Associations between cervical, breast and colorectal cancer screening uptake, chronic diseases and health-related behaviours: Data from the Italian PASSI nationwide surveillance

Francesco Venturelli[a,b,c,*], Letizia Sampaolo[d,e], Giuliano Carrozzi[d], , on behalf of PASSI Working Group, Marco Zappa[f], Paolo Giorgi Rossi[a]

[a] *Epidemiology Unit, Azienda USL-IRCCS di Reggio Emilia, via Amendola, 2, 42122 Reggio Emilia, Italy*
[b] *Specialization school of Hygiene and Preventive Medicine, Department of Biomedical, Metabolic and Neural Sciences, University of Modena and Reggio Emilia, via Campi, 287, 41126 Modena, Italy*
[c] *Clinical and Experimental Medicine PhD Program, University of Modena and Reggio Emilia, via Campi, 287, 41126 Modena, Italy*
[d] *Epidemiology Unit, AUSL of Modena, Strada Martiniana, 21, 41126 Modena, Italy*
[e] *Department of Economics, Ca' Foscari University of Venice, San Giobbe, Cannaregio, 873, 30121 Venice, Italy*
[f] *Clinical Epidemiology Section, Cancer Research & Prevention Institute (ISPO), via delle Oblate 2, 50139 Florence, Italy*

ARTICLE INFO

ABSTRACT

Screening programmes have been proposed as a privileged setting for health promotion interventions. We aim to assess the associations between behavioural risk factors, chronic conditions and diseases and cervical, breast and colorectal cancer screening uptake. Secondly, we aim to assess whether these associations are due to underlying differences in socioeconomic characteristics.

In Italy, a random sample was interviewed by the PASSI surveillance (106,000 interviews) in 2014–2016. Screening uptake adjusted for age and gender alone and for age, gender and socioeconomic characteristics (educational attainment and self-reported economic difficulties) were estimated using multivariate Poisson regression models.

Screening uptake was 79%, 73% and 45% for cervical (age 25–64), breast (women aged 50–69) and colorectal cancer (both sexes age 50–69), respectively. People with low consumption of vegetables and fruits and those with insufficient physical activity had lower uptake than people with healthy behaviours (20–22% and 8–15% lower, respectively), as did those obese and diabetic compared to healthier people (7–10% and 5–8% lower, respectively). Those with high-risk drinking behaviour, self-reported driving after drinking alcohol, and former smokers had higher screening uptake (3–7%, 3–6%, and 7–14% higher, respectively). Differences in uptake decreased after adjusting for socioeconomic characteristics, but trends were unvaried.

In conclusion, screening uptake is negatively associated with unfavourable behaviours and health conditions that are also risk factors for breast and colorectal cancer incidence. Socioeconomic characteristics do not fully explain these differences. Health promotion interventions targeting diet and physical activity nested in screening programmes might miss part of the at-risk population.

1. Introduction

Behavioural risk factors are related to almost one third of attributable disability-adjusted life years, representing the main risk category, followed by metabolic and environmental risk factors (GBD 2015 Risk Factors Collaborators, 2016). Moreover, tobacco smoke, alcohol use and diet-related risk factors have an important role in the carcinogenic process (Global Burden of Disease Cancer Collaboration, 2017; O'Leary et al., 2017). Indeed, human behaviours are a complex issue whose determinants have been extensively debated in the literature (Cortis and Puggina, 2017; Noll et al., 2017). The complexity of these determinants makes any attempt to change unhealthy habits challenging,

even when the detrimental consequences on individual health are well known (Macdonald et al., 1996). Thus, evidence-based primary and secondary prevention strategies should be implemented to decrease the prevalence of behavioural risk factors and to identify related diseases early to reduce disability and mortality.

Organised cervical, breast and colorectal cancer screening programmes have been implemented in Italy since the beginning of the 2000s (Ministero della Salute and Direzione Generale della Prevenzione, 2005). Despite the demonstrated efficacy of the recommended screening tests, the effectiveness of screening programmes depends largely on organizational issues and on behavioural issues (i.e. whether invited men and women participate) (Perry et al., 2008; von Karsa et al., 2015; von Karsa et al., 2013). As for behavioural risk factors, participation in screening programmes also has individual- and context-related determinants (Mansfield et al., 2016). Indeed, non-participation is a particularly important issue when it involves people with risk factors (Buron et al., 2017; Douglas et al., 2016).

Although determinants of uptake in prevention programmes and determinants of behavioural risk factors have been explored by numerous previous studies (Cortis and Puggina, 2017; Grosso et al., 2017; Noll et al., 2017; Pornet et al., 2010; Spencer et al., 2014), only few have assessed the association between the two with inconsistent results (He et al., 2018; Jepson et al., 2000; Labeit et al., 2013; Wools et al., 2016; Zappa et al., 1998). In addition, the contribution of socioeconomic characteristics to these potential associations has not been clearly reported.

To plan health promotion and to increase screening participation in an equitable way and to address the right populations, it is important to measure associations between health behaviours. This is particularly crucial when trying to exploit the capillary contacts with the healthy population that screening programmes offer as a vehicle for health promotion interventions addressing different lifestyle and behavioural risk factors (Anderson et al., 2013; Gorini et al., 2012; National Screening Unit, 2004).

Furthermore, measuring the association between screening participation and health behaviour and conditions allows quantifying the possible influence of self –selection bias on observational studies aimed at evaluating screening effectiveness.

The main objective of the present study was to describe the associations between behavioural risk factors (diet, physical activity, alcohol use, smoking, road safety behaviours and vaccine uptake), chronic conditions strictly related to these behaviours (obesity, hypertension and hypercholesterolemia, diabetes, cancer, depressive symptoms) and breast, cervical and colorectal cancer organised and spontaneous screening uptake. Secondly, this study aimed to assess whether these associations were linked to underlying differences in socioeconomic characteristics in both screening uptake and other health-related behaviours.

2. Methods

2.1. Study design

This study is an analysis of data from repeated cross-sectional surveys.

2.2. Setting

In Italy, 21 Regional Health Services are responsible for implementing organised cancer screening programmes for cervical, breast and colorectal cancer with active invitation of the target population. In accordance with European recommendations (Ministero della Salute and Direzione Generale della Prevenzione, 2005; The Council of the European Union, 2003) (Table 1). In 2016, organised programmes regularly invited 81%, 80% and 75% of the resident target population for cervical, breast and colorectal cancer screening, respectively;

participation was 40%, 56% and 40%, respectively (ONS, 2017).

Spontaneous screening uptake in Italy, particularly for cervical cancer and breast cancer, contributes appreciably to overall screening uptake, probably because of the low cost of the test and gynaecologists' habit of performing a Pap test during reproductive health visits (Carrozzi et al., 2015).

