



European transnational ecological deprivation index and participation in population-based breast cancer screening programmes in France



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ABSTRACT

Background: We investigated factors explaining low breast cancer screening programme (BCSP) attendance taking into account a European transnational ecological Deprivation Index.

Patients and methods: Data of 13,565 women aged 51–74 years old invited to attend an organised mammography screening session between 2010 and 2011 in thirteen French departments were randomly selected. Information on the women's participation in BCSP, their individual characteristics and the characteristics of their area of residence were recorded and analysed in a multilevel model.

Results: Between 2010 and 2012, 7121 (52.5%) women of the studied population had their mammography examination after they received the invitation. Women living in the most deprived neighbourhood were less likely than those living in the most affluent neighbourhood to participate in BCSP (OR 95%CI = 0.84[0.78–0.92]) as were those living in rural areas compared with those living in urban areas (OR 95%CI = 0.87[0.80–0.95]). Being self-employed ($p < 0.0001$) or living more than 15 min away from an accredited screening centre ($p = 0.02$) was also a barrier to participation in BCSP.

Conclusion: Despite the classless delivery of BCSP, inequalities in uptake remain. To take advantage of prevention and to avoid exacerbating disparities in cancer mortality, BCSP should be adapted to women's personal and contextual characteristics.

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Introduction

Breast cancer (BC) is the leading cancer site and the leading cause of death from cancer among women in Europe (Ferlay et al., 2013). It is more a progressive than a systemic disease (Tabar and Dean, 2010) and the progression of this disease can be slowed through early detection on mammography screening (MS) and treatment at an early stage (Autier, 2011; Autier et al., 2009; Ballard-Barbash et al., 1999; Giordano et al., 2012). Estimates of mortality reduction attributed to screening range from 10 to 30% (Arveux et al., 2003; Broeders et al., 2012; Giordano et al., 2012; Peipins et al., 2011; Perry et al., 2008;

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Puliti and Zappa, 2012; Smith et al., 2011). Despite controversies around the benefit and harm of MS (Gotzsche and Jorgensen, 2013; Independent UK Panel on Breast Cancer Screening, 2012; Jorgensen and Gotzsche, 2009; Jorgensen et al., 2009), organised mammography screening programmes (SP) have been implemented in many countries. According to the European recommendations, to reduce BC mortality through MS, programmes must reach a participation rate of 70% of the target population (von Karsa et al., 2008) with regular attendance to screening (Arveux et al., 2003; Giordano et al., 2012; Ouedraogo et al., 2011). In several Northern European countries, participation of around 80% has been achieved (Hakama et al., 2008). However, in France as in many other European countries, the annual national participation rate barely exceeds 50% (European Commission and Eurostat, 2009).

Factors explaining non-attendance in breast cancer screening (BCS) have been examined in many previous studies (Barr et al., 2001; Dailey et al., 2007, 2011; Engelman et al., 2002; Esteve et al., 2008; Gonzalez and Borrayo, 2011; Hyndman et al., 2000; Jackson et al., 2009; Kinnear et al., 2011; Lagerlund et al., 2000; Pernet et al., 2010; von Euler-Chelpin et al., 2008). Neighbourhood income had been widely reported to be an important determinant of participation in BCS programmes. In the United Kingdom or in Canada, where the National health services provide free BCS for all eligible women, lower uptake in more deprived areas and in areas further away from screening locations has been reported (Kothari and Birch, 2004; Maheswaran et al., 2006). However, these studies performed in Anglo-Saxon countries used neighbourhood deprivation indicators like the Townsend score (Townsend, 1987) which is more appropriate for the context in these countries. Recently, a new ecological deprivation index called the European Deprivation Index (EDI), which is based on a European survey, has become available (Pernet et al., 2012). This Index corresponds better to cultural and social policy in European countries as a whole.

To harmonize analysis and allow the inclusion of intervention-based studies performed elsewhere it is necessary to use transnational indicators. The ultimate goal of this study was to identify barriers to participation in SP in order to implement action that could increase programme attendance. We conducted this large study to investigate predictive factors of low participation in population-based mammography SPs in thirteen French departments taking into account the new EDI and putative factors such as the type of health insurance plan, the travel time to the nearest MS centre and the urban-rural status of the place of residence.

