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1 **Factors associated with compliance to cervical cancer screening in France: the**
2 **EDIFICE 6 survey**

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5 *Short title:*

6 Cervical cancer screening in France

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24 Thibault de la Motte Rouge, Morgan Rouprêt and Jean-François Morère have received
25 honoraria from Roche. Christine Lhomel is an employee of Roche. The other authors have
26 no conflicts of interest to declare.

27

28 *Data statement*

29 The data that support the findings of this study are available from the corresponding author
30 upon reasonable request.

31

32 **Abstract**

33 Introduction. A nationwide cervical cancer (CC) screening program was implemented in
34 France in 2018. Asymptomatic women are invited for a cytological test once every 3 years
35 (age, 25-29 years), and an HPV test every 5 years (age, 30-65 years). We investigated the
36 characteristics of women who are resistant to CC screening.

37 Methods. Since 2005, the EDIFICE survey program has assessed attitudes toward cancer
38 screening in France. The 6th edition (2017) included 12 046 representative women (age, 18-
39 69 years). Social vulnerability was assessed using the EPICES score. Multivariate stepwise
40 logistic regression analysis identified factors correlated with nonuptake of CC screening.

41 Results. Questionnaires from 4499 women (age, 25-65 years) with no history of cancer were
42 analyzed; 88% (N=3960) reported at least one test in their lifetime, and 73% (N=3262) did
43 the test in the previous 3 years. Compared to ever-screened women, never-screened women
44 were younger (38 ± 11 yrs vs 44 ± 12 yrs, $P<0.05$), and more likely to be single (48% vs 20%,
45 $P<0.05$) and/or socially vulnerable (59% vs 38%, $P<0.05$). In multivariate analysis, items
46 significantly ($P<0.05$) associated with never screening included living alone (OR=2.26, 95%
47 CI [1.85-2.75]) and social vulnerability (OR=1.95 [1.59-2.40]). Women who were not
48 compliant with recommendations were more likely to be older (mean age, 49.2 yrs vs. 43.2
49 yrs), living alone (single, widowed or divorced, 40% vs. 30%, $P<0.05$), and/or socially
50 vulnerable (55% vs. 35%, $P<0.05$; OR=1.78, 95% CI [1.49-2.12]).

51 Conclusion. This analysis identified several factors associated with never screening and
52 under-screening. Effective prevention messages should specifically target these populations.

53

54 **Keywords**

55 Uterine Cervical Neoplasms

56 Early Detection of Cancer

- 57 Mass Screening
- 58 Attitude to Health
- 59 Socioeconomic factors
- 60 Risk factors
- 61

62 Introduction

63 Cervical cancer (CC) is the most frequent human papillomavirus (HPV)-related disease
64 worldwide with the majority of cases attributable to this group of viruses. Although most HPV
65 infections resolve spontaneously (90% within two years), the risk of cervical cancer persists
66 for 15 to 20 years, even in women with a normal immune system. The incidence rate of CC
67 increases between the ages of 20 and 25 years, with a peak in the fourth decade. Median
68 age at diagnosis is 53 years [1].

69 The World Health Organization recommends primary prevention based on HPV vaccination,
70 and secondary prevention through screening and treatment of pre-cancerous lesions in
71 women from the age of 30 [2]. The efficacy and benefit/risk ratio of organized nationwide
72 cancer screening programs are largely contingent on the age range of eligible average-risk
73 populations. The first guidelines for organized population-based CC screening in Europe
74 were published in 1993 [3]. Although only nine of the 28 European member states had
75 effective organized nationwide screening programs in place in 2016, 22 were in the process
76 of implementing such programs [3].

77 Opportunistic screening for cervical cancer depends on individual initiatives or physician
78 recommendations, and has existed in France for many years, independently of any
79 organized population-based program. The recommendations for this approach were
80 established following the 1990 Lille consensus conference [4], and stipulate that
81 asymptomatic women between the ages of 25 and 65 years should be called for a Pap
82 smear test once every 3 years following two normal initial tests at a one-year interval.
83 Universal healthcare coverage exists in France, thus providing access to health-related
84 examinations for all women.

85 A notable decrease in the frequency of CC and the subsequent death-rate was observed in
86 France between 1990 and 2018 [1]. Although the annual incidence rates dropped on average
87 by -1.8% between 1990 and 2018 (10.2 per 100 000 in 1990 vs. 6.1 in 2018), the trend was

88 less notable over the period 2010-2018 (-0.7% per year). Stagnation in screening coverage
89 and the limitations of individual screening likely contributed to this effect [1].

90 The organized national program was implemented in France in 2018. It is based on a
91 cervical cytology screening test once every 3 years for women between the ages of 25 and
92 30 (following normal results on two tests at a 1-year interval) and an HPV screening test
93 once every 5 years for women between 30 and 65 years of age. Since the implementation of
94 the organized program, women now receive an invitation to the screening test. Screening
95 tests may be indicated before the age of 25, notably in immune-compromised women who
96 require more specifically targeted care.

97 Additionally, since 2007, primary prevention with prophylactic HPV vaccination has been in
98 place for girls aged 11-14 years. Vaccination coverage however remains low: in 2018, 23.7%
99 of 16-year-old girls had received the 2 doses of the vaccine [5].

