Massachusetts
Department Of
Public Health

Evaluation of Breast Cancer Incidence in Woburn, MA

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Bureau of
Environmental Health,
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Program

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I. Introduction

In December 2009, the Massachusetts Department of Public Health's (MDPH) Bureau of Environmental Health (BEH) received a call from a resident concerned about the occurrence of breast cancer in Woburn, MA. Concerns were focused on the occurrence of breast cancer in younger women and more specifically among women who graduated from Woburn High School between the years 1980 and 1991. In response to these concerns, the BEH's Community Assessment Program (CAP) reviewed available cancer incidence data from the Massachusetts Cancer Registry (MCR) for the city of Woburn and its seven census tracts and information on breast cancer diagnoses among Woburn High School graduates provided by the resident. In addition, CAP researched whether any environmental data exist for the former Woburn High School (which was rebuilt between 2004 and 2006) to suggest that possible exposure opportunities to environmental contaminants existed that may have put young women at increased risk of breast cancer[1].

II. Methods for Analyzing Cancer Incidence

A. Case Identification/Definition

One component of this evaluation was a review of breast cancer incidence in Woburn women in general, based on the most current data available at the initiation of this analysis. Breast cancer incidence data (i.e., reports of new cancer diagnoses) for the city of Woburn for the ten years spanning 1998 through 2007 were obtained from the MCR within the MDPH Office of Data Management and Outcomes Assessment. These data were separated into two five-year periods to evaluate breast cancer incidence over time. Women diagnosed with breast cancer were

[1] This report was supported in part by funds from a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), U.S. Department of Health and Human Services. This document has not been reviewed and cleared by ATSDR.

selected for inclusion based on their residential address reported to the hospital or reporting medical facility at the time of their diagnosis. Breast cancer incidence was evaluated for two populations: women of all ages in Woburn and women who were under the age of 50 at the time of diagnosis. A second component of this evaluation was a review of information provided by the Woburn High School graduate on classmates and friends who developed breast cancer after graduating from the school, mainly in the 1980s. It is important to note that the MCR collects information on cancer diagnoses based on a person's residence at diagnosis. Therefore, it is not possible to review MCR data based on other personal information such as schools attended or previous residences, or to calculate breast cancer rates based on such personal information.

The MCR is a population-based surveillance system that began collecting information in 1982 on Massachusetts residents diagnosed with cancer in the state. Massachusetts law requires all new cancer diagnoses among residents to be reported to the MCR within six months of the date of diagnosis (M.G.L. c.111. s 111b). This information is kept in a confidential database. Data are collected on a daily basis and are reviewed for accuracy and completeness. This process corrects misclassification of data (for example, incorrect city/town assignment). Once these steps are finished, the data for that year are considered "complete". Due to the volume of information received by the MCR, the large number of reporting facilities, and the six-month period between diagnosis and required reporting, the most current registry data that are complete will inherently be a minimum of two years prior to the current date. The year 2007 constituted the most recent and complete cancer incidence data available at the initiation of this analysis. For subsequent years, 2008 to the present, the MCR database was reviewed to confirm additional diagnoses reported to the CAP by the requestor.

The term "cancer" is used to describe a variety of diseases associated with abnormal cell and tissue growth. Cancers are classified by the location in the body where the disease originated (the primary site) and the tissue or cell type of the cancer (histology). Epidemiologic studies have revealed that different types of cancer are individual diseases with separate causes, risk factors, characteristics and patterns of survival (Berg 1996). Therefore, it is appropriate to evaluate each type of cancer separately. Cancers that occur as the result of the metastasis or the spread of a primary site cancer to another location in the body are not considered as separate cancers and therefore were not included in this analysis.

It should be noted that any duplicate records included in the MCR data were eliminated from analyses in this report. Duplicate diagnoses are additional reports of the same primary site cancer diagnosed in an individual by another health-care provider. The decision that a diagnosis was a duplicate and should be excluded from the analyses was made by the MCR after consulting with the reporting hospital/diagnostic facility and obtaining additional information regarding the histology and/or pathology of the diagnosis. However, reports of individuals with multiple primary site cancers were included as separate diagnoses in this report. In general, a diagnosis of a multiple primary cancer is defined by the MCR as a new cancer in a different location in the body or a new cancer of the same histology (cell type) as an earlier cancer, if diagnosed in the same primary site (original location in the body) more than a specified period of time after the initial diagnosis, depending upon the particular cancer type (NCI 2012).

