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# Implementation of cancer prevention practices in primary care: results of a cohort study in Chile 2018–2022

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ABSTRACT

*Objectives:* The burden of cancer is increasing rapidly in Latin America. Primary care has an essential role in cancer prevention, but implementation levels of prevention practices are not well known. This study evaluated implementation levels and associated factors of cancer preventive practices in primary care over time.
*Study design:* The study incorporated a retrospective multicentre cohort study.
*Methods:* A population of 59,949 patients registered at three primary care clinics was followed from January 2018 to December 2022 in Santiago, Chile. We studied human papillomavirus (HPV) and hepatitis B virus (HBV) immunisation, brief counselling for smoking cessation and alcohol consumption, and cervical and breast cancer screening practices. Standardised electronic medical records were utilised as the source of information. Social, clinical, and organisational factors associated with prevention practices were studied.
*Results:* The cohort attrition level was 17.1%. Most of the population was of a low socioeconomic status, and 70% visited a primary health centre yearly. Implementation rates of immunisation practices were 90.84% for HPV and 80.94% for HBV in 2022. In contrast, brief counselling for smoking and alcohol consumption was below 20% during the study period. Cervical cancer screening decreased by 25.58% between 2018 and 2022, whereas breast cancer screening reached only 41.71% of the target population. Opportunistic medical visits were strongly associated with brief counselling and breast cancer screening.
*Conclusion:* Implementation practices for cancer prevention in a Chilean primary care cohort are high for immunisation and very low for brief counselling and screening practices. A comprehensive non-medical-based model is needed to improve cancer prevention in primary care.


## Introduction

The burden of cancer in Latin America is increasing rapidly.[1] Cancer is the primary cause of premature death in half of Latin American countries.[2] Brazil and Chile are among the countries with the highest projected increase in cancer incidence rates in Latin America, with an estimated change of 65.9% and 66.1%, respectively, for the period 2020–2040.[3] These estimations are higher than those projected for the United States of America or Canada.[3] The most frequent cancers in Latin America in 2020 were prostate (15%), breast (14%), colorectal (9%), lung (7%), and stomach (5%).[1] Fatality rates, as calculated by the mortality-to-incidence ratio in Latin America, are higher than those in North American or Western European countries.[3] The mortality-to-incidence ratio for Chile is 0.53, which is higher than the average of 0.48 reported for South America.[1] This ratio reflects, in part, a later-stage diagnosis for prevalent cancers.[2] In contrast to a declining trend in mortality rates estimated for North American countries for the next two decades, cancer mortality rates are expected to increase in most Latin American countries, including Chile.[1,3]

The high prevalence of modifiable risk factors such as smoking, alcohol consumption, unhealthy diet, sedentary behaviour, and low

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adherence to screening practices have been associated with the increasing incidence and mortality rates observed in the region.[4] Smoking and alcohol consumption have been attributed to 22% of cancer cases in the Chilean population.[5] Chile has the highest smoking prevalence in Latin America, with 31.6% of males and 26.8% of females being active smokers.[4] Alcohol consumption prevalence in Chile is higher than in many Latin American countries such as Mexico and Colombia,[4] and the prevalence of harmful drinking is increasing and rose from 8.1% in 2014 to 9.3% in 2018.[6] Secondary cancer prevention in Chile includes screening for cervical and breast cancer through PAP (Papanicolaou) smear tests and mammography. Despite free access to these tests for the population, the estimated national adherence for PAP tests was 52% and for mammograms, about 40% in 2019.[7]

Primary care has a key role in cancer prevention and control.[8] In many Latin American countries, primary and secondary prevention strategies such as immunisation, brief counselling for healthy behaviours, and screening practices are delivered at the primary care level.[7] Despite the robust evidence supporting the benefits of these interventions,[9,10] implementation levels of these practices in primary care are not well known and are not monitored, and therefore, there is no timely information on areas that might need improvement.[11] The gap between research evidence and implementation of practices observed in real clinical scenarios is a problem widely recognised.[12] An essential step to reduce this gap is knowing the preventive practice rates in real primary care scenarios. In Chile, the national preventive program includes assessment and brief counselling for smoking and alcohol consumption and also PAP smear tests and mammography for women.[13] However, there is no systematic information on the implementation level of these interventions in primary care.