100 The EDIFICE survey program (Etude sur le Déplststage des cancers et ses Facteurs de
101 compliance [*Study on cancer screening and compliance factors*]) was initiated in 2005 with a
102 view to improving our understanding of the behavior of the French population with regard to
103 cancer screening. The first five editions of the survey were conducted using the same
104 methodology (computer-assisted telephone interviewing [CATI]) with populations of
105 approximately 1500 men and women. These surveys have provided robust evidence on
106 prevention and screening of breast, cervical, colorectal, prostate, and lung cancer in France
107 [6], including misconceptions relating to risk factors for cancer [7], the role of general
108 practitioners in screening programs [8], the influence of social vulnerability [9], and evolving
109 trends in prostate cancer screening [10].

110 In 2017, the methodology was changed to online self-administered questionnaires addressed
111 to approximately 12 000 individuals for the EDIFICE 6 survey.

112 In the present analysis of the 6th edition, we sought to determine the characteristics of
113 women who resist CC screening, and those who have undergone at least one Pap smear

114 test but without returning for the repeat test after the recommended 3-year interval. We also
115 studied off-target populations who undergo opportunistic screening for cervical cancer up to
116 5 years before the recommended age.

117 **Methods**

118 The sixth edition of the survey was conducted with a new methodology via online self-
119 administered questionnaires, from 26 June to 28 July 2017 in 12 046 individuals (age, 18-69
120 years). The study population was selected from the Kantar LightSpeed Panel according to
121 the following criteria: gender, age (six strata), professional categories (three strata), town
122 size (five strata), and region of France (12 strata), according to the classification of the
123 French National Institute for Statistics and Economic Studies (*Institut National de Statistiques*
124 *et d'Etudes Economiques* [INSEE]), Paris, France. Representativeness of the sample
125 population was ensured by the quota method based on statistics from the French
126 Employment Survey, adjusted for sex, age, and profession. The quotas were based on 6
127 strata, with 4 for the 25-65-year age group.

128 Social vulnerability was determined using the EPICES score [11], which is calculated from
129 weighted scoring of responses to 11 questions, giving an overall score between 0 and 100.
130 Questions cover health insurance, living arrangements (alone/with a partner), home
131 ownership, financial situation, physical exercise, recreational activities, vacations, family ties,
132 and social support. Vulnerability is defined by a mean EPICES score ≥ 30 .

133 The study questionnaire requires approximately 25 minutes to complete. All returned
134 questionnaires underwent quality-control; questionnaires (1) completed in less than 15
135 minutes, and (2) with too many identical answers to similar question types on the Likert-scale
136 or qualitative questions were rejected.

137 Respondents were asked the following questions: "Have you ever had a Pap smear test
138 during a gynecological examination" (all women 18-65 years). If the answer to this was "yes",
139 the next question was: "When was your last Pap smear test?" (all women 18-65 years); if the

140 answer was “No”, the next question was: “Why have you never had a Pap smear test” (only
141 women 25-65 years). Compliance to the recommended period of 3 years between two
142 successive examinations was determined according to the date of last Pap smear test; and
143 reasons for non-compliance were collected from the question “Why did you not return for the
144 repeat examination?”. Answers to these questions were assessed according to marital status
145 (single, living with a partner), socioprofessional category, smoking status (current,
146 former/never smoker), and social vulnerability (EPICES score). Information on the type of
147 residential area (urban, rural), close relatives with cancer, and personal interpretation of own
148 cancer risk (greater, identical/lower than average) was also collected.

149 Quantitative data were expressed as means and standard deviation (SD), and categorical
150 data as percentages. Multivariate stepwise logistic regression analysis was used to identify
151 factors likely to explain the non-uptake of screening and non-uptake of follow-up screening.

152 In addition, data were analyzed using a technique of customized statistics implemented
153 under the R software environment. This approach—hereafter referred to as the *Target &*
154 *Levers* analysis—combines the search for a sample structure (targets) and the search for
155 criteria (levers). Target criteria can be continuous, discrete, qualitative, or ordinal quantitative
156 variables. The method identifies the best segmentation (according to certain performance
157 criteria) by testing each variable and each division. Levers are obtained by regression
158 models for the segment identified.

159 Protection of personal data was ensured in line with European Directives and fulfilled the
160 requirements of the French Data-Protection Watchdog (CNIL [*Commission Nationale de*
161 *l'Informatique et des Libertés*]). The survey was carried out in accordance with the
162 international code of ethics governing opinion polls.

163

164 Results

165 Population

166 Of the total survey population of 12 046 individuals (age, 18-69 years), 11 307 had no
167 personal history of cancer, and 4499 of the latter were in the target population (age, 25-65
168 years) for CC screening. Of those, 88% (N=3960) reported having done at least one Pap
169 smear test in their lifetime, and 73% (N=3262) did the test in the past 3 years. Forty-two
170 percent (N=264) of the off-target sub-group (N=633; age, 20-24 years) had a Pap smear test
171 up to 5 years before the recommended age.