B. Calculation of Standardized Incidence Ratios (SIRs)

To determine whether an elevation occurred among women diagnosed with breast cancer in Woburn, cancer incidence data were tabulated by gender according to eighteen age groups to

compare the observed number of cancer diagnoses to the number that would be expected based on the statewide cancer rate. Standardized incidence ratios (SIRs) were then calculated for two time-periods, 1998-2002 and 2003-2007, to evaluate temporal patterns of breast cancer incidence in Woburn compared to the statewide cancer experience.

SIRs were not calculated when the number of observed diagnoses was less than five. It is standard DPH policy not to calculate rates with fewer than five observed diagnoses due to the instability of the rate. However, the expected number of diagnoses was calculated, and the observed and expected numbers of diagnoses were compared to determine whether excess numbers of cancer diagnoses were occurring.

C. Interpretation of a Standardized Incidence Ratio (SIR)

An SIR is an estimate of the occurrence of cancer in a population relative to what might be expected if the population had the same cancer experience as a larger comparison population designated as "normal" or average. Usually, the state as a whole is selected to be the comparison population. Using the state of Massachusetts as a comparison population provides a stable population base for the calculation of incidence rates.

Specifically, an SIR is the ratio of the observed number of cancer diagnoses in an area to the expected number of diagnoses multiplied by 100. The statewide incidence rate is applied to the population structure of each community to calculate the number of expected cancer diagnoses. The SIR is a comparison of the number of diagnoses in the specific area (i.e., city/town or census tract) to the statewide rate. Comparison of SIRs between communities or census tracts is not possible because each of these areas has different population characteristics.

An SIR of 100 indicates that the number of cancer diagnoses observed in the population being evaluated is equal to the number of cancer diagnoses expected in the comparison or "normal" population. An SIR greater than 100 indicates that more cancer diagnoses occurred than were expected, and an SIR less than 100 indicates that fewer cancer diagnoses occurred than were expected. Accordingly, an SIR of 150 is interpreted as 50% more cancer diagnoses than the expected number; an SIR of 90 indicates 10% fewer cancer diagnoses than expected.

Caution should be exercised, however, when interpreting an SIR. The interpretation of an SIR depends on both the size and the stability of the SIR. Two SIRs can have the same size but not the same stability. For example, an SIR of 150 based on four expected diagnoses and six observed diagnoses indicates a 50% excess in cancer, but the excess is actually only two diagnoses. Conversely, an SIR of 150 based on 400 expected diagnoses and 600 observed diagnoses represents the same 50% excess in cancer, but because the SIR is based upon a greater number of diagnoses, the estimate is more stable. It is very unlikely that 200 excess diagnoses of cancer would occur by chance alone. As a result of the instability of incidence rates based on small numbers of diagnoses, SIRs were not calculated when fewer than five diagnoses were observed for a particular cancer type.

D. Calculation of the 95% Confidence Interval

To help interpret or measure the stability of an SIR, the statistical significance of each SIR was assessed by calculating a 95% confidence interval (95% CI) to determine if the observed number of diagnoses is “significantly different” from the expected number or if the difference may be due solely to chance (Rothman and Boice 1982). Specifically, a 95% CI is the range of estimated SIR values that have a 95% probability of including the true SIR for the population. If

the 95% CI range does not include the value 100, then the disease rate in the study population is statistically significantly different from the comparison or "normal" population. "Statistically significantly different" means there is less than a 5% chance that the observed difference (either increase or decrease) in the rate is the result of random fluctuation in the number of observed cancer diagnoses.

For example, if a confidence interval does not include 100 and the interval is above 100 (e.g., 105–130), there is a statistically significant excess in the number of cancer diagnoses. Similarly, if the confidence interval does not include 100 and the interval is below 100 (e.g., 45–96), the number of cancer diagnoses is statistically significantly lower than expected. If the confidence interval range includes 100, the true SIR may be 100. In this case, it cannot be determined with certainty that the difference between the observed and expected number of diagnoses reflects a real cancer increase or decrease or is the result of chance. It is important to note that statistical significance alone does not necessarily imply public health significance. Determination of statistical significance is just one tool used to interpret cancer patterns in a community.

In addition to the range of the estimates contained in the confidence interval, the width of the confidence interval also reflects the stability of the SIR estimate. For example, a narrow confidence interval, such as 103–115, allows a fair level of certainty that the calculated SIR is close to the true SIR for the population. A wide interval, for instance 85–450, leaves considerable doubt about the true SIR, which could be much lower than or much higher than the calculated SIR. This would indicate an unstable statistic. Again, due to the instability of incidence rates based on small numbers of diagnoses, statistical significance was not assessed when fewer than five diagnoses were observed.

