

Optimizing cancer screening rates in populations with low literacy in France: Results of a mixed-methods cancer educational intervention study

ABSTRACT

Background: Vulnerable populations, including those with low income and literacy, are less likely than the general population to participate in cancer education programs and screenings. It is therefore crucial to examine the role of a cancer educational intervention in increasing the suboptimal cancer screening rates in France.

Objectives: We aimed to evaluate the effect of an eight-week cancer educational intervention on self-efficacy, cancer, and cancer prevention knowledge. We also aimed to study the uptake of colorectal, breast, and cervical cancer screenings among low-income immigrant women with low levels of literacy in France.

Materials and Methods: Between January 2019 and March 2020, we implemented a cancer educational intervention and followed up with a mixed-methods study in the Ain Department in the east of France, triangulating quantitative survey data with qualitative interview data. Participants completed a survey assessing their knowledge and self-efficacy of cancer and cancer screenings before and after an eight-week in-person cancer educational program. Semi-structured qualitative interviews were also conducted with each participant. Screening outcomes were obtained two years after the interviews. Appropriate quantitative and qualitative analyses were performed.

Results: Study outcomes in our cohort ($n = 164$ women) improved following the cancer educational intervention as shown in pre- versus post-survey results: self-efficacy (8 [9.4%] to 48 [56.5%]), cancer knowledge (14 [16.5%] to 72 [84.7%]), screening knowledge (4 [4.7%] to 54 [63.5%]), and screening outcome (25 [30.6%] to 61 [73.6%], $P < 0.0001$ for at least one screening). The interview data were consistent with the quantitative results.

Conclusions: Developing specific cancer educational initiatives for vulnerable low-income and low-literate populations can significantly improve knowledge about cancer and cancer prevention, and increase cancer screening rates. The provision of audience-tailored cancer educational interventions is an effective strategy to eradicate cancer inequities in France.

Keywords: Breast cancer, cancer education intervention, cervical cancer, colorectal cancer, low literacy

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INTRODUCTION

Cancer is the second leading cause of death worldwide, with nearly one in six deaths caused by cancer.^[1,2] In France, the Institut National Du Cancer (National Institute of Cancer) reported 382,000 new cancer cases and 157,400 cancer deaths in 2018.^[3] In particular, breast cancer is considered the

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PUTTING IN PERSPECTIVE

Central question

- Given that little is known about the impact of cancer education programs on cancer knowledge and screening in vulnerable populations in France, what is the impact of a cancer educational intervention among low-income immigrant women with low levels of literacy?

Key findings

- Self-efficacy improved following the intervention (9.4% to 56.5%; 8 participants to 48 participants, respectively).
- Cancer knowledge improved following the intervention (16.5% to 84.7%; 14 participants to 72 participants, respectively).
- Screening knowledge improved following the intervention (4.7% to 63.5%; 4 participants to 54 participants, respectively).
- Screening outcomes increased following the intervention (30.6% to 73.6%; 25 participants to 61 participants, respectively).

Impact

- Cancer educational initiatives specifically tailored to vulnerable low-income and low-literate populations increase cancer knowledge and screening uptake.
- Audience-tailored cancer educational interventions may reduce cancer inequities in France.

most common cancer and has the highest cancer mortality rate among women in France. In 2018, 58,500 new cases of breast cancer were reported, as well as 12,100 deaths.^[3] Lung cancer and colorectal cancer follow as the second and third most common cancers in France, with 46,300 and 43,100 new cases, respectively. These two types of cancer represent the top two causes of cancer deaths, with 33,100 and 17,100 deaths, respectively, recorded in 2018.^[3]

Recent studies demonstrate that most of the cancer burden affects vulnerable populations such as those with a disability, the poor, prisoners, and those with language barriers and a lack of access to healthcare. These groups are also considered at high risk due to a high body mass index, low consumption of fruits and vegetables, lack of physical exercise, and elevated smoking and alcohol consumption rates.^[4-12] Several nationally organized cancer screening programs have been initiated in France^[13] to reduce the disproportionate impact of these cancers on vulnerable populations (e.g., a breast cancer program in 2004,^[14] colorectal cancer program in 2007,^[14] and cervical cancer program in 2018^[15]).

These programs witnessed low national participation rates. Only 60.4% of French women aged 50 to 74 years participated in mammography screening during the 2016 to 2017 period,^[16] and 28.9% of French individuals participated in colorectal cancer screening from 2019 to 2020.^[17] European recommendations for acceptable participation rates for breast and colorectal cancer screening programs are 70%

and 45%, respectively.^[18,19] The rate of triennial cervical cancer screening for women in France aged 25 to 65 years was 58.2% from 2017 to 2019^[20] compared to the European recommendation of 70%.^[21] These low participation rates are associated with factors such as low socioeconomic levels, poverty, low educational levels, and belonging to an immigrant community. Audience-tailored programs and prevention strategies specific to these high-risk populations may lead to an increase in screening uptake rates.^[22-25]

In France, the ten-year cancer control strategy prescribes several actions to reduce inequities in cancer screening uptake. These actions consist of telephonic reminders, letter reminders, and educational sessions in French or the audience's native language.^[26,27] Given the paucity of cancer-related evidence regarding vulnerable immigrant populations with low-income and low-literacy levels in France, we aimed to examine the impact of an eight-week cancer educational intervention among women with low levels of income and literacy in Ain, France. We hypothesized that the intervention would increase their self-efficacy, cancer knowledge, and screening outcomes.

MATERIALS AND METHODS

General study details

This study was part of a larger intervention study titled, "Action to promote organized cancer screenings among individuals with low literacy in the Ain" (Action de promotion

du Dépistage Organisé des Cancers auprès des Publics en cours d'Alphabétisation dans l'Ain [ADOCPA]). The study was funded by the Auvergne-Rhône-Alpes Regional Health Agency (Agence Régionale de Santé Auvergne-Rhône-Alpes). This mixed-methods study was conducted in five territories of the Department of Ain located in the Auvergne-Rhône-Alpes region of France.^[28,29] The study was conducted according to the ethical guidelines established by the Declaration of Helsinki and other guidelines such as Good Clinical Practice Guidelines and those established by the Institutional Ethics Review Board of the Auvergne-Rhône-Alpes Regional Health Agency. The study was approved by the Institutional Ethics Review Board of the Auvergne-Rhône-Alpes Regional Health Agency on October 30, 2015, number 0481921218 (Protocol RS-DT01-PREVENTION-PROMOTION-SANTE@ARS; protocol provided in Supplementary appendix 1). Before enrollment, we obtained written informed consent from each participant. The study was not registered in a publicly accessible clinical trial registry as this is not required by the Auvergne-Rhône-Alpes Regional Health Agency.