172 Never-screened women

173 Twelve percent (N=539) of those who had not previously taken part in a screening program
174 were in the CC screening target age group. Notable characteristics of the never-screened
175 population (versus women who had undergone CC screening at least once in their lifetime)
176 were: a lower mean age (38 ± 11 yrs vs. 44 ± 12 yrs, $P<0.05$), and higher proportions of single
177 women (48% vs. 20%, $P<0.05$), socially vulnerable individuals (59% vs. 38%, $P<0.05$), and
178 never-smokers (69% vs. 49%, $P<0.05$) (Table 1). Multivariate analysis showed a statistically
179 significant association ($P<0.05$) between not undergoing CC screening and living alone
180 (OR=2.26, 95% CI [1.85-2.75]); social vulnerability (OR=1.95 [1.59-2.40]); and belonging to
181 the socioprofessional categories of unskilled workers (OR=1.89 [1.17-2.94]), skilled manual
182 workers and supervisory or clerical workers (OR=1.80 [1.02-3.05]), and higher managerial
183 and professional occupations (OR=1.74 [1.32-2.28]). Additionally, the status of “current
184 smoker” was inversely associated with never-screening (OR=0.62 [0.49-0.78]).

185 The most frequently cited reasons for not undergoing screening were “I don't feel concerned”
186 (40%), “individual negligence/not a priority” (31%), reasons related to the examination (28%)
187 or to the physician (25%, “I don't go to see my doctor regularly” or “my doctor didn't prescribe
188 it”). Interestingly, non-vulnerable women cited, “I don't feel concerned” (45% vs. 36%, $P<0.05$)
189 and reasons related to the examination/results (36% vs. 25%, $P<0.05$), more frequently than

190 vulnerable women. One percent of never-screened women declared having had a
191 hysterectomy (“I no longer have a uterus”).

192 The Target & Levers analysis highlighted three profiles of women in terms of
193 sociodemographic attributes and attitudes towards screening. Firstly, the pivotal age of 32.5
194 years segmented the study population into two subgroups. Younger women (<32.5 years)
195 who had never been screened were noticeably more likely to be single and to belong to the
196 higher socioprofessional categories (higher managerial and professional occupations).
197 Marital status subsequently segmented the population of older women (≥ 32.5 years) into two
198 further profiles: among those living with a partner, the fact of belonging to lower
199 socioprofessional categories (unskilled workers) was significantly associated with never-
200 screening whereas in the group of single older women, social vulnerability was associated
201 with never-screening (Table 2 and Figure 1). Social vulnerability was consistently associated
202 with never screening in all subgroups of age and marital status, and in the main population.

203 Under-screened women

204 Fifteen percent (N=671) of women in the target age range for CC screening, and who had
205 done at least one Pap smear test in their lifetime, did not return for the repeat examination
206 within the recommended 3 years. Compared to those who were compliant with the
207 recommendations, the population of non-compliant women was older (mean age 49.2 yrs vs.
208 43.2 yrs); there were also higher proportions of women living alone (single, widowed or
209 divorced, 40% vs. 30%, $P < 0.05$), and socially vulnerable individuals (55% vs. 35%, $P < 0.05$),
210 smokers (35% vs. 26%, $P < 0.05$), and lower proportions of high socioprofessional categories
211 (23% vs. 34%, $P < 0.05$) (Table 3). In multivariate analysis, the items associated with non-
212 compliance included: social vulnerability (OR=1.78, 95% CI [1.49-2.12]), current smoking
213 (OR=1.54 [1.28-1.85]) and rating as “not important” the progress enabled by clinical research
214 (OR=1.49 [1.10-1.99]).

215 The most frequently cited reasons for non-uptake of subsequent Pap smear tests were "I
216 don't feel concerned" (48%), "individual negligence/not a priority" (42%), reasons related to
217 the physician (27%) or to the examination (22%). Vulnerable women cited reasons related to
218 the physician (30% vs. 23%) more frequently than non-vulnerable women. Eleven percent of
219 under-screened women declared having had a hysterectomy ("I no longer have a uterus).

220 Off-target screening

221 Premature CC screening was more frequent among current smokers compared to non-
222 smokers, and among women living with a partner compared to those living alone. Other
223 characteristics such as living in urban or rural areas, or social vulnerability had no significant
224 impact on premature screening (Figure 2).

225 Discussion

226 This analysis of the EDIFICE 6 survey shows that 73% of the CC screening target population
227 had one Pap smear test within the past 3 years, thus complying with the recommended 3-
228 year interval. It also brings to light certain characteristics of women who are in the target
229 population for CC screening yet appear reluctant, either because they have never had a
230 screening test in their lifetime or because they did not do the repeat test within the
231 recommended timeframe.

232 While our analysis focuses on the population in France, large disparities in screening uptake
233 are known to exist worldwide, with compliance rates of approximately 80% in North America
234 [12, 13], but below 20% in China [14], and ranging from 70-75% in New Zealand and 60% in
235 Australia to 32% in Japan and 2.6% in India [15]. Our results can legitimately be compared to
236 European data published by the International Agency for Research on Cancer (IARC) [16],
237 where examination coverage figures correspond to the proportion of the target population
238 tested in the year, and include opportunistic screening. Rates ranging from 9.2% (Romania)
239 to 86.3% (Sweden) were reported (all ages). Among other features, inter-country disparities
240 reflect the differences in progress in terms of the implementation of cancer screening

241 programs. It must however be noted that these figures date back to 2013 and have likely
242 evolved as health policies focus actively on promoting organized programs.

