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ORIGINAL ARTICLE

The impact of the COVID-19 pandemic on preventive health services: A five-year assessment of cancer screening in Ankara, Türkiye

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ABSTRACT

Objective: This study evaluated the impact of the COVID-19 pandemic on population-based breast, colorectal, and cervical cancer screening programs in Ankara, by analysing the five-year screening rates.

Method: This descriptive study used routinely collected data from the Ankara Provincial Health Directorate and included HPV, mammography, and faecal occult blood testing (FOBT) results between 2018-2022. The population at risk was obtained from official address-based population statistics. Annual screening rates per 100 individuals were calculated, and trend changes were evaluated using Joinpoint regression analysis.

Results: A total of 261,895 HPV, 182,347 mammography, and 228,040 FOBT tests were evaluated. Screening rates declined severely in 2020. HPV screening rates decreased from 4.8 per 100 in 2019 to 1.54 in 2020 (-67.9%). Mammography dropped from 4.9 to 1.5 per 100 (-69.4%), and FOBT from 5.9 to 1.7 per 100 (-71.2%). Across all screening programs, 2020 marked a statistically significant turning point (joinpoint) in the observed screening trends ($p<0.05$). Partial recovery occurred in 2021–2022: HPV reached 3.0 per 100 (+165% increase from 2021), mammography 4.8 per 100 (+182%), and FOBT 6.6 per 100 (+267%). Only FOBT exceeded pre-pandemic levels, while HPV and mammography screenings remained below baselines. HPV positivity rose to 7.5% in 2020 despite reduced screening volume, whereas FOBT positivity showed year-to-year variability (2.5-6.6%).

Conclusion: The pandemic caused major disruptions in cancer screening in Ankara, with 68-71% declines during 2019-2020 and incomplete recovery by 2022 for HPV and mammography. Developing resilient, adaptable screening systems and catch-up strategies to strengthen population-level cancer control efforts for future public health crises is essential.

Keywords: Breast Neoplasms, COVID-19, Early Detection Of Cancer, Human Papillomavirus, Mass Screening, Pandemic

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INTRODUCTION

Cancer remains a significant global public health problem, with one of the leading causes of morbidity and mortality worldwide. According to GLOBOCAN, approximately 20 million individuals worldwide were newly diagnosed with cancer in 2022[1]. Breast, cervical, and colorectal cancers contribute substantially to the global cancer burden due to their high incidence and mortality worldwide. Breast cancer accounts for 11.6% of new cancer cases and is the most common cancer among women worldwide[1]. Cervical cancer is largely preventable through HPV vaccination and screening; however, it remains a significant cause of mortality, particularly in low- and middle-income settings[2]. Colorectal cancer was the third most commonly diagnosed cancer worldwide in 2022, with more than 1.9 million new cases. According to projections, the global cancer burden is expected to rise substantially, with annual new cancer cases projected to reach 35 million by 2050, a 77% increase compared with 2022[1]. However, the World Health Organization (WHO) indicates that 38% of cancers can be prevented by avoiding risk factors and applying evidence-based preventive strategies. Furthermore, the overall cancer burden can be significantly reduced by early diagnosis and treatment[3].

Effective screening programs are essential for global cancer control, as they facilitate early diagnosis and timely treatment of breast, cervical, and colorectal cancers. Since the 1980s, breast cancer mortality has significantly declined, due to both screening and advancements in treatment[4-7]. In the context of colorectal cancer, Zheng et al.'s[8] meta-analysis showed that biennial fecal occult blood testing (gFOBT) can reduce colorectal cancer mortality by up to 69%. Cervical cancer, on the other hand, is the second leading cause of death among women of reproductive age[9], and the WHO's global strategy to eliminate cervical cancer targets 90% HPV vaccination coverage among girls by the age of 15; 70% screening coverage by ages of 35 and 45; and treatment for 90% of women with pre-cancers and invasive cervical cancer by 2030[2]. Continuum of organised screening programs, therefore, is a key component of decreasing mortality and eliminating cervical cancer[10].