2.3. Data sources and population

In the present study, the analysed data were collected by PASSI between 2014 and 2016, with interviews of > 106,000 people, a representative sample of the Italian population aged 18–69. PASSI collects information on behavioural risk factors and the implementation of preventive health care services. The survey and sampling methods have been described elsewhere (Baldissera et al., 2014; 2011).

In addition, the PASSI questionnaire gathers information about educational attainment (4 classes: elementary school, middle school, high school or higher education), occupational status (employed, employment seeker, retired or other unemployed), perceived economic difficulties (3 classes: many, some or no economic difficulties) and citizenship (2 classes: Italian plus foreign nationals from high-income countries and foreign nationals from middle or low-income countries, according to the World Bank classification (UNDP, 2007)).

2.4. Outcomes definition

2.4.1. Cancer screening uptake (Fig. 1)

PASSI questionnaire collects the date of the last test before the interview, provider of the last test (free or paid out of pocket, proxy of organised and spontaneous screening, respectively), reception of invitation letter mailed by organised programmes and screening promotion by health professionals.

For the assessment of cervical cancer screening uptake, we considered a Pap test in the last 3 years or an HPV-DNA test in the last 5 years for women aged 25 to 64.

For breast cancer screening uptake assessment, we took into account a mammogram in the last 2 years for women aged 50–69.

For colorectal cancer screening uptake assessment, we considered an FOBT in the last 2 years or a colonoscopy or flex sigmoidoscopy in the last 5 years for people aged 50–69. Interviews of residents in the Piedmont region were excluded for colorectal cancer screening due to the different screening protocol.

2.5. Exposure definition

2.5.1. Healthcare and lifestyle-related behaviours and chronic conditions

We included the following information: seasonal influenza vaccination uptake in people aged 65–69 or of any age but reporting at least one chronic disease, in accordance with current guidelines (European Centre for Disease Prevention and Control (ECDC), 2017); lifestyle-related behavioural risk factors, i.e. smoking habit (smoker, former smoker, non-smoker), daily fruit and vegetable intake (0, 1–2, 3–4, 5 + portions), high-risk drinking behaviour, physical activity level (active, partially active, sedentary) and road safety-related behaviours (i.e. frequency of front and back seat belt use, wearing a motorcycle helmet and driving after drinking alcohol); self-perceived health status (very good/good, normal, bad/very bad), nutritional status (underweight/normal, overweight, obese); diagnosis of hypertension, hypercholesterolemia, depressive symptoms and diabetes. A positive anamnesis for cancer was also included among exposures, since several previous studies showed positive association with screening uptake (Giorgi Rossi et al., 2005; He et al., 2018; Jepson et al., 2000; So et al., 2012).

The description of each variable and related categories is reported in Supplementary material-Table A.1.

Table 1
Screening protocols: screening protocols according to Italian guidelines. Italy, April 2018. FOBT = faecal occult blood test.

Screening programs	Invited population	Recommended test and intervals	References
Cervical cancer	Women aged 25–29	Pap test every 3 years	(Ministero della Salute and Direzione Generale della Prevenzione, 2005)
	Women aged 30–64	HPV-DNA test every 5 years	(Ronco et al., 2012; von Karsa et al., 2015)
Breast cancer	Women aged 50–69	Mammogram every 2 years	(Ministero della Salute and Direzione Generale della Prevenzione, 2005)
	Women aged 45–74	Mammogram every 1 year between 45 and 49 years; every 2 years between 50 and 74 years	In Emilia-Romagna and Piedmont regions only. (Distante et al., 2007)
Colorectal cancer	Men and women aged 50–69	FOBT every 2 years	(Ministero della Salute and Direzione Generale della Prevenzione, 2005)
	Men and women aged 58–60	Once-only sigmoidoscopy (or FOBT)	In Piedmont region only. FOBT offered only to those not participating in sigmoidoscopy. (Ministero della Salute and Direzione Generale della Prevenzione, 2005)

2.6. Statistical analysis

In this article, descriptive analyses and multivariate Poisson regression were performed with the Stata 11 software and were all appropriately weighed. In PASSI, each Local Health Authority extracts a proportionate stratified sampling for the sex and age class (18–34, 35–49, 50–69 years) of the resident population. Therefore, data analysis at regional and national level required data weighing to take into account stratification (geographic area of the Local Health Authority, age and sex) to be representative of the whole population. The weight used in the analysis is the inverse of the sample fraction.

In this work, screening uptake within the recommended time intervals are shown for socioeconomic variables as weighted percentages with 95% confidence interval (95% CI). The probabilities of performing screening tests within the recommended time intervals adjusted for age (five-year class) and gender (only for colon) or adjusted for age, gender, educational attainment and economic difficulties were calculated according to the presence/absence of behavioural risk factors, chronic conditions and/or chronic diseases. These probabilities were estimated using multivariate Poisson regression models. Age- and gender-adjusted results were compared with those adjusted for age, gender, educational attainment and economic difficulties.

2.7. Ethics and data sharing

In the PASSI surveillance system, personal data are processed in compliance with the privacy laws (Decree law 196/2003). PASSI was approved by the Ethics Committee of the National Institute of Public Health on January 23, 2007.

Although the anonymized dataset is not yet available, the National Institute of Public Health is working to make it available on request (http://www.epicentro.iss.it/passi/PresPolicy.asp).

Participation in the survey is free and voluntary. The interviewers receive specific training on the correct procedures to follow in the processing of personal data. The people selected for the interview are informed by letter and by the interviewer about the objectives of the investigation, its methods and the arrangements taken to ensure the confidentiality of the information collected. Individuals can also refuse to be interviewed or can interrupt the interview at any time.

Interviews are transferred anonymously to a national archive via a secure internet connection. Personal Identifiers on paper or computer are subsequently locally destroyed.

3. Results

The overall self-reported screening uptake in our study was 79%, 73% and 45% for cervical, breast and colorectal cancer screening, respectively. There were strong associations with socioeconomic conditions, with lower uptake in more disadvantaged people, for all the screenings (Table 2).

3.1. Association with behaviours

All screening uptakes were associated with each other, i.e., uptake in one screening was associated with uptake in the other two, whether through organised screening programme or spontaneous uptake, while no association was observed between screening and influenza vaccination (Table 3; Table 4).

Non-smokers showed slightly higher test uptake than smokers in all screenings, while former smokers showed the highest uptake. High-risk drinking behaviour and driving after drinking alcohol were both associated with higher test uptake for all screenings. Instead, unhealthy behaviours concerning diet, physical activity and other road safety items were associated with lower screening uptake.