243 There is a paucity of recent data on CC screening uptake in France. In 2010, two studies
244 reported uptake rates of 72% [17] and 83% [18]. More recently, preliminary estimations from
245 a pilot program of organized screening showed that 62% of the target population from 13
246 French departments respected the recommended 3-year timeframe over the period 2010-
247 2012 [19].

248 *Age and marital status*

249 The Target & Levers analysis suggests that the socioprofessional subgroup of never-
250 screened women may be closely correlated with age and marital status. We postulate that
251 young women who are committed to their education and their early career likely defer
252 healthcare issues such as screening for cervical cancer.

253 Our survey was conducted shortly before the organized nationwide CC screening program
254 was implemented in France. Women of reproductive age were most frequently referred for
255 screening during the course of a routine gynecological check-up. In France, over 90% of Pap
256 smear tests are done by gynecologists [20], and compliance to screening is associated with
257 a follow-up visit for contraception [21]. Younger women and those living alone were therefore
258 likely to have never been screened. Likewise, older (post-menopausal) women or those living
259 alone were likely to have ceased screening [20, 22]. Lower uptake of CC screening in older
260 age groups was reported in the context of opportunistic screening [23], but also in the pilot
261 program of organized screening in 13 French departments [19]. Interestingly, the main factor
262 associated with CC screening for women in the 50-65-year age group was the fact of having
263 recently been screened for breast cancer [23]. The well-established (since 2003) breast
264 cancer screening program in France could serve as an enabling context to increase
265 awareness in the population of peri- and post-menopausal women and encourage
266 participation in the more recently implemented nationwide CC screening program.

267 *Social vulnerability*

268 In our survey, social vulnerability was seen to be correlated with lower rates of screening in a
269 lifetime and with higher rates of drop-out from screening recommendations. There is
270 substantial evidence for the critical impact of socioeconomic vulnerability on cancer
271 incidence and mortality, particularly in France [18, 24]. The greater risk of infections among
272 socially vulnerable populations [24] likely accounts for the notably higher incidence of
273 cervical cancer among women in the most vulnerable social groups [18]. Sub-optimal CC
274 screening uptake also affects survival of CC patients [18] and has already been reported in
275 vulnerable populations [17, 20, 23, 25]. The current organized nationwide CC screening
276 program is expected to reduce the inequalities between more or less vulnerable populations
277 [20].

278 *Tobacco status*

279 Several suggestions have been put forward in an attempt to explain the relationship between
280 screening uptake and different lifestyles, including tobacco consumption [17, 22, 23].
281 Interestingly, healthy attitudes were seen to be associated with lower screening rates, based
282 on the assumption that people believe their healthy lifestyle is protective. This may well apply
283 to our observations of never smokers who were found to be less likely to begin (or to
284 anticipate undergoing) CC screening than current smokers, whereas poor self-esteem and/or
285 fear of the results may explain the behavior of individuals who are less compliant with the
286 recommended timeframe for repeat screening tests [17, 20]. Regular screening is however
287 an integral feature of health prevention, and as such is more likely to be adopted by non-
288 smokers.

289 *Premature screening*

290 In line with previous findings, our analysis highlights a notably high rate of screening uptake
291 among the 20-25-year old off-target age group [26]; this rate is even higher in current
292 smokers and women living with a partner, and concurs with our observation on ever-

293 screened women in the target population. Surprisingly however, social vulnerability did not
294 significantly affect uptake of premature screening.

295 In certain specific epidemiological situations where there is an increased risk of cervical
296 cancer (mainly early sexual activity), lowering the age for the first Pap test to 20 years can be
297 considered [27]. This may partly explain the premature CC screening rate of this population.
298 However, evidence does not consistently favor initiating CC screening from the age of 20
299 [28] and the potential risk of consequences on obstetrical morbidity has been suggested [26].

300 *Perspectives and ultimate goal of CC screening in France and developed countries*

301 Eliminating CC in France is currently contingent on an organized nationwide screening
302 program stratified by age (HPV and Pap smear test), and the extension of HPV vaccination
303 coverage (notably recently extended to include boys aged 11-14 years). In 2019, the French
304 Health Authorities recommended primary CC screening in women as from the age of 30,
305 using HPV testing every 5 years instead of the 3-yearly Pap smear test. The 3-yearly Pap
306 smear test is however maintained for women before the age of 30.

307 Interestingly, much like France, Australia implemented HPV vaccination in 2007, has used
308 Pap smear test screening since 1991, and recently transitioned to primary screening with
309 HPV testing every 5 years [29-31]. HPV screening was shown to still be cost effective
310 despite high vaccination coverage [32] and reasons for under-screening and never-screening
311 were very similar to our own findings [29]. A modelling study in 2018 anticipated the
312 elimination of CC in Australia (<4 cases per 100 000 women) within the next 20 years, as
313 long as vaccination coverage remains high, and screening is maintained with 5-yearly HPV
314 primary screening for women between 25-65 years [30]. Another study has however
315 suggested that this novel approach may actually increase the incidence of CC in Australia
316 [31]. It would be interesting to determine whether our findings on different populations who
317 are resistant to cervical cancer screening are also observed in other developed countries.
318 Should that be the case, the development of appropriate targeted measures could be

319 facilitated, resulting in a more favorable cost/benefit ratio for screening. Conducted
320 concurrently with vaccination strategies, this approach has the potential to enable preventive
321 strategies to achieve the ultimate goal of virtually eliminating cervical cancer mortality.