The COVID-19 pandemic caused significant disruptions to preventive health services, including organized cancer screening programmes. Systematic reviews have consistently reported substantial reductions in screening activity and diagnostic work-up during the pandemic period[11]. More recent systematic reviews confirm that this adverse effect was observed across breast, cervical, and colorectal cancer screening programs[12]. International data reveal substantial heterogeneity in the organization, coverage, follow-up performance, and data infrastructure of breast, cervical, and colorectal screening systems across countries. Consequently, findings from one context cannot be directly generalized to another[13]. A population-based assessment from Ontario, Canada, demonstrated that disruptions to cancer screening programs during the pandemic extended beyond reductions in testing volume to include diagnostic delays following abnormal test results. These delays disproportionately affected older individuals and residents of low-income neighborhoods[14]. Subsequent post-pandemic analyses further demonstrated that pre-existing inequities widened, particularly for breast and colorectal cancer screening among immigrants and individuals living in low-income neighbourhoods[15]. In the United States, data indicate that recovery has also been uneven across cancer types, with cervical screening remaining below prepandemic levels even as breast and colorectal screening rebounded[16]. Although evidence from low- and middle-income countries is comparatively limited, existing multicountry analyses demonstrate substantial variation in the magnitude of reduction. In 2020, declines ranged from 14.1% to 72.9% for cervical screening and from 14.2% to 49.4% for breast screening across the included programs[17]. At the primary healthcare level, record-based data from Gaziantep, Türkiye, similarly indicated that despite an increase in target populations over time, the percentages of breast, cervical, and colorectal screenings declined in 2020[18]. A comprehensive assessment of breast, cervical, and colorectal cancer screenings in Ankara can clarify the extent and patterns of influences in national screening programs. Such analysis provides a local evidence base for backlog management, service restructuring, and health system preparedness. Therefore, this study aimed to

explore the impact of the COVID-19 pandemic on breast, cervical, and colorectal cancer screenings in Ankara. The findings are intended to inform policy decisions and guide planning for future public health emergencies.

METHODS

Cancer Screening in Türkiye

Screening for breast, colorectal, and cervical cancers has been recommended in Türkiye as part of the national cancer screening program and carried out free of charge by the Ministry of Health. Breast cancer screening with mammography is recommended every two years for women aged 40-69. HPV DNA testing is administered every 5 years for women aged 30-65, with Pap smear used for reflective triage. For women and men aged 50-70, FOBT is recommended every two years and a colonoscopy every ten years[19].

National screening standards for breast, cervical, and colorectal cancers were established in Türkiye in 2009 and revised in 2013. Screening services are provided free of charge through Cancer Early Diagnosis, Screening and Training Centers (KETEMs), family physicians, and other primary care or community-based structures. The integration of family physicians into screening activities began in 2013. In 2014, HPV-DNA-based community cervical screening was expanded to all 81 provinces. Subsequently, mobile mammography and centralized reporting initiatives were introduced to enhance breast cancer screening delivery. Türkiye maintains an organized, population-based screening system with invitation and follow-up mechanisms, although some opportunistic participation occurs in routine practice. Official program documents set coverage targets, such as achieving at least 70% screening coverage for cervical cancer, while actual participation rates may fluctuate over time, by screening modality, and by setting[19].

As in many countries, at the beginning of the pandemic in Türkiye, the Ministry of Health and medical organisations recommended postponing non-urgent screenings. During this period, resources from the Cancer Early Detection, Screening, and Education Centres were directed to combating COVID-19.

Ethical Approval and Official Permissions

Ethical approval was received from the Non-Interventional Clinical Research Ethics Committee of Dr. Abdurrahman Yurtaslan Ankara Oncology Training and Research Hospital, University of Health Sciences, Türkiye (research code no: 2023-08/66). Subsequently, written permission was obtained from the Commission for the Evaluation of Research Requests in Primary Health Care, General Directorate of Public Health, Ministry of Health of Türkiye (Letter dated 13.10.2023, numbered E-51381736-771-22675317, subjected 'Research Permission').

Dataset and Analysis

After obtaining the necessary permissions for the study, the results of breast, cervical, and colorectal cancer screenings in Ankara between January 1, 2018, and December 31, 2022, were obtained from the Ankara Provincial Health Directorate.

The screening counts in this study indicate the total number of screening tests performed, not the number of unique individuals screened. Because national cancer screening programs in Türkiye are conducted at defined intervals, individuals may participate in screenings across multiple years according to the recommended schedule. As a result, repeated screening episodes in different years were counted separately. The dataset was received in anonymized form, with no personal identifiers available. Therefore, it was not possible to determine whether records from different years belonged to the same individual. Individuals with abnormal screening results are referred to higher-level healthcare facilities for further diagnostic evaluation, while those without identified risk are re-screened at intervals recommended by the national screening program. Therefore, the analyses reflect the overall volume of screening services delivered during the study period, rather than the number of unique persons screened.