E. Determination of Geographic Distribution of Breast Cancer Cases

In addition to calculating SIRs, the address at the time of diagnosis for each woman diagnosed with breast cancer in Woburn was mapped using a computerized geographic information system (GIS) (ESRI 2009). This allowed for an evaluation of the spatial distribution of residences at a smaller geographic level within neighborhoods. The geographic pattern was assessed using a qualitative evaluation of the point pattern of cancer diagnoses in the community. This evaluation also included consideration of the population density within Woburn. In instances where the address information from the MCR was incomplete (that is, did not include specific streets or street numbers), efforts were made to research those individuals diagnosed with breast cancer (e.g., by using telephone books issued within 2 years of an individual's diagnosis or searching files via the Registry of Motor Vehicles). For confidentiality reasons, it is not possible to include maps showing the locations of residences for women diagnosed with breast cancer in this report. [Note: MDPH is bound by state and federal patient privacy and research laws not to reveal the name or any other identifying information of an individual diagnosed with cancer and reported to the MCR.]

Accurate age group and gender-specific population data are required to calculate SIRs. Therefore, the CT is the smallest geographic area for which cancer rates can be accurately calculated. Specifically, a CT is a smaller statistical subdivision of a county as defined by the U.S. Census Bureau. CTs usually contain between 1,500 and 8,000 persons and are designed to be homogeneous with respect to population characteristics (U.S. DOC 2000). The city of Woburn has seven CTs (see Figure 1).

F. Evaluation of Cancer Risk Factor Information

Available information reported to the MCR related to risk factors for breast cancer development among women in Woburn was reviewed and compared to known or established incidence patterns. This information is collected for each individual at the time of cancer diagnosis and includes the woman's age at time of diagnosis and any previous cancer diagnoses. Experts believe that, for most types of cancer, several risk factors acting over time can be related to the development of the cancer. Heredity, or family history, is an important factor for several cancers including breast cancer. However, information about personal risk factors such as family history and other factors that may also influence the development of breast cancer is not collected by the MCR. According to the American Cancer Society (ACS) and the medical literature, women who have had no children or who had their first child after age 30 have a slightly higher breast cancer risk. Having multiple pregnancies and becoming pregnant at an early age reduces breast cancer risk. MDPH reviewed summary data on maternal age at first birth, available through the Massachusetts Community Health Information Profile (MassCHIP), for Woburn.

III. Breast Cancer Incidence Rates

Tables 1 through 4 summarize the breast cancer incidence data evaluated for the city of Woburn. These tables provide information on the observed number of women diagnosed with breast cancer in Woburn, the expected number of diagnoses, and the standardized incidence ratio (SIR) with its 95% confidence interval for the time periods of 1998-2002 and 2003-2007. Tables 1 and 2 cover the 1998-2002 time period for women of all ages (Table 1) and women under age 50 at diagnosis (Table 2) and, similarly, Tables 3 and 4 cover the 2003-2007 time period for the two age groupings, respectively.

For the five-year period 1998-2002, 170 women of all ages were diagnosed with breast cancer in Woburn compared to approximately 162 diagnoses expected based on statewide rates (Table 1). The difference between the numbers of observed and expected diagnoses is not statistically significant and most likely represents natural random variation in the number of observed diagnoses. For this same time period, 42 women under the age of 50 were diagnosed with breast cancer in Woburn compared to approximately 34 diagnoses expected. This difference was not statistically significant.

For the more recent five-year period 2003-2007, 178 women of all ages were reported to be diagnosed with breast cancer compared to approximately 156 diagnoses expected based on statewide rates (Table 3). This elevation was of borderline statistical significance. For women under the age of 50 at diagnosis during this time period, a statistically significant elevation in breast cancer incidence occurred with 51 diagnoses observed compared to approximately 35 expected (Table 4).

IV. Review of Geographic Distribution of Diagnoses

The incidence of breast cancer was evaluated by census tract within Woburn to determine the following:

- Were the rates of breast cancer elevated in particular census tracts?
- If a rate was elevated in a particular census tract, was it consistently elevated over both time periods and was the elevation(s) statistically significant?
- Did the census tract rates differ depending on the age grouping being evaluated (all ages versus under age 50 at diagnosis)?

