



Does women's education affect breast cancer risk and survival? Evidence from a population based social experiment in education



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ABSTRACT

Breast cancer is a notable exception to the well documented positive education gradient in health. A number of studies have found that highly educated women are more likely to be diagnosed with the disease. Breast cancer is therefore often labeled as a “welfare disease”. However, it has not been established whether the strong positive correlation holds up when education is exogenously determined. We estimate the causal effect of education on the probability of being diagnosed with breast cancer by exploiting an education reform that extended compulsory schooling and was implemented as a social experiment. We find that the incidence of breast cancer increased for those exposed to the reform.

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1. Introduction

Worldwide, breast cancer is the most common cancer and the leading cause of cancer death among women. In the year 2008 alone, 2.6 women were diagnosed with breast cancer every minute across the globe. More than 52 women died of breast cancer every hour in the same year (Ferlay et al., 2010). These aggregate numbers mask large differences in trends in breast cancer incidence and mortality across the developed and developing economies. Historically, western societies have experienced a heavier burden of the disease, however in the last couple of decades the incidence and mortality from breast cancer has been on the rise in developing countries (Althius et al., 2005). While it is plausible that this rise is due to increased screening and better medical and vital records keeping, some have argued that more affluent societies and westernization also contribute to these recent trends (ibid).

Breast cancer in women is one of the rare health conditions that exhibit a positive incidence gradient with socio-economic status (SES), and in particular with attained education (see e.g. Hemminki and Li, 2003, 2004; Lund and Jacobsen, 1991; Hussain

et al., 2008). This is in stark contrast with the well-documented negative association between education and all-cause mortality and with the positive effects of education on health-promoting behaviors (Cutler and Lleras-Muney, 2006, 2011 for reviews of the literature). Frequently diagnosed cancers of the female reproductive organs, such as cervical cancer, show the opposite, negative association with education in correlational studies (Baquet et al., 1990). Part of the observed positive correlation between education and breast cancer could be due to more frequent screening and more adequate response to risk factors among the better educated (Lange, 2011). Still, environmental and social factors could also affect breast cancer risk and survival. A recent report by the Interagency Breast Cancer and Environmental Research Coordinating Committee (IBCCERCC) in the US forcefully argues that research on the causes of increased breast cancer risk and consequently on increased prevention is of first order importance in designing public health strategies to contain the disease.¹

A key question on the etiological background to the link between education and the incidence of breast cancer is whether the relation is made up by life style factors, such as delayed childbearing,

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¹ “Prioritizing Prevention” Summary of Recommendations of the Interagency Breast Cancer and Environmental Research Coordinating Committee (<http://www.niehs.nih.gov/about/assets/docs/ibccercc.full.pdf>).

that may be acquired along with prolonged education, or if it can be attributed to factors and individual characteristics correlated with both educational attainments and the probability to get breast cancer. The most common research strategy used in epidemiological studies is to add confounders that are known to be associated with educational attainments and potentially etiologically related to breast cancer, such as delayed childbearing in a regression framework, and to investigate if the correlation remains (see e.g. Braaten et al., 2004; Danø et al., 2004; Heck and Pamuk, 1997). There are at least two problems with this strategy. First, there is an identification problem. Most confounders, such as fertility behavior, are likely to be endogenous to educational attainment. This means that it is still not clear if including them in the regression makes up for a causal relation with education, or if they just proxy individual characteristics correlated with educational attainments. Second, adding independent variables in a regression would in most cases aggravate the downward bias from measurement errors (see e.g. Greene, 2003).

An alternative strategy to analyze this research question is to use exogenous variations in educational attainments created by natural experiments. A number of influential studies have used this research strategy to study the relationship between education and measures of general health. Lleras-Muney (2005), Oreopoulos (2006) and Clark and Royer (2012) use variation induced by changes in compulsory schooling legislations in the US and the UK as a source of exogenous variation in education. Spasojevic (2010), Meghir et al. (2012) as well as Lager and Torssander (2012) investigate the health consequences of the introduction of comprehensive school reform in Sweden. An interesting related question is whether the health effects of education vary by gender² and diagnosis.