Chile does not have an organised surveillance system for cancer preventive strategies. Cancer surveillance data are essential for identifying needs, planning interventions, directing public health resources, and evaluating the effectiveness of cancer control initiatives.[14] Estimates of cancer preventive practices in Chile are at a national level, and individual-level information over time is very limited. In the Public Health Report developed by the Organization for Economic Cooperation and Development (OECD) for Chile, the panel stressed the priority to implement traceability systems to monitor preventive practices over time at a local level.[15] This study estimates the level of implementation of cancer prevention practices on an individual basis in a primary care cohort in Chile and explores factors associated with cancer prevention practices in primary care.

## Methods

### *Study design*

We conducted a retrospective cohort study that included the population registered at the Ancora primary care network, which serves 60,000 people in Santiago, Chile. The population was studied during the period 2018–2022, and we identified the implementation of cancer preventive practices and associated factors over time.

### *Setting*

In Chile, 70% of the population belongs to the public health care system and is registered at a primary care clinic. Primary care clinics are funded on a capitation-based model and, therefore, have to report their registered population at an individual level yearly. The population registered at the clinics receives free care that includes preventive (e.g., immunisations, well-childcare, pre-natal, adult check-ups, PAP smear tests, mammograms) and clinical and emergency primary care services.

The Ancora network holds three primary health centres (PHCs) located in La Pintana and Puente Alto in the South East Metropolitan area of Santiago, Chile. This area is inhabited by communities of middle and low socioeconomic status. The average poverty rate of the population in La Pintana and Puente Alto is 9.6% (7.99%–15.34%). The average rate is similar to the Chilean national rate of 10.8%.[16] The clinics are funded by the standard public capitation system and serve a population of 59,949 people in 2018 and 59,470 in 2022.

### *Participants and procedures*

The information on the primary care cohort was based on data extracted at a patient level, from the electronic medical record system (OMI-AP®) at the Ancora primary care network. The network integrates three primary care clinics and has data on all individuals registered at the clinics from a defined geographic population of La Pintana and Puente Alto in Santiago. Data from each clinic are prospectively recorded, and information on healthcare utilisation services must be reported regularly by law to the regional health service. Data from patients enrolled in the clinics from January 1, 2018, to December 31, 2022, were included. The data used in this study were de-identified prior to analysis and mapped using the Observational Medical Outcomes Partnership Common Data Model (OMOP-CDM) to establish both a baseline and follow-up of cancer preventive practices.[17]

### *Exposure and outcome variables*

The dependent or outcome variables explored in this study were the implementation rates of primary and secondary cancer preventive practices included in the Chilean National Guidelines.[18] Fig. 1 presents the target populations for each selected cancer preventive practice. Primary preventive practices included immunisation for human papillomavirus (HPV) and hepatitis B Virus (HBV) for children as well as brief counselling for smoking and alcohol consumption for adults. For the HPV vaccine, the target population is defined at the school level and includes all children in the fourth (first dose) and fifth (second dose) grades (up to 14 years of age). Primary care clinics are assigned a number of local schools to deliver the HPV vaccine for children. The HBV vaccine is indicated for neonates and infants at 2, 4, 6, and 18 months registered at the PHC. Brief advice for smoking and alcohol consumption is included in the Chilean national preventive program[13] and targets the adult population between 25 and 64 years of age. The Chilean National Guidelines state that all current drinkers should be screened and receive brief advice according to their estimated risk based on the Alcohol Use Disorders Identification Test (AUDIT). The AUDIT is a 10-item screening instrument for hazardous and harmful alcohol consumption developed by the World Health Organization[19] and validated in Chile.[20] The Chilean Guideline states that consumers with non-hazardous consumption (score eight or less) should receive brief counselling to limit their consumption. Those with higher scores should receive more intense advice (e.g., motivational interviewing). On the other hand, all smokers should receive brief advice on quitting. The target population is based on the prevalence of smoking and alcohol consumption of the population reported by the National Health Survey[21] in the defined age interval applied to the local population. Secondary prevention practices include cervical cancer screening (PAP test) for women aged 25–64 years every three years and breast cancer screening (mammography) every two years for women aged 50–74 years.[18]