- Did any unusual geographic or spatial patterns emerge when the residences at diagnosis were examined on a map?

There were some differences between the numbers of observed and expected diagnoses in the census tracts, however, the differences were not consistent. Sometimes there were more individuals diagnosed with breast cancer than expected and sometimes there were fewer individuals diagnosed than expected. In the majority of census tracts, no statistically significant differences were seen during either time period evaluated. In one census tract, 3332.00, the difference between the number of observed and expected diagnoses in women under the age of 50 at diagnosis was of borderline statistical significance during the later time period, 2003-2007. Ten diagnoses occurred compared to approximately five expected; these ten diagnoses occurred among eight women, meaning that two women were diagnosed twice with breast cancer during the five-year time period. It is important to note that, once diagnosed with breast cancer, the risk of developing breast cancer a second time increases. During the earlier time period, fewer diagnoses were observed among women under 50 in this census tract than expected, with two observed and approximately five expected.

For women of all ages, when breast cancer incidence was examined by census tract over time, variability in incidence was noted for four of the seven census tracts. That is, no consistent pattern emerged. For each of these four census tracts, more diagnoses occurred than expected in one time period while fewer diagnoses occurred than expected in the second time period. Three census tracts had either more diagnoses than expected or fewer diagnoses than expected in both time periods; however, these differences were not statistically significant for these census tracts and may represent natural variability in the number of observed diagnoses.

For women under the age of 50 at diagnosis, when breast cancer incidence was examined by census tract over time, no unusual patterns emerged for most census tracts. For the majority of the census tracts, the number of observed diagnoses was close to the expected number of diagnoses. For one census tract, 3331.00, elevations occurred among women under 50 during both time periods. As mentioned earlier, in census tract 3332.00, an elevation of borderline statistical significance occurred during 2003-2007 while fewer than expected diagnoses occurred during 1998-2002.

Residence at time of diagnosis for each woman diagnosed with breast cancer in Woburn between 1998 and 2007 was plotted on a map. These residences were then reviewed to determine if any unusual geographic pattern existed that would suggest a common factor (environmental or non-environmental) was associated with cancer diagnoses among these female residents. No unusual geographic patterns emerged and the pattern of residences at diagnosis seemed to correspond to population density patterns in the city. The rates of breast cancer in census tract 3335.02, where the Woburn High School is located, were approximately as expected during both time periods evaluated for women of all ages as well as women under the age of 50 at diagnosis.

V. Risk Factors for Breast Cancer

Breast cancer is the most common cancer among women, comprising 28% of all new cancer diagnoses in Massachusetts women (MCR 2010). The chance of developing invasive breast cancer at some time in a woman's life is about 1 in 8 (12%). A woman's risk of developing breast cancer increases with age, with age being the strongest risk factor for breast cancer. About 1 out of 8 invasive breast cancers are found in women younger than 45, while about 2 out of 3 invasive breast cancers are found in women age 55 or older (ACS 2010).

In addition to age as a risk factor, approximately 5 to 10% of breast cancer diagnoses are thought to be hereditary, resulting directly from gene changes or mutations inherited from a parent. For women with BRCA1 and BRCA2 mutations, their risk of developing breast cancer may be as high as 80%; these cancers tend to occur in younger women and are more often bilateral (in both breasts) compared to women with breast cancer who are not born with one of these gene mutations. Women with a first degree relative (such as a mother or sister) are at twice the risk of developing breast cancer as other women while women with two first degree relatives are at five times the risk. Seventy to eighty percent of women who develop breast cancer, however, do not have a family history of the disease. Experts estimate that fifty percent of breast cancer diagnoses cannot be explained by known risk factors for the disease (ACS 2010).

As previously mentioned, women who have had no children or who had their first child after age 30 and women of higher socioeconomic status have a slightly higher breast cancer risk. MDPH reviewed data on maternal age at first birth, available through MassCHIP, for Woburn. (These data are available by community but not by census tract.) In 2000, 60% of the women in Woburn had their first child at age 30 or older compared to 54.5% statewide. In 2008, the last year of cancer incidence data evaluated, 44% of women in Woburn had their first child at age 30 or older compared to 41% statewide.

According to the 2000 U.S. Census data available on MassCHIP, approximately 28% of Woburn women age 25 or older have at least a Bachelor's or graduate-level degree compared to 31% statewide. When examined by census tract, the percent of women age 25 or older with at least a Bachelor's degree or higher ranged from 23.6% for census tract 3334 to 32.1% for census tract 3331.

