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Immigration, Ethnicity and Cancer in U.S. Women

James Ted McDonald
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SEDAP Research Paper No. 206

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Immigration, Ethnicity and Cancer in U.S. Women[#]

James Ted McDonald[*] and Jeremiah Neily[†]

Abstract: This study examines differences in the prevalence of various forms of cancer among American women identified by both ethnicity and immigrant status. Our focus is on four types of cancer – breast, cervical, ovarian, and uterine – that afflict adult working-age women. We analyse the extent to which the prevalence of these cancers among immigrants changes with years in the United States, after controlling for age and socio-economic influences. The paper also examines the extent to which use of preventative health screening and/or lifestyle behaviors might help to explain any observed differences. Data are drawn from the U.S. National Health Interview Survey (NHIS) over the period 1998 to 2005. We find significant evidence of differences in cancer occurrence among immigrants by ethnicity that change with years spent in the USA, as well as pronounced differences by race. The results confirm that the healthy immigrant effect is present in terms of the prevalence of certain forms of cancer in comparison with both US born whites and with US born ethnic minority groups. The result appears not to be due to differences in health behaviors or in the utilization of general health services.

JEL Classifications: I18, I19

Keywords: cancer, immigrants, ethnic minorities, women's health

Résumé: Cette étude examine les différences dans la prévalence de diverses formes de cancer chez les femmes américaines selon leurs origines ethniques et leurs statuts d'immigration. Notre attention se porte sur quatre formes de cancers (le cancer du sein, cervical, ovarien, et de l'utérus) qui affectent les femmes adultes en âge de travailler. Nous étudions dans quelle mesure la prévalence de ces cancers dans la population immigrante évolue en fonction des années de résidence aux Etats-Unis, après avoir contrôlé pour les effets liés à l'âge et aux facteurs socioéconomiques. Nous examinons aussi dans quelle mesure le recours à des programmes de dépistages préventifs et/ou les comportements liés au mode de vie pourraient aider à expliquer les différences observées. Notre étude repose sur les données de l'enquête américaine « National Health Interview Survey » (NHIS) couvrant la période allant de 1998 à 2005. On constate des différences significatives dans la fréquence du développement du cancer dans la population immigrante selon les origines ethniques et le temps passé aux Etats-Unis, ainsi que des différences raciales importantes. Les résultats confirment l'existence d'un « effet de l'immigrant en bonne santé » en termes de la prévalence de certaines formes de cancer par apport à la population blanche de souche et aux minorités ethniques nées aux Etat-Unis. Ces résultats ne semblent pas être le fruit de différences de comportements en matière de santé ou dans l'utilisation des services de soin de santé.

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Immigration, Ethnicity and Cancer in U.S. Women

1. Introduction

According the U.S. Congressional Budget Office (2004), there were approximately 33 million foreign-born residents in the United States as of March 2003, approximately 12 percent of the total population. Not only is this the highest share since 1930, but the immigrant population continues to grow at a rate of 1 million per year. Latin America, in particular Mexico, is the most common origin of immigrants residing in the U.S., accounting for more than half of the foreign-born population. Although racial differences in health outcomes and health services use have long been a focus in the population health literature, there has been significantly less research on the health outcomes of immigrants, especially for specific immigrant groups and specific health conditions such as cancer. Research in the US, Canada, Australia and elsewhere has found that recent immigrants tend to be in significantly better physical health than their native-born peers, though this advantage is lost with time in the host country. However, there exists substantial variation in immigrant health differentials for particular conditions and by ethnicity and country of origin (Jasso et.al., 2004; McDonald and Kennedy, 2004), suggesting that analysis of particular dimensions of physical health is a promising way to advance our understanding about the drivers of immigrant and minority health.

One dimension of health of significant interest to researchers is cancer affecting women. The American Cancer Society estimated there were 662,870 new cases of female cancer in 2005 (http://www.cancer.org). Breast cancer continues to be the most prevalent diagnosis for women. There were 211,240 new cases diagnosed and 40,410 disease-

related deaths in 2005.[1] While marked disparities in cancer incidence rates among women of different races have been widely studied, less attention has focused on how cancer rates vary by nativity, and among immigrants by the time spent in the United States.[2] Further, there has been relatively little research on cancer incidence among immigrant groups by region of origin and with time in the new country that has involved the analysis of population-level data: the vast majority of the research in this area has tended to focus on particular immigrant groups resident in particular areas.

The objective of this study is to examine differences in the occurrence of various forms of cancer among American women by both ethnicity and immigrant status. Our focus is on four types of cancer – breast, cervical, ovarian, and uterine – that afflict adult working-age women. A question of particular interest in the paper is the extent to which the occurrence of these cancers among immigrants changes with years in the United States, after controlling for age and socio-economic influences. The paper also examines the extent to which use of preventative health screening and/or lifestyle behaviors might help to explain any observed differences. Data are drawn from the U.S. National Health Interview Survey (NHIS) over the period 1998 to 2005, and are restricted to women between the ages of 20 and 70. The total combined sample size of our dataset is 111,756 observations. We find significant evidence of differences in cancer occurrence among immigrants by ethnicity that change with years spent in the USA, as well as pronounced

[1] The U.S. Centers for Disease Control and Prevention reported that the 2002 age-adjusted incidence rates per 100,000 for breast, cervical, ovarian, and uterine cancer were, respectively, 124.9, 8.7, 13.1 and 0.8. The death rates per 100,000 were highest for breast (25.5), followed by ovarian (9.0), cervical (2.5), and then uterine cancer (2.2).

[2] Age-adjusted incidence rates per 100,000 females for all cancer sites combined were highest among Whites (408.9), followed by Blacks (377.5), Hispanics (310.4), Asians/Pacific Islanders (264.5), and American Indians/Alaska Natives (215.4). Death rates were highest among Blacks (190.9), then Whites (161.9), American Indians/Alaska Natives (114.5), Hispanics (107.4), and Asians/Pacific Islanders (96.6) (http://www.cdc.gov/).

differences by race, after controlling for the influence of age, socio-economic status and other factors. The results seem to confirm that the healthy immigrant effect is present in terms of the prevalence of certain forms of cancer in comparison with both US born whites and with US born ethnic minority groups. The gradual increase in cancer prevalence among immigrants to the US with years in the new country is also consistent with other literature that has found a similar pattern for specific immigrant groups in specific regions of the country.