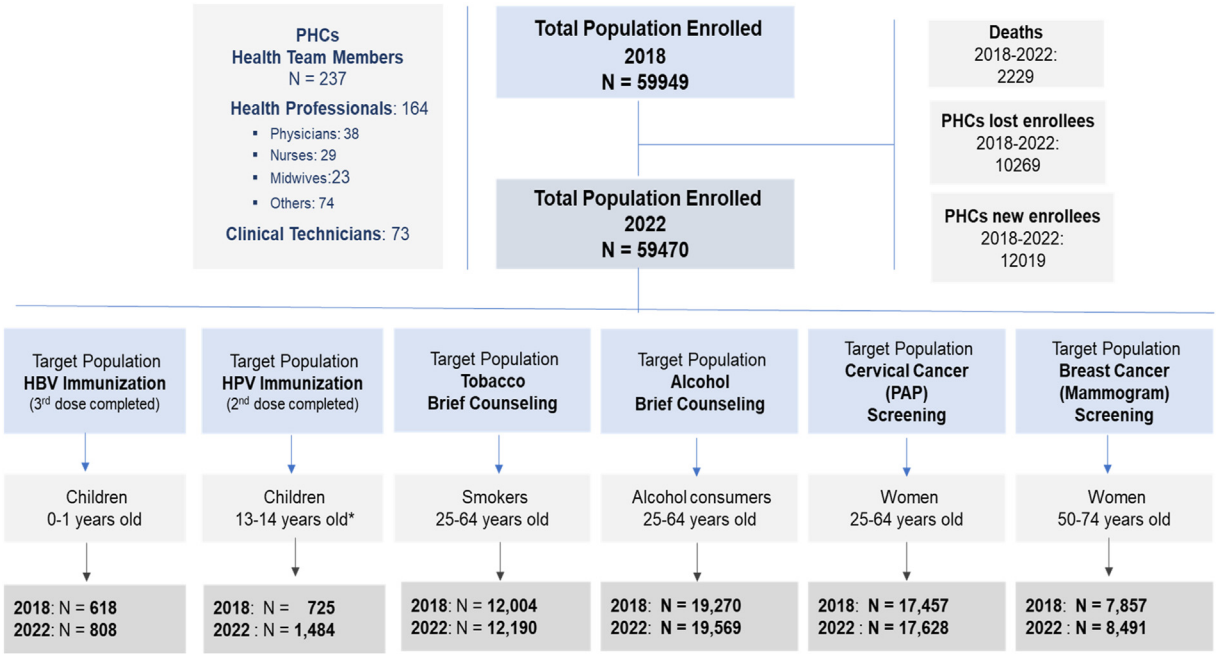


**Fig. 1.** Target populations for each selected cancer preventive practice. *The target population is children in fifth grade (up to 14 years) who received the second HPV dose.

The exposure variables included demographic and socioeconomic factors, primary care utilisation factors (medical and non-medical visits to PHCs), and clinical conditions such as hypertension, diabetes, chronic respiratory diseases, and depressive disorders.

*Analysis*

In the descriptive analysis, we described the demographic and clinical profile of the cohort population. The level of implementation practices was described as the proportion of the target population that received the intervention over the total target population according to the national guideline definition. Statistical differences were estimated by comparing implementation rates in 2018 and 2022. Simple logistic regression analysis allowed us to evaluate the factors associated with cancer prevention practices at the primary and secondary levels in 2022. We used adherence or practice implementation as binary outcomes and modelled the effect of exposure variables such as gender, age, socioeconomic status, medical and non-medical visits, and clinical conditions for each cancer prevention practice, fitting binomial generalised linear models. For medical—physicians—and non-medical—nurses, midwives, and nutritionists—visits to a PHC, we analysed both the effect of the number of visits in the year as a continuous predictor and the recurrence of visits—at least one visit in a year vs. none—as dichotomous variables.

We used listwise deletion as a method for missing data treatment, considering its low prevalence (under 8% in every case). To evaluate the association of comorbidities and depression disorders, we also conducted multiple logistic regression analyses, controlling for the effect of patients' visits to a PHC, considering that people with those clinical conditions would also attend more medical institutions for treatment. To express the magnitude of the effects and variability observed in the analysis, we used odds ratios (ORs) and 95% confidence intervals (CIs). All statistical analyses were performed using R (version 4.3.0).

## Results

The profile of the population included in the study is presented in Table 1. The great majority of the population was adults aged over 18 years of low or very low socioeconomic status; about 30% of them had a cardiovascular or respiratory chronic condition, and 15% of them had a depressive disorder. About 70% of the adult population visited a PHC each year. Approximately half of the adult population had a medical visit, with an average of 3 visits per year. Between a quarter and a third of the adult population had a visit to a nurse or midwife at the PHC each year.