Participants

The target audiences for the ADOCPA intervention were low-income and low-literate women and men aged 50–74 years for colorectal cancer screening, women aged 50–74 years for mammography screening, and women aged 25–65 years for cervical cancer screening. However, very few men ultimately enrolled in the intervention ($n = 11$), and thus, the focus of the analysis comprised only female participants ($n = 164$). The exclusion criteria were a history of breast cancer, colorectal adenoma, or a total hysterectomy.

Aims/objectives

We aimed to examine whether the adoption of an eight-week cancer educational intervention would impact the self-efficacy, cancer knowledge, and screening outcomes of a vulnerable low-income, immigrant population with low levels of literacy in Ain, France.

Study methodology

To our knowledge, very few studies have explored the impact of cancer education programs on cancer screening behaviors in populations with low literacy in France. ADOCPA had two main objectives: to increase the participation rate of organized screening for colorectal, breast, and cervical cancer among illiterate populations through health educational interventions, followed by the delivery of a fecal immunochemical test (FIT) screening kit for colorectal cancer or by invitation letters to individuals to get screened; and to increase illiterate individuals' self-efficacy in obtaining cancer screenings. We tailored the educational intervention approach and materials for a population with low levels of literacy.^[28] The 2-hour long

group discussions were facilitated by health promoters and held in private conference rooms of nonprofit organizations in the Department of Ain, where the intervention took place. There were a total of eight discussions. We used multiple strategies, including interactive discussions and easy-to-understand written and visual materials. For example, we used short, common words and images to describe different cancers, and we color coded each cancer screening to increase participants' comprehension of each screening. Sentences were written at a first-grade level and were kept short, approximately 10 words in length and in the active voice. We also used easily legible font types and sizes. Finally, the educational sessions were interactive, whereby we encouraged the active participation of all the women in each session. All materials were disseminated during the discussions (Table 1 in the Supplementary Appendix 1).

The Auvergne-Rhône-Alpes Regional Cancer Screening Coordination Center (Centre Régional de Coordination des Dépistages des Cancers Auvergne-Rhône-Alpes or CRCDC AuRA) is mandated by the Ministry of Health in France to develop and implement screening programs for breast, colorectal, and cervical cancers.^[14,15] These three cancer screenings were targeted as part of a larger educational intervention between January 2019 and March 2020 to promote organized cancer screening programs in different regions of France.

The population, socio-demographic, and macroeconomic indicators of the study territories have been reported elsewhere (Tables 2-4 in the Supplementary Appendix 1).^[28] Ain has had a steady population growth and is the leading industrial department in France in terms of employment (21% of the population is employed compared to an average of 12% in metropolitan France). Ain ranks 16th nationally in terms of immigrant population size. This immigrant population is very heterogeneous, ranging from highly qualified executives to more vulnerable residents from disadvantaged neighborhoods who experience language and employment barriers. Health promoters went to various organizations in the community and provided information to community members about the cancer educational intervention and invited them to participate. They answered any questions and obtained informed consent from those who agreed to participate. Participants completed a pre-survey at the beginning (March 2018) and at the end (December 2018) of the eight-week cancer educational intervention, which took place between April 2018 and November 2018. Between January 2019 and March 2020, one month following the intervention, we also conducted hour-long semi-structured qualitative interviews with each participant.

The pre- and post-surveys assessed participants' knowledge and self-efficacy. Interview questions were translated into Arabic, English, and Spanish to ensure that they were understood by each participant. The questions reflected the information that was disseminated during the educational intervention sessions. The 2-hour long interviews were held in private spaces in the nonprofit organizations where the intervention took place. The interviews were audio-recorded and subsequently transcribed. The interviews were conducted by the Auvergne-Rhône-Alpes Regional Cancer Screening Coordination Center employees responsible for implementing the health educational interventions. These employees had a background in public health and social psychology. They either had a master's or a doctoral degree. We adopted an inductive, qualitative-driven research design.

Sample interview questions covered several domains: (1) knowledge of cancer (e.g., Can cancer be prevented? Can the early detection of cancer lead to better outcomes?); (2) knowledge of cancer screening information (e.g., Do I have to go to an X-ray office for a mammogram? Do I have to go to my doctor for colorectal cancer screening?); and (3) self-efficacy (e.g., Am I able to make a doctor's appointment? Am I able to go to the doctor alone?). Participants' responses were coded as "Yes" for correct answers and "No" for incorrect answers.

Participants were assigned to one of these groups for the analyses: (1) All age-eligible screenings were performed (mammography, FIT, and/or Papanicolaou smear); (2) two out of the three screenings were completed and/or only one of the two screenings was completed; (3) only one of the three screenings was completed; and (4) no test was completed. With permission from each participant, we verified the cancer screening status of each participant in the CRCDC AuRA database two years following the post-intervention interview.

Statistics

No separate sample size calculation was performed for this study as we analyzed the data from the cohort that participated in the cancer educational intervention. Analyses were performed using Stata 13.0,^[30] and $P < 0.05$ level was used to determine statistical significance. We analyzed the changes in participants' knowledge and self-efficacy between the pre- and post-survey questionnaires. For those eligible for screening, we analyzed any changes in their screening status (i.e., whether they underwent screening or not) by comparing their status before and following the eight-week cancer educational intervention.

When analyzing participants' screening status two years following the intervention, the groups that fell under

the categories "no test performed" and "not eligible for screening at the time of the intervention" were merged, and subsequently, we compared this group with the group labeled, "at least one screening test performed." Proportions were compared using McNemar's test for matched groups or McNemar's exact test, where appropriate.

RESULTS

We enrolled 164 participants in the study [Figure 1]. The study was conducted on the following dates: pre-survey = March 2018; cancer educational intervention = April 2018–November 2018; post-survey = December 2018; and interviews = January 2019–March 2020.