Methods

Study population

We examined data of women aged 51 to 74 years old invited to attend a free-of-charge organised MS session between 2010 and 2011 in France. In France, women aged from 50 to 74 years old are eligible for the BCS programme. Those who had not had their mammography six months after the first invitation received a reminder. We retained data on women aged 51–74 years old to consider the delay between the invitation to attend an MS session and having the examination. The study was conducted in thirteen French departments: Côte d'Or, Nièvre, Rhône, Ain, Loire, Haute Savoie, Ardèche, Isère, Drôme, Doubs, Jura, Haute Saône and Territoire de Belfort. France counts 101 departments which are territorial divisions between regions and districts. The departments included in this study accounted for about 12% of women eligible for BCS in France in 2010–2011. The study concerned 709,764 eligible women insured by the three main health insurance schemes and for whom addresses were available, corresponding to 66% of the women eligible for BCS in the thirteen departments.

Each French department is also divided into smaller geographical census units of 1800 and 5000 inhabitants called IRIS ("Ilots Regroupés pour l'Information Statistique": Merged Islet for Statistical Information). The major towns are divided into several IRISes and small towns form one IRIS (Pernet et al., 2010). The departments included in this study comprised a total of 6806 IRISes. According to Twisk (2006), the sample-size in multilevel studies can be calculated in a "conservative" manner, in which the first individual provides

100% of new information and no new information is obtained with the increase in the number of subjects for a certain cluster (IRIS). Then, 13,565 women were randomly selected from the eligible population without replacement. With this sample size, the study would have a power of 90% to detect a difference of at least 10% on participation rates between deprived and affluent IRISes (50% participation rate in deprived IRISes and 60% participation rate in affluent IRISes) with an alpha risk of 0.05. This study was approved by ethics committees: "Comité Consultatif sur le Traitement de l'Information en matière de Recherche dans le domaine de la Santé", "Commission Nationale de l'Informatique et des Libertés" and the Ethics Committee of Besançon Teaching Hospital.

Studied variables

Data on participation and other individual information such as the women's age, their health insurance scheme, their address and the address of the accredited screening centres in the department were provided by institutions in charge of organising SPs. Lists of accredited screening facilities are provided regularly by the French health authorities. These centres meet baseline quality standards for equipment and professional abilities and are allowed to perform BCS.

Age was entered as five categories (51–54, 55–59, 60–64, 65–69 and 70–74 years old). The women were insured by one of the three main health insurance schemes: the general medical insurance scheme (GMIS), which insures employees; the agricultural insurance scheme (AIS), which insures farm workers and the self-employed insurance scheme (SEIS), which insures the self-employed.

As women eligible for BCS programmes are aged 50–74 years old, and in our population, about 57% were more than 60 years old and thus probably retired, the travel time from their place of residence to the nearest accredited screening centre by private car was considered. The travel time was calculated using "MOVIRIS" software based on a road route algorithm. Based on its distribution and on the literature (Evain, 2011), the travel time to the nearest accredited screening centre was split into two categories: living at most 15 min away or more than 15 min away.

The French EDI, which reflects fundamental needs and is associated with objective and subjective poverty (Pernet et al., 2012), was calculated for each IRIS on the basis of ten variables: variables related to households (the percentage of households with more than one person per room, those with no central or electric heating system, those that are not owner-occupied, those with no access to a car, those with six persons or more and the percentage of single-parent households) and other variables concerning the residents: the percentage of unemployed people, foreign nationals, unskilled or skilled factory workers and persons with a low level of education. Preliminary validation showed that the French EDI presents a stronger association with two socioeconomic variables measured at an individual level: income (p trend = 0.0059) and educational level (p trend = 0.0070) than does the Townsend score (p trend = 0.0409 and p trend = 0.2818, respectively) (Pernet et al., 2012). The scores were divided into three classes according to their distribution: the most affluent, the intermediate and the most deprived class. For each IRIS, the environment (rural, semi-urban or urban) was also provided by the French National Institute for Statistics and Economic Studies.

Statistical analyses

Analyses were performed using STATA Data Analyses and Statistical Software (StataCorp LP, College Station, Texas, USA). Categorical variables are given as percentages with the percentage of missing data, while continuous variables are given as means, standard deviations (SD), medians and ranges. Chi2 or Fisher's exact tests and the Mann and Whitney or Kruskal and Wallis non-parametric tests were used for categorical and continuous variables, respectively, to compare variables in women who participated in organised SPs with those in women who did not.

The effects of characteristics at the individual and area-level on participation in population-based SPs were assessed using univariable logistic regression models. All variables with a $p \leq 0.20$ from univariable logistic analyses were eligible for inclusion in the multilevel multivariable model (using the "xtmelogit" command in Stata 11 software). Correlations and interactions between variables in each level were tested. We also examined cross-level interactions between the effects of neighbourhood and individual factors. Multilevel multivariable logistic regression was then performed using individual and area level variables in the same model. All reported p -values are two sided. The statistical significance level was set at $p < 0.05$.

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