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Original Paper

Time Trend of Female Breast Carcinoma *In Situ* by Race and Histology in Connecticut, U.S.A.

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A rapid increase of female breast cancer has been reported in many areas of the world and the reasons are not fully understood. While some have attributed the increase to the increasing detection of early stage breast cancer through mammography screening, few studies have directly examined the time trend of *in situ* breast cancer specifically. This study included all incident cases of female breast carcinoma *in situ* reported to the Connecticut Tumor Registry between 1973 and 1992. The age-adjusted incidence rates and age-specific incidence rates were calculated by histology and by race. The age-adjusted incidence rates were standardised to the 1970 United States standard million population. The study found that the overall age-adjusted incidence rate of *in situ* breast cancer has increased dramatically, from 3.53/100 000 in 1973–1975 to 17.51/100 000 in 1991–1992. The increase was not uniform during the past two decades of cancer registration. In fact, most of the observed rise has occurred since the early 1980s. This increase was found in both Caucasians and Blacks. The results by histology indicate that the dramatic increase in carcinoma *in situ* is mostly attributable to an increase in ductal carcinoma *in situ*. The increase was also observed in all age groups 40 years and over. These results are consistent with the use pattern and the reported effect of mammography screening. Therefore, these results are qualitatively consistent with the idea that mammography screening is largely responsible for the recent upsurge in female breast cancer incidence in this population. The study also found that the age group 40–49 years in whites experienced a rapid increase in incidence that began in the same time period as the older age groups, but it has since levelled off. The potential impact of the highly publicised debate regarding the efficacy of mammography in this age group in recent years is discussed.

Key words: breast carcinoma *in situ*, histology, incidence, time trend, Connecticut, U.S.A.

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INTRODUCTION

FEMALE BREAST cancer has been reported to be increasing and the reasons are not fully understood. While some have suggested that the greater detection of early stage breast cancer through mammography screening might be responsible for the observed increase, few studies have directly examined the time trend of *in situ* cancer specifically [1–3].

If mammography screening is indeed largely responsible for the observed increase in breast cancer, we would anticipate a rapid rise in *in situ* breast cancer since the early 1980s when an escalation in the use of the mammogram occurred [3–6]. We would also anticipate a much more rapid increase in ductal carcinoma *in situ* during the past decade since earlier studies have suggested that screening has a much larger impact on ductal carcinoma *in situ* [7, 8].

There has been much debate about the effectiveness of screening for those under age 50 years, especially on the use of mammography screening in women aged 40–49 years [4, 9, 10]. While the American Cancer Society has recommended screening of asymptomatic women beginning at 40 years of age and continuing at 1–2 years intervals until age 49 years, this recommendation has not been accepted by many other organisations. Some consider that existing data do not justify the screening of women in this age group

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as cited by Dodd [4]. If screening has an effect on detecting breast cancer in this age group as it does in older age groups, we would anticipate an increase in incidence of carcinoma *in situ* in the age group 40–49 years, parallel to that observed in older age groups beginning in the early 1980s. This conjecture can be examined by an analysis of the time trend for age-specific incidence rates of breast carcinoma *in situ* from population-based registry data. If the incidence rate in this age group has indeed increased along with an increase in mammography screening and if this increase is coupled with a significant decrease in the mortality rate, as observed in older age groups, then this would imply that routine mammography screening in the age group 40–49 years is consistent with a beneficial effect.

The Connecticut Tumor Registry (CTR) has been collecting data, including histological information, on all types of cancer since 1935. Since 1973, the CTR has been participating in the Surveillance, Epidemiology and End Results (SEER) programme sponsored by the National Cancer Institute of the United States, and data are currently available up to 1992. Therefore, this data source provides us with a unique opportunity to examine the time trend of breast carcinoma *in situ* in order to test the suggested mammography screening hypothesis. The data since 1973 is used for this purpose because the data for breast carcinoma *in situ* are more reliable since the CTR joined the SEER programme in 1973. In addition, a rapid increase in the use of mammography screening has been reported between the late 1970s and the late 1980s.

MATERIALS AND METHODS

CTR has been a major source of cancer incidence data for descriptive epidemiological studies within the United States. By 1955, hospitals reporting cases to the Registry represented more than 95% of all Connecticut hospital beds. As of 1965, reporting cases by hospitals in Connecticut was considered nearly complete. Since 1971, there has been a legal requirement for all cancer cases occurring in the state [11]. As stated previously, the CTR has been participating in the SEER programme sponsored by the National Cancer Institute of the United States since 1973. Based on the ICD-O first edition, breast cancer is coded ICD-O 174.0–174.9.