Table 1: Socio-demographic characteristics of interviewees

Characteristic	Number (percentage) (n = 164)
Sex	
Female	164 (100)
Age (years)	
<25	6 (3.7)
25–49	91 (55.5)
50–74	64 (39.0)
74 +	3 (1.8)
Education*	
Primary	52 (31.7)
Secondary	56 (34.2)
Post-secondary	8 (4.9)
Other (e.g., special education programs)	4 (2.4)
No schooling	30 (18.3)
Missing	14 (8.5)
Level of comprehension in French**	
Beginner	31 (18.9)
Intermediate	64 (39.0)
Advanced	51 (31.1)
Missing	18 (11.0)
Level of oral expression in French**	
Beginner	52 (31.7)
Intermediate	52 (31.7)
Advanced	43 (26.2)
Missing	17 (10.4)
Origin	
Africa	80 (48.8)
Asia and Middle East	37 (22.6)
Europe	32 (19.5)
Latin America	1 (0.6)
Missing	14 (8.5)

*Elementary school (école primaire): 6–11 years old; middle school/junior high (college): 11–15 years old; high school (lycée): 15–18 years old; post-secondary: 18 years plus (e.g., vocational or academic diploma in university or specialized school, apprenticeships, or civil service). **Level of comprehension or oral expression in French referred to the participants' proficiency in understanding or speaking the language at the elementary (beginner), strong grasp (intermediate), and mastery (advanced) levels. French language course instructors assessed students and assigned a level to each student

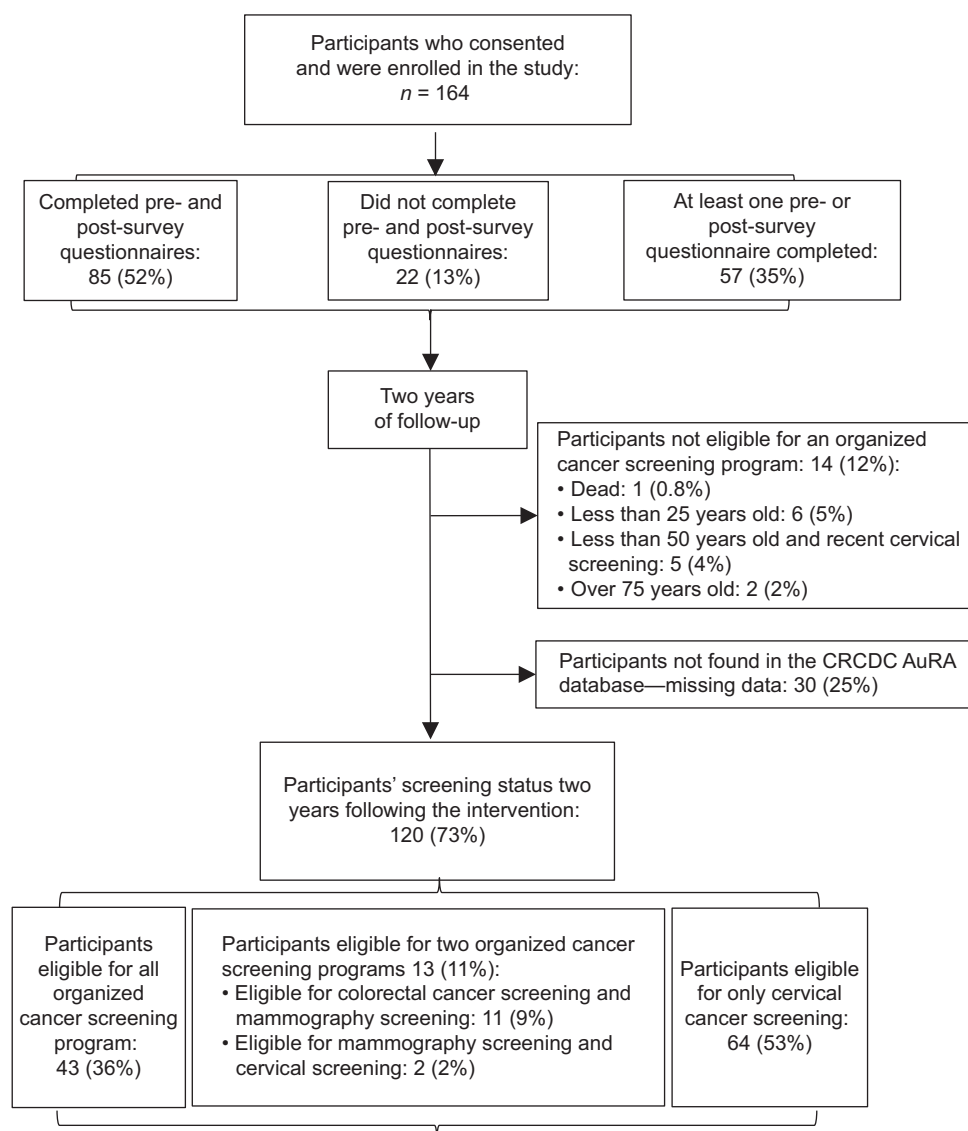


Figure 1: Flowchart of the participants' enrollment, educational intervention, and screening outcomes. (CRCDC AuRA: Auvergne-Rhône-Alpes Regional Cancer Screening Coordination Center)

The socio-demographic characteristics of the participants are presented in Table 1. At baseline, more than 96% of the participants (158 women) were in the 25- to 74-year age group and were eligible for at least one of the three organized cancer screening programs in France.

Pre- and post-survey analysis

Figure 2 provides a diagrammatic representation of the main survey findings. More than half the participants (85 women, 51.8%) completed both the pre- and post-surveys. At the beginning of the intervention, participants' knowledge and self-efficacy were assessed in terms of domains such as cancer-related risk factors and perceptions, colorectal cancer and screening, breast cancer and screening, and cervical cancer and screening. The percentages of correct answers overall were 16.5% (14 participants) for

cancer knowledge, 4.7% (four participants) for screening knowledge, and 9.4% (eight participants) for self-efficacy. After the eight-week cancer educational intervention, we observed a significant increase in the rate of correct answers: 84.7% (72 participants; $P < 0.001$) for cancer knowledge, 63.5% (54 participants; $P < 0.001$) for screening knowledge, and 56.5% (48 participants; $P < 0.001$) for self-efficacy. Cancer screening knowledge increased significantly after the eight-week cancer educational intervention, with more than 75% correct answers for each question ($P < 0.001$) [Table 2].

