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Determinants of breast cancer screening uptake in women, evidence from the British Household Panel Survey

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ABSTRACT

Breast cancer screening is an integral part of the cancer control strategies of many developed economies. In Britain individuals screened in a given year are re-called every three years unless results indicate a need for more immediate investigation. This pattern may create a legacy arising from past decisions, a legacy that should be considered when examining current decisions. In this paper we use a balanced panel drawn from the British Household Panel Survey of 1997 women over an 18 year period to examine variations in uptake. A dynamic random effects probit model is used to control for unobserved heterogeneity and the legacy of previous decisions. As might be expected women to whom universal screening is offered are more likely to screen than others. Changes during the study period in the eligible age range saw an increase in uptake among the age group to whom the programme was extended but not among other groups. Past screening behaviour was found to be a significant predictor of current behaviour. Failure to account for past choices may result in model mis-specification and a failure to develop policies aimed at promoting initial engagement that may compromise the screening programme. Income was not found to be a significant determinant of uptake.

Introduction

Breast cancer was estimated to account for 31 percent of all female cancers diagnosed in the UK in 2008 and to account for 8 percent of all cancer related deaths in 2009 (Cancer Research UK). Globally it is responsible for more female deaths than any other disease and is the most commonly occurring cancer in women in the developed world (Brown, Lipscomb, & Snyder, 2001; National Cancer Institute, 2011; Pallis, Tsiantou, Simou, & Maniadakis, 2010; Parkin, Bray, Ferlay, & Pisani, 2001). Unlike many cancers which are often associated with older age, 50 percent of breast cancer cases are diagnosed in women under the age of 58 (National Cancer Institute, 2011). Given its prevalence and the age group it affects it is perhaps unsurprising that it is ranked third amongst cancers in terms of potential years of life lost (National Cancer Institute, 2011).

The stage at which breast cancer is detected and treated may be an important determinant of patient outcomes and treatment costs – patients that are treated earlier may be more likely to experience better outcomes and incur lower costs (Groot, Baltussen, Groot, Anderson, & Hortobágyi, 2006). Acknowledging the importance of early detection, several countries, including the UK, have adopted breast cancer screening programmes as part of their cancer control strategies. In Britain publicly funded breast cancer screening was introduced for women aged 50–64 in 1988, although full population coverage was not attained for this group until 1994 (Department of Health and Social Security, 1986). Under the programme, women in the eligible age range, registered with a GP, are invited for screening every three years (Sharp, Peters, Bartholomew, & Shaw, 1996) though individual risk may see some screened on a more frequent basis. New guidelines issued in 2000 (Department of Health, 2000), extended the targeted age range to include women up to age 70 (to be fully rolled out by 2005).

While all identified eligible women are invited for screening, not all attend – possibly reflecting variations in the perceived costs and benefits of screening as well as differences in the discount rate applied to these by individuals. Studies examining variations in uptake, for example, have shown a range of factors to explain systematic differences in uptake, factors that within an economics framework can be readily interpreted as relating to perceived costs, benefits and time preference. Studies that have explained variations with reference to distance to the screening centre as well as family history – women with a family history being more likely to attend screening than those who were not (Isaacs et al., 2002; Meiser et al., 2000), age (Walsh, Silles, & O'Neill, 2011) and marital status (Gatrell, Garnett, Rigby, Maddocks, & Kirwan, 1998), for example, can all be readily related to differences in perceived costs, benefits and time preference.

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With respect to income and socio-economic status, variables one might expect to impact on the opportunity cost of screening, the relationship with uptake is less clear. Sabates and Feinstein (2008) using data from the UK, for example, found that income did not play a significant role in the uptake of screening across a range of illnesses including breast cancer. Maheswaran, Pearson, Jordan, and Black (2006) by contrast found that as socio-economic status rose (and with it one imagines income) so the probability of attending breast screening increased (though as the studies use different control variables the possibility exists that the role of income is conflated with omitted variables). Similarly, Aarts, Voogd, Duijm, Coebergh, and Louwman (2011) in the Netherlands found that women with lower socioeconomic status were less likely to attend for breast screening and were more likely to present with breast cancer at a more advanced stage than those of higher socio-economic status (Aarts et al., 2011).