Implementation rates of cancer preventive practices during the 2018–2022 period are presented in Table 2. Immunisation rates for HPV and HBV during the study period were over 70%, with a significant increase of 15% for HPV between 2018 and 2022. Other primary prevention interventions, such as smoking and alcohol consumption brief counselling, had very low implementation rates and experienced a significant reduction between the 2018 and 2022 period. Only 10% of current smokers and 7% of alcohol consumers received brief counselling in 2022. According to the National Chilean Guideline, all current alcohol consumers should receive counselling regardless of their level of consumption or dependence. The intensity of the counselling for alcohol consumption should be based on the AUDIT screening test. Secondary prevention practices were well below the 70% target coverage in 2018 and 2022. The screening rate for cervical cancer experienced a 25% absolute reduction between 2018 and 2022. Screening rates for mammography remained at 41% during the study period.

Fig. 2 presents the exposure factors associated with the implementation of cancer preventive practices. Demographic variables were not associated with immunisation rates for HBV; however, they had a significant but low effect on brief counselling for smoking and alcohol consumption. They also had a low effect on screening practices. Physician visits had the highest effect on implementation of brief counselling for smoking (OR: 13.86, 95% CI: 11.44–16.99) compared to other professionals such as nurses (OR:

**Table 1**
Demographic and clinical profile population.

| Variable | 2018 | 2022 |
|---|---|---|
| **Population** | ***n* = 59,949** | ***n* = 59,470** |
| **Gender** | | |
| Female | 32,333 (54%) | 31,930 (54%) |
| Male | 27,612 (46%) | 27,536 (46%) |
| Non-binary or Indeterminate | 4 (<0.1%) | 4 (<0.1%) |
| **Age:** mean (SD) | 35 (21) | 36 (21) |
| 0–17 | 15,636 (26%) | 13,959 (23%) |
| 18–49 | 27,950 (47%) | 27,625 (46%) |
| 50–64 | 10,782 (18%) | 11,255 (19%) |
| 65–75 | 3905 (6.5%) | 4562 (7.7%) |
| 76+ | 1676 (2.8%) | 2069 (3.5%) |
| **Socioeconomic status** | | |
| Very low | 22% | 18% |
| Low | 30% | 37% |
| Middle Low | 18% | 18% |
| Middle | 30% | 27% |
| High | – | – |
| **Chronic diseases** | | |
| High blood pressure | 19.4% | 19.1% |
| Diabetes | 9.2% | 9.4% |
| Chronic respiratory disease | 0.7% | 0.6% |
| **Depressive disorders** | 15.1% | 14.7% |
| **Visits to the PHC in the last year** (total population) | 64% | 73% |
| **Visits to the PHC in the last year** (population 18 years or older) | 70% | 74% |
| **Physician's visits to PHCs** (total population) | 51% | 50% |
| **Physician's visits to PHCs** mean**,** (SD) | 3 (5) | 3 (5) |
| **Visits to nurses in PHCs** | 26% | 34% |
| **Visits to midwives in PHCs** | 22% | 22% |
| **Visits to Nutritionist in PHCs** | 11% | 7.6% |

Abbreviations: PHC = primary health centre; SD = standard deviation.

**Table 2**
Implementation rate (%) of cancer preventive practices by year.

| | Implemented/ *n* target population.%/ (*n*) | | | | | 2022 vs. 2018 | |
|---|---|---|---|---|---|---|---|
| | 2018 | 2019 | 2020 | 2021 | 2022 | Delta | |
| **Primary prevention** | | | | | | | |
| **Immunisation HPV**[a] | **75.03%** 544/725 | **89.44%** 881/985 | **81.17%** 1349/1662 | **73.42%** 939/1279 | **90.84%** 1348/1484 | +15.81% | $P < 0.001$ |
| **Immunisation hepatitis B**[b] | **80.4%** 497/618 | **76.9%** 741/964 | **77.8%** 738/949 | **84.8**% 697/822 | **80.94%** 654/808 | +0.54% | $P < 0.001$ |
| **Smoking Brief counselling**[c] | **25.42%** 3051/12,004 | **20.91%** 2963/14,167 | **10.45%** 1503/14,389 | **6.97%** 1019/14,617 | **10.48%** 1277/12,190 | −14.94% | $P < 0.001$ |
| **Alcohol consumption Brief counselling**[d] | **18.32%** 3530/19,270 | **17.87%** 4065/22,743 | **12.21%** 2820/23,098 | **3.01%** 706/23,464 | **6.72%** 1316/19,569 | −11.6% | $P < 0.001$ |
| **Secondary prevention** | | | | | | | |
| **PAP test adherence**[e] | **50.7%** 8850/17,457 | **48.33%** 8574/17,739 | **37.97%** 6822/17,969 | **41.41%** 7224/17,443 | **25.12%** 4428/17,628 | −25.58% | $P < 0.001$ |
| **Mammography adherence**[f] | **41.95%** 3296/7857 | **41.26%** 3349/8116 | **35.48%** 2970/8372 | **36.91%** 3031/8211 | **41.71%** 3542/8491 | −0.24% | $P = 0.001$ |