3.2. Association with chronic conditions

Hypertension was slightly inversely associated with screening uptake, while hypercholesterolemia was directly associated with screening uptake. Obese and overweight people had lower screening uptake, with a stronger trend for cervical and colorectal cancer screening than for breast; differences were smaller for the organised screening programme component. Depressive symptoms were slightly inversely associated with test uptake for all screenings.
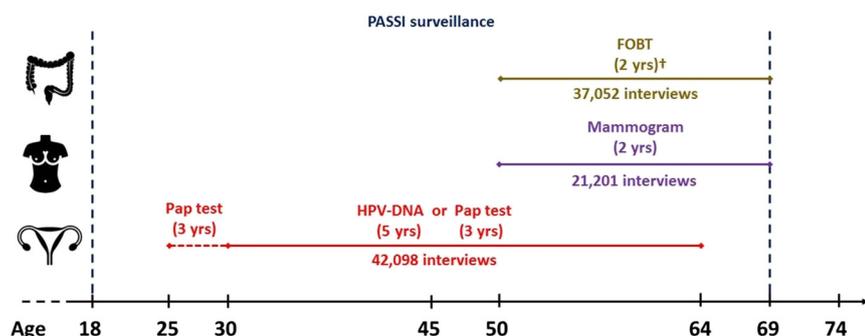
Fig. 1. Study design. Screening tests (with recommended screening intervals) and age of target populations of the three organised cancer screening programmes implemented in Italy: colorectal cancer (for men and women), cervical cancer and breast cancer. For each screening, the number of people in the target population interviewed by PASSI surveillance in the period 2014–2016 is also reported. The vertical dashed lines show the target population of the PASSI surveillance. † For colorectal cancer screening, a colonoscopy or flex sigmoidoscopy in the last 5 years was also considered as screening uptake.

Table 2

Spontaneous or within organised programme screening uptake (Number of people reporting screening uptake, weighted % and 95% Confidence Interval; 95% CI) for socio-demographic characteristics. PASSI 2014–2016, Italy. Cervical cancer screening: Pap test within 3 years before the interview or HPV-DNA test within 5 years before the interview; breast cancer screening: mammogram within 2 years before the interview; colorectal cancer screening: faecal occult blood test within 2 years before the interview or colonoscopy/flex sigmoidoscopy within 5 years before the interview (residents in Piedmont were excluded due to the different colorectal cancer screening protocol).

	Cervical cancer screening uptake according to screening protocols (n = 42,098)						Breast cancer screening uptake according to screening protocols (n = 21,201)						Colorectal cancer screening uptake according to screening protocols (n = 37,052)					
	Organised programmes			Spontaneous			Organised programmes			Spontaneous			Organised programmes			Spontaneous		
	N	%	95% CI	N	%	95% CI	N	%	95% CI	N	%	95% CI	N	%	95% CI	N	%	95% CI
Age classes																		
25–34	3716	36.2	35.0–37.4	2687	36.4	35.0–37.7												
35–49	8880	43.9	43.1–44.8	6004	38.8	37.9–39.7												
50–69[a]	8600	51.0	50.0 – 52.0	3644	27.1	26.2–28.1	12,440	53.7	52.9–54.6	3558	18.8	18.1–19.5	15,941	37.2	36.6–37.8	2606	7.6	7.2–7.9
Gender																		
Men													7582	37.8	37.0–38.6	1368	8.2	7.7–8.8
Women	21,196	44.9	44.4–45.5	12,335	34.0	33.4–34.6	12,440	53.7	52.9–54.6	3558	18.8	18.1–19.5	8359	36.7	36.0–37.5	1238	6.9	6.4–7.5
Educational attainment																		
None/Elementary	1028	40.8	37.7–44.0	371	20.5	18.1–23.1	2199	52.1	49.8–54.4	345	12.1	10.4–14.0	2274	34.1	32.5–35.7	258	5.3	4.3–6.4
Middle school	6393	48.6	47.5–49.8	2831	27.5	26.4–28.6	4576	54.7	53.3–56.2	1086	16.1	15.0–17.3	5955	37.3	36.3–38.3	792	6.1	5.5–6.6
High school	9756	45.5	44.6–46.3	6007	35.5	34.6–36.4	4437	54.4	53.0–55.8	1547	22.1	20.9–23.3	5990	38.6	37.6–39.6	1070	8.4	7.8–9.1
Higher education	4006	40.1	38.9–41.4	3123	43.2	41.9–44.6	1224	51.4	48.9–53.9	578	27.6	25.4–30.0	1716	36.8	35.1–38.5	486	12.3	11.1–13.6
Economic difficulties																		
Many	2692	41.3	39.7–43.0	1432	27.7	26.2–29.3	1427	42.2	39.9–44.6	427	15.2	13.6–17.0	1543	25.1	23.6–26.6	276	5.5	4.7–6.4
Few	8765	44.1	43.1–45.0	5038	33.4	32.5–34.4	5065	51.7	50.3–53.0	1447	19.1	17.9–20.3	5338	31.8	30.9–32.7	1015	7.6	7.0–8.3
None	9642	47.2	46.3–48.1	5841	37.2	36.3–38.1	5889	60.6	59.4–61.8	1672	19.8	18.8–20.9	8694	47.4	46.5–48.2	1299	8.3	7.7–8.8
Citizenship[b]																		
Italians + foreign nationals HIC	19,692	44.5	43.9–45.1	11,815	34.8	34.2–35.4	12,030	53.7	52.8–54.5	3494	19.0	18.3–19.7	15,577	37.3	36.7–37.8	2571	7.6	7.3–8.0
Foreign nationals MLIC	1494	52.2	49.9–54.5	507	21.3	19.4–23.4	403	56.5	52.1–60.8	60	10.1	7.7–13.0	358	36.2	32.7–39.9	34	3.6	2.5–5.2
Occupational status																		
Employed	13,129	46.3	45.5–47.0	8187	37.4	36.6–38.1	4883	55.1	53.7–56.4	1728	23.2	22.0–24.4	7325	36.0	35.2–36.8	1467	8.8	8.3–9.4
Employment seeker	1746	40.0	38.1–42.0	996	29.8	27.9–31.8	353	52.0	46.8–57.1	108	18.3	14.6–22.6	504	28.4	25.7–31.3	66	4.3	3.2–5.9
Retired	1259	54.7	51.9–57.4	382	21.0	18.8–23.4	3502	59.8	58.1–61.4	586	11.9	10.9–13.0	5613	46.1	44.9–47.3	697	7.1	6.5–7.8
Other unemployed	4950	41.9	40.6–43.2	2707	30.6	29.4–31.9	3648	48.2	46.5–49.8	1110	18.9	17.6–20.3	2398	28.6	27.3–29.9	366	6.0	5.1–7.0
Living situation																		
Alone	1670	41.3	39.3–43.3	1004	33.9	31.8–35.9	1380	53.4	50.8–56.0	339	15.3	13.3–17.5	1647	37.4	35.5–39.3	242	7.1	5.9–8.5
With spouse/partner	15,226	47.9	47.1–48.6	8567	34.7	34.0–35.5	9196	55.0	54.0–56.0	2647	19.4	18.5–20.2	12,411	38.2	37.6–38.8	2043	7.8	7.3–8.3
With other people except for partner	4293	38.0	36.8–39.3	2760	32.1	30.9–33.4	1860	48.8	46.6–51.0	570	18.5	16.9–20.3	1878	32.0	30.4–33.7	319	6.6	5.8–7.5

[a] Women aged 50–64 for cervical cancer screening.