322 An additional approach to improving cervical cancer screening could be based on self-
323 testing. Self-testing is not yet available in France. The National Cancer Institute (INCa) is
324 funding research projects and medico-economic studies on this test to assess the usefulness
325 in the current national setting. Preliminary results show that it is indeed a potentially useful
326 method, particularly for women who are not compliant with conventional screening [33]. We
327 believe that this may be an additional means to improve the overall cervical cancer screening
328 rate, and we hope that self-testing will become available in the near future.

329 *Limitations of the study*

330 The findings of the EDIFICE 6 survey may be affected by the inherent bias of declarative
331 surveys. The proportion of women who reported having undergone screening at least once
332 may therefore be over-estimated and a memory bias may have impacted the under-screened
333 rate. However, the large sample size confirms the statistical power.

334 **Conclusion**

335 Targeted awareness campaigns are currently needed to specifically reach certain
336 populations, namely socially vulnerable women—who are known to have a greater risk of
337 cervical cancer—and those who do not undergo regular gynecological check-ups. The latter
338 are more likely to be single and either peri-/post-menopausal (under-screened), or young
339 women with no children (never screened). Effective prevention messages should specifically
340 target the most common reasons for under-screening and never-screening.

341

342 **Contributions of authors**

343 Thibault de la Motte Rouge, Chantal Touboul, Christine Lhomel, Morgan Rouprêt and Jean-
344 François Morère were involved in the conception and design of the study. Thibault de La
345 Motte Rouge and Chantal Touboul wrote the manuscript.

346 Chantal Touboul provided study material and collected the data. Thibault de la Motte Rouge,
347 Chantal Touboul, Christine Lhomel, Morgan Rouprêt and Jean-François Morère analyzed
348 and interpreted the data. All authors validated the report.

349

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353

354 References

- 355 [1] Defossez G, Guyader-Peyrou SL, Uhry Z, *et al.* Estimations nationales de l'incidence et
356 de la mortalité par cancer en France métropolitaine entre 1990 et 2018. Saint-Maurice (Fra):
357 Santé publique France, 2019. 161 p. Available from:
358 [https://www.santepubliquefrance.fr/maladies-et-traumatismes/cancers/cancer-du-](https://www.santepubliquefrance.fr/maladies-et-traumatismes/cancers/cancer-du-sein/documents/rapport-synthese/estimations-nationales-de-l-incidence-et-de-la-mortalite-par-cancer-en-france-metropolitaine-entre-1990-et-2018-volume-1-tumeurs-solides-etud)
359 [sein/documents/rapport-synthese/estimations-nationales-de-l-incidence-et-de-la-mortalite-](https://www.santepubliquefrance.fr/maladies-et-traumatismes/cancers/cancer-du-sein/documents/rapport-synthese/estimations-nationales-de-l-incidence-et-de-la-mortalite-par-cancer-en-france-metropolitaine-entre-1990-et-2018-volume-1-tumeurs-solides-etud)
360 [par-cancer-en-france-metropolitaine-entre-1990-et-2018-volume-1-tumeurs-solides-etud.](https://www.santepubliquefrance.fr/maladies-et-traumatismes/cancers/cancer-du-sein/documents/rapport-synthese/estimations-nationales-de-l-incidence-et-de-la-mortalite-par-cancer-en-france-metropolitaine-entre-1990-et-2018-volume-1-tumeurs-solides-etud)
- 361 [2] World Health Organization. Human papillomavirus (HPV) and cervical cancer 2019 [Last
362 date accessed 2020 17 february 2020]. Home/ Newsroom/ Fact sheets/ Detail/ Human
363 papillomavirus (HPV) and cervical cancer]. Available from: [https://www.who.int/news-](https://www.who.int/news-room/fact-sheets/detail/human-papillomavirus-(hpv)-and-cervical-cancer)
364 [room/fact-sheets/detail/human-papillomavirus-\(hpv\)-and-cervical-cancer.](https://www.who.int/news-room/fact-sheets/detail/human-papillomavirus-(hpv)-and-cervical-cancer)
- 365 [3] Chrysostomou AC, Stylianou DC, Constantinidou A, *et al.* Cervical Cancer Screening
366 Programs in Europe: The Transition Towards HPV Vaccination and Population-Based HPV
367 Testing. *Viruses*. 2018;10(12).
- 368 [4] Fédération des gynécologues et obstétriciens de langue française. Conférence de
369 consensus sur le dépistage du cancer du col utérin, Lille 5-6-7-8 septembre 1990.
370 recommandations. *Gynecol Obstet Biol Reprod*. 1990;19:1-16.
- 371 [5] Fonteneau L, Barret AS, D. L-B. Évolution de la couverture vaccinale du vaccin contre le
372 papillomavirus en France – 2008-2018. *Bull Epidémiol Hebd*. 2019;22-23:424-30.
- 373 [6] Eisinger F. Knowledge-Based Cancer Control. *Curr Oncol Rep*. 2018;20(Suppl 1):19.
- 374 [7] Morère J-F, Viguié J, Couraud S, *et al.* Awareness and Misconceptions of Breast Cancer
375 Risk Factors Among Laypersons and Physicians. *Curr Oncol Rep*. 2018;20(Suppl 1):15.
- 376 [8] Viguié J, Calazel-Benque A, Eisinger F, *et al.* Organized colorectal cancer screening
377 programmes: how to optimize efficiency among general practitioners. *Eur J Cancer Prev*.
378 2011;20 Suppl 1:S26-32.
- 379 [9] Morère J-F, Eisinger F, Touboul C, *et al.* Decline in Cancer Screening in Vulnerable
380 Populations? Results of the EDIFICE Surveys. *Curr Oncol Rep*. 2018;20(Suppl 1):17.