This retrospective review was conducted between October 15, 2023, and February 15, 2024. In Türkiye, national cancer screening programs target specific age groups according to cancer type (women aged 40-69

years for breast cancer screening, women aged 30-65 years for cervical cancer screening, and individuals aged 50-70 years for colorectal cancer screening). In this study, the population at risk was defined as residents of Ankara who, in the relevant screening year, fell within the target age range for each screening program. Population data were obtained from the Address-Based Population Registration System published by the Turkish Statistical Institute (TURKSTAT)[20]. For each cancer type, the screening rate was calculated by dividing the number of screening tests performed in a given year by the corresponding population at risk for that year, using the target age group and sex, where applicable. Accordingly, annual TURKSTAT population data were extracted separately for each cancer type and corresponding target group and used in the analyses.

Joinpoint regression analysis identifies statistically significant changes in temporal trends and the specific time points at which these changes occur. In the present study, Joinpoint regression was applied to annual screening rates instead of total screening test counts. For each cancer type, annual screening rates were determined by dividing the number of screening tests performed in a given year by the corresponding at-risk population for that year. The calendar year served as the independent variable, while the annual screening rate was the dependent variable. Analyses were conducted using the Joinpoint Regression Program, version 4.5.0.1 (Statistical Research and Applications Branch, Surveillance Research Program, National Cancer Institute)[21]. Annual percent change values and corresponding 95% confidence intervals were estimated using log-linear models. A constant variance model was assumed, and the rates were log-transformed before analysis. Annual positivity rates were calculated and reported descriptively as secondary outcomes. Joinpoint analysis and other formal trend modeling were not performed since the study was not intended for inferential evaluation of positivity trends. Additionally, the limited number of annual aggregated observations could compromise the stability and interpretability of model-based estimates.

Statistical Analysis

The study data were analysed using IBM SPSS version 27.0. Descriptive data were presented as numerical and percentage values.

RESULTS

This study evaluated a total of 261,895 HPV, 182,347 mammography, and 228,040 FOBT tests conducted in Ankara between 2018 and 2022. It was determined that all three screening programs experienced a significant decrease in 2020 due to the impact of the COVID-19 pandemic, but a resurgence was observed in 2022.

Significant fluctuations were observed in HPV screening over the five years (Table 1, Figures 1, 2). The total number of screening tests ranged from ranged from 60,339 to 65,561 in the 2018-2019 period before the pandemic, dropping to 21,238 in the initial year of the pandemic. Negative rates ranged from 91.2% to 93.9% across years, while positive rates reached a peak of 7.5% in 2020. In 2022, during the late phase of the pandemic, the number of screenings increased to 42,109. The screening rate (per 100 population) was recorded as 4.5-4.8% in the pre-pandemic 2018-2019 period, 1.54% during the pandemic year, and 3.0% in the late pandemic 2022.

Joinpoint regression analysis revealed the following annual percent changes (APC) for HPV screening rates: 2018-2019: +5.73%; 2019-2020: -67.92%; 2020-2021: -26.62%; 2021-2022: +165.49%. A statistically significant joinpoint was identified in 2020, corresponding to a nearly 68% decline from 2019 to 2020. Although a strong rebound was observed from 2021 to 2022 (+165%), the increase is partly explained by the very low baseline rate in 2021, and overall screening levels did not fully return to pre-pandemic values.

Table 1. HPV screening results between 2018 and 2022

Year	Total Screened N	Negative N (%)	Positive N (%)	Lack of sample N (%)	Population at Risk	Rate per 100
2018	60,339	56674 (93.9%)	3557 (5.9%)	108 (0.2%)	1,327,084	4.54
2019	65,561	61260 (93.4%)	4169 (6.4%)	132 (0.2%)	1,365,670	4.8
2020	21,238	19584 (92.2%)	1586 (7.5%)	68 (0.3%)	1,376,907	1.54
2021	15,786	14400 (91.2%)	1367 (8.7%)	19 (0.1%)	1,400,813	1.13
2022	42,109	39186 (93.1%)	2842 (6.7%)	81 (0.2%)	1,417,796	3.0

