6)	4.1 (1.5)	4.6 (1.9)	<0.001

**Abbreviations:** SD, standard deviation.

these findings remained comparable. Moreover, in a further supplementary analysis ([Supplementary Table 2](#)), multiple logistic regressions with postponed cancer screenings since March 2020 due to the COVID-19 pandemic as outcome measure (0= no, attended as planned, 1 = postponed) were performed among individuals aged 50 years and over (since most cancer screenings are performed among older adults). Please see [Supplementary Table 2](#) for further details.

## Discussion

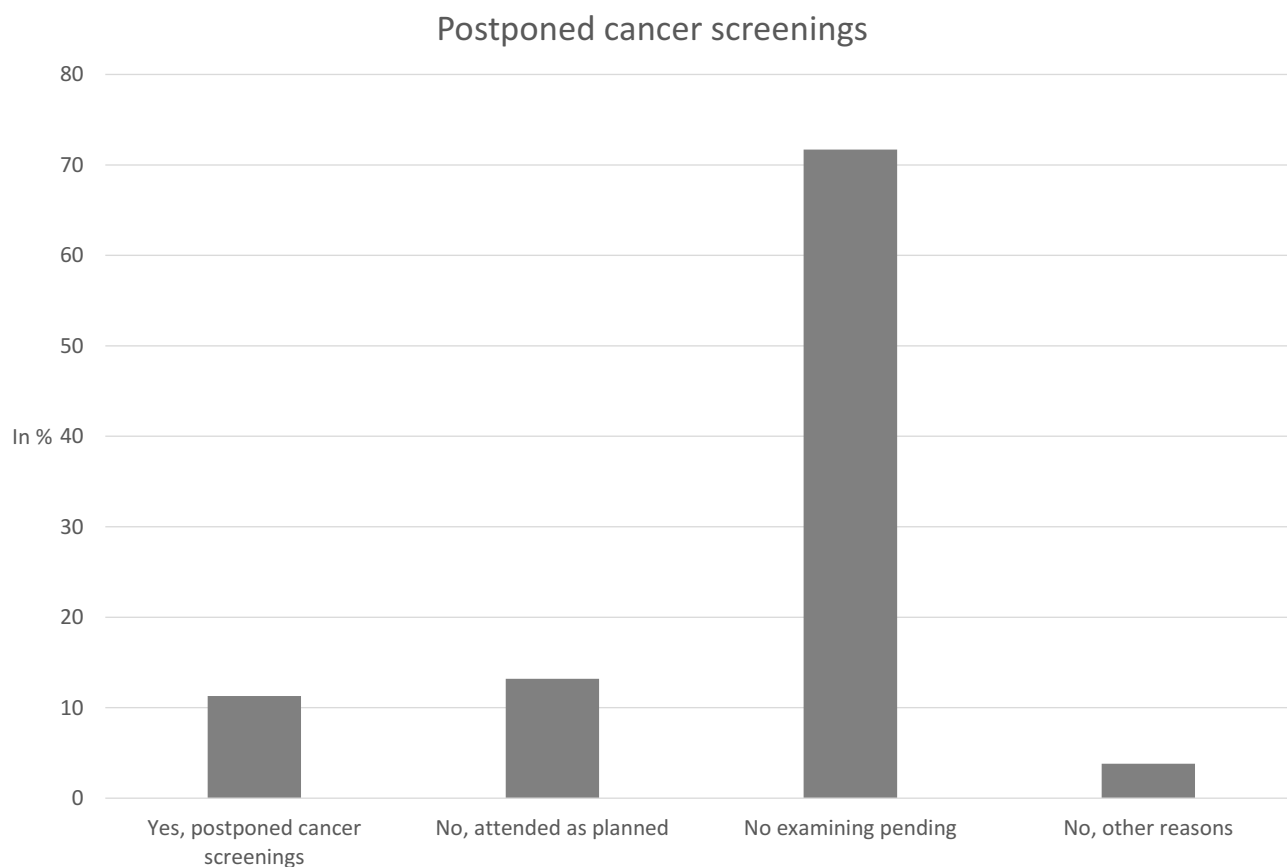
Based on nationally representative cross-sectional data, the aim of this study was to clarify the frequency of postponed cancer screening due to the COVID-19 pandemic and to identify its correlates. Overall, more than 10% of the individuals postponed cancer screenings since between March and July 2020 due to the COVID-19 pandemic, particularly women and individuals aged 30 to 49 years. It should be noted that approximately 46% postponed their cancer screening (when we exclusively compare individuals who

postponed cancer screenings and individuals who did not attend as planned).

Regressions showed that the likelihood of postponed cancer screening was positively associated with higher affect regarding COVID-19, whereas it was negatively associated with younger age.

Differences in the likelihood of postponed cancer screening between individuals aged 18 to 29 years and individuals aged 30 to 49 years may be determined by a low number of cancer screenings offered to individuals aged 18 to 29 years. For example, in this young age group health insurances in Germany reimburse solely one annual genital examination (including pap smear) for women aged 20 years and older (to detect cervical cancer). However, in older age, various additional cancer screening procedures are fully paid by health insurances.