2. Previous Research

Research specifically on cancer has found that occurrence, stage of diagnosis, and survival rates are all influenced by an interaction of socioeconomic and lifestyle factors (Wright, 2002; Winkleby & Cubbin, 2005; Singh et al., 2004; Gornick et al., 2004; Ward et al., 2004; Crimmins et al., 2005). These factors are typically measured by age, gender, income, education, exercise, smoking, body weight and diet.[3] While these variables have been shown to vary significantly by race (e.g., Singh and Siahpush, 2002), it is often the case that differences in cancer rates between majority and minority Americans persist after lifestyle, demographic and socio-economic factors are controlled for.[4] For cancers that affect women, White American females have been found to experience higher all-stage rates of breast cancer incidence than African-American, Hispanic-Latino, American

[3] Interestingly, some researchers have found a positive relationship between education and cancer incidence, which has been rationalized as a consequence of "living life in the fast lane" (Okunade & Karakus, 2003; Hemminki & Li, 2003; Crimmins et al., 2005).

[4] Kaufman et al. (1997) and Baumeister et.al. (2000) allude to the possibility that variables reflecting race/ethnicity may in fact be picking up residual variation from poorly measured socioeconomic variables, creating potentially misleading conclusions about racial health disparities. Similarly, Rebbeck et.al. (2006) suggest that concepts of race or ethnicity may be poorly considered or crudely applied, resulting in the identification of spurious differences across ethnic groups.

Indian, and Asian women (Ward et al., 2004; Newman, 2005).[5] Deapen et.al. (2002) find that breast cancer incidence rates have increased over time for Japanese American women in Los Angeles County and are approaching rates for non-Hispanic white women. Rates among Japanese women are also approximately twice those of Chinese and Korean women. However, African-American females experience higher rates of late-stage diagnoses and higher mortality rates (Smigal et.al., 2006, Ward et al., 2004; Gornick et al., 2004; Newman, 2005; Okunade & Karakus, 2003). Yap and Matthews (2006) also find that survival for cancer of the uterine corpus is significantly lower for black women than white women. It is speculated in the literature that the higher mortality rates could be due to a larger share of late-stage diagnoses and/or disproportionate access to and quality of treatment. Randall and Armstrong (2003) provide evidence to support this claim in their analysis of endometrial cancer – they find that African-American females are more likely to present with advanced-stage disease, are less likely to undergo primary surgery, and also have shorter survival than white females.

Ward et al. (2004) present cervical cancer incidence rates by race using data from 1996 to 2000 from the National Cancer Institute's SEER program in the United States. The data indicate that Hispanic-Latinos have the highest rate of cervical cancer, followed by African Americans and Asian/Pacific Islanders. Only American Indian/Alaskan Natives have a lower rate than Whites. Singh et al. (2004) used an early subset of SEER data, 1988 to 1996, and found similar results where Hispanics experience the highest rates of cervical cancer incidence and American Indians the lowest.

[5] Incidence is defined as the proportion of people at risk of developing cancer who actually are diagnosed with the disease in a given year. As will be discussed later, the focus of this paper is instead on the prevalence of cancer – the proportion of living people of a given age group who have ever been diagnosed with cancer.

While most attention in this literature has centered on racial disparities in breast and cervical cancer (due both to the higher prevalence of these forms of cancer and the availability of effective screening procedures), there has also been work that has considered ovarian and uterine cancer. Gornick et al. (2004) compared differences in the proportion of black and white patients with early, late and unstaged diagnosis for ovarian and uterine cancer. The results of the step-wise logistic regression indicate, for both forms of cancer, that blacks experience a higher proportion of late stage diagnoses than whites. However, the researchers' sample was restricted to women aged 67 and older, and the authors did not report on the prevalence of cancer by race. Earlier work by Herrinton et.al. (1994) found that the incidence of ovarian cancer among US born women of Asian descent - Chinese, Japanese, and Filipino each analyzed separately - was comparable to that of women born in Asia.

Breast cancer incidence specifically among the immigrant population is extensively reviewed in Andreeva et.al.(2007) who observe a general pattern of increased risk with duration of stay in the destination country in the literature. What appears to be a more important predictor of breast cancer risk is generation in the host country, with risk in second and subsequent generations higher than in the migrant generation. With few exceptions however, the vast majority of this work has focused on specific ethnic immigrant groups in specific locations and so cannot be generalized to the wider population. Early work on other forms of cancer includes Kasl and Berkman (1983) who find that among Japanese immigrants to the US, mortality from colon cancer is near US rates although mortality from breast cancer remains relatively low. Singh and Siahpush (2002) report that immigrants have lower mortality rates from cancer generally than both

native-born individuals of the same ethnicity and native-born whites. Kliewer and Smith (1995a,b) examine breast cancer and ovarian cancer mortality among female immigrants to Australia and Canada. They find that mortality from both types of cancer moves toward native-born women's mortality statistics over time for female immigrants from a majority of source countries.

Broader measures of physical health of immigrants have been widely studied, particularly in terms of mortality rates, and the typical finding is that immigrants are in better physical health than comparable native-born residents. Singh and Siahpush (2001) find that all-cause mortality rates are significantly lower for immigrants than the native-born Americans, while Swallen (2002) finds immigrants belonging to particular ethnic groups have longer life expectancies than native-born people of the same ethnicity. (See also Singh and Yu 1996; Guendelman et al. 1990; and Hummer et al. 1999). Singh and Siahpush (2002) find that immigrants to the US have lower rates of smoking, obesity, hypertension and chronic conditions. Antecol and Bedard (2006) also find lower rates of chronic conditions and activity limitations among immigrants than native-born Americans overall and disaggregated by broad ethnic group. Jasso et.al (2004) use data drawn from the New Immigrant Pilot Survey and show that recent immigrants have lower rates of most chronic conditions and better self-assessed health than native-born Americans. A closely related literature documents the so-called Hispanic paradox where Hispanic immigrants have significantly lower income and education levels but better mortality and morbidity rates (Markides and Coreil, 1986; Liao et.al, 1998; Abraido-Lanza et.al., 1999).