Post-interview data revealed that many of the participants had acquired new knowledge about screening (pseudonyms are used for each participant to protect privacy):

Table 2: Pre- and post-survey knowledge and self-efficacy

		Survey		
	Pre: <i>n</i> (%) (<i>n</i> =85)	Post: <i>n</i> (%) (<i>n</i> =85)	<i>P</i>	
Cancer knowledge level				
Can cancer be prevented?				
No	30 (35.3)	4 (4.7)	<0.001	
Yes	49 (57.7)	81 (95.3)		
Missing answer	6 (7.1)	0		
Can the early detection of cancer lead to better outcomes?				
No	6 (7.1)	2 (2.4)	0.290*	
Yes	78 (91.8)	83 (97.7)		
Missing answer	1 (1.2)	0		
Is a polyp the beginning of colorectal cancer?				
No	48 (56.5)	6 (7.1)	<0.001	
Yes	21 (24.7)	77 (90.6)		
Missing answer	16 (18.8)	2 (2.4)		
Cancer screening knowledge level				
Do I have to go to an X-ray office for a mammogram?				
No	54 (63.5)	21 (24.7)	<0.001	
Yes	25 (29.4)	64 (75.3)		
Missing answer	6 (7.1)	0		
Do I have to go to my doctor for a colorectal cancer screening?				
No	32 (37.7)	7 (8.2)	<0.001	
Yes	44 (51.8)	77 (90.6)		
Missing answer	9 (10.6)	1 (1.2)		
Mammogram—is it the screening test for breast cancer?				
No	14 (16.5)	3 (3.5)	0.010*	
Yes	67 (78.8)	82 (96.5)		
Missing answer	4 (4.7)	0		
Fecal immunochemical test—is it the screening test for colorectal cancer?				
No	37 (43.5)	5 (5.9)	<0.001	
Yes	44 (51.8)	80 (94.1)		
Missing answer	4 (4.7)	0		
Cervical—uterine smear—is it the screening test for cervical screening?				
No	20 (23.5)	4 (4.7)	<0.001	
Yes	63 (74.1)	80 (94.1)		
Missing answer	2 (2.4)	1 (1.2)		
In the nationally organized cancer screening programs, is the cancer screening test free?				
No	-	0 (not asked)	-	
Yes	-	85 (100)		
Self-efficacy				
Am I able to make a doctor's appointment?				
No	23 (27.1)	7 (8.2)	<0.001	
Yes	62 (72.9)	78 (91.8)		
Am I able to go to the doctor alone?				
No	23 (27.1)	16 (18.8)	0.120*	
Yes	62 (72.9)	69 (81.2)		
Am I able to achieve cancer screenings at home?				
No	49 (57.7)	8 (9.4)	<0.001	
Yes	25 (29.4)	76 (89.4)		
Missing answer	11 (12.9)	1 (1.2)		
Do I understand cancer screening invitation letters?				
No	52 (61.2)	9 (10.6)	<0.001	
Yes	28 (32.9)	76 (89.4)		
Missing answer	5 (5.9)	0		

Contd...

Table 2: Contd...

	Survey		P
	Pre: n (%) (n=85)	Post: n (%) (n=85)	
Do I feel capable of taking the necessary steps to get mammography screening?			
No	41 (48.2)	1 (1.2)	<0.001
Yes	36 (42.4)	64 (75.3)	
Missing answer	8 (9.4)	20 (23.5)	
Overall cancer knowledge level			
Incorrect answer to the three questions	4 (4.7)	0	
One correct answer	28 (32.9)	1 (1.2)	
Two correct answers	39 (45.9)	12 (14.1)	
Correct answers to the three questions	14 (16.5)	72 (84.7)	
Overall cancer screening knowledge level			
Incorrect answers to the five questions	1 (1.2)	0	
One correct answer	5 (5.9)	0	
Two to four correct answers	73 (85.9)	31 (36.5)	
Correct answers to the five questions	4 (4.7)	54 (63.5)	
Overall self-efficacy level			
Incorrect answers to the five questions	9 (10.6)	0	
One correct answer	15 (17.7)	1 (1.2)	
Two to four correct answers	53 (62.4)	36 (42.4)	
Correct answers to the five questions	8 (9.4)	48 (56.5)	

n=number; %=percentage; P=P value of McNemar's test for matched groups or (*) McNemar's exact test

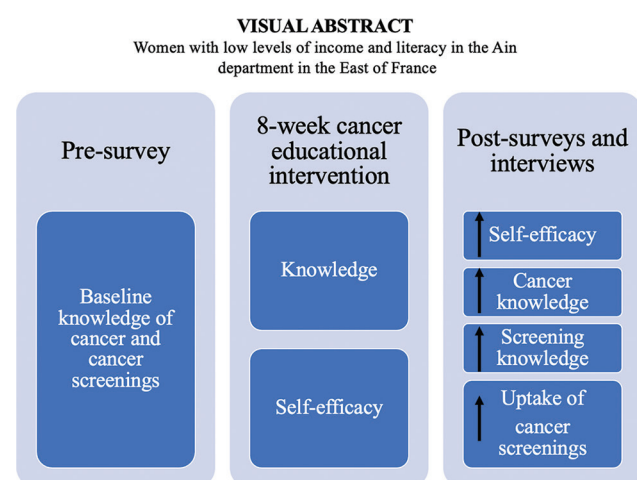


Figure 2: Diagrammatic representation of main survey findings

"I learned a lot of things, before, I didn't know anything. Yeah, I learned a lot of things like polyp in the colon. That's good. Even if I go to the doctor now and he talks to me about that, I know, not like before when he talked to me about things I didn't know, now I saw how the colon is, things like that, now I understand what the doctor says." (Aïssa)

"I learned new things, [...] Yeah, I'm not less worried about breast cancer, but I know that you have to keep an eye on it, everyone has to keep an eye on it, I do it (screening) from time to time." (Kenisha)

"There are things about cancer that we didn't know about before. There are women and men who have colon cancer, breast cancer

and cervix cancer. For breast cancer, when you touch it and there are little lumps, you go to the gynecologist, and you do a breast x-ray and if something is wrong, you do an ultrasound. For cervix cancer, we do a pap smear, and we receive a letter at home if there is a problem or if something is going wrong... if we have symptoms that will make us less stressed." (Saïda)