Cumulative exposure of the breast tissue to estrogen is also associated with breast cancer risk. Several factors can influence estrogen levels. Women who started menstruating at an early age (before age 12) and/or went through menopause at a later age (after age 55) have a slightly higher risk of breast cancer. Also, as discussed above, women who have had no children or those whose first pregnancy occurred when they were over the age of 30 have an increased risk for developing breast cancer. Women who have had more children and those who have breast-fed seem to be at lower risk.

Other risk factors include certain benign breast conditions, having dense breast tissue, a previous cancer diagnosis, and previous radiation therapy to the chest. Alcohol consumption has also been associated with increased risk for breast cancer. Women who consumed one alcoholic beverage per day experienced a slight increase in risk (approximately 10%) compared to non-drinkers, however those who consumed 2 to 5 drinks per day experienced a 1.5 times increased risk. Recent studies have indicated that being overweight or obese may put a woman at increased risk of breast cancer, especially after menopause.

A great deal of research has been reported and more is being done to understand possible environmental influences on breast cancer risk. Of special interest are compounds in the environment that have been found in animal studies to have estrogen-like properties, which could in theory affect breast cancer risk. For example, substances found in some plastics, certain cosmetics and personal care products, pesticides (such as DDE), and PCBs (polychlorinated biphenyls) seem to have such properties. To date, however, there is not a clear link between breast cancer risk and exposure to these substances.

VI. Breast Cancer Staging

MDPH reviewed cancer staging information for women diagnosed with breast cancer in Woburn for the two five-year periods (1998-2002 and 2003-2007). Staging describes the extent of spread of an individual's cancer. From a public health perspective, earlier breast cancer staging reflects to some extent that women are being screened early and regularly for breast cancer whereas distant staging may reflect a lack of access to early screening. In Woburn, for women of all ages and for women under the age of 50 at diagnosis, the percent of women diagnosed at the local stage of breast cancer was higher than that for all women diagnosed with breast cancer in Massachusetts while the percent of women diagnosed at the distant stage was lower than that for women statewide. Although these findings were not statistically significant, they may indicate that women in Woburn are being screened earlier and/or more regularly than women statewide and therefore the incidence rates of breast cancer may appear somewhat higher.

VII. Breast Cancer among Woburn High School Graduates

As discussed earlier, individuals are reported to the MCR based on their residence at diagnosis rather than high school attended. It is the completeness of case ascertainment/reporting to the MCR that allows for the calculation of cancer rates for the city as well as its census tracts. (The MCR typically achieves 95% or higher case ascertainment each year, reflecting a high degree of completeness.) Although the rate of breast cancer among former graduates of Woburn High School cannot be calculated with available data, information that was provided to MDPH/BEH about breast cancer diagnoses among former graduates of Woburn High School was reviewed.

A list of 24 breast cancer diagnoses among Woburn High School graduates, spanning 12 graduating classes between 1980 and 1991, was provided to MDPH/BEH. The ages at diagnosis

ranged from 27 to 45. Among this group of 24 women, their years of birth spanned 1962 to 1973. It was also reported that the group of 24 women grew up in different parts of Woburn and approximately half of these women were not residents of Woburn at the time of their diagnosis. Their years of diagnosis spanned 14 years, ranging from 1996 to 2009. Sixteen of the 24 diagnoses were able to be confirmed in the MCR database. The remaining individuals' diagnoses could not be confirmed either because they were made out-of-state or insufficient information was provided to MDPH/BEH to allow confirmation.

As mentioned previously, the rate of breast cancer among Woburn High School graduates cannot be calculated because such data are not reported to MDPH. However, an estimate of the expected number of women diagnosed with breast cancer in Woburn under the age of 45 can be made based upon the total number of women in Woburn diagnosed with breast cancer during the 10-year period examined and the American Cancer Society's estimate that about 1 out of 8 invasive breast cancers are found in women younger than 45. A total of 348 women were diagnosed with breast cancer in Woburn over 10 years. If 1 in 8 women are expected to be under the age of 45 at diagnosis, then you'd expect approximately 44 women in Woburn to be diagnosed with breast cancer under the age of 45 over a 10-year period. MDPH/BEH was made aware of 24 women who attended Woburn High School over approximately a 14-year span who were diagnosed under the age of 45, about half of whom resided outside Woburn at the time of their diagnosis. During the 10-year period of 1998-2007, the period for which cancer incidence rates were reviewed in this report, approximately 16 (of the 24 reported to MDPH/BEH) Woburn High School graduates were diagnosed with breast cancer; the remainder were diagnosed either before 1998 or after 2007. Although the total number of Woburn High School graduates with breast cancer is an estimate, this crude analysis suggests that the number of reported Woburn

High School graduates diagnosed with breast cancer under the age of 45 may not be unusual. Approximately 44 women in Woburn diagnosed with breast cancer would be expected to be under the age of 45 compared to the approximately 16 reported to MDPH/BEH.