Termed the healthy immigrant effect, the result that recent immigrants are in better health than comparable native-born residents has also been established in Canada (Newbold and Danforth, 2003; Deri, 2004; McDonald and Kennedy, 2004) and Australia (Biddle, Kennedy and McDonald, 2007; Kennedy and McDonald, 2006). Possible reasons include positive immigrant self-selection, screening by immigration authorities in terms of health and/or skills, better home-country health-behaviors in terms of diet and activity, and under-reporting of particular health conditions owing to language or cultural barriers in accessing diagnostic health services. Jasso et.al. (2004) and Kennedy, McDonald and Biddle (2006) both find evidence against this last hypothesis and in favor of a pronounced immigrant self-selection effect. What has also been established in this literature is that immigrant physical health declines with years in the host country, eventually converging to native-born levels. The relative decline in health with years in the host country could reflect the outcome of acculturation, a reduction in reporting bias, possible environmental influences, and/or long-term consequences of health service under-utilization. McDonald and Kennedy (2005) and Antecol and Bedard (2006) find similar results in terms of the incidence of obesity among Canadian and American immigrants respectively.[6]

3. Methodology

We estimate logistic models of the occurrence of different types of cancer (breast, cervical, ovarian, uterine, any of these four types of cancer, and any type of cancer) as a function of a range of demographic, socio-economic and health behavior characteristics

[6] Researchers have also found that long-term under-utilization of certain screening services such as Pap smear testing is more likely tied to cultural beliefs than to economic or language barriers to access (Harlan et al., 1991; Chen & Bakken, 2004; Lin et al., 2005; McDonald and Kennedy, 2007).

that have been established in the literature as potentially important determinants of physical health. The relevant question in the National Health Interview Surveys that is used for the analysis is "Have you ever been diagnosed with cancer?" If the individual answers in the affirmative, then the NHIS data asks the location(s) of the cancer and the year that it was diagnosed. Thus the key dependent variable is a (self-reported) measure of the prevalence of cancer among the living population. Estimates for the incidence of cancer – defined to be the proportion of individuals in a given year who are newly diagnosed with cancer - can also be obtained indirectly using information on the year of diagnosis. However, doing so limits the sample size of cancer sufferers substantially, and given our interest in ethnic minority and immigrant populations, we focus on prevalence instead of incidence. As a robustness check, we also examine the prevalence of cancer diagnosed within the last three years.

Based on what is available in the NHIS data, we classify ethnicity according to the following groups: non-Hispanic white, non-Hispanic black, Hispanic, non-Hispanic American Indian, and non-Hispanic Asian/Pacific Islander.[7] We classify immigrants according to the years since they migrated to the United States: less than 5 years, 5 to less than 10 years, 10 to less than 15 years, and 15 or more years. We further disaggregate ethnicity and immigrant status by separately identifying Hispanic individuals according to whether they were born in the US or in another country.[8] We control for socio-economic status with a number of variables, including total family income, education level, and whether the individual received dividend or investment income (as a proxy for

[7] Antecol and Bedard (2006) use a similar classification by race and birthplace in their analysis of obesity among immigrant and minority groups in the US.
[8] Small sample sizes preclude us from disaggregating the other ethnic groups into immigrants and native-born Americans.

wealth). We also include a control for whether the individual has private health insurance.

In terms of health behaviors possibly related to the chance of having cancer, we include controls for the person's smoking status (current regular smoker, former regular smoker, current occasional smoker, and never smoked), the age the person started to smoke regularly, whether the person consumes alcohol regularly, whether the person engaged in binge drinking in the last month (defined as 5 or more drinks in one period), whether the person engaged in moderate or vigorous activity in the last week and whether the person is obese (BMI of at least 30). Clearly there is a potential endogeneity problem with many of these health behavior measures, as current physical health (such as having cancer) may well affect a person's lifestyle choices. For this reason, we put particular emphasis on the age started smoking for those who were ever daily smokers, as this decision will most likely predate any cancer diagnosis.[9] Similarly, measures of longer term socio-economic status such as education level and receipt of dividend income are likely to predate current health status.

In order to investigate the extent to which observed differences in cancer prevalence by ethnicity and immigrant status are explained by differences in socio-economic status and/or health behaviors, we present regression results in three stages: the first presents results based on specifications that include only controls for age, marital status, and survey year along with the ethnic and immigrant controls; the second presents results after socio-economic controls are added to the specification; and the third presents

[9] Unfortunately, the only retrospective information in the datasets concerning health behaviors earlier in life is age started smoking and whether the person was ever a daily smoker. Information about diet, exercise, and alcohol consumption relates only to the year prior to the survey date.

results based on specifications with controls for health behaviors included as well. In each case, we present regression results as odds ratios relative to a base group.

Two caveats concerning the sample should also be noted. First, since differences in overall stage at diagnosis and cancer survival rates have been documented across immigrant and ethnic minority groups (e.g., Palloni & Ewbank, 2005; Jasso et al., 2004), survival bias may arise, particularly with a focus on older individuals. For this reason, we restrict the sample of adults under consideration to those aged between 21 and 70 for the main analysis, and we examine the robustness of our results to employing a younger age cutoff later in the paper. We also restrict the dependent variable to be cancer cases diagnosed relatively recently as another check on the results. Second, a sample could be biased towards healthier immigrants if immigrants with cancer or other health problems migrate back to their country of origin (Abraido-Lanza et.al, 1999). If so, it may partially explain the lower rates of reported cancer incidence in the foreign-born population, particularly for foreign-born Hispanics given the proximity of their home country (Crimmins et al., 2005). However the theory contrasts with the robust result that indicates a worsening of immigrant health with years in the new country, which would suggest that it is actually the healthier immigrants who are emigrating.

4. Results

Table 1 gives a preliminary overview of the age-adjusted prevalence of cancer among adult women in the US, overall and by ethnicity and immigrant status. For any cancer and for all of the four cancers of interest, white women have a higher prevalence of cancer than any of the other groups except for native-American women. Hispanics

born outside of the US and Asians have the lowest rates of cancer, and what is particularly notable is that cancer prevalence is approximately twice as high among Hispanics born in the US as it is among Hispanics born elsewhere. Among non-Hispanic immigrants, cancer prevalence is uniformly lower than native-born non-Hispanic Americans.