HPV: Human papillomavirus

A significant pattern of decline and recovery was also observed in mammography screenings over the years (Table 2, Figure 1, Figure 2). While annual mammography screenings approached nearly 50,000 before the pandemic, this number decreased to 14,810 during the first year of the pandemic. The BI-RADS 0 rate increased from 5.7% before the pandemic to 9.3% in 2020. BI-RADS 1–2 rates remained around 89% throughout the pandemic, while BI-RADS 4 and 5 rates showed slight increases. Screening rates were 4.9-5.2% before the pandemic, but 1.5% in 2020 and 4.8% in 2022.

APC for mammography screening rates were calculated as follows: 2018–2019: -5.77%; 2019–2020: -69.39%; 2020–2021: +13.33%; 2021–2022: +182.35%. A significant 69% decline occurred between 2019 and 2020, similar in extent to that of HPV screening. Despite a marked recovery in 2022 (+182%), mammography screening did not fully return to pre-pandemic levels.

Table 2. Mammography screening results between 2018 and 2022

Year	Total Screened N	BI-RADS 0 N (%)	BI-RADS 1–2 N (%)	BI-RADS 4 N (%)	BI-RADS 5 N (%)	Population at Risk	Rate per 100
2018	49,846	2858 (5.7%)	46688 (93.7%)	199 (0.4%)	101 (0.2%)	950,476	5.2
2019	48,037	2755 (5.7%)	44977 (93.6%)	184 (0.4%)	121 (0.3%)	990,059	4.9
2020	14,810	1370 (9.3%)	13294 (89.8%)	99 (0.7%)	47 (0.3%)	1,013,766	1.5
2021	18,095	1756 (9.7%)	16126 (89.1%)	116 (0.6%)	97 (0.5%)	1,048,792	1.7
2022	51,559	4774 (9.3%)	46232 (89.7%)	415 (0.8%)	138 (0.3%)	1,072,130	4.8

A significant impact of the pandemic was observed in FOBT screening rates (Table 3, Figure 1, Figure 2). The number of screenings decreased from 64,525 in 2019 to 19,166 in 2020. Negative rates were high in all years, ranging from 93.4% to 97.6%. The positivity rate was 2.5% in the first year of the pandemic and 4.0% in the late pandemic period of 2022. Screening rates were recorded as 4.2-5.9% before the pandemic, 1.7% during the pandemic year, and 6.6% during the late pandemic period.

APC for FOBT screening were as follows: 2018–2019: +40.48%; 2019–2020: -71.19%; 2020–2021: +5.88%; 2021–2022: +266.67%. The most substantial pandemic-related decline was observed in FOBT screening, with a 71% decrease from 2019 to 2020. In the post-pandemic period, FOBT showed the strongest recovery among all three screening programs, with a 266% increase from 2021 to 2022, surpassing pre-pandemic levels.

Table 3. Faecal occult blood test screening results between 2018 and 2022

Year	Total Screened N	Negative N (%)	Positive N (%)	Population at Risk	Rate per 100
2018	44,551	41599 (93.4%)	2952 (6.6%)	1,050,116	4.2
2019	64,525	62151 (96.3%)	2374 (3.7%)	1,098,309	5.9
2020	19,166	18683 (97.5%)	483 (2.5%)	1,125,371	1.7
2021	20,953	20444 (97.6%)	509 (2.4%)	1,166,668	1.8
2022	78,845	75693 (96.0%)	3152 (4.0%)	1,199,536	6.6

When the changes in screening rates across the three screening programs are examined together over the years, it is seen that all tests showed a common downward trend in 2020, a partial recovery in 2021, and a tendency to approach or even exceed pre-pandemic levels in 2022 (Figure 1).

Across all three screening programs, Joinpoint regression identified 2020 as the single statistically significant breakpoint, corresponding to the onset of the COVID-19 pandemic. The annual declines between 2019 and 2020 were -67.9% for HPV, -69.4% for mammography, and -71.2% for FOBT. Although screening utilization increased in 2021–2022, only FOBT exceeded pre-pandemic levels, whereas HPV and mammography demonstrated partial but incomplete recovery.