In this paper we investigate whether there is a causal effect of education on the incidence and mortality from breast cancer in the population of women born in Sweden between 1940 and 1957 who survived until at least 1985. We make use of a compulsory schooling reform that increased the number of compulsory years of education from 7 or 8 depending on municipality to 9 years nationwide. We also compile a unique nationally representative dataset from various Swedish national data registries, including the Swedish Cancer Registry.

The Swedish setting is particularly well suited to study how education affects the incidence of a “welfare disease” such as breast cancer in women for several reasons. First, Sweden is ethnically and racially homogenous, especially in the cohorts under study. This reduces potential omitted confounders that could correlate both with the hereditary genetic make-up and the SES of some ethnic or racial subgroups. Second, health care is free at the point of access and the Swedish government provides free universal health insurance. Disparities arising from differential access to care due to financial constraints are unlikely to play a role in the Swedish setting. Breast cancer screening covers the entire female population in the critical ages and is free of charge. The screening program was adopted nation-wide in 1986 after the first results from the Swedish mammography trials became available (Tabar et al., 1985). The take up rate of this screening program after the first invitation to screen is about 80 percent (see e.g. Hussain et al., 2008). Third, the Swedish Cancer Registry is the oldest cancer registry and one of the best in terms of data quality and accuracy in the world today.

² Clark and Royer (2012) as well as Meghir et al. (2012) investigate for differential effects of education by gender and find inconclusive evidence. Gathman et al. (2012) analyze a number of compulsory schooling reforms in Europe and find diverging effects of education on mortality by gender.

The closest study we are aware of is by Glied and Lleras-Muney (2008) who use the Surveillance, Epidemiology and End Results Program (SEER) data to estimate the effects of technological progress on cancer deaths by education, relying on US compulsory schooling laws for exogenous variation in educational attainment. They find that conditional on technological progress, extra education reduces overall cancer mortality in men, but not in women. Excluding cancers of the reproductive system, inclusive of breast cancer, makes the estimated effects for men and women consistent. The authors do not specifically test for the effects of education on survival from reproductive system cancers in women, relying on the findings in the medical literature we discuss above.

This study finds that attaining higher levels of education increases the risk of being diagnosed with breast cancer in women, confirming the results obtained from purely correlational studies. However, we also find that this heightened probability of diagnosis is later followed by an elevated probability of death from breast cancer among better educated women. Further, we investigate the potential role of fertility decisions, which has been pointed out as the mechanism linking education and the incidence of breast cancer. We find no convincing evidence in favor of this hypothesis. The curious association between education and the most common cancer diagnosis in women appears to be affected by qualities, behaviors, and risk factors acquired in the process of obtaining more education, rather than pre-existing characteristics that predispose some women to both get more education and be diagnosed with the disease.

2. The comprehensive school reform

2.1. The Swedish school system before and after the reform

Sweden implemented a compulsory schooling reform as a social experiment between 1949 and 1962. Prior to the implementation of the reform, pupils attended a common basic compulsory school (*folkskolan*) until grade six. After the sixth grade pupils were selected to continue either for one or, in mainly urban areas, two years in the basic compulsory school, or to attend the three year junior secondary school (*realskolan*). The selection of pupils into the two different school tracks was based on their past academic performance, measured by grades. The pre-reform compulsory school was in most cases administered at the municipality level. The junior secondary school was a prerequisite for the subsequent upper secondary school, which was itself required for higher education.

In 1948 a parliamentary committee proposed a school reform that implemented a new nine-year compulsory comprehensive school.³ The reform had three main elements:

1. An extension of the number of years of compulsory schooling to 9 years in the entire country.
2. Abolition of early selection and tracking based on academic performance. Although pupils in the comprehensive schools were able to choose between three tracks after the sixth grade – one track including vocational training, a general track, and an academic level preparing for later upper secondary school – they were kept in common schools and classes until the ninth grade.
3. Introduction of a national curriculum. The new curriculum replaced the pre-existing curriculum which varied between municipalities.

³ We offer a brief description of the main parts of the Swedish comprehensive school reform. The school reform and its development are described in Meghir and Palme (2003, 2005), and Holmlund (2007). For more detailed reference on the reform, see Marklund (1981).

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