Given that incidence statistics based on SEER data and cited earlier suggest a *higher* incidence of cervical cancer among Hispanic women, these results require additional discussion. In order to facilitate a fair comparison of the NHIS cancer statistics, we obtain 10-year prevalence statistics from SEER disaggregated by age group and ethnicity and compare them to 10-year prevalence statistics computed from NHIS self-reports.[10] As can be seen in Appendix Table A1, the prevalence rates for breast cancer are of comparable magnitude between the SEER and NHIS data, giving us some reassurance as to the validity of our measure of breast cancer. In contrast however, there is a marked discrepancy in prevalence rates for cervical/uterine cancer, particularly for Hispanics. We believe that one of the key distinctions is that the SEER data explicitly exclude cervical cancer *in situ*, while in the NHIS, women diagnosed with this (the most common) stage of cervical cancer may still report having been diagnosed with cervical cancer. Thus, if both sets of results are qualitatively accurate, they suggest that while white women are more likely to get all four forms of cancer than ethnic minority groups (except American Indians), Hispanic women are relatively more likely to experience invasive cervical cancer perhaps because of late diagnosis of irregular cervical cells. We return to this issue later in the paper.

[10] We base these calculations on women diagnosed with cancer who reported that the diagnosis was made within 10 years of the interview date.

While the results in Table 1 are adjusted for age, they do not control for differences in other factors likely to be important determinants of the prevalence of cancer in adult women. Tables 2a-2d present statistics on educational attainment, family income and insurance status, smoking and other health behaviors by ethnicity and immigrant status. As has been well documented elsewhere, Hispanic immigrants have by far the lowest educational attainment as well as the lowest family income. They are also least likely to have private health insurance. Blacks and Native Americans also have relatively low rates of educational attainment and low family incomes, while Asians have the highest. For non-hispanic immigrant women, education levels are substantially higher although family income is broadly comparable. In terms of health behaviors, Native American women have the highest rates of current smoking while Asians and Hispanic immigrants have the lowest. Immigrants generally also have lower rates of smoking than non-immigrants. All minority ethnic groups except Asians have higher rates of obesity than white Americans, and non-hispanic immigrants have significantly lower obesity rates than non-hispanic native-born women. The extent to which these factors contribute to the differences in cancer prevalence is the subject to which we now turn.

Table 3 presents selected odds ratios for the key variables of interest – the controls for ethnicity and immigrant status – for the prevalence of any cancer and any of the four cancers specific to women. Comparing results across the three specifications, we find that the inclusion of the additional variables has only a small effect on the odds ratios. In general, controlling for socio-economic status widens ethnic and immigrant differences somewhat, and controlling for health behaviors narrows the differences

somewhat. Thus for brevity we focus our discussion on the set of results corresponding to specification 3.

The results indicate two important results: first, all ethnic groups except native-Americans have significantly lower prevalence of cancer than white American women. This remains true after controlling for differences in socio-economic status, health behaviors, health insurance and other demographic characteristics. Second, immigrants have a significantly lower prevalence rates of cancer than non-immigrants but the gap narrows with time in the US. That is, cancer prevalence rates among immigrants shows the same pattern with years in the host country as other measures of health that have been documented in the literature. This can be seen from the pattern of the odds ratios for the immigrant terms. With the inclusion of controls for years in the US, the odds ratio on the immigrant variable measures the relative odds of having cancer between established immigrants (in the country at least 15 years – the omitted immigrant arrival category) and comparable native-born women. The odds ratios for more recent arrivals give the relative odds of having cancer for a recent immigrant compared with an otherwise similar longer term immigrant, and they are clearly smallest for immigrants arriving within 10 years and relatively larger (though still less than 1) for immigrants in the US between 10 and 15 years. Finally, since the odds ratio for Hispanics born outside of the US is also less than one, this suggests that the gap between foreign and native-born Hispanics is larger than for foreign and native-born members of other ethnic groups. However it is not significant at conventional levels. (Note that the various underlying effects are cumulative, so that the estimated effect of being a foreign-born Hispanic is in addition to the estimated effects of being Hispanic and being an immigrant. Odds-ratios can be combined

multiplicatively to obtain differences between, say, foreign born Hispanics and US-born whites.)[11]

Table 4 presents the same set of specifications but for the prevalence of cancer by specific site – breast, cervix, ovaries and uterus. Because of smaller numbers of individual women with particular forms of cancer in the NHIS data, estimates are less precise and so the reported odds ratios are statistically significant less often. For this reason we combine immigrants who arrived within 5 years and immigrants who arrived between 5 and 10 years ago. (For brevity, the table omits p-values though significance levels are indicated by asterisks.) Odds ratios are again almost all less than one for all ethnic groups except native Americans and are statistically significant for black women for each cancer and for Hispanics and Asians for cervical and uterine cancer. For immigrants, patterns are broadly similar for breast, cervical and ovarian cancer, with the more recent arrivals having lower cancer prevalence than more established immigrants and American-born women. Although the odds ratios for longer term immigrants (given by the Immigrant odds ratio on its own) are uniformly less than one, they are not significant at conventional levels. The implication then is that there is no statistical evidence of a difference in cancer prevalence between longer term immigrants and US born women. Hispanic immigrants are found to have even lower prevalence of each form of cancer compared to both other immigrants and native-born Hispanics although again the odds ratio is significant (at the 10% level) only for cervical cancer.

Though not reported here, the results for the other explanatory variables are generally consistent for cervical, ovarian and uterine cancer (all results are available on

[11] Allowing the impact on cancer prevalence of time in the US to vary between Hispanic and non-Hispanic immigrants has little effect on the results. That is, the estimated time path of cancer prevalence for immigrants does not seem sensitive to whether the immigrant is Hispanic or not.

request). Having a university degree actually increases the likelihood of having cancer, and breast cancer in particular, but reduces the prevalence of cervical, ovarian and uterine cancer. Being in the lowest income group is negatively associated with the prevalence of cancer generally but is positively associated with the prevalence of breast, ovarian and uterine cancer. Women with private insurance have lower prevalence rates of cancer overall and cervical, ovarian and uterine cancer, but does not appear to relate to the prevalence rate of breast cancer. Current and former smokers are found to have a much higher prevalence of cancer generally and cervical, ovarian and uterine cancer. Furthermore, among the group of current and former smokers, the age at which the woman started smoking regularly is also strongly and positively associated with the prevalence of these cancers. In contrast, current and previous smoking behavior appears to have relatively little effect on the prevalence of breast cancer.