VIII. Woburn High School

CAP conducted research to obtain any information available on environmental conditions associated with the Woburn High School, to assess whether opportunities for some common exposure may have existed among high school building occupants during the 1980s and early 1990s, the years of interest. Unfortunately, information on environmental conditions at the Woburn High School during this time period is very limited. In a 2001 memorandum from the New England Association of Schools and Colleges' Commission on Public Secondary Schools, the school was described as having water leaks, uneven heat distribution, an outdated electrical system, and the inability to support updated technology. While these conditions may have had impacts on comfort conditions at the school (for example, exposure to mold and moisture), such exposures would not be expected to have had an impact on breast cancer development. This document does not mention any chemical or other environmental hazards associated with the facility.

The new Woburn High School opened in September 2006. In 2004, prior to construction of the new school, soil sampling was conducted on the school grounds in and around the athletic fields (Geotechnical Services, Inc. 2004). This was done to evaluate the quality of the fill present on the property in light of erecting the new high school on the existing football field and developing other areas of the campus for new athletic fields. Existing playing fields on the campus had been filled repeatedly over the years to minimize the possibility of flooding. Results from this

investigation identified one location on the school property (near the baseball field and at a depth of below 2 feet from the surface) that was contaminated by hydrocarbons above applicable environmental standards. The source of the contamination was reported to be the fill brought onto the field. Once identified, the contamination was excavated and removed from the property. Because of the depth of the contamination, exposure to any athletes or students was unlikely.

IX. Discussion

This report is descriptive in nature and therefore has certain inherent limitations. The results of a descriptive investigation cannot be used to establish a causal link between a particular risk factor (either environmental or non-environmental) and a disease outcome (Adami and Trichopoulus 2002). Neither can this type of epidemiological investigation conclusively determine what may have caused cancer in any one individual. However, the results can be useful in identifying areas where further public health investigations or interventions may be warranted. Despite the limitations of descriptive studies, these types of investigations can help to identify patterns of risk factors that may exist, such as behaviors or opportunities for environmental exposures, in a geographic context.

X. Conclusions and Recommendations

Based upon the review of breast cancer incidence in Woburn between 1998 and 2007, information provided to MDPH on women who graduated from Woburn High School between 1980 and 1991 who later developed breast cancer, and information on environmental conditions at the former Woburn High School, the following conclusions have been drawn:

- No existing environmentally-related information that was available for review suggests that attendance at Woburn High School put young women at increased risk of breast cancer.

- A crude analysis of available data suggests that the number of Woburn High School graduates diagnosed with breast cancer under the age of 45 is not unusual, based upon the American Cancer Society's estimate that 1 in 8 invasive breast cancers are found in women under the age of 45.

- The rates of breast cancer in the census tract where the Woburn High School is located were approximately as expected during both time periods evaluated for women of all ages as well as women under the age of 50 at diagnosis.

- No unusual geographic patterns of breast cancer in Woburn were seen. The geographic distribution of address at diagnosis for women diagnosed with breast cancer between 1998 and 2007 closely followed the population patterns in the City and did not show any unusual clustering.

- Although the incidence of breast cancer was somewhat higher than expected in Woburn females, particularly in women under 50 during the latter half of the ten-year period, it most likely represents natural random variation in the number of observed diagnoses. Factors that may partially contribute to the increased incidence include more and earlier breast cancer screening of Woburn women than statewide and more Woburn women having children above age 30 than statewide. Women having children later in life are at slightly higher risk of developing breast cancer.

- Upon request, MDPH/BEH's staff physician is available to review the medical records of women who graduated from Woburn High School in the period of interest and have breast cancer. Although it is not possible to identify specific causes of breast cancer through a medical record review, it may be informative by identifying common risk factors among these women (if sufficient numbers of women request a medical record review).

XI. References

Adami HO. Trichopoulus D. 2002. Concepts in cancer epidemiology and etiology. In: Adami HO. Hunter D. Trichopoulos D. editors. Textbook of cancer epidemiology. New York: Oxford University Press.