- 381 [10] Eisinger F, Morère JF, Touboul C, *et al.* Prostate cancer screening: contrasting trends.
382 *Cancer Causes Control.* 2015;26(6):949-52.
- 383 [11] Labbe E, Blanquet M, Gerbaud L, *et al.* A new reliable index to measure individual
384 deprivation: the EPICES score. *Eur J Public Health.* 2015;25(4):604-9.
- 385 [12] Watson M, Benard V, King J, *et al.* National assessment of HPV and Pap tests: Changes
386 in cervical cancer screening, National Health Interview Survey. *Prev Med.* 2017;100:243-7.
- 387 [13] Datta GD, Blair A, Sylvestre MP, *et al.* Cervical cancer screening in Montreal: Building
388 evidence to support primary care and policy interventions. *Prev Med.* 2018;111:265-71.
- 389 [14] Wang B, He M, Chao A, *et al.* Cervical Cancer Screening Among Adult Women in China,
390 2010. *Oncologist.* 2015;20(6):627-34.
- 391 [15] Garland SM, Bhatla N, Ngan HY. Cervical cancer burden and prevention strategies: Asia
392 Oceania perspective. *Cancer Epidemiol Biomarkers Prev.* 2012;21(9):1414-22.
- 393 [16] Ponti A, Anttila A, Ronco G, *et al.* Cancer Screening in the European Union - Report on
394 the implementation of the Council Recommendation on cancer screening. International
395 Agency for Research on Cancer (IARC), 2017. Available from:
396 https://ec.europa.eu/health/sites/health/files/major_chronic_diseases/docs/2017_cancerscreening_2ndreportimplementation_en.pdf.
397
- 398 [17] Sicsic J, Franc C. Obstacles to the uptake of breast, cervical, and colorectal cancer
399 screenings: what remains to be achieved by French national programmes? *BMC Health Serv*
400 *Res.* 2014;14:465.
- 401 [18] Tron L, Belot A, Fauvernier M, *et al.* Socioeconomic environment and disparities in
402 cancer survival for 19 solid tumor sites: an analysis of the French network of cancer
403 registries (FRANCIM) data. *Int J Cancer.* 2018.
- 404 [19] Beltzer N, Hamers FF, Duport N. Résultats finaux de l'évaluation du dépistage du cancer
405 du col de l'utérus organisé dans 13 départements en France 2010-2014 [Final results of the
406 evaluation of organised screening for cervical cancer in 13 departments in France, 2010-
407 2014]. *Bull Epidémiol Hebd.* 2017;2017(2-3):26-31.

- 408 [20] Menvielle G, Richard JB, Ringa V, *et al.* To what extent is women's economic situation
409 associated with cancer screening uptake when nationwide screening exists? A study of
410 breast and cervical cancer screening in France in 2010. *Cancer Causes Control.*
411 2014;25(8):977-83.
- 412 [21] Mignot S, Ringa V, Vigoureux S, *et al.* Pap tests for cervical cancer screening test and
413 contraception: analysis of data from the CONSTANCES cohort study. *BMC Cancer.*
414 2019;19(1):317.
- 415 [22] Barbadoro P, Ricciardi A, Di Tondo E, *et al.* Utilization patterns of cervical cancer
416 screening in Italy. *Eur J Cancer Prev.* 2015;24(2):135-40.
- 417 [23] Duport N, Serra D, Goulard H, *et al.* [Which factors influence screening practices for
418 female cancer in France?]. *Rev Epidemiol Sante Publique.* 2008;56(5):303-13.
- 419 [24] Bryere J, Dejardin O, Launay L, *et al.* Socioeconomic status and site-specific cancer
420 incidence, a Bayesian approach in a French Cancer Registries Network study. *Eur J Cancer*
421 *Prev.* 2018;27(4):391-8.
- 422 [25] Barré S, Massetti M, Leleu H, *et al.* Caractérisation des femmes ne réalisant pas de
423 dépistage du cancer du col de l'utérus par frottis cervico-utérin en France. *Bull Epidémiol*
424 *Hebd.* 2017;2017(2:3):39-47.
- 425 [26] Maura G, Chaignot C, Weill A, *et al.* Dépistage du cancer du col de l'utérus et actes
426 associés chez les femmes de moins de 25 ans entre 2007 et 2013 en France : une étude sur
427 les bases de données médico-administratives françaises. *Bull Epidémiol Hebd.*
428 2017;2017(2:3):32-8.
- 429 [27] Duport N. Données épidémiologiques sur le cancer du col de l'utérus - État des
430 connaissances – Actualisation 2008. 2008.
- 431 [28] Haute autorité de santé (HAS) État des lieux et recommandations pour le dépistage du
432 cancer du col de l'utérus en France. Haute autorité de santé 2010.
- 433 [29] Nagendiram A, Bougher H, Banks J, *et al.* Australian women's self-perceived barriers to
434 participation in cervical cancer screening: A systematic review. *Health Promot J Austr.* 2019.