Our key results for breast, uterine and ovarian cancer are also not likely to be due to survivor bias since restricting the sample to women aged 20-59 has little effect on the results for the three types of cancer (breast, uterine and ovarian) more prevalent in older women.

Time since diagnosis and age at diagnosis

The focus to this point has been on the prevalence of cancer – for the current sample of women, what proportion has ever been diagnosed with cancer. We now consider two other issues that could help to shed some light on what might underpin the main results obtained. In the first, we define a new dependent variable that takes the value one if the woman has been diagnosed with cancer only within the last three years.

The calculation is based on the difference between the person's current age and the age at which she reported being diagnosed with cancer, and this variable may be a more reasonable indicator of cancer incidence.[12] Estimated odds ratios for ethnic minority and immigrant women are generally comparable to those reported in Tables 3 and 4: recent immigrants are significantly less likely to have been recently diagnosed with cancer, with any of the four types of cancer, and with each form of cancer except uterine cancer. Native-born black women are similarly less likely to have been recently diagnosed with each measure of cancer, suggesting that survival bias is not substantially affecting the inferences that can be drawn from the results for cancer prevalence (since we are already controlling for age and other factors).[13] Native-born Asian women are also less likely to have been recently diagnosed with any cancer, cervical cancer and uterine cancer. The key difference in the results relates to Hispanics. Specifically, while native-born Hispanic women are still significantly less likely to have been recently diagnosed with cancer, these women are on average no less likely than American-born white women to have been recently diagnosed with one of the group of four female-specific cancers. (The odds ratio increases from 0.688 (p-value = .000) to 0.971 (p-value = .674.) The change in results appears to be driven by the recent incidence of breast cancer and uterine cancer – in both cases the odds ratio for Hispanic women is substantially (though not significantly) greater than 1.

[12] For comparison purposes, we would ideally estimate the determinants of cancer incidence among the current target population at risk of developing cancer, but small sample sizes preclude us from doing so.
[13] Based on other results in the literature, incidence of cancer among black women might be under-reported owing to the fact that cancer has not yet been diagnosed at earlier stages. If they are likely to be diagnosed later and so have a higher mortality rate from the disease, this might explain the observed patterns. We return to this point later.

Such a result might arise from relatively higher rates of mortality for Hispanic women, although in contrast, age-adjusted breast cancer mortality rates are known to be lower for Hispanic women generally than white women (e.g., CDC, 2002). These divergent results are worthy of further research and suggest that it may be important to distinguish among Hispanic women by country of birth when examining cancer incidence and mortality rates. However, the fact that sample sizes are small for US-born and foreign born Hispanic women in our dataset when considering a recent diagnosis of cancer suggests that caution be used in drawing inferences from this particular result.

The second issue is whether there are differences in the age at diagnosis between ethnic minority and immigrant women and white American-born women. Table 5 gives median age at diagnosis for women by broad age group and by ethnic/immigrant status. For breast cancer, the age at diagnosis for white, black and Hispanic women by broad age group is similar. The same is true for both Hispanic and non-Hispanic immigrants, though small cell sizes preclude us from disaggregating further by year of arrival. Where differences are more pronounced is for age at diagnosis of cervical cancer. Both black and Hispanic women report being diagnosed with cervical cancer at a later age than for white women, holding broad age group constant.[14] Regression analysis confirms that both black women and Hispanic immigrants (but not American-born Hispanics) are diagnosed with cervical cancer at a later age.[15]

General health service use

[14] The pattern is most evident for the oldest age group (55-70); 20-30 years ago, the time when the onset of cervical cancer was more prevalent for this age group, the racial differences in access and treatment may have been more extreme than today.

[15] Quantile regression techniques were used that involved age at diagnosis being regressed on a cubic in current age, survey year dummy variables plus the indicators for immigrant status and ethnicity.

A later age at diagnosis could arise for two reasons. One reason is that the onset of the disease actually occurs later for particular groups due to physiological, behavioral or socio-economic characteristics. An alternative possibility is that the diagnosis itself occurs later at a more advanced stage of the disease. Without information on the stage at diagnosis, it is difficult to differentiate precisely between these hypotheses, however. What we are able to do is investigate whether there are marked differences in the use of general and preventative screening health services that may indicate barriers to accessing health care and so less chance of being diagnosed with cancer at a relatively early stage of the disease. Table 6 presents selected odds ratios for ethnic minority and immigrant use of four types of regular health service use: a Pap smear in the last three years, a mammogram in the last three years, consultation with any health care professional in the last year and consultation with a GP in the last year. For recent immigrants, the results clearly indicate a significantly lower level of health service use, particularly for cancer screening, but convergence towards American born levels with years in the US.[16] In contrast, black and Hispanic have as high or higher rates of cancer screening as white women, and Hispanic immigrants are significantly more likely than other immigrants to have undergone such testing. In contrast, Hispanic women are less likely to have had a recent consultation with a GP or a health care professional, but Hispanic immigrants are more likely than other immigrants to have done so. Overall, Hispanic immigrants are about as likely as American-born Hispanic women to have consulted with a GP or health care professional. Asian Americans are less likely to have had any of the forms of health service use considered.

[16] McDonald and Kennedy (2007) find similar evidence in terms of Pap smear testing among immigrants to Canada, though with substantial variation by region of origin.

To see the extent to which differences in health service might be driving observed differences in cancer prevalence, we re-estimate determinants of a recent (within 5 years) cancer diagnosis after restricting the sample of women to those who reported seeing a GP in the past year. If differences in recent cancer incidence are being driven by lower rates of consultation with medical professionals in general, then presumably conditioning on a recent doctor visit would imply narrower observed differences in health outcomes between ethnic minorities/immigrants and American-born white women. This assumes of course that consultations with medical professionals by minority/immigrant women are as effective at identifying cancer as for white women, and this may not necessarily be the case.[17] Interestingly, imposing this sample restriction and re-estimating has little qualitative effect on the results, which are found to be similar to those reported in Table 4. The implication is therefore that differences in the use of regular health care between immigrant/minority women and other women does not explain differences in the prevalence of recently diagnosed cancer, though the *effectiveness* of such visits at identifying cancer may still be a factor.