Abbreviation: HPV: human papillomavirus.
[a] 13-year-old females.
[b] Males and females 1 year or less with 3 or more doses.
[c] Smokers +1 or more cigarettes daily + attendants to counselling between 25 and 64 years of age from the population between 25 and 64 years of age multiplied by the tobacco consumption prevalence (0.38).
[d] People between 25 and 64 years of age with any AUDIT score from the population between 25 and 64 years old multiplied by the alcohol consumption prevalence (0.61). AUDIT: Alcohol Use Disorder Test: low risk: 0–7 for men, 0–6 for women; moderate risk: 8–15 for men, 7–15 for women; high risk (harmful level): 16–19 for men and women.
[e] Women aged between 25 and 64 years.
[f] Women aged between 50 and 74 years.

7.64, 95% CI: 6.73–8.69), nutritionists (OR: 6.2, 95% CI: 5.42–7.09) or midwives (OR: 3.21, 95% CI: 2.87–3.6). Physician and nurse visits had a similar effect on improving the rate of alcohol brief advice (OR: 6.23, 95% CI: 5.4–7.22; OR: 6.38, 95% CI: 5.66–7.21). Midwife visits had a very strong effect on breast cancer screening rates (OR: 70.65, 95% CI: 61.54–81.3). Having comorbidities and depressive disorders was associated with a higher probability of delivering cancer preventive practices. The effect of comorbidities on adherence is reduced for brief tobacco counselling and PAP test screening when adjusting for the number of visits to the PHC. After adjusting for PHC visits, the effect of comorbidities on alcohol brief counselling and mammogram screening adherence is strongly reduced for people with 2 (OR: 0.66, 95% CI: 0.50–0.83) or 3 comorbidities (OR: 0.59, 95% CI: 0.51–0.69). The effect of depression on brief