[b] Italian and foreign nationals from high-income countries (HIC); foreign nationals from middle or low-income countries (MLIC).

Table 3

Raw uptake probabilities (number of people reporting screening uptake, % and 95% CI) of cervical, breast and colorectal cancer screening in target population, spontaneous or within organised programs, according to the uptake of other preventive interventions, lifestyle and road safety-related behaviours and chronic conditions and diseases.

| | Cervical cancer screening uptake according to screening protocols (n = 42,098) | | | | | | Breast cancer screening uptake according to screening protocols (n = 21,201) | | | | | | Colorectal cancer screening uptake according to screening protocols (n = 37,052) | | | | | |
| | Organised programmes | | | Spontaneous | | | Organised programmes | | | Spontaneous | | | Organised programmes | | | Spontaneous | | |
	N	%	95% CI	N	%	95% CI	N	%	95% CI	N	%	95% CI	N	%	95% CI	N	%	95% CI
SCREENING TEST COVERAGE																		
CERVICAL CANCER SCREENING																		
Yes	–	–	–	–	–	–	7924	59.9	58.8–61.0	2572	23.4	22.4–24.4	5226	39.8	38.7–40.8	815	7.8	7.2–8.5
No	–	–	–	–	–	–	902	28.5	26.5–30.7	325	12.0	10.4–13.8	507	17.1	15.5–18.9	112	4.1	3.0–5.6
BREAST CANCER SCREENING																		
Yes	7395	58.0	56.9–59.1	3087	30.1	29.0–31.2	–	–	–	–	–	–	7456	44.7	43.8–45.7	1055	8.1	7.5–8.8
No	1148	31.0	29.0–33.1	530	18.4	16.6–20.3	–	–	–	–	–	–	840	16.0	14.7–17.5	177	3.9	3.3–4.7
COLORECTAL CANCER SCREENING																		
Yes	4464	60.7	59.1–62.2	1579	27.9	26.5–29.4	6970	69.0	67.7–70.3	1556	18.2	17.1–19.3	–	–	–	–	–	–
No	3105	40.9	39.5–42.4	1837	28.6	27.2–30.0	4134	39.9	38.6–41.1	1814	20.8	19.8–21.9	–	–	–	–	–	–
INFLUENZA VACCINATION UPTAKE[a]																		
Yes	307	54.2	48.8–59.5	112	23.4	19.3–28.1	477	56.8	52.6–61.0	86	13.8	10.9–17.2	725	42.0	39.0–45.1	102	7.1	5.7–8.8
No	1297	49.2	46.9–51.6	664	29.9	27.7–32.2	1127	57.4	54.5–60.2	247	15.2	13.3–17.3	1552	41.3	39.4–43.3	247	7.8	6.8–9.0
LIFESTYLE BEHAVIOURS																		
SMOKING HABIT																		
Non-smoker	13,391	44.7	44.0–45.5	7664	33.5	32.7–34.2	7803	53.3	52.2–54.4	2269	19.1	18.2–20.0	8267	36.3	35.5–37.1	1306	7.2	6.7–7.7
Former smoker	3383	48.5	46.9–50.1	1944	36.4	34.8–38.0	2344	58.1	56.0–60.1	658	19.5	17.9–21.2	4818	44.4	43.2–45.6	764	8.7	7.9–9.5
Smoker	4379	43.0	41.7–44.3	2711	34.1	32.7–35.4	2273	51.1	49.0–53.2	630	17.2	15.7–18.9	2812	30.6	29.4–31.9	535	7.3	6.6–8.1
FRUIT AND VEGETABLE DAILY INTAKE																		
≥5 portions	2673	49.3	47.6–51.1	1498	33.7	32.1–35.4	1991	58.4	56.3–60.5	582	19.4	17.8–21.2	2353	44.6	42.8–46.3	384	9.2	8.1–10.3
3–4 portions	9754	47.2	46.3–48.1	5498	34.3	33.4–35.2	6206	56.3	55.0–57.5	1734	19.1	18.0–20.2	7552	40.9	40.0–41.9	1092	7.3	6.7–7.9
1–2 portions	8473	42.0	41.0–42.9	5125	34.2	33.3–35.2	4131	49.1	47.6–50.6	1200	18.2	17.1–19.4	5858	31.8	31.0–32.7	1093	7.4	6.9–8.0
0 portions	292	35.2	30.5–40.2	213	25.6	21.9–29.8	111	39.8	31.8–48.3	42	15.5	11.1–21.3	177	27.2	22.6–32.3	37	5.9	4.0–8.7
PHYSICAL ACTIVITY																		
Active	9980	46.0	45.1–46.9	5991	35.4	34.5–36.3	5630	56.4	55.2–57.7	1616	19.2	18.2–20.3	8199	42.2	41.3–43.0	1202	7.4	6.9–7.9
Partially active	5776	48.3	47.1–49.5	3179	34.2	33.0–35.4	3045	58.6	56.7–60.4	835	18.8	17.4–20.4	3913	40.8	39.5–42.1	635	8.6	7.7–9.5
Sedentary	5258	40.1	39.0–41.3	3095	31.9	30.7–33.1	3692	47.6	46.1–49.2	1085	18.2	16.9–19.5	3720	28.2	27.2–29.3	756	7.2	6.6–7.9
HIGH-RISK DRINKING BEHAVIOUR																		
No	18,576	44.9	44.3–45.5	10,792	33.9	33.3–34.5	11,263	53.8	53.0–54.7	3211	18.7	18.0–19.5	13,523	36.7	36.1–37.2	2230	7.6	7.2–8.0
Yes	2347	45.9	44.0–47.8	1386	35.3	33.4–37.3	1062	56.9	53.7–60.1	291	18.0	15.8–20.5	2235	44.6	42.7–46.4	324	7.3	6.4–8.3
ROAD SAFETY																		
DRIVING AFTER DRINKING																		
No	20,930	44.9	44.3–45.5	12,145	34.0	33.4–34.6	12,360	53.7	52.9–54.6	3527	18.7	18.0–19.5	15,264	37.0	36.5–37.6	2514	7.6	7.2–8.0
Yes	266	45.1	40.0–50.3	190	38.3	33.3–43.6	80	55.6	45.7–65.1	31	20.9	14.2–29.6	677	43.3	40.1–46.6	92	7.2	5.7–9.2
ANTERIOR SEAT BELT (ALWAYS USED)																		
Yes	19,130	46.3	45.7–46.9	11,045	34.6	34.0–35.2	12,225	55.6	54.7–56.5	3178	19.2	18.4–19.9	14,309	39.7	39.1–40.3	2249	7.7	7.3–8.1
No	1850	36.4	34.5–38.4	1205	31.6	29.6–33.6	1015	43.6	40.8–46.4	344	16.9	15.0–19.0	1455	24.9	23.4–26.5	334	7.1	6.2–8.1
POSTERIOR SEAT BELT (ALWAYS USED)																		
Yes	4720	50.9	49.5–52.2	8627	32.8	31.4–34.1	7910	62.1	60.2–63.9	680	17.8	16.4–19.3	3585	49.8	48.3–51.3	438	6.9	6.2–7.7
No	14,280	43.5	42.8–44.2	2410	34.6	33.9–35.3	2760	52.0	51.0–53.1	2442	19.7	18.8–20.6	8742	33.6	32.9–34.3	1610	8.1	7.6–8.6
HELMET (ALWAYS USED)																		
Yes	2814	40.9	39.3–42.5	2239	41.4	39.8–43.2	985	54.3	51.1–57.5	353	23.5	20.8–26.4	2434	41.7	40.2–43.2	430	8.8	7.9–9.9