Other measures of health

Our final extension is to determine whether the patterns we have identified in cancer prevalence among immigrant and minority American women are also observed in other health measures reported in the same dataset. We consider three alternative measures of physical health – whether the woman has been diagnosed with a chronic condition (diabetes, emphysema, bronchitis, arthritis, coronary heart disease, angina,

[17] Another limitation is that ideally we would have information on regular physician consultations in the period prior to the diagnosis of cancer. Given the small number of women diagnosed with cancer in the year prior to the survey, we are forced to consider recent diagnosis within the last five years.

heart attack, other heart conditions and cancer), whether she has coronary heart disease or other heart condition, and whether she reports being in poor or fair self-assessed health. Results are reported in Table 7 and are based on the empirical specifications as were estimated for cancer prevalence. For brevity, we only report the odds ratios for our main variables of interest. Odds ratios for chronic conditions, heart problems and fair/poor self-assessed health are consistent with those for cancer – in general, recent immigrants have relatively lower rates of disease than American-born women but these increase with years in the US so that the apparent health advantage enjoyed by immigrants is reduced. However, longer term immigrants – those in the US for at least 15 years – retain lower rates of chronic conditions than American born women. For ethnic minorities, blacks, Hispanics and Asians all have significantly lower rates of chronic conditions and heart problems but have significantly higher rates of poor/fair health. Native-Americans have higher rates of chronic disease than otherwise comparable white women.

5. Discussion

Results in the previous section indicate that female ethnic minorities (aside from Native Americans) and immigrants have lower prevalence of cancer generally and lower prevalence of cancers affecting women. Among immigrants, prevalence is lowest for recent arrivals and increases with time in the US after controlling for age, socio-economic status, and other factors – a trend also observed for other health conditions. Interestingly, a similar pattern is apparent in the prevalence of cancer after controlling for health behaviors, including measures reflecting choices earlier in life and important for future cancer rates, such as age began smoking. The results also control for differences in health

insurance status, a factor particularly important when comparing Hispanic immigrants and other immigrants given the former group's generally lower socio-economic status.

Differences in cancer prevalence rates appear not to be driven by the significant differences in the use of health and screening services across race groups. The results show that blacks utilize health and screening services more than other races/ethnicities, while the estimation results found that blacks have the lowest prevalence rates for all forms of cancer and for the four female cancers. This is not a definitive test of course as it presumes that there have not been significant changes in the use of cancer screening across successive cohorts of women. Again, the low odds ratio for Hispanics for cervical cancer is likely a result of the reporting difference in our sample.

One result to emphasize is that lower rates of cancer prevalence among immigrants may be due in part to under-reporting and under-diagnosis arising from markedly lower rates of cancer screening (in terms of Pap smears and mammograms) but also in terms of a recent consultation with a health care professional. Recent evidence from Canada (McDonald and Kennedy, 2004) indicates that there do not appear to be economic or language barriers in access to general health services use although the effectiveness of such interactions at improving health remains to be determined. The links between screening and subsequent health outcomes for recent immigrants should be the subject of future research, given the slow rate of increase in cancer screening with additional years in the US.

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Table 1: Prevalence rate of Cancer among American women

(age-adjusted, number of cases per 1000 women aged 21-70)

	Any cancer	Cancer specific to women	Breast cancer	Cervical cancer	Ovarian cancer	Uterine cancer
All women	61.2	34.9	15.3	11.5	3.3	6.3
<u>Ethnicity</u>						
White	71.0	39.7	16.6	14.1	3.7	7.1
Black	32.9	21.6	10.6	5.4	1.8	4.4
Hispanic – US born	42.0	29.2	13.8	7.9	3.3	5.8
Hispanic – Other	24.3	15.8	8.6	3.0	1.7	2.8
Asian	27.2	17.5	11.9	2.8	1.8	1.4
Native American	72.1	41.7	9.3	22.2	6.3	7.4
<u>Birthplace</u>						
Non-Hispanic US born	66.9	37.9	16.1	13.1	3.5	6.9
Non-Hispanic Immigrant	36.2	20.1	11.4	5.1	1.8	2.9

Table 2a: Ethnicity, Immigrant status and Educational Attainment
(Proportion of the total number of women in a particular ethnic/nativity category with the stated characteristic)

	Less than High School	Graduated High School	Some College	University degree
All women	0.141	0.291	0.308	0.251
Ethnicity				
White	0.090	0.302	0.320	0.280
Black	0.190	0.302	0.330	0.166
Hispanic – US born	0.224	0.309	0.334	0.125
Hispanic – Other	0.521	0.202	0.166	0.091
Asian	0.115	0.199	0.240	0.430
Native American	0.229	0.337	0.298	0.120
Birthplace				
Non-Hispanic US born	0.105	0.303	0.323	0.261
Non-Hispanic Immigrant	0.125	0.227	0.260	0.373

Table 2b: Ethnicity, Immigrant status, Annual Family Income and Health Insurance
(Proportion of the total number of women in a particular ethnic/nativity category with the stated characteristic)

	Less than $20,000*	$20,000 to $44,999	$45,000 to $74,999	$75,000 or more	Has private health insurance
All women	0.181	0.229	0.196	0.201	0.781
Ethnicity					
White	0.141	0.219	0.213	0.233	0.844
Black	0.318	0.252	0.141	0.095	0.662
Hispanic – US born	0.238	0.258	0.185	0.145	0.661
Hispanic – Other	0.312	0.286	0.134	0.070	0.459
Asian	0.160	0.183	0.188	0.272	0.782
Native American	0.303	0.318	0.163	0.088	0.529
Birthplace					
Non-Hispanic US born	0.168	0.224	0.204	0.213	0.818
Non-Hispanic Immigrant	0.166	0.204	0.184	0.231	0.763

* income numbers do not add to 1 owing to non-reporting of family income

Table 2c: Ethnicity, Immigrant status and Smoking
(Proportion of the total number of women in a particular ethnic/nativity category with the stated characteristic)