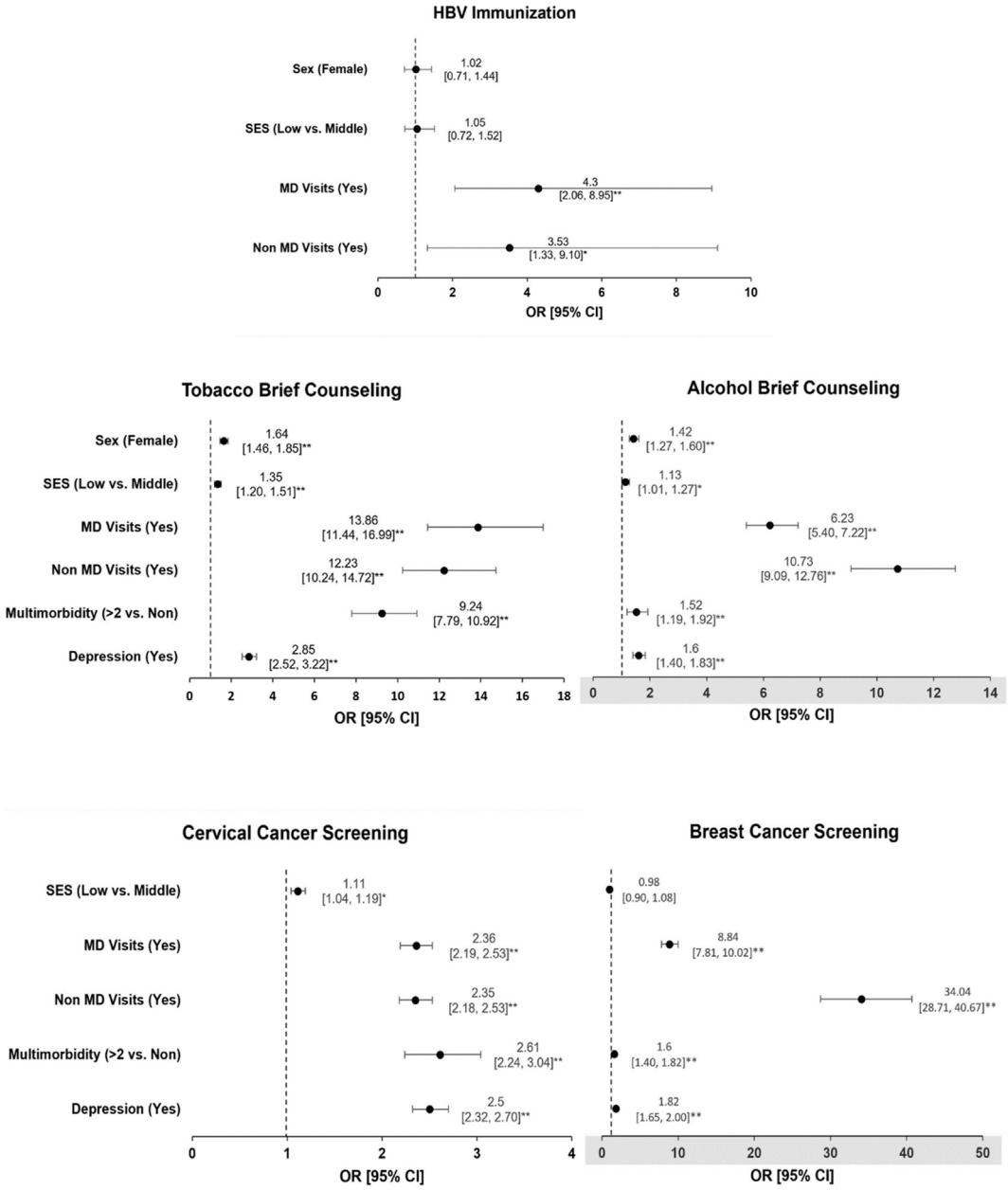


**Fig. 2.** Factors associated with cancer preventive practices implementation. *$P < 0.05$; **$P < 0.01$.

counselling for smoking cessation and alcohol consumption is also reduced after adjusting for visits to the PHC.

## Discussion

This study contributes to understanding implementation practices of cancer prevention in a region where cancer is an increasing problem and primary care has been recognised as a key player in controlling this burden.[1,8,22,23] The wide range of implementation levels observed in our study reflects a gradient of strategies varying from a more systematic-organised preventive model (i.e., immunisation practices) that achieves high implementation rates to more opportunistic preventive practices (i.e., brief counselling and screening) that achieve very low rates. According to international standards, organised preventive programs include systematic follow-up of local target populations that integrates reminder and recall strategies.[14,23,24] These elements are incorporated in the Chilean immunisation strategies but are not present in the other cancer preventive practices (i.e., brief counselling, cancer screening) implemented in primary care in Chile.

The gap between research evidence and implementation of practices observed in real clinical scenarios is a problem widely recognised.[12] Our study provides patient-level information from real-world primary care scenarios and showed that uptake of most cancer preventive practices is low despite the high interaction between the population and the primary care network. About 70% of the adult population in our study contacted their PHC each year. However, only 25% and 18% of them received brief counselling for smoking cessation and alcohol consumption, respectively, in 2018. The counselling rate was even lower in 2022 after the COVID-19

pandemic. These rates are similar to those reported in other studies.[25,26] In a national evaluation of the Health Check Program in England, Patel et al. (2020) reported that only 17% of the attendees received smoking cessation advice, and 15.5% of them received brief advice for alcohol consumption.[25] However, brief counselling for high-risk populations was higher and was delivered to 50% of patients. Clinical encounters tend to favour a high-risk opportunistic approach to delivering preventive practices. However, this approach is associated with a high rate of missed opportunities for cancer prevention. In our study, a higher number of clinical encounters were associated with a higher probability of preventive practices. The higher probability of developing preventive practices associated with co-morbidities was reduced when adjusting for the number of visits to the PHC, suggesting that a large part of this effect was related to the number of clinical encounters rather than the existence of co-morbidities. In our study, preventive practices relied heavily on clinical encounters.