"I learned a lot about cancer, I discovered the body. Before, I didn't know anything, now I know about breast cancer, colon cancer, cervical cancer, how to do screening at home.... Before my husband said, 'You don't know anything' and now, thanks to you, I'm teaching him things and I'm doing it on my own, I'm proud of myself." (Zoubida)

"These are things we didn't know before. Before, we went for a smear test and then we turned the page, we didn't know why we were doing it, at the beginning when I had the smear test, I didn't even know what it was for." (Katerina)

Participants' self-efficacy to obtain their screenings also increased, as revealed in the post-survey questions. For example, self-efficacy scores for the questions, "I understand the invitation letter for cancer screening," "I feel able to perform a colon cancer screening test at home," and "I feel able to book an appointment by phone for breast cancer screening" increased significantly after the eight-week cancer educational intervention ($P < 0.001$). In contrast, nearly 73% of participants (62 women) reported being able to go to their doctor alone at baseline. This rate did not change significantly after the 8-week cancer educational intervention ($P, 0.120$) [Table 2].

An increase in self-efficacy was also expressed by participants during the interviews:

"If I find someone who has cancer, I can talk with her because I know about colon cancer and breast cancer. I know how to make an appointment with the doctor." (Safi)

"Afterwards, it became interesting because we also learnt how it happens, how to do it, how to share the information with others." (Houada)

"Before, when I went to the doctor, I was always accompanied by someone, but now I go alone to the mammography, to the doctor." (Zara)

"I helped someone the other time, I was very happy that I helped, yes, it will stay in my head for the rest of my life, when I'll be fifty years old and they come to the house, I'll be very happy to do it, it's very easy, you see, I showed everything." (Rachida)

Cancer screening uptake two years post-intervention

At the CRCDC AuRA, the first invitation letters for organized cervical cancer screening were sent to women in January 2020. Thus, two years after the end of the cancer educational

intervention, 120 women were eligible for at least one organized screening program.

At the beginning of the educational intervention, only 30.8% (37 participants) of those 120 women had obtained at least one screening test. Two years after the cancer educational intervention, the percentage of participants who had completed at least one screening test increased significantly to 80.0% (96 participants) ($P < 0.001$) [Table 3].

Among those 120 women, 71 (59.2%) were only eligible for cervical cancer screening at the beginning of the study, and none of them had already undergone cervical cancer screening. Two years following the cancer educational intervention, seven women (6%) had reached age eligibility (i.e., 50 years, which is the target age for breast and colorectal cancer screening) as per the cancer screening guidelines of the Ministry of Public Health in France.^[13] Among the remaining, 64 (53%) were eligible only for cervical cancer screening, and 48 (40%) had undergone cervical screening. In particular, the cancer educational intervention enabled 63.6% of participants (76 women), who were eligible for screening but had never been screened to undergo an organized

Table 3: Cancer screening uptake two years following intervention

Cancer screening outcome	At baseline; n (%) (n=120)	Two years after the educational intervention n (%) (n=120)	P
Did not complete or ineligible for screening	83 (69.2)	24 (20.0)	<0.001
Participants who had completed 1/3 screening	22 (18.3)	22 (18.3)	
Participants who had completed 2/3 or 1/2 screening	0	18 (15.0)	
Participants who had completed all screenings	15 (12.5)	56 (46.7)	

n=number; %=percentage; P=P value of McNemar's test for matched groups

Table 4: Participants' self-efficacy to obtain a cancer screening before and after educational intervention

Self-efficacy	At baseline; n (%)	Two years after the educational intervention; n (%)	P
Yes, I can make a doctor's appointment	(n=70)	(n=70)	<0.001
Did not complete screening	50 (71.4)	16 (22.9)	
Participants who had completed at least one screening	20 (28.6)	54 (77.1)	
Yes, I can go to the doctor alone	(n=63)	(n=63)	<0.001
Did not complete screening	42 (66.7)	15 (23.8)	
Participants who had completed at least one screening	21 (33.3)	48 (76.2)	
Yes, I can achieve cancer screenings at home	(n=74)	(n=74)	<0.001
Did not complete screening	51 (68.9)	16 (21.6)	
Participants who had completed at least one screening	23 (31.1)	58 (78.4)	
Yes, I understand cancer screening invitation letter	(n=72)	(n=72)	<0.001
Did not complete screening	51 (70.8)	16 (22.2)	
Participants who had completed at least one screening	21 (29.2)	56 (77.8)	
Yes, I feel capable of taking the necessary steps to get mammography screening	(n=55)	(n=55)	<0.001
Did not complete screening	40 (72.7)	12 (23.6)	
Participants who had completed at least one screening	15 (27.3)	43 (76.4)	

n=number; %=percentage; P=P value of McNemar's test for matched groups

cancer screening for the first time. For those not eligible for the screening program at baseline (72 participants, 60%), the intervention enabled more than 76.4% of those participants (55 women) to undergo at least one screening.

After eight weeks of cancer educational intervention sessions, we observed a significant increase in the uptake of at least one screening with $P < 0.001$ for those who answered “Yes” to the self-efficacy post-survey questions [Table 4]. These data were consistent with our qualitative findings:

“If someone has the letter, I know how to explain it to her, do this, do that. I did it twice.” (Mariem)

“Yes, I talk, I swear I talk. Yes, even to my friends, I talk about this [...] We talk about palpation of breasts...” (Kaira)

“Yes, and I talk a lot about that, especially when I walk my children to school in the morning, all the women who stay, I talk to them, afterwards I always talk about that [...] even with my husband, he always smoked, I said, ‘It’s not good to smoke, that’s the first thing that causes cancer.’” (Isaura)

DISCUSSION

This study provides evidence that developing specific cancer educational initiatives for vulnerable low-income and low-literate populations can influence cancer screening uptake by reducing access and knowledge barriers. Following the eight-week cancer educational intervention, we observed a significant increase in self-efficacy (8 [9.4%] to 48 [56.5%]), cancer knowledge (14 [16.5%] to 72 [84.7%]), screening knowledge (4 [4.7%] to 54 [63.5%]), and screening outcome (25 [30.6%] to 61 [73.6%]).