	Daily smoker	Occasional smoker	Former smoker	Never smoked	Cigarettes per day*
All women	0.179	0.039	0.179	0.596	14.3
Ethnicity					
White	0.202	0.039	0.210	0.542	15.3
Black	0.161	0.042	0.112	0.672	10.7
Hispanic – US born	0.125	0.055	0.128	0.687	9.0
Hispanic – Other	0.055	0.028	0.082	0.829	7.7
Asian	0.069	0.019	0.064	0.839	11.2
Native American	0.301	0.073	0.173	0.451	13.4
Birthplace					
Non-Hispanic US born	0.201	0.040	0.197	0.554	14.7
Non-Hispanic Immigrant	0.084	0.022	0.108	0.779	12.2

* for daily or occasional smokers only

Table 2d: Ethnicity, immigrant status and other health behaviors
(Proportion of the total number of women in a particular ethnic/nativity category with the stated characteristic)

	Any weekly physical activity	Drinks alcohol	Binge drank last month	Average BMI (level)	Obese
All women	0.591	0.584	0.025	26.6	0.235
Ethnicity					
White	0.640	0.649	0.028	26.1	0.213
Black	0.464	0.437	0.017	29.1	0.375
Hispanic – US born	0.532	0.569	0.036	27.9	0.315
Hispanic – Other	0.383	0.320	0.009	27.0	0.239
Asian	0.560	0.371	0.011	23.3	0.073
Native American	0.540	0.510	0.066	28.4	0.358
Birthplace					
Non-Hispanic US born	0.617	0.621	0.027	26.6	0.240
Non-Hispanic Immigrant	0.547	0.443	0.011	24.5	0.127

Table 3: Ethnicity and Immigration Controls - any cancer and cancer specific to women

	Any cancer Odds-ratio	p-value	4 cancers Odds-ratio	p-value
Specification 1				
Black	0.443***	0.000	0.536***	0.000
Hispanic	0.567***	0.000	0.719***	0.000
Asian	0.498***	0.000	0.585***	0.003
Native American	1.042	0.811	1.138	0.527
White	1.000	--	1.000	--
Immigrant (FB)	0.761***	0.001	0.732***	0.004
Hispanic FB	0.884	0.361	0.882	0.455
US born	1.000	--	1.000	--
FB arr. <5 yrs ago	0.347***	0.001	0.416**	0.020
FB arr. 5-10 yrs ago	0.485***	0.000	0.413***	0.000
FB arr. 10-15 yrs ago	0.658**	0.023	0.613**	0.029
FB arr. 15+ yrs ago	1.000	--	1.000	--
Specification 2				
Black	0.413***	0.000	0.456***	0.000
Hispanic	0.542***	0.000	0.632***	0.000
Asian	0.499***	0.000	0.593***	0.003
Native American	0.957	0.799	0.939	0.759
White	1.000	--	1.000	--
Immigrant (FB)	0.767***	0.001	0.751***	0.009
Hispanic FB	0.864	0.282	0.817	0.233
US born	1.000	--	1.000	--
FB arr. <5 yrs ago	0.336***	0.000	0.393**	0.014
FB arr. 5-10 yrs ago	0.474***	0.000	0.393***	0.000
FB arr. 10-15 yrs ago	0.647**	0.019	0.587**	0.018
FB arr. 15+ yrs ago	1.000	--	1.000	--
Specification 3				
Black	0.435***	0.000	0.500***	0.000
Hispanic	0.580***	0.000	0.688***	0.000
Asian	0.537***	0.000	0.667**	0.023
Native American	0.921	0.644	0.879	0.549
White	1.000	--	1.000	--
Immigrant (FB)	0.807***	0.010	0.811*	0.058
Hispanic FB	0.856	0.259	0.819	0.247
US born	1.000	--	1.000	--
FB arr. <5 yrs ago	0.364***	0.001	0.451**	0.036
FB arr. 5-10 yrs ago	0.517***	0.001	0.444***	0.001
FB arr. 10-15 yrs ago	0.633**	0.019	0.577**	0.021
FB arr. 15+ yrs ago	1.000	--	1.000	--

*** - significantly different from 1.0 at the 1% level of significance; ** - 5% level; * - 10% level

Table 4: Ethnicity and Immigration Controls – particular cancers specific to women

	Breast Odds-ratio	Cervical Odds-ratio	Ovarian Odds-ratio	Uterine Odds-ratio
Specification 1				
Black	0.645***	0.388***	0.497***	0.637***
Hispanic	0.851	0.567***	0.844	0.826
Asian	0.892	0.263***	0.912	0.339**
Native American	0.547	1.607*	1.920	1.147
White	1.000	1.000	1.000	1.000
Immigrant (FB)	0.846	0.709	0.682	0.591
Hispanic FB	0.825	0.701	1.084	0.881
US born	1.000	1.000	1.000	1.000
FB arr. < 10 yrs ago	0.335***	0.421**	0.252**	0.899
FB arr. 10-15 yrs ago	0.759	0.551	0.633	0.497
FB arr. 15+ yrs ago	1.000	1.000	1.000	1.000
Specification 2				
Black	0.687***	0.277***	0.388***	0.459***
Hispanic	0.914	0.440***	0.723	0.610***
Asian	0.878	0.268***	0.946	0.345**
Native American	0.593	1.075	1.439	0.777
White	1.000	1.000	1.000	1.000
Immigrant (FB)	0.842	0.757	0.713	0.624*
Hispanic FB	0.866	0.580*	1.040	0.704
US born	1.000	1.000	1.000	1.000
FB arr. < 10 yrs ago	0.354***	0.420**	0.233**	0.794
FB arr. 10-15 yrs ago	0.790	0.546	0.595	0.444*
FB arr. 15+ yrs ago	1.000	1.000	1.000	1.000
Specification 3				
Black	0.713***	0.362***	0.404***	0.463***
Hispanic	0.852	0.572***	0.789	0.710**
Asian	0.918	0.336***	1.068	0.391*
Native American	0.577	1.003	1.338	0.771
White	1.000	1.000	1.000	1.000
Immigrant (FB)	0.869	0.807	0.799	0.720
Hispanic FB	0.899	0.583*	0.954	0.678
US born	1.000	1.000	1.000	1.000
FB arr. < 10 yrs ago	0.357***	0.547*	0.270**	0.914
FB arr. 10-15 yrs ago	0.748	0.548	0.514	0.501
FB arr. 15+ yrs ago	1.000	1.000	1.000	1.000