Table 3 (*continued*)

| | Cervical cancer screening uptake according to screening protocols (n = 42,098) | | | | | | Breast cancer screening uptake according to screening protocols (n = 21,201) | | | | | Colorectal cancer screening uptake according to screening protocols (n = 37,052) | | | | | |
| | Organised programmes | | | Spontaneous | | | Organised programmes | | | Spontaneous | | Organised programmes | | | Spontaneous | | |
	N	%	95% CI	N	%	95% CI	N	%	95% CI	N	%	N	%	95% CI	N	%	95% CI
No	69	42.6	31.0–55.1	27	15.9	10.1–24.2	31	69.2	49.9–83.5	4	6.2	38	26.6	17.6–37.9	13	8.8	4.9–15.4
CHRONIC CONDITIONS AND NUTRITIONAL STATUS																	
Underweight/normal weight	14,240	44.8	44.1–45.5	8857	36.0	35.3–36.7	6769	54.8	53.7–55.9	2141	20.6	7420	39.1	38.3–40.0	1221	7.4	7.0–7.9
Overweight	4878	45.6	44.2–46.9	2537	31.8	30.4–33.2	3805	51.9	50.3–53.5	1013	17.8	6171	36.2	35.3–37.2	1011	7.9	7.3–8.6
Obese	2004	44.5	42.3–46.6	904	26.2	24.3–28.2	1826	54.2	51.7–56.7	394	14.2	2308	34.5	33.0–36.1	371	7.0	6.1–8.0
HYPERCHOLESTEROLEMIA																	
No	14,252	45.2	44.5–45.9	8812	36.1	35.4–36.9	7099	52.8	51.6–53.9	2161	19.4	9235	36.3	35.6–37.1	1471	7.3	6.8–7.8
Yes	4139	49.9	48.4–51.4	2103	32.4	31.0–33.9	4553	58.1	56.6–59.6	1188	18.7	5885	43.3	42.2–44.4	1000	9.0	8.3–9.7
HYPERTENSION																	
No	16,582	44.6	44.0–45.3	10,292	36.4	35.7–37.0	7812	54.1	53.0–55.2	2444	20.3	9778	38.1	37.4–38.8	1553	7.2	6.8–7.7
Yes	3320	49.6	47.9–51.3	1456	26.7	25.3–28.3	4192	53.8	52.2–55.4	976	16.2	5718	37.3	36.3–38.4	982	8.5	7.8–9.2
CHRONIC DISEASES																	
None	17,661	44.2	43.6–44.9	10,628	34.9	34.3–35.6	8941	53.6	52.6–54.6	2753	19.8	10,898	36.4	35.7–37.1	1816	7.2	6.8–7.6
Cancer (current or past)	1069	52.8	49.7–55.9	500	30.0	27.3–32.9	1205	60.0	57.1–62.9	273	17.2	1429	49.9	47.4–52.3	193	8.9	7.6–10.5
Diabetes	644	48.1	44.0–52.2	266	22.0	19.0–25.4	896	52.3	48.5–56.0	160	11.9	1433	33.8	31.8–35.9	201	7.3	5.8–9.1
DEPRESSIVE SYMPHTOMS																	
No	19,182	45.2	44.6–45.8	11,286	34.5	33.9–35.1	11,016	54.7	53.8–55.6	3126	18.6	14,548	38.2	37.6–38.7	2346	7.6	7.2–7.9
Yes	1395	44.1	41.6–46.7	775	30.9	28.6–33.3	1054	50.0	46.8–53.2	287	18.5	1075	34.6	32.3–37.0	192	8.5	6.8–10.5
SELF PERCEIVED HEALTH STATUS																	
Good/very good	14,280	44.1	43.4–44.8	8765	35.5	34.8–36.2	6173	54.6	53.4–55.8	1968	20.7	8491	37.8	37.0–38.6	1334	7.0	6.6–7.5
Normal	6228	46.7	45.5–47.9	3271	31.6	30.4–32.7	5529	53.3	52.0–54.6	1431	17.4	6572	36.8	35.9–37.7	1125	8.1	7.5–8.7
Bad/Very bad	682	45.8	42.1–49.6	296	25.2	22.1–28.5	733	50.6	46.6–54.6	157	13.8	873	35.6	32.8–38.4	144	8.7	6.7–11.2

Table 4

Overall screening uptake probabilities (reported as % with relative 95% CI) by the uptake of other preventive interventions (other screening and vaccination), lifestyle and road safety-related behaviours and chronic conditions. Left columns report probabilities calculated adjusting only for age (and gender for colorectal cancer screening); right columns report probabilities calculated adjusting for age (and gender for colorectal cancer screening) and SES (educational attainment and economic difficulties). PASSI 2014–2016, Italy.