Cancer educational initiatives for populations with low literacy could encourage participation in nationally organized screening programs in France.^[26,27] These data are consistent with previous studies that examined the role of increasing cancer screening awareness and health literacy^[31,32] and how medical practitioners who are aware of their patients’ social contexts including barriers to screening can also play an important role in promoting cancer screenings.^[33,34]

In France, colorectal cancer is a major public health burden. The colorectal screening participation rate is low (28.9% in 2019–2020),^[17] which is below the recommended rate of 45%, as per the European guidelines,^[19] and lower than the breast cancer screening rate (45.6%).^[35,36] These low

participation rates negatively impact cancer mortality rates. Lack of knowledge is a key driver linked to these suboptimal cancer screening rates.^[26–28,37] The results from our study demonstrate that participants possessed low levels of knowledge of both colorectal and breast cancer screenings, although colorectal cancer is less publicly discussed than breast cancer.^[37] Importantly, our study findings are consistent with recent studies that have revealed that most of the cancer burden and suboptimal screening rates affect vulnerable populations such as those with low levels of income and literacy, as well as language barriers and a lack of access to healthcare.^[4–12]

Several limitations of the study must be noted. Given that slightly more than half the participants were between the ages of 25–49 years, they were not directly concerned with breast and colorectal cancer screening. In addition, given the younger age range (25–49 years) of the overall sample, the participants were likely more susceptible to learning. We were also not able to include men’s perceptions in our analyses, given the low number of men who enrolled in the study. Additionally, the missing data after two years of follow-up (i.e., due to death or loss to follow-up) did not allow us to examine the impact of the intervention on each individual cancer screening program. We also did not have additional follow-up data after the two years.

Future studies should investigate cancer-specific educational programs to determine whether we need to adapt cancer educational initiatives by cancer type and/or gender. Our qualitative data revealed that individuals who had undergone their cancer screenings were successful in convincing members of their social networks to also get screened. Although we did not examine this question in our survey, further research examining the impact of social networks on cancer screening uptake is warranted.

CONCLUSION

Developing specific cancer educational initiatives for vulnerable low-income and low-literate populations can significantly improve cancer and cancer prevention knowledge and cancer screening rates in France. These initiatives can serve as a key mechanism to reduce cancer inequities in the country.

Data sharing statement

The study protocol and data will be made available on reasonable request, by Dr. Christian Balamou (christian.balamou@depistagecanceraura.fr), until 10 years after publication.

Author contributions

CB proposed the grant; CB, MDJ, CR, and SR conceived or designed the study; CR and SR collected the data; CB, CR, SR, and MDJ analyzed and interpreted the data; MDJ critically revised the article; and all authors drafted the manuscript, approved the final version of the article to be published, and are accountable for all aspects of the work.

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Conflicts of interest

There are no conflicts of interest.

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SUPPLEMENTARY APPENDIX 1—STUDY PROTOCOL

Action to promote organized cancer screening among people learning to read and write in Ain (ADOCPA01)

The Auvergne-Rhône-Alpes Regional Cancer Screening Coordination Center or Centre Régional de Coordination des Dépistages des Cancers Auvergne-Rhône-Alpes (CRCDC AuRA) has been commissioned by the French Ministry of Health to organize and implement screening programs for breast, colorectal, and cervical cancer in the Auvergne-Rhône-Alpes region, in accordance with specifications published in the Journal Officiel. The target groups for these programs are women and men aged 50 to 74 (immunological screening test for colorectal cancer), women aged 50 to 74 (screening mammography), and women aged 25 to 65 (screening smear or HPV test, depending on age). A screening promotion strategy has been put in place to increase the number of screening examinations conducted in areas with the lowest participation rates and to work in partnership (medical, social, associative, and institutional) to reduce inequalities in access for the most vulnerable groups.

As part of this study, facilitators contacted all the structures (social and sociocultural centers¹, association) offering sociolinguistic workshops in the Ain Department to propose health education sessions aimed at illiterate or illiterate people. This article presents the results of health education workshops conducted in nine structures (seven social and sociocultural centers and two associations) between January 2019 and March 2020. The structures participating in the study had a territory of action that covered five communities of communes located in the south and northeast of the Ain Department. Table 3 presents the socio-demographic, economic, and educational typology of households living in these communities. Based on a review of the literature on evidence-based actions that influence behavior change in the face of cancer and cancer screening, employees designed health education sessions in line with health literacy criteria and inspired by the health belief model. The objectives of these sessions were to increase the level of knowledge about health, cancers, and screening; to rectify erroneous representations about cancer; to increase the feeling of self-efficacy and autonomy in the face of cancer and cancer screening; to increase the uptake of cancer screening; and to analyze changes in knowledge, social, and cultural representations and the feeling of self-efficacy in the face of cancer and cancer screening among a population in illiterate or illiterate situations. A pilot study conducted in 2017 in the same department defined the average number of health education sessions as 8 (between 5 and 10), depending on the level of understanding of the groups formed. These eight sessions are referred to in this article as the “intervention,” and Table 1 provides a description and objectives for each session. Sessions lasted between 1.5 and 2 hours, ensuring a satisfactory and efficient exchange between participants and the facilitator. The participating structures were the place where the intervention was conducted and all the data were collected.

¹These centers are centers of initiative driven by residents and supported by professionals, capable of defining and implementing a social development project for the entire population of a given area (sources <https://www.centres-sociaux.fr/qui-sommes-nous/>). Centres sociaux et socioculturels make listening to and meeting local residents, as well as observing and methodically collecting data and the tools of their analyses, thus contributing to the elaboration of concerted territorial diagnoses. These centers do not act alone; they know the other associative, administrative, political, or economic players in their project area. In this way, they forge the relationships necessary for the actions to be taken.

For this study, we contacted all 14 structures in the Ain Department that organized sociolinguistic workshops for all audiences except asylum seekers. Figure 1 shows the geographical location of these structures in the department. Following this request, nine of the 14 structures agreed to take part in the study. Participation in the study by the structures and individuals did not entitle them to remuneration or any other form of benefit. Participation was voluntary and subject to registration. The team had a background in public health, health management, social psychology, and psychology.

In the health sector, members' academic degrees ranged from master's to doctorate (MSc, MPh, PhD, and MD).