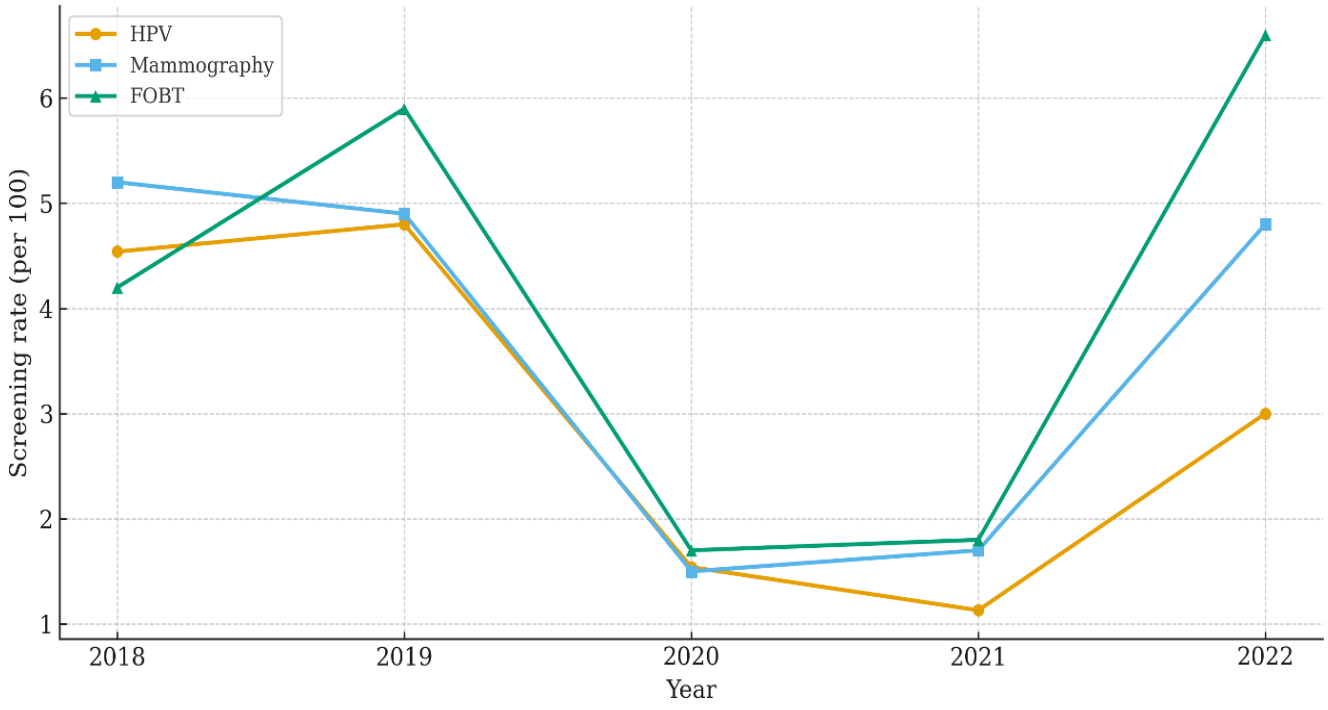


Figure 1. Trends in HPV, Mammography, and FOBT screening rates in Ankara, 2018–2022
HPV: Human papillomavirus, FOBT: Fecal occult blood test