| | Cervical cancer screening | | | | Breast cancer screening | | | | Colorectal cancer screening | | | |
| | Probabilities % adj. by age | | Probabilities % adj. by age and SES[a] | | Probabilities % adj. by age | | Probabilities % adj. by age and SES[a] | | Probabilities % adj. by age and gender | | Probabilities % adj. by age, gender, SES[a] | |
	Overall uptake	95% CI	Overall uptake	95% CI	Overall uptake	95% CI	Overall uptake	95% CI	Overall uptake	95% CI	Overall uptake	95% CI
Cervical cancer screening uptake												
Yes	–	–	–	–	83.6	82.7–84.5	83.1	82.2–84.1	48.5	47.4–49.6	47.6	46.5–48.8
No	–	–	–	–	41.1	38.7–43.4	42.1	39.7–44.5	21.1	19.1–23.1	22.4	20.3–24.5
Breast cancer screening uptake												
Yes	88.2	87.4–89.0	87.7	86.9–88.5	–	–	–	–	53.5	52.5–54.4	52.6	51.6–53.6
No	51.0	48.7–53.2	51.9	49.6–54.1	–	–	–	–	20.5	19.0–22.0	21.4	19.8–22.9
Colorectal cancer screening uptake												
Yes	89.5	88.4–90.7	88.2	87.0–89.4	87.9	86.9–88.8	86.5	85.5–87.5	–	–	–	–
No	69.9	68.5–71.3	70.7	69.3–72.0	61.1	59.8–62.4	61.9	60.6–63.1	–	–	–	–
Influenza vaccination uptake[b]												
Yes	79.4	74.9–83.8	79.4	75.0–83.8	71.2	67.8–74.5	71.3	68.0–74.6	49.6	46.8–52.4	50.1	47.3–52.9
No	79.2	77.0–81.4	79.2	77.0–81.3	72.8	70.7–74.9	72.8	7.7–74.8	50.3	48.6–51.9	50.0	48.4–51.6
Smoking habit												
Non-smoker	78.7	78.0–79.4	78.6	77.9–79.2	73.0	72.0–74.0	73.1	72.1–74.1	44.2	43.3–45.0	44.0	43.2–44.9
Former smoker	85.0	83.8–86.3	83.9	82.7–85.1	77.9	76.0–79.8	76.5	74.7–78.3	52.7	51.4–54.1	51.6	50.4–52.9
Smoker	77.7	76.5–78.9	78.7	77.6–79.9	68.3	66.3–70.3	69.0	67.1–71.0	39.1	37.8–40.5	40.5	39.1–41.9
Daily fruit and vegetable intake												
≥5 portions	83.4	82.0–84.7	82.1	80.8–83.4	78.2	76.4–80.1	76.6	74.8–78.4	54.2	52.4–56.0	52.2	50.4–53.9
3–4 portions	81.8	81.1–82.5	81.2	80.4–81.9	75.8	74.7–76.9	75.2	74.1–76.4	48.9	47.9–49.8	48.1	47.2–49.1
1–2 portions	76.8	75.9–77.6	77.5	76.7–78.3	67.7	66.3–69.2	68.9	67.5–70.4	39.9	38.9–40.8	40.8	39.8–41.8
0 portions	62.6	57.3–67.8	65.6	60.2–70.9	55.8	46.9–64.7	58.6	49.3–67.8	34.3	29.0–39.6	37.3	31.6–43.0
Physical activity												
Active	81.8	81.1–82.5	81.3	80.6–82.0	76.0	74.9–77.1	75.1	74.0–76.3	50.3	49.4–51.2	49.0	48.2–49.9
Partially active	82.5	81.5–83.5	81.8	80.8–82.8	77.5	75.8–79.2	76.7	75.1–78.4	51.0	49.6–52.4	50.0	48.6–51.4
Sedentary	73.0	71.9–74.1	74.2	73.1–75.3	66.5	64.9–68.0	67.9	66.4–69.4	35.4	34.3–36.6	37.1	36.0–38.3
High-risk drinking behaviour												
No	79.1	78.5–79.7	79.2	78.7–79.8	73.0	72.2–73.8	73.1	72.3–74.0	44.9	44.2–45.5	45.0	44.3–45.6
Yes	83.2	81.7–84.8	82.1	80.6–83.6	75.5	72.6–78.4	74.2	71.4–76.9	52.3	50.4–54.2	51.1	49.3–52.9
Driving after drinking alcohol												
No	79.3	78.8–79.9	79.4	78.9–79.9	72.9	72.1–73.7	72.9	72.2–73.7	45.2	44.6–45.8	45.3	44.7–45.9
Yes	84.7	80.3–89.0	82.4	78.2–86.6	76.1	67.5–84.7	72.8	64.5–81.1	50.8	47.4–54.1	48.6	45.5–51.7
Front seat belt (always used)												
Yes	81.3	80.8–81.8	80.9	80.4–81.5	75.2	74.3–76.0	74.8	74.0–75.6	48.1	47.4–48.7	47.6	46.9–48.2
No	68.9	67.0–70.8	71.0	69.1–72.9	61.1	58.3–63.8	63.2	60.4–66.1	32.5	30.9–34.2	34.5	32.7–36.2
Back seat belt (always used)												
Yes	83.6	82.5–84.7	82.6	81.5–83.7	80.3	78.8–81.9	79.0	77.5–80.6	57.3	55.8–58.8	54.9	53.5–56.4
No	78.7	78.1–79.3	78.9	78.3–79.5	72.1	71.1–73.1	72.4	71.4–73.4	42.3	41.5–43.0	42.7	41.9–43.5
Helmet (always used)												
Yes	82.7	81.4–84.0	82.6	81.3–84.0	78.0	74.9–81.1	78.0	75.0–80.9	51.0	49.4–52.6	50.9	49.3–52.5
No	61.8	48.7–74.9	64.3	51.7–76.9	77.4	61.4–93.3	77.3	62.0–92.6	36.7	25.5–48.0	39.2	27.6–50.9
Nutritional status												
Underweight/normal weight	81.4	80.8–82.0	80.4	79.8–81.0	75.6	74.6–76.7	74.3	73.3–75.3	48.1	47.1–49.0	46.8	45.9–47.8
Overweight	77.5	76.3–78.7	78.7	77.5–79.9	70.4	68.8–71.9	71.2	69.6–72.7	44.2	43.2–45.2	44.6	43.6–45.7
Obese	71.0	68.9–73.1	74.2	72.2–76.3	69.1	66.7–71.5	72.1	69.7–74.5	41.4	39.8–43.1	43.4	41.7–45.2
Hypercholesterolemia												
No	81.5	80.9–82.2	81.5	80.9–82.1	72.4	71.3–73.4	72.3	71.3–73.4	44.5	43.7–45.3	44.5	43.7–45.3
Yes	83.6	82.4–84.8	83.7	82.5–84.9	77.8	76.5–79.1	77.8	76.5–79.2	52.2	51.1–53.3	52.1	51.0–53.2
Hypertension												
No	81.3	80.7–81.9	80.9	80.4–81.5	74.5	73.5–75.5	73.7	72.7–74.7	46.7	45.9–47.5	46.2	45.4–47.0
Yes	77.4	75.9–79.0	79.2	77.6–80.8	71.2	69.6–72.7	72.6	71.0–74.1	45.2	44.2–46.3	46.1	45.0–47.2
Chronic diseases												
None	79.6	79.0–80.2	79.3	78.8–79.9	73.6	72.7–74.5	72.9	72.0–73.8	44.9	44.2–45.6	44.0	43.3–44.7
Cancer (current or past)	83.1	80.8–85.5	83.3	80.9–85.6	78.1	75.5–80.6	78.5	75.9–81.0	57.9	55.5–60.3	58.3	55.9–60.7
Diabetes	72.0	68.1–76.0	75.8	71.9–79.7	65.8	62.1–69.4	69.3	65.6–72.9	39.7	37.6–41.9	42.7	40.4–45.0
Depressive symptoms												