Before the intervention began, the facilitators (master's and PhD) presented the study to the head of the sociolinguistic workshops and, with their help, whenever possible, formed homogeneous groups (groups with the same linguistic profile) to carry out the intervention. We were thus able to form 12 homogeneous groups of the 17 that benefited from the intervention. The intervention was systematically offered to all participants in the sociolinguistic workshops. Table 2 shows the main characteristics of our study population. The two animators performed all the interventions, and the same animator performed

the entire intervention in each of his groups. The sociolinguistic workshop leaders from the different facilities took part in the intervention as observers.

The intervention scheme and a number of sessions had been tested in 2017 during the pilot study. In addition to the “pre-intervention questionnaire” and the “post-intervention questionnaire,” we used the free association method to ask participants what a word evoked in them:

“cancer,” “screening” In this approach, the facilitator gave a simple instruction: “*What do you think of when I say cancer?*” and noted all the participants’ answers. The brainstorming method was also used by the facilitators to carry out a rapid end-of-session evaluation. The aim was to collect the elements retained by the participants and thus observe the acquisition of new knowledge during the sessions. The intervention was followed by a single, semi-directive, individual interview conducted in French. However, depending on the language skills of the facilitator, some questions were translated to ensure that they were properly understood. During the interview, the facilitators made an audio recording to collect the data. During the interviews, the participants addressed questions concerning 1—the acquisition of new knowledge; 2—the participants’ feelings during and following the interventions; 3—the ability to provide information on cancers and screening and to help those around them to undergo screening examinations; 4—the participants’ intention to undergo cancer screening examinations; and 5—the quality of the interventions and modifications to be made to them. The interviews and their transcriptions were performed by the facilitator who conducted the intervention. The transcripts were not validated by the participants. For this work, it was decided not to define a saturation threshold for data collection and thus to give the floor to everyone available during the interview slots.

Table 1: Presentation grid for health education sessions

Session	Session name	Session objectives	Operational objectives
a	Presentation of the speakers and the intervention	- Introducing the facilitator and health education sessions - Pre-intervention evaluation questionnaire*	- Build trust between the facilitator and participants - Informing participants about the study and obtaining their non-opposition - Gather information on participants' profiles (identity, age, gender, origin, level of education, level of French comprehension, level of French expression, linguistic profile, telephone, neighborhood, and commune of residence) - Distribution of the health education session presentation binder - Pre-intervention evaluation questionnaire assessing participants' knowledge and sense of self-efficacy before the intervention - 11 questions including two on knowledge of cancers, three on the ability to make medical appointments, to visit one's general practitioner (GP) or a healthcare professional involved in cancer screening programs, and six on cancer screening methods and examinations
b	Healthcare professionals	- Acquire knowledge about health and its determinants - Acquire new individual health skills	- Know the functions of body parts - Know the health specialists for each body part - Understand the central role of the primary care physician and the importance of the coordinated care - Offering resources to people without GPs - Introduce cancer screening by naming and locating the different parts of the body involved (colon–breast–skin–uterus)
c	Risk factors and representations of cancer	Acquire knowledge about health and its determinants	- Enable participants to express themselves and exchange views on the theme of cancer - Bring out the representations associated with cancer - Answering questions and deconstructing misconceptions - Inform about cancer risk factors
d, e, and f	Information on organized screening for breast, colorectal, and cervical cancer Section 1	- Acquire knowledge about health and its determinants - Acquire new individual health skills - Influencing behavior - Learn about prevention and lifestyle resources - Helping you make a decision - Influencing behavior	- Share and learn about the female reproductive system, its function, and cervical cancer - Exchange and share knowledge about cervical cancer screening the uterus - Discuss cervicovaginal smear tests (obstacles, why, how) - The role of midwives, GPs, gynecologists, and other health professionals in screening - Learn about and discuss breast cancer screening - Learn about and discuss colorectal cancer screening - Remind people how to take advantage of these screenings - Reminder of exclusion criteria for organized breast cancer screenings and colorectal cancer - Practical implementation of the colorectal cancer screening test
g	Information on organized screening for breast, colorectal, and cervical cancer - Section 2	- Knowledge of prevention resources - Helping you make a decision - Acquire new individual health skills - Influencing behavior	- Deciphering the screening invitation letter for each cancer - Discuss invitation letters - Criteria for exclusion from the screening program for each cancer - How to obtain the invitation letter to participate in cervical cancer screening
h	Assessment of the intervention	- Qualitative assessment of intervention. - Post-intervention evaluation questionnaire*.	- Review key messages from previous sessions. - Invitation letters sent to the women concerned. - Completion of a post-intervention evaluation questionnaire that assessed the participants' knowledge and sense of self-efficacy following the intervention. 18 questions, including 11 from the pre-intervention questionnaire and seven questions about the benefits of screening and invitation letters.

*The pre- and post-intervention questionnaires consisted of text and illustrations. **Optional, depending on the needs and audience of each group.

Table 2: Description of the main characteristics of the study population

Characteristic	Number	Characteristic	Number	Characteristic	Number
Age		Gender		Language profile	
<25 years	8	Female	164	ACC	34
25 to 49 years	97	Male	11	AELE	48
50 to 74 years	67			ASL	21
over 74 years	3			Mixed	70
				Missing	2
Schooling		Level of French comprehension		Level of expression in French	
Not in school	28	Low	17	Low	32
Primary	53	Medium	46	Good	37
Secondary	56	Good A1	47	Medium	41
More than secondary	6	A2	9	A1	13
Other	5	B2	14	A2	10
Missing	27	Missing	3	B2	3
			39	Missing	39
Pre-intervention questionnaire		Post-intervention questionnaire		Individual interviews	
Yes	128	Yes	115	Yes	63
No	47	No	60	No	111
Home/origin		Structures			
Africa Latin	85	Social and sociocultural centers	161		
America	1	Resto du cœur	9		
Asia/Middle East Europe	36	Association Prévessin-Moëns que j'aime	5		
Missing	36				
	17				

Table 3: Socio-demographic, economic, and educational typology of households by commune