American Cancer Society (ACS). 2010. Detailed Guide: Breast Cancer. Atlanta: American Cancer Society, Inc. http://www.cancer.org

ACS. 2008. Cancer Facts & Figures 2008. Atlanta: American Cancer Society, Inc.

ACS. 2001. Clinical Oncology. Atlanta, Georgia.

Berg JW. 1996. Morphologic classification of human cancer. In: Cancer Epidemiology and Prevention. Schottenfeld D and Fraumeni JF Jr. (eds). New York: Oxford University Press, 1996: 28-44.

Environmental Systems Research Institute (ESRI). 2009. ArcGIS, Arcview license ver. 9.3.1, Redlands, California.

Geotechnical Services, Inc. 2004. Limited Subsurface Investigation Report, Woburn High School. Prepared for Tappe Associates, Inc. Project 203417.

Massachusetts Cancer Registry. 2010. Cancer Incidence and Mortality in Massachusetts 2003-2007: Statewide Report. Massachusetts Department of Public Health, Bureau of Health information Statistics, Research and Evaluation, Boston, MA. June 2010.

MCR. 2003. Massachusetts Cancer Registry Abstracting and Coding Manual for Hospitals. Fifth edition. Massachusetts Department of Public Health, Bureau of Health Information Statistics, Research and Evaluation, Boston, MA. December 2003.

National Cancer Institute (NCI). 2012. "Multiple Primary and Histology Coding Rules - SEER." http://seer.cancer.gov/tools/mphrules/.

Rothman, K.J., and J.D. Boice. 1982. Epidemiologic Analysis with a Programmable Calculator. Boston: Epidemiology Resources, Inc.

U.S. DOC. 2000. 2000 Census Populations: General Population Characteristics, Massachusetts. U.S. Department of Commerce, Washington, D.C.

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Figure 1
Census Tracts in Woburn, MA