*** - significantly different from 1.0 at the 1% level of significance; ** - 5% level; * - 10% level

Table 5: Median age when diagnosed with cancer by current age and ethnicity/immigrant status

	Breast			Cervical		
	Women aged 20-39	Women aged 40-54	Women aged 55-70	Women aged 20-39	Women aged 40-54	Women aged 55-70
All women	31	44	55	24	30	36
Ethnicity						
White	32	44	55	24	30	36
Black	30	41	55	24	32	49
Hispanic	27	42	56	25	36	42
Asian	#	48	53	#	#	#
Native American	#	#	#	#	#	#
Birthplace						
Non-Hispanic Immigrant	#	45	55	26	30	40
Hispanic Immigrant	#	42	56	29	36	#

	Ovarian			Uterine		
	Women aged 20-39	Women aged 40-54	Women aged 55-70	Women aged 20-39	Women aged 40-54	Women aged 55-70
All women	25	37	48	27	35	40
Ethnicity						
White	24	38	48	27	35	41
Black	23	33	#	26	38	34
Hispanic	27	41	#	28	35	44
Asian	#	#	#	#	#	#
Native American	#	#	#	#	#	#
Birthplace						
Non-Hispanic Immigrant	#	#	#	#	#	#
Hispanic Immigrant	#	44	#	#	35	40

#: less than 10 observations

Table 6: Ethnicity and Immigration Controls – health services use and cancer screening

	Pap-smear test within last 3 years[#]	Mammogram within last 3 years[# &]	Consultation with any health care worker within 1 year	Consultation with a GP within 1 year
	Odds-ratio	Odds-ratio	Odds-ratio	Odds-ratio
Black	1.883***	1.404***	1.116***	1.042
Hispanic	1.045	1.002	0.703***	0.782***
Asian	0.607***	0.614***	0.640***	0.875***
Native American	1.461*	1.292	0.798*	0.882
White	1.000	1.000	1.000	1.000
Immigrant (FB)	0.770***	0.908	0.812***	0.925**
Hispanic FB	1.446***	1.539***	1.208***	1.082
US born	1.000	1.000	1.000	1.000
FB arr. <5 yrs ago	0.355***	0.355***	0.472***	0.597***
FB arr. 5-10 yrs ago	0.483***	0.536***	0.650***	0.720***
FB arr. 10-15 yrs ago	0.593***	0.868	0.721***	0.825***
FB arr. 15+ yrs ago	1.000	1.000	1.000	1.000

#: sample is restricted to those NHIS waves that include information on the use of cervical and breast cancer screening

&: sample restricted to women aged 40-70

Table 7: Ethnicity and Immigration Controls – other measures of physical health

	Chronic condition[#] Odds-ratio	Heart disease[##] Odds-ratio	Fair/poor self-assessed health Odds-ratio
Black	0.957*	0.876***	1.397***
Hispanic	0.848***	0.700***	1.318***
Asian	0.794***	0.798**	1.193*
Native American	1.327***	1.343**	1.458***
White	1.000	1.000	1.000
Immigrant (FB)	0.693***	0.721***	0.868**
Hispanic FB	0.958	1.015	0.869*
US born	1.000	1.000	1.000
FB arr. <5 yrs ago	0.605***	0.869	0.627***
FB arr. 5-10 yrs ago	0.557***	0.533***	0.763***
FB arr. 10-15 yrs ago	0.641***	0.641***	0.777***
FB arr. 15+ yrs ago	1.000	1.000	1.000

Note: regression results are based on specifications that do not include health behaviors such as smoking. Including these variables has little qualitative effect on the results reported here.

#: includes cancer, diabetes, arthritis, emphysema, bronchitis, coronary heart disease, heart attack, angina and other heart conditions

##: includes coronary heart disease, angina, heart attack and other heart conditions

Appendix Table A1: Comparison of 10-year cancer prevalence rates using NHIS and SEER data

NHIS		20-29	30-39	40-49	50-59	60-69	70-79
1998-05	Breast						
	White	0.05%	0.29%	1.03%	2.35%	3.36%	4.18%
	Black	0.12%	0.23%	0.48%	1.17%	2.18%	1.64%
	Asian	0.00%	0.11%	0.49%	2.07%	1.50%	4.15%
	Hispanic	0.06%	0.10%	0.71%	2.05%	1.88%	2.71%
	Cervix/Uterus						
	White	1.49%	1.45%	0.81%	0.70%	0.58%	0.69%
	Black	0.45%	0.59%	0.60%	0.40%	0.24%	0.65%
	Asian	0.25%	0.15%	0.00%	0.23%	0.00%	0.35%
	Hispanic	0.54%	0.66%	0.54%	0.43%	0.42%	0.50%
	Ovarian						
	White	0.23%	0.15%	0.20%	0.19%	0.32%	0.22%
	Black	0.06%	0.13%	0.09%	0.12%	0.03%	0.33%
	Asian	0.33%	0.04%	0.22%	0.00%	0.00%	0.00%
	Hispanic	0.05%	0.16%	0.20%	0.20%	0.18%	0.12%
SEER 11		20-29	30-39	40-49	50-59	60-69	70-79
2003	Breast						
	White	0.01%	0.15%	0.78%	1.93%	2.96%	3.54%
	Black	0.01%	0.17%	0.67%	1.52%	2.12%	2.56%
	Asian	0.01%	0.14%	0.67%	1.44%	1.83%	1.93%
	Hispanic	0.01%	0.10%	0.54%	1.18%	1.67%	1.98%
	Cervix/Uterus						
	White	0.01%	0.09%	0.13%	0.11%	0.10%	0.09%
	Black	0.01%	0.06%	0.11%	0.12%	0.14%	0.14%
	Asian	0.00%	0.03%	0.10%	0.14%	0.16%	0.15%
	Hispanic	0.01%	0.09%	0.20%	0.22%	0.21%	0.23%
	Ovarian						
	White	0.01%	0.02%	0.05%	0.12%	0.18%	0.19%
	Black	0.01%	0.02%	0.03%	0.06%	0.09%	0.10%
	Asian	0.01%	0.02%	0.05%	0.10%	0.13%	0.17%
	Hispanic	0.01%	0.02%	0.04%	0.09%	0.12%	0.15%

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