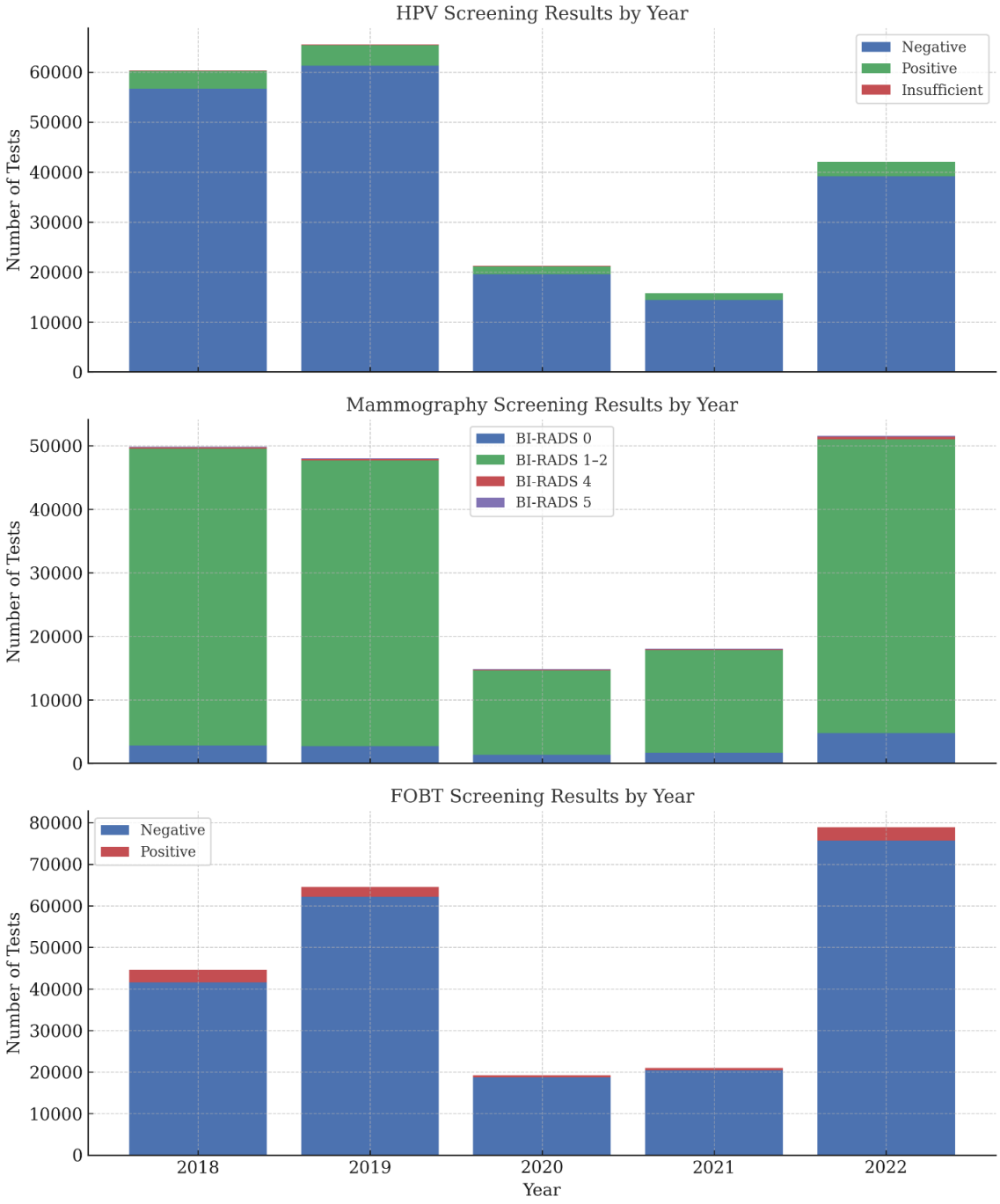


Figure 2. Annual outcomes of HPV, mammography, and FOBT screening tests between 2018 and 2022
HPV: Human papillomavirus, FOBT: Fecal occult blood test

DISCUSSION

The results of this study show that the national cancer screening programs in Ankara, Türkiye's capital, were significantly affected by the COVID-19 pandemic. Breast, cervical, and colorectal cancer screenings declined significantly compared to previous years, particularly during the initial phase of the COVID-19

pandemic, with a partial recovery in the subsequent period.

The substantial 70% decrease across all three screening programs in 2020 is supported by international studies. The Centers for Disease Control and Prevention (CDC) reported a decrease by 84% and 87% respectively for cervical and breast cancer screenings in the United States (US) in April 2020 compared to the same month in the previous five years22. A self-reported survey study from the US showed breast and cervical cancer screening prevalence decreased by 6% and 11%, respectively, between 2018 and 2020[23]. Consistent with our findings, a study from Rize, Türkiye, reported a 44% overall decrease in mammography screenings during the pandemic compared to the pre-pandemic period, most notably in April (98% drop)[24]. Another study conducted with women presenting for breast screening 15 months after the start of the pandemic in Türkiye, 62% of women reported missing a screening mammogram during the pandemic. Fear of COVID-19 transmission was reported by almost all participants (92%) as the most common reason for missing mammography[25]. Retrospective analyses from Bolu, Türkiye also showed significant decreases in HPV/Smear, FOBT, and mammography screenings in 2020 compared to the pre-pandemic period[26].