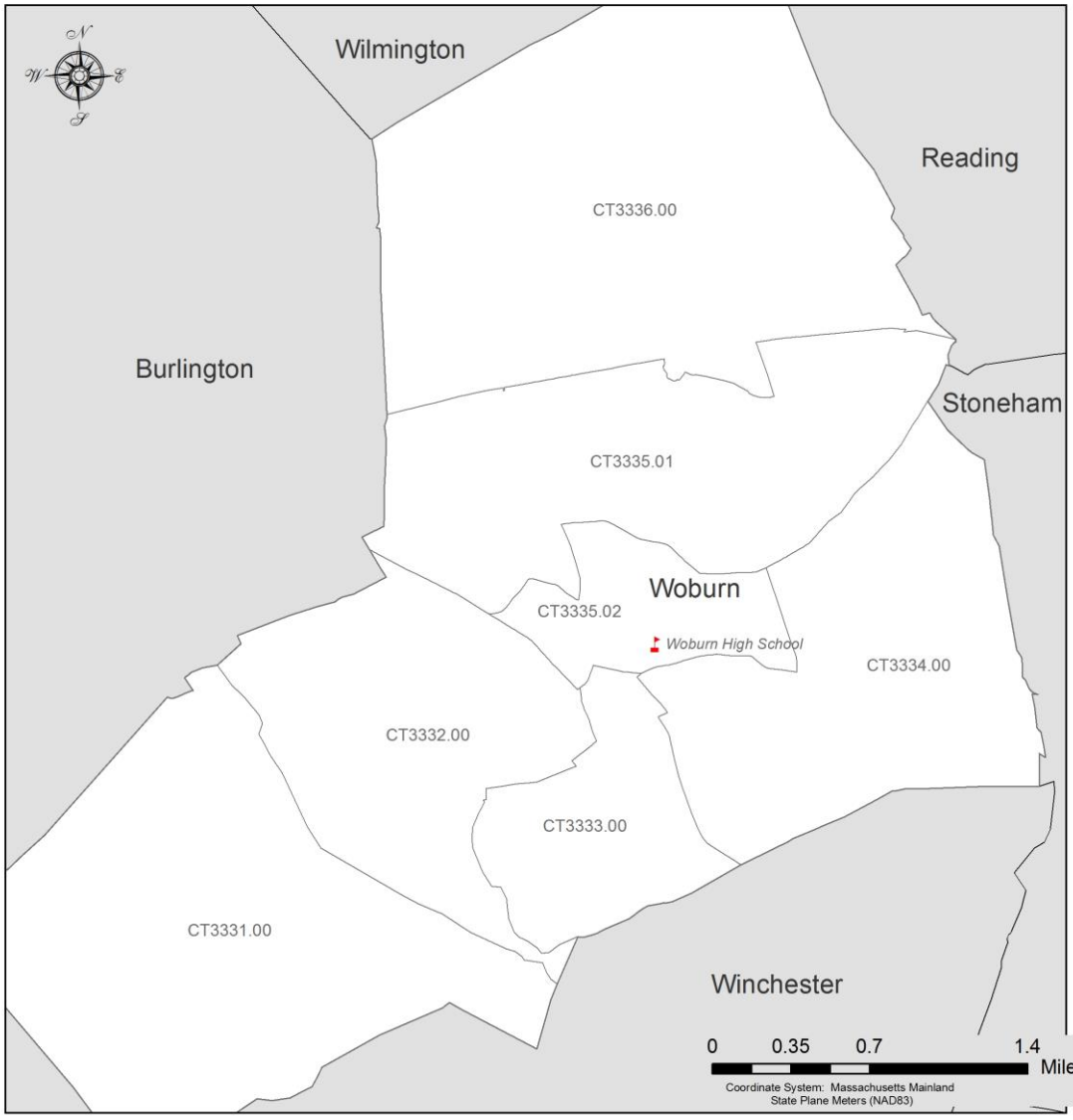

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Table 1
Breast Cancer Incidence
Females, All Ages
Woburn, Massachusetts
1998-2002

Census Tract	Females			
	Obs	Exp	SIR	95% CI
3331.00	36	38.6	93	65 -- 129
3332.00	23	24.1	95	60 -- 143
3333.00	15	15.2	99	55 -- 163
3334.00	27	23.5	115	76 -- 167
3335.01	28	22.0	127	84 -- 184
3335.02	11	15.0	73	36 -- 131
3336.00	26	23.3	112	73 -- 163
City Total[1]	170	161.7	105	90 -- 122

[1] Cases for which census tract designation was not possible are included in the town total.

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Table 2
Breast Cancer Incidence
Females under 50 at Diagnosis
Woburn, Massachusetts
1998-2002

Census Tract	Females			
	Obs	Exp	SIR	95% CI
3331.00	11	6.5	171	85 -- 305
3332.00	2	4.5	NC	NC -- NC
3333.00	4	3.7	NC	NC -- NC
3334.00	10	5.7	176	84 -- 323
3335.01	7	5.3	132	53 -- 273
3335.02	3	2.7	NC	NC -- NC
3336.00	3	5.7	NC	NC -- NC
City Total[1]	42	34.1	123	89 -- 167

[1] Cases for which census tract designation was not possible are included in the town total.

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Table 3
Breast Cancer Incidence
Females, All Ages
Woburn, Massachusetts
2003-2007

Census Tract	Females			
	Obs	Exp	SIR	95% CI
3331.00	41	35.8	115	82 -- 155
3332.00	27	22.5	120	79 -- 175
3333.00	16	14.3	112	64 -- 182
3334.00	28	24.4	115	76 -- 166
3335.01	26	21.2	123	80 -- 180
3335.02	13	14.1	92	49 -- 157
3336.00	22	23.3	94	59 -- 143
City Total[1]	178	155.6	114	98 -- 133

[1] Cases for which census tract designation was not possible are included in the town total.

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
Exp = Expected number of diagnoses
SIR = Standardized Incidence Ratio
95% CI = 95% Confidence Interval
NC = Not calculated
* = Statistical significance

Table 4
Breast Cancer Incidence
Females under 50 at Diagnosis
Woburn, Massachusetts
2003-2007

Census Tract	Females						
	Obs	Exp	SIR	95% CI			
3331.00	12	6.5	186	96	--	325	
3332.00	10	4.8	208	100	--	383	
3333.00	5	3.8	130	42	--	305	
3334.00	6	6.2	97	36	--	212	
3335.01	7	5.0	139	56	--	286	
3335.02	2	2.9	NC	NC	--	249	
3336.00	5	6.2	81	26	--	189	
City Total[1]	51	35.4	144	* 107	--	190	

[1] Cases for which census tract designation was not possible are included in the town total.

Note: SIRs are calculated based on the exact number of expected diagnoses.
Expected number of diagnoses presented are rounded to the nearest tenth.
SIRs and 95% CIs are not calculated when the observed number is < 5.

Obs = Observed number of diagnoses
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