(continued on next page)

Table 4 (*continued*)

	Cervical cancer screening				Breast cancer screening				Colorectal cancer screening			
	Probabilities % adj. by age		Probabilities % adj. by age and SES[a]		Probabilities % adj. by age		Probabilities % adj. by age and SES[a]		Probabilities % adj. by age and gender		Probabilities % adj. by age, gender, SES[a]	
	Overall uptake	95% CI	Overall uptake	95% CI	Overall uptake	95% CI	Overall uptake	95% CI	Overall uptake	95% CI	Overall uptake	95% CI
No	**80.2**	79.7–80.7	**80.0**	79.4–80.5	**73.7**	72.9–74.6	**73.4**	72.5–74.2	**46.4**	45.7–47.0	**46.0**	45.3–46.6
Yes	**75.5**	73.0–77.9	**78.3**	76.0–80.6	**69.2**	66.0–72.4	**72.7**	69.4–75.9	**43.6**	41.0–46.2	**48.3**	45.5–51.1
Self-perceived health status												
Good/very good	**80.3**	79.7–80.9	**79.5**	78.9–80.2	**75.3**	74.3–76.4	**73.8**	72.7–74.9	**46.0**	45.2–46.9	**44.2**	43.4–45.0
Normal	**78.2**	77.2–79.3	**79.5**	78.5–80.5	**71.4**	70.1–72.7	**72.3**	71.1–73.5	**45.0**	44.0–46.0	**46.4**	45.4–47.4
Bad/very bad	**72.0**	68.7–75.3	**76.2**	72.8–79.6	**65.6**	61.7–69.4	**70.7**	66.7–74.7	**43.7**	40.8–46.6	**50.6**	47.3–53.9

[a] SES = educational attainment and economic difficulties.
[b] Target population: People aged 50–69 or with at least one chronic disease.

Diabetes was negatively associated with uptake for all the screenings. Instead, previous cancer diagnosis increased screening uptake, particularly for colorectal cancer screening. Finally, feeling in good health was positively associated with test uptake for all screenings; the association was smaller in the organised screening component for cervical and breast cancer screening.

3.3. Model adjusted by socioeconomics

In general, adjusting for educational attainment and economic difficulties, differences in uptake became smaller than in the models only adjusted by age, but the trend was unvaried. There were only a few exceptions when the observed differences disappeared: diabetes and hypertension for all screenings, depressive symptoms for breast and colorectal cancer, high-risk drinking behaviour for breast cancer, and self-perceived health status in colorectal cancer (Table 4).

4. Discussion

Our study shows that, with few exceptions, people with unhealthy behaviours or with poorer health conditions have lower test uptake for all the recommended screenings. In general, these differences are all smaller for participation in organised screening. These associations are not fully explained by underlying socioeconomic conditions since adjusting for educational attainment and economic difficulties only slightly reduced the observed differences in screening test uptake. In fact, differences in coverage are small, with higher participation among Italians, the highly educated, those with no economic difficulties, the employed and those living with partner, in accordance with most previous studies (Broberg et al., 2018; Deding et al., 2017; Hanske et al., 2016; Wools et al., 2016). Screening programmes are mitigating some of these inequalities, with higher participation by the most deprived groups, but not for economic difficulties, occupational status and living conditions.

Even though screening coverage in persons with low fruit and vegetable consumption or low physical activity is 10% to 20% lower, other associations are smaller: almost null for smoking and even positive for former smoking. This suggests that self-selection bias may go in the direction of overestimating the benefits of screening in observational studies evaluating the effect of test coverage both in organised screening programs and opportunistic screening. On the contrary, the net effect of self-selection bias is probably small or even in the direction of underestimating the screening benefit for studies considering only the impact of participation in organised screening (Puliti et al., 2017; 2008; Ventura et al., 2014). This is consistent with the small differences observed in mortality for causes other than breast cancer between participants and non-participants in countries with population-based breast cancer screening programmes (Broeders et al., 2012).

We found a strong association between participation in the three screenings, which is clearly visible both in organised screening participation and in spontaneous uptake. This association cannot be explained by a contamination of the interventions because the intervals and the target populations are different for cervical cancer screening and, in Italy, there are no programmes that invite the population for colorectal and breast cancer screening on the same day. Similar findings were reported by previous studies, particularly for breast and cervical cancer (Bankhead et al., 2003; He et al., 2018; Jepson et al., 2000; Labeit and Peinemann, 2015). On the contrary, we found no association between screening uptake and influenza vaccination. Two previous studies showed a positive association with colorectal cancer screening uptake (Sewitch et al., 2007; Zimmerman et al., 2006).

In our study, non-smokers had only a slightly higher uptake than did smokers, and we found a much higher uptake in former smokers, according to previous findings (He et al., 2018; Labeit et al., 2013; Labeit and Peinemann, 2015; Shapiro et al., 2001; Wools et al., 2016).

Healthy diet and physical activity, two protective factors for breast and colorectal cancer incidence, were strongly associated with test uptake; the negative effects of unhealthy behaviours and non-participation in screening were therefore compounded (Bradbury et al., 2014; Namasivayam and Lim, 2017). These results are consistent with previous studies on colorectal cancer screening uptake (Sewitch et al., 2007; Shapiro et al., 2001), although no association with fruit and vegetable intake was suggested by a large recent study (He et al., 2018). Furthermore, although screening test uptake, unhealthy diet and reduced physical activity were each associated with socioeconomic deprivation, differences are still appreciable when we adjusted for educational attainment and economic difficulties. This therefore means not only that healthy behaviours are mediators of socioeconomic conditions, but that other common psychosocial characteristics act independently of the cultural and economic level.