- 435 [30] Hall MT, Simms KT, Lew JB, *et al.* The projected timeframe until cervical cancer
436 elimination in Australia: a modelling study. *Lancet Public Health.* 2019;4(1):e19-e27.
- 437 [31] Cox B, Sneyd MJ. HPV screening, invasive cervical cancer and screening policy in
438 Australia. *J Am Soc Cytopathol.* 2018;7(6):292-9.
- 439 [32] Simms KT, Smith MA, Lew JB, *et al.* Will cervical screening remain cost-effective in
440 women offered the next generation nonavalent HPV vaccine? Results for four developed
441 countries. *Int J Cancer.* 2016;139(12):2771-80.
- 442 [33] Haguenoer K, Giraudeau B, Gaudy-Graffin C, *et al.* Accuracy of dry vaginal self-
443 sampling for detecting high-risk human papillomavirus infection in cervical cancer screening:
444 a cross-sectional study. *Gynecol Oncol.* 2014;134(2):302-8.
- 445

Figure 1

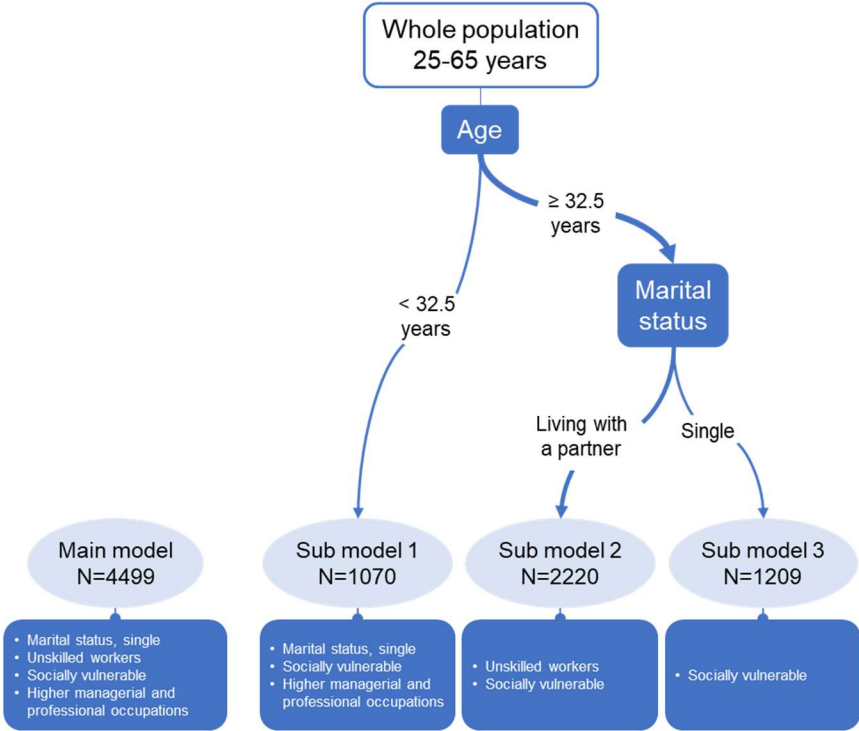


Figure 1 Main factors associated with never-screening. Main model and Target & Lever analysis showing the segmentation of the study population.