Higher affect regarding COVID-19 was associated with postponed cancer screenings in our study. This appears to be plausible since negative affect regarding COVID-19 is linked to anxiety.<sup>23</sup> A previous review showed that factors such as anxiety or cancer worry are



**Figure 1** Postponed cancer screenings.

clearly linked to cancer screening behavior.<sup>24</sup> However, these existing findings differ in direction.<sup>24</sup> Thus, future research is required to clarify the link between affect regarding COVID-19 and postponed cancer screenings during the COVID-19 pandemic.

It is worth noting that the decision to postpone intended cancer screenings can additionally be caused by balancing effects of cancer screenings and potential costs, particularly for individuals in poor health. Consequently, delaying cancer screenings can make sense for certain groups to avoid serious health consequences caused by COVID-19.

A strength of this study is that it is the first nationwide study identifying the frequency and its determinants of postponed cancer screenings during the COVID-19 pandemic. Data were derived from general

adult population. However, individuals aged 75 years and above were not included and should be examined in future studies. Due to data availability differentiation between types of cancer screening is not possible. Nevertheless, we provide first insights into determinants of postponed cancer screenings in general. The cross-sectional study design is a limitation because it is difficult to draw causal conclusions. Thus, future longitudinal studies are required to clarify the directionality.

## Conclusion

Study findings showed that one out of ten individuals postponed cancer screenings during the COVID-19 pandemic. We determined two correlates of them (age and affect regarding COVID-19). Individuals with an increased

**Table 2** Determinants of Postponed Cancer Screenings (0 = No, Not Postponed; 1 = Yes, Postponed) Due to the COVID-19 Pandemic Since March 2020. Findings of Multiple Logistic Regressions

Independent Variables	Postponed Cancer Screenings
Gender: Female (Ref.: Male)	1.26 (0.70–2.27)
Age category: - 18 to 29 years (Ref.: 30 to 49 years)	0.17** (0.05–0.64)
- 50 to 64 years	0.49 (0.24–1.02)
- 65 years and over	0.38* (0.16–0.89)
Children (under 18 years): Yes (Ref.: Absence of children under 18 years)	1.17 (0.56–2.46)
Education: General qualification for university entrance (Ref.: absence of qualification for university entrance)	0.64 (0.35–1.19)
Town size: - Medium sized town (20.001–100.000) (Ref.: municipality/small town (1–20.000))	0.95 (0.45–1.96)
- Small city (100.001–500.000)	2.45* (1.00–5.99)
- Big city (> 500.000)	1.05 (0.48–2.29)
Region: East Germany (Ref.: West Germany)	0.93 (0.39–2.23)
Cases/100,000 population: Above median (Ref.: below median)	0.69 (0.36–1.32)
Relationship/Marriage: Yes (Ref.: no partnership/marriage)	0.96 (0.41–2.23)
Living situation: At least 2 individuals in the same household (Ref.: living alone)	0.89 (0.36–2.18)
Migration background: Yes (Ref.: no migration background)	1.24 (0.52–2.92)
Self-employment: Yes (Ref.: not self-employed)	0.99 (0.40–2.46)
Chronic disease: Yes (Ref.: no chronic diseases)	1.02 (0.55–1.89)
Affect regarding COVID-19 (higher values correspond to higher affect regarding COVID-19)	1.65** (1.16–2.35)
Presumed severity of COVID-19 disease (higher values correspond to higher severity)	0.93 (0.74–1.18)
Observations	239

**Notes:** Odds ratios are reported; 95% confidence intervals in parentheses; \*\*  $p < 0.01$ , \*  $p < 0.05$ .

**Abbreviation:** Ref, reference category.

likelihood of postponed cancer screenings should be specifically addressed.

## Abbreviations

COSMO, COVID-19 Snapshot Monitoring in Germany; COVID-19, coronavirus disease 2019; Ref, reference category; SD, standard deviation; OR, odds ratio; CI, confidence interval.

## Data Sharing Statement

Data are not publicly available but interested parties may contact the authors for more information (Permission granted by PIs of COSMO study).

## Ethics Approval and Informed Consent

Informed consent was obtained from all individual participants included in the study. All procedures performed in the COSMO studies involving human participants were in accordance with the ethical standards of the University of Erfurt institutional research committee (#202000302) and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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## Author Contributions

All authors significantly contributed to conceptualization; A.H. contributed to methodology/formal analysis; A. H. contributed to writing - original draft preparation; All authors substantially contributed to writing - review and editing; H.-H.K contributed to supervision. All authors have agreed on the journal to which the article will be submitted. Moreover, all authors reviewed and agreed on all versions of the article before submission and during

revision. All authors agree to take responsibility and be accountable for the contents of the article.

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## Disclosure

The authors report no conflicts of interest in this work.

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