A surprising finding was the positive associations between high-risk drinking behaviour and driving after drinking alcohol and test uptake. Although not widely explored in the literature (Jepson et al., 2000), a slightly positive association between alcohol consumption and colorectal cancer screening uptake was already reported (He et al., 2018). It is difficult to explain the positive association between screening uptake and driving after drinking alcohol because the association with all other road safety behaviours was inverse, consistent with a previous study (Shapiro et al., 2001). It is noteworthy that adjusting for educational attainment and perceived economic difficulties, the differences in uptake for driving after drinking alcohol almost disappeared, especially for breast cancer screening, yet the associations with other road safety behaviours remained.

While test uptake was similar for people with or without hypertension, those with hypercholesterolemia had higher test uptake. This finding could be due to an association between cholesterol

screening and cancer screening mediated by general practitioners' recommendations. The PASSI questionnaire does not distinguish between those with low cholesterol and those who have never been tested. Few previous studies explored these associations with inconsistent results (Wools et al., 2016).

Our findings on mental health are consistent with those of the few previous studies on this topic, which found an underuse of medical services among people suffering from depression (Zhang et al., 2016), and in particular, a lower probability of being screened for women with a high depressive symptom burden (Pirraglia et al., 2002).

Overweight and obesity are negatively associated with test uptake, according to previous studies on breast and cervical cancer screening (Aldrich and Hackley, 2010). Some authors suggest that obesity may cause embarrassment, and thus may be a barrier to presenting to screening (William Flint et al., 2016). We found that the effect was smaller for organised screening, where active invitation is implemented, but probably privacy and embarrassment are no less an issue than in private clinics. We also observed this trend in colorectal cancer screening, which in Italy is based on FOBT, with the stool self-sampled at home. These counterintuitive results are consistent with some previous studies (Ferrante et al., 2006; He et al., 2018; Rosen and Schneider, 2004), while other studies found no or positive association between overweight and colorectal cancer screening uptake (Wools et al., 2016). In summary, our findings do not support any role of embarrassment to justify lower participation of obese people.

People with a previous diagnosis of cancer had an only slightly higher test uptake rate than the average for breast and cervical cancer, while the effect was definitely stronger for colorectal cancer. Previous studies have found clear associations between having a history of cancer and breast (Jepson et al., 2000) and colorectal cancer screening uptake (Giorgi Rossi et al., 2005; He et al., 2018; So et al., 2012). Indeed, FOBT and endoscopic test uptake is much lower than it is for mammography and Pap test; thus, there is much more room for improvement when an awareness-increasing factor is present. Furthermore, endoscopy screening is widely recommended in first-degree relatives of colorectal cancer patients (Ministero della Salute and Osservatorio Nazionale Screening, 2006).

In general, all the other chronic diseases were negatively associated with screening uptake. This could be the consequence of an informed choice based on the fact that the balance of benefits and harms of screening goes in the direction of more harm and less benefit if life expectancy is shorter, but it could also be the consequence of lower awareness of the importance of screening. Unexpectedly, the lowest uptake rate was for those with diabetes, which does not have such a strong effect on life expectancy and because of which patients have repeated contact with health services. This suggests there are many missed opportunities to advise these patients on the importance of screening (Rawshani et al., 2017). Finally, we observed lower uptake rates in those reporting a bad perceived health status, similar to previous studies (He et al., 2018; Labeit et al., 2013). The difference was minimal for the organised screening component, at least for breast and cervical cancer screening. Differences for diabetes and self-perceived health almost disappeared when adjusting for educational attainment and economic concerns.

4.1. Implications for policy

Screening programmes offer a unique opportunity for contact between healthy individuals and health operators. Some researchers and public health decision makers have thus started exploring how to nest health promotion interventions within screening programmes, i.e. during history taking for cervical sample or mammography or when the kit for occult faecal test is delivered (Anderson et al., 2013; Gorini et al., 2012; Ministero della Salute, 2014; National Screening Unit, 2004). As a general consideration, participants in organised screening programmes are almost evenly distributed in all the educational levels.

Also, foreigners, often the most deprived part of the population in this historical period in Italy, participate only slightly less than do Italians. This implies that screening programmes may be an equitable vehicle for health promotion.

Brief advice interventions for smoking cessation (Prochaska et al., 1994) and screening for high-risk alcohol consumption followed by advice on possible motivational counselling or group programs (Prochaska et al., 1994) will probably reach the right target; interventions promoting healthy diet and physical activity, instead, are likely to miss a significant part of the at-risk population and might also increase inequalities because the most fragile part of the target population, i.e. those who are already overweight and obese, does not attend screening. Furthermore, organised programmes for cervical and colorectal cancer have low participation rates in Italy, particularly in southern regions that are the most deprived geographical areas (ONS, 2017). Thus, the opportunity to contact young women and men is limited particularly in southern Italy.

Finally, given that on average people with diabetes have more contacts with their general practitioner and with the diabetes care clinics for drug prescription and checkup for possible complications, often within outreaching programs, it is surprising that they have lower test coverage for all the screening. Our data suggest that check-ups for chronic conditions are not exploited to advise patients on the importance of screening, particularly for colorectal cancer.

4.2. Study limitations and strengths

The main limit of this study is that most of the observed associations are context- and time-specific. Thus, our conclusion about the impact on self-selection bias in observational studies cannot be generalised to other countries and other historical periods. Nevertheless, as some patterns are quite consistent among international studies, the implications of the selection of populations attending screening on possible health promotion interventions should be considered in all countries and specific assessment should be conducted locally.

The PASSI Surveillance System is based on self-reported data. Answers, therefore, can be affected by desirability bias and recall bias (particularly telescoping bias) and may be influenced by educational attainment and health conditions. Nevertheless, the entity of recall and telescoping bias was quantified in a similar Italian survey conducted on Pap test uptake just before the start of PASSI, finding minimal impact on test coverage estimates when present (Giorgi Rossi et al., 2006).

The survey has, by definition, a cross-sectional design, which has associated limitations: we measure the exposure to risk factors and health conditions at the same time in which we measure the screening test uptake. In some cases, exposure (i.e. the risk factor or health condition onset) could occur after deciding whether to participate in screening. Actually, most of the putative determinants we considered are chronic conditions or behaviours that are very unlikely to change in as short a time span as that of screening testing (i.e. generally 2 or 3 years).

As the survey collects retrospective information on the timing and payment of the last exam, it can underestimate the use of the test within screening programmes due to the phenomenon of over-use, especially in cervical screening. Thus, screening participation in organised programmes is more accurately photographed by institutional screening information flows (Zappa, 2017).

5. Conclusions

Screening test uptake is negatively associated with some unfavourable behaviours and health conditions, in particular with obesity, unhealthy diet and low physical activity, which are also risk factors for breast and colorectal cancer incidence, thus exacerbating the existing risks for related morbidity. Socioeconomic characteristics do not fully explain these differences.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ypmed.2019.01.007.

Conflict of interest

Acknowledgments

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