The dramatic reduction in screening utilization can be attributed to several pandemic-related factors. These include the restructuring of healthcare services during the COVID-19 pandemic, the reduction in service capacity of primary healthcare institutions that provide preventive healthcare services such as Cancer Early Diagnosis, Screening and Education Centres, Healthy Life Centres, and Community Health Centres, and/or their diversion to combat the pandemic, curfews, and individuals' behaviour to avoid seeking healthcare services. The literature also cites curfews, the cessation of elective services in healthcare institutions, and the public's avoidance of healthcare facilities due to concerns about contracting COVID-19 as the primary reasons for the decline in this period[11].The three cancer screening modalities evaluated in this study differ substantially in their delivery models, target populations, infrastructure requirements, degree of direct patient contact, and reliance on specialized personnel[13,27]. In the present study, although all three screening programs experienced a marked decline in 2020, their subsequent recovery patterns differed, likely due to distinct delivery requirements. In Türkiye, colorectal screening is primarily based on FOBT, which can be completed at home and requires minimal direct contact with health facilities. In contrast, mammography depends on face-to-face attendance, imaging infrastructure, and specialized personnel. HPV-based cervical screening, while highly effective, also relies on sample collection within the healthcare system under the current service model[19]. These differences are significant, as international evidence suggests that screening modalities requiring in-person attendance and greater clinical infrastructure were generally more vulnerable to disruption during the pandemic, whereas lower-contact approaches demonstrated greater resilience. A global meta-analysis found a greater decline for colonoscopy compared to FOBT or fecal immunochemical test (FIT)-based screening[27]. Our finding that FOBT screening recovered more rapidly and even exceeded prepandemic levels by 2022, while mammography and HPV screening remained comparatively less recovered, supports this structural interpretation.

In Türkiye, cancer screening is provided free of charge through primary healthcare organisations, utilizing invitation systems based on population registries and family doctor or primary care lists19. However, nationwide data indicate that participation also varies by education, income, chronic disease status, and recent contact with a family physician28. Therefore, post-pandemic recovery may depend not only on the characteristics of the screening test but also on the effectiveness of efforts to reach eligible individuals and reintegrate them into screening pathways. In a study covering approximately 90,000 women in Samsun (2022), the HPV positivity rate was reported as 4.9%[29]. Similarly, Gültekin et al.[30] reported a 4.39% HPV positivity (2020) rate among 4 million asymptomatic women in Türkiye. In our study, HPV positivity rates exceeded those reported in previous Turkish studies. However, this finding warrants

cautious interpretation. An elevated positivity rate during the pandemic does not necessarily reflect a short-term increase in the true population prevalence of cervical precancer or cancer. Instead, it may indicate shifts in the characteristics of women who underwent screening during the pandemic, with those having prior abnormalities, heightened perceived risk, or stronger motivation to seek care potentially being overrepresented among attendees[28]. Supporting this interpretation, data from Catalonia demonstrated that cervical screening participation declined during the pandemic, while the prevalence of abnormal cytology was 1.4 times higher than expected, in a context where follow-up visits for previous abnormalities continued during lockdown[31]. Therefore, the increased HPV positivity observed in our study may more plausibly be attributed to epidemiological effects of selective attendance, rather than to an abrupt biological increase in disease occurrence.

The increased positivity rates observed for mammography and HPV screening during the pandemic should be interpreted with caution. Given the short duration of observation, it is epidemiologically improbable that the COVID-19 pandemic directly caused a true biological increase in the incidence of breast or cervical cancer. A more likely explanation is selective attendance: while many asymptomatic or lower-risk individuals postponed routine screening, individuals with symptoms, previous abnormalities, family history, or higher perceived risk may have been more likely to seek care[31,32]. This interpretation is supported by studies indicating that diagnostic mammography declined far less than screening mammography during the pandemic, and that breast cancers diagnosed during this period were more often symptomatic and associated with palpable masses[32,33]. Therefore, higher positivity rates in this study should not be interpreted as evidence of a sudden increase in cancer incidence in the population, but rather as a reflection of changes in the characteristics of those screened during a period of significant service disruption.