Figure

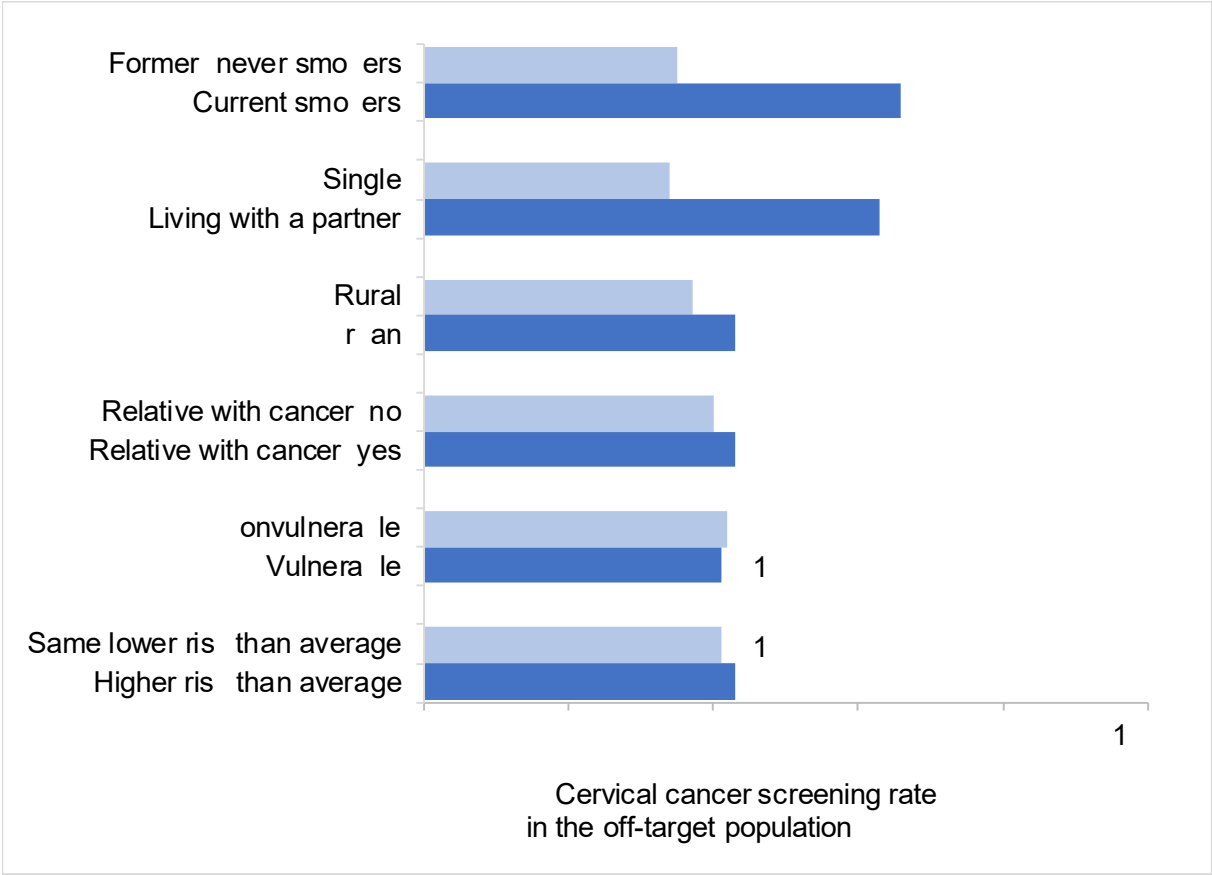


Figure Indicators of premature cervical cancer screening amongst off-target su - populations who underwent opportunistic screening for cervical cancer y prior to the recommended age.

Table 1. Characteristics of the study population. Comparison (Z-Test) of women who had at least one smear test in their lifetime (N=3960) and never screened women (N=539).

† assessed by the EPICES score

Characteristics	Screened at least once (N=3960)	Never screened (N=539)	P Value (Z-Test)
Mean age (SD), years	44.2 (11.6)	38.0 (11.0)	<0.05
Marital status			
Living with a partner	68%	46%	<0.05
Single	32%	54%	<0.05
Socially vulnerable †	38%	59%	<0.05
Not socially vulnerable †	62%	41%	<0.05
Socioprofessional category (SPC)			
High SPC	32%	33%	NS
Low SPC	45%	43%	NS
Retired	10%	4%	<0.05
Unemployed	13%	20%	<0.05
Tobacco status			
Current smokers	27%	21%	<0.05
Former smokers	24%	10%	<0.05
Never smokers	49%	69%	<0.05

Table 2. Target & Levers analysis. Significant odd ratios ($p < 0.05$) provided in the main model based on the whole population (4499 women, 25-65 years) and on the sub populations (sub model 1 : 1070 women, < 32.5 years; submodel 2 : 2220 women, ≥ 32.5 years and living with a partner; submodel 3 : women ≥ 32.5 years and single). NS : not significant.

	Sample populations			
	All women	< 32.5 years	≥ 32.5 years	
			Living with a partner	Single
	Main model (N=4499)	Sub model 1 (N=1070)	Sub model 2 (N=2220)	Sub model 3 (1209)
Marital status, single	2.31	2.58	-	-
SPC, unskilled workers	1.95	NS	2.81	NS
Socially vulnerable	1.83	1.76	2.15	1.77
SPC, higher managerial and professional occupations	4.69	2.42	NS	NS

Table 3. Characteristics of the study population. Comparison (Z-Test) between compliant women who returned after the recommended 3-year interval (N=3262) and non-compliant women (N=678). † assessed by the EPICES score

Characteristics	Compliant (N=3262)	Not compliant (N=671)	P Value (Z-Test)
Mean age (SD), years	43.2 (11.4)	49.2 (11.4)	<0.05
Marital status			
Living with a partner	70%	60%	<0.05
Single	30%	40%	<0.05
Socially vulnerable †	35%	55%	<0.05
Not socially vulnerable †	65%	45%	<0.05
Socioprofessional category (SPC)			
High SPC	34%	23%	<0.05
Low SPC	45%	42%	NS
Retired	8%	17%	<0.05
Unemployed	13%	18%	NS
Tobacco status			
Current smokers	26%	35%	<0.05
Former smokers	24%	23%	NS
Never smokers	50%	42%	<0.05