Our results are in line with those reported by Patel et al. (2020) and showed that a higher-risk population with multimorbidity increased the probability of delivering brief counselling for smoking and alcohol consumption.[25] However, a large proportion of patients are left with no preventive recommendations. Real clinical scenarios, with competing interests and time constraints, might not be the best scenarios to deliver systematic brief counselling interventions to a large proportion of patients. More comprehensive strategies that go beyond clinical encounters should be implemented to target a larger population of patients.

Low implementation rates of cancer preventive practices were also observed in cancer screening. In our study, breast cancer screening rates remained low and stable at about 40% during the study period. These rates are similar to those reported at a country level in Chile.[7] They are higher than those reported in other Latin American countries such as Brazil (24%) or Colombia (33%)[7] but much lower than those reported in the United Kingdom (75%) or Spain (82%) that have systematic-organised screening strategies.[27] The low rates of breast cancer screening are associated with a significant later-stage diagnosis, especially in underserved populations in Chile.[28] The increasing trend in incidence rates of breast cancer in Chile (38.2/100.000 in 2022)[3] reinforces the need to improve not only primary prevention but also screening coverage rates to reduce the higher burden of the disease that is affecting a higher number of Chilean women each year. Cervical cancer screening rates experienced a profound decrease after the pandemic. In our study, adherence to PAP screening tests decreased by 25% between 2018 and 2022. The pandemic would explain part of this decrease mainly due to a reorganisation of the team members` tasks, especially of midwives and nurses, in late 2021, preparing for a longer pandemic. The reorganisation produced a relative shortage in the available working hours of midwives, the professionals who do most of the PAP testing, and an expansion of available working hours of other professionals (nurses, physical therapists) to address detection, traceability, and recovery of COVID-19 patients. Similar effects were observed in other Latin American countries such as Brazil[29] and Peru,[30] where reported rates decreased to 76% and 44%, respectively. The decline in cervical cancer screening rates was lower in countries with more systematic-organised cancer preventive programs. In the United Kingdom, screening rates decreased by 5.3% during the COVID-19 epidemic period,[31] in the United States of America, the reduction reported was 11%, and in Canada, it was 7.3%.[32]

In contrast with the low implementation levels observed for brief counselling and screening practices, immunisation rates observed for HPV and HBV remained very high and even increased during the study period. The high coverage of immunisation programs will accelerate the reduction in the incidence rates of cervical (11.3/100.000 in 2022) and liver cancer (4.6/100.000 in 2022), which have been decreasing slowly during the last ten years.[3] These preventive practices follow the principles of an organised, systematic preventive strategy and are less dependent on opportunistic clinical contacts between patients and healthcare providers. Organised preventive practices have been mainly used for screening programs[33,34] but share similar characteristics with many preventive practices delivered in primary care.[35] The results observed in immunisation rates in our study stress the importance and feasibility of developing an organised, systematic strategy for cancer prevention at the primary care level. The results of our study are in line with the recommendations made for Chile by the OECD in their Public Health Report[15] (OECD, 2019).

This study has some limitations that are important to address. The study population might not represent the national population at large, and therefore, inferences at the national level should be taken cautiously. However, about 70% of the population in Chile is registered in a primary care clinic where they receive their regular care with low mobility, especially in underserved areas. The attrition level for the five-year study period was 17.1%, which confirms a stable population (82.9%) over time. The retrospective cohort design based on electronic data minimised the risk of recall bias typically present in retrospective studies. The OMOP data platform allowed us to standardise the electronic database clinical information system, reducing the registration variability. In observational studies, external, non-controlled factors, such as the COVID-19 pandemic, might have intervened in the primary outcome measures, as probably is the case in our study. The design of our study allowed us to expose the effect of the COVID-19 pandemic over time, but there might be other non-controlled factors associated with primary outcome measures.

In conclusion, our study exposes the gap between cancer preventive guidelines and their implementation in real primary care scenarios. The study suggests that opportunistic clinical strategies are insufficient for achieving high implementation levels in most cancer preventive practices. In contrast, systematic-organised preventive strategies are more robust and achieve better results.

## Author statements

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*Ethical approval*

The project was reviewed and approved by the Ethical Committee at Universidad Católica de Chile (ID: 230228003) and the Ethical Committee at the South East Metropolitan Service ID: SSMSO-191023).

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*Competing interests*

There was no conflict of interest.

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