Our findings demonstrate a partial recovery in screening programs during the late phase of the pandemic (2021–2022). With the easing of restrictions in 2021, the implementation of COVID-19 prevention measures in healthcare institutions (masks, social distancing, patient appointments, etc.), and the introduction of vaccinations, may increased screening numbers compared to 2020. In 2022, in particular, screening services returned to near-full capacity, sometimes even exceeding it. This recovery trend does not mean that the pandemic-related screening gap has been fully addressed. There are still periods where screening remains below the 2018–2019 average. However, FOBT screening rates have exceeded pre-pandemic levels. This improvement in FOBT may be related to the test's ease of use, its ability to be administered at home, and the widespread recommendations from family health centres. Similarly, for cervical cancer screening, HPV self-sampling has been proposed as a potentially more resilient alternative. A systematic review reports that self-sampling is highly acceptable due to its ease of use, and privacy concerns[34,35]. Furthermore, self-sampling delivered by general practitioners is an effective and practical approach for women who face cultural or social obstacles, hesitancy, or limited awareness of cervical screening, enabling them to overcome these barriers and increase participation in HPV screening programs[36].

The urgency of catch-up screening should be justified primarily by the absolute deficit in screening volume and the increased risk of missed or delayed diagnoses, rather than by elevated positivity rates alone. Large population-based studies have documented significant screening backlogs during the pandemic. For instance, in Ontario, organized screening programs delivered 41% fewer screening tests in 2020 compared to 2019, and most program volumes remained below historical levels at the end of the year14. In the United States, registry-based analyses estimated that over 134,000 cancer cases may have remained undetected during the first 10 months of the pandemic[37]. Additionally, modeling studies suggest that if screening interruptions are not promptly addressed, there may be a shift toward more advanced-stage diagnoses[38]. Therefore, the public health significance of restoring screening is to reduce missed opportunities for early detection and to limit future stage migration, particularly among

underserved populations. Recovery strategies should incorporate an equity perspective, as participation in cancer screening in Türkiye varies according to education, income, healthcare access, and contact with family physicians[28,39].

Practical Implications and Policy Recommendations

The findings of our study demonstrate the importance of implementing strategies such as flexible appointment systems, widespread use of home-based tests, including FOBT and HPV self-sampling, and establishing comprehensive catch-up screening plans post-pandemic to sustain screening programs during crises and prevent future disruptions.

Study Limitations

This study was based on data from Ankara province, therefore, generalisability may be limited. Furthermore, since the data were aggregated, it was not possible to assess individual risk factors. However, analysing real-world data from the national screening program, covering a five-year timeframe, and evaluating three different cancer types together are important contributions to the literature. A further limitation is that increases in mammography and HPV positivity observed during the pandemic do not provide direct evidence of an increased population-level disease burden. The substantial reduction in screening participation may have led to systematic differences between individuals who continued to attend screening and those who deferred care, potentially introducing selection bias that could artificially inflate the proportion of positive cases. Additionally, the study includes only five annual time points (2018–2022), which restricts the number of observations. This limitation should be considered when interpreting the Joinpoint analysis and the descriptive year-to-year variations in positivity rates.

CONCLUSION

This Ankara-based study revealed that the pandemic created a significant gap in cancer screening. Although recovery began by 2022, HPV and mammography screenings have not fully returned to pre-pandemic levels. These data indicate that national screening strategies should be strengthened in the post-pandemic period to ensure resilience and continuity of screening services. Health policymakers should allocate additional resources to close the screening gap, organize public awareness campaigns, and include continuity of screening services in contingency plans for future pandemics.

Use of Artificial Intelligence: Grammarly was used for language editing and proofreading only. The authors reviewed all changes and take full responsibility for the manuscript.

Author Contributions: Concept: HSÇ, GÖE, SÖ; Design: HSÇ, GÖE, SÖ; Supervising: SÖ; Data collection and analysis: GÖE; Literature search: HSÇ, GÖE; Writing: HSÇ, GÖE, SÖ; Critical review: HSÇ, GÖE, SÖ

Ethical Declaration: Ethical approval was received from the Non-Interventional Clinical Research Ethics Committee of Dr. Abdurrahman Yurtaslan Oncology Training and Research Hospital, University of Health Sciences, Türkiye (Research code no: 2023-08/66). Subsequently, written permission was obtained from the Commission for the Evaluation of Research Requests in Primary Health Care, General Directorate of Public Health, Ministry of Health of Türkiye (Letter dated 13.10.2023, numbered E-51381736-771-22675317, subjected 'Research Permission') .

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