To develop appropriate policy interventions to encourage uptake of screening it is important to understand differences in uptake between groups and what factors underlie such differences. The lack of consensus here is troubling and may in part relate to deficiencies in the methodological approached adopted by these studies. With respect to Sabates and Feinstein (2008), for example, the authors failed to account for the three year cycle by which breast screening is offered in the UK and thereby the possibility that past decisions may create a legacy that impacts on current choices. Similarly, Maheswaran et al. (2006) adopted what was essentially a cross sectional approach in their analysis as did Aarts et al. (2011). By failing to adjust for previous encounters with the screening programme, analyses of this type ignore the role this may have in explaining observed uptake at a given point in time. By extension, ignoring the pattern of behaviour over time discards important information that may explain behaviours and with this misses the opportunity to develop more nuanced policy interventions to address low uptake than might otherwise be the case.

In this paper we examine the factors that influence uptake of screening amongst women aged 50–70 in Britain using data from the British Household Panel Survey. The use of a panel analysis allows us to explicitly model idiosyncratic variations between respondents while inclusion of terms designed to address previous encounters with the programme allows us to correct for the possible legacy of previous decisions upon current decisions The remainder of this paper is developed in the following sections: in section 2 we discuss the data used in the study; in section 3 we present the econometric methodology used in our analyses and in section 4 our results; in section 5 we discuss our findings and present our conclusions.

Data

Data were taken from the British Household Panel Survey (BHPS) between 1991 and 2008. The BHPS dataset consists of approximately 127,000 observations on approximately 5500 households drawn from across Britain using a stratified random sampling approach. The balanced sub-panel used in this analysis was based on the 1997 women present for all 18 years. The flow diagram in Fig. 1 in Appendix 2 offers details on how the final sample was obtained. As women may have undergone screening outside of the NHS programme for which, as noted, an age based eligibility criterion exists, respondents were categorised into four groups that included those outside the eligible age range, those aged 16–49, those aged 50–64 (the reference group), those aged 65–70, and those older than seventy.

Other data collected as part of the survey included annual household income, self reported health status, geographic region, educational attainment, use of other health services and marital status; factors based on previous analyses of screening that one might expect to impact on screening uptake (Moser, Patnick, & Beral, 2009; Walsh, Silles, & O'Neill, 2010, 2011). Self-reported health status as well as use of health services was captured in the survey using categorical variables. With respect to health respondents could report being in/very poor, poor, fair, good and excellent health With respect to use of GP services respondents could similarly choose between a range of categories reflecting different frequencies of contact. Highest educational attainment was categorised as third level, upper secondary, lower secondary or none of these, ranging from primary to degree or higher. As uptake may be influenced by different cultural norms in different parts of the country, the region in which the respondent resided was also examined. Britain is divided into six regions for the purposes of this analysis, North England, South England, Midlands, Wales and Scotland with London as the base category. Marital status was modelled, as was whether or not the woman had a child under age sixteen. The precise definition of all variables is presented in Appendix 1.

Methodology

As part of the universal screening programme, women in the UK are invited to screening every three years. Given a woman's previous behaviour in respect of screening may influence current behaviour, we include a dummy variable for whether the woman reported having screened 3 years previously. To allow for the possibility that the results of a screen may have resulted in a shorter interval between screens than that suggested by the programme (where for example a woman is perceived to be at higher risk) screening behaviour in all three of the previous three years were modelled using lags of the dependent variable (The third lag allows for an increased likelihood of screening due to an invitation as part of the routine screening programme). To reflect this dynamic nature of screening, we use a dynamic random effects panel probit model developed by Wooldridge (2005) in which the legacy of previous contact with the programme is referred to as 'state-dependence'.

In addition to the observable attributes likely to impact on uptake (age, socio-economic status, etc.) unobserved characteristics were also allowed for in the modelling exercise. For example, the worried well (and their logical counterpart the unworried sick) may be more (less) likely to avail of screening, ceteris paribus, than others though no obvious observable variable for this attribute exists. In a panel setting time invariant unobserved heterogeneity is often modelled by introducing fixed or random effects into the model. Consistent with Wooldridge (2005) we adopt a random effects approach. The income variable included in the BHPS is equivalised at a household level (that is adjusted to take account of household size). To allow for correlation between the included continuous variable (logged equivalised household income in 2008 prices) and the random effects, we include the average of logged income, effectively partitioning income into a permanent and a transitory component. If time invariant unobserved variables (such as worry) are related to income, these influences will be captured by the coefficient on mean income, leading to an improved estimate of the effect of income based on the transitory component of income (Mundlak, 1978).

However, the presence of the time invariant unobserved variable can also lead to misleading inferences regarding the extent to which past screening decisions influence current screening since these unobserved time invariant factors will influence the decision whether to screen in multiple years. Since these factors are not observed, it will appear that past screening has a greater impact on current screening than is actually the case – leading to biased