Population	CA Haut-Bugey Agglomération	CC de Miribel et du Plateau	CC de la Plaine de l'Ain	CA du Pays de Gex	CC de la Côtière in Montluel	France Métropole
Population in 2017	63236	23839	77644	95070	24847	64 639 133
Population density (number of inhabitants per km ²) in 2017	91,8	363,6	109,1	234,8	1 94,9	118,8
Number of households in 2017	26 714	9 392	32 837	40 350	9 316	28 734 433
Sources: Insee, RP2012 and RP2017 main geographic surveys on January 1, 2020						
Housing	CA Haut-Bugey Agglomération	CC de Miribel and Plateau	CC de la Plaine de l'Ain	CA du Pays de Gex	CC de la Côtière in Montluel	France Métropole
Total number of units in 2017	31 810	10 137	38 035	48 994	9 998	34 980 732
Percentage of households owning their main residence in 2017	52,2	66,6	63,9	55,9	66,1	57,6
Source: Insee, RP2017 principal exploitation in geography on January 1, 2020						
Revenue	CA Haut-Bugey Agglomération	CC de Miribel and Plateau	CC de la Plaine de l'Ain	CA du Pays de Gex	CC de la Côtière in Montluel	France Métropole
Number of tax households in 2017	25 823	9 170	32 687	33 183	9 091	27 409 461
Percentage of tax households paying income tax in 2017	49,4	64,8	54,8	52,5	59,2	52,1
Median disposable income per consumption unit in 2017, in euros	19 920	25 310	22 260	34 520	23 220	21 110
Poverty rate in 2017	16,0	6,7	9,8	13,0	7,3	14,5
Warning : For reasons of statistical confidentiality, some indicators may not be available. Sources: Insee-DGFIP-CNAF-CNAV-CCMSA, Fichier localisé social et fiscal in geography at January 1, 2020						
Employment—census unemployment	CA Haut-Bugey Agglomération	CC de Miribel and Plateau	CC de la Plaine de l'Ain	CA du Pays de Gex	CC de la Côtière in Montluel	France Métropole
Total employment (salaried and non-salaried) at place of work in 2017	27 395	12 150	30 332	19 722	10 480	25 826 145
<i>*of which salaried employment at place of work in 2017, in %.</i>	89,0	89,9	88,1	83,5	90,0	86,9
Change in total employment at place of work: average annual rate between 2012 and 2017, as a % of total	-0,9	0,3	1,6	1,6	0,4	0,0
Employment rate of 15- to 64-year-olds in 2017	75,1	76,4	78,3	81,3	79,8	74,1
Unemployment rate for 15- to 64-year-olds in 2017	13,7	9,2	10,5	10,0	8,2	13,4
Sources: Insee, RP2012 and RP2017 main geographic surveys on January 1, 2020						

CA: community agglomeration; CC: community commune; CAHB : CA Haut-Bugey Agglomération (42 communes including Arbent, Bellignat, Nantua, Oyonnax); CC de Miribel et du Plateau (six communes including Miribel); CC de la Plaine de l'Ain (53 communes including Ambérieu-en-Bugey and Saint-Rambert-en-Bugey); CA du Pays de Gex (27 communes including Prevestin Moens); and CC de la Côtière à Montluel (nine communes including Montluel)

Table 4: School enrollment and proportion of part-time employees

	School enrollment by age and gender, 2017*						Employees aged 15 to 64, by gender, age, and part-time status in 2017**				
	Total population with age group	Set	School percentage of population schooling				Men	Of which % part-time	Women	Of which % part-time	
			Men	Women							
CA Haut-Bugey Agglomeration	25 to 29 years old	3 300	114	3,5	3,2	3,8	25 to 54 years	8 788	3,7	8 114	21,3
	30 years or more	40 474	317	0,8	0,7	0,8	55 to 64 years	1 753	9,3	1 620	27,3
CC de Miribel et du Plateau	25 to 29 years old	599	24	4,0	4,6	3,4	25 to 54 years	1 483	3,7	1 515	23,6
	30 years or more	6 144	40	0,6	0,7	0,6	55 to 64 years	240	5,2	244	28,5
CC de la Plaine de l'Ain	25 to 29 years old	4 472	115	2,6	1,9	3,2	25 to 54 years	12 175	3,2	11 447	25,0
	30 years or more	48 923	299	0,6	0,5	0,8	55 to 64 years	1 800	8,7	2 159	31,0
Pays de Gex CA	25 to 29 years old	6 748	518	7,7	7,8	7,5	25 to 54 years	17 930	6,4	16 140	32,7
	30 years or more	58 342	1 058	1,8	1,6	2,0	55 to 64 years	2 581	8,8	2 272	38,3
CC de la Côtière in Montluel	25 to 29 years old	1 642	69	4,2	3,7	4,8	25 to 54 years	4 085	2,3	3 703	21,3
	30 years or more	14 717	114	0,8	0,7	0,9	55 to 64 years	631	7,4	688	29,6
France	25 to 29 years old	3 762 208	310 058	8,2	7,9	8,6	25 to 54 years	8 603 767	5,5	8 620 215	25,0
Metropole	30 years or more	41 646 935	406 277	1,0	0,9	1,0	55 to 64 years	1 533 757	9,1	1 750 370	30,5

*Source: Insee, RP2017 main survey, geography on January 1, 2020. **Source: Insee, RP2017 exploitation principal, geography on January 1, 2020

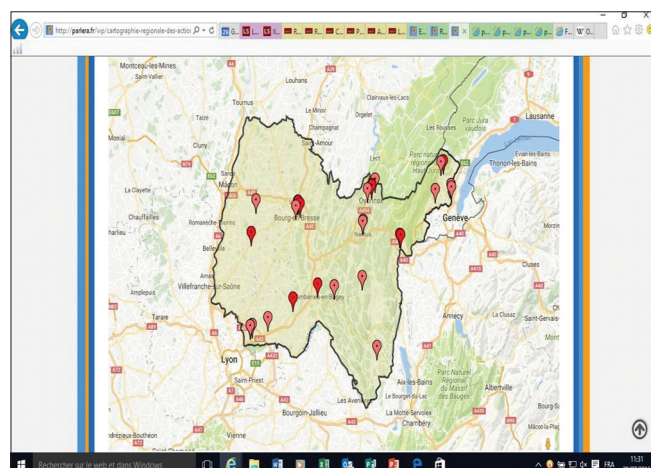


Figure 1: Geographical location of structures in the Ain Department. Source: <http://parlera.fr/wp/cartographie-regionale-des-actions-2/map>