All cases of female breast carcinoma *in situ* reported to the CTR between 1973 and 1992 were included in this study. Carcinoma *in situ* was further subdivided into three major histological subtypes: ductal carcinoma *in situ* (DCIS; ICD-O 8500/2), lobular carcinoma *in situ* (LCIS; ICD-O 8520/2), and other specified or not otherwise specified carcinomas (NOS). Age-specific incidence rates were calculated, and these were age-adjusted using the direct method standardised to the 1970 United States standard million population.

RESULTS

A total of 3217 incident cases of female breast carcinoma *in situ* were reported to the CRT between 1973 and 1992. Of these, 3048 (95%) were diagnosed in Caucasians and 169 (5%) in Blacks. In addition, 2243 (70%) were diagnosed as ductal carcinoma *in situ*, 844 (26%) lobular carcinoma *in situ*, and 130 (4%) NOS carcinomas.

The overall crude and age-adjusted incidence rates reported to the CTR by year of diagnosis are presented in Table 1. The overall age-adjusted incidence rate of *in situ* breast cancer in females has been increasing in Connecticut, from 3.53/100 000 in 1973–1975 to 17.51/100 000 in 1991–1992. The increase, however, was not uniform during the past two decades of cancer registration; the increase was very slow before 1982–1984, and was followed by a much sharper rise in recent years.

The age-adjusted incidence rates for Caucasians and Blacks are presented in Figure 1. Before 1982–1984, the rates were low and showed only a slight increase in both Caucasians and Blacks. The rates increased rapidly thereafter, with the most dramatic rise seen between 1983 and 1987 among Caucasians and between 1984 and 1987 among the Blacks. The rates peaked in 1990 among Blacks and have since decreased, although small numbers do not preclude the possibility of a plateau. However, the rates among Caucasians are still increasing, reaching 19.3/100 000 in 1991–1992, but the rate of increase has slowed since 1988 compared to the rate of increase observed between 1983 and 1987.

The results by histological type and by race are presented in Figure 2. The dramatic increase of carcinoma *in situ* shown in Figure 1 was not observed in both histological subtypes. Rather, the overall increase is mostly attributable to an increase in DCIS, which was true for both Caucasians and Blacks. LCIS also showed an increase between 1983 and 1987 in Caucasian females, but the magnitude of the rise, relative to DCIS, is much smaller.

The age-specific incidence rates for Caucasians and Blacks are presented in Figure 3, showing an especially large increase among those 40 years of age and over. In Whites, the age group 40–49 years showed a rapid increase beginning with the same time period as the older age groups, but it has now levelled off. Among Blacks, the incidence rates are less stable due to small numbers, but for the age group 40–49 years, it has continued increasing since 1985. In fact, the age groups 40–49 and 70–79 years are

Table 1. Number of cases and age-adjusted incidence rate (per 100 000) for female breast carcinoma in situ *in Connecticut,* 1973–1992

Year Incidence rates	Number of cases Ductal	Lobular	NOS
1973–75 3.53	96	66	19
1976–78 3.11	97	60	7
1979–81 3.95	126	75	9
1982–84 5.70	176	105	33
1985–87 12.41	483	197	25
1988–90 15.90	698	218	21
1991–92 17.51	567	123	16

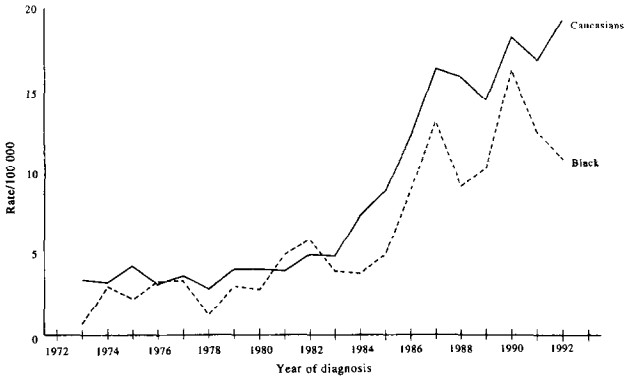

Figure 1. Age-adjusted incidence rates (per 100 000) of breast carcinoma *in situ* for Caucasian and Black females in Connecticut, 1973–1992.

the only two age groups which showed a continuing and substantial increase in rates among Blacks.

DISCUSSION

The results from this descriptive epidemiology study indicate that female breast carcinoma *in situ* has increased in both Caucasians and Blacks since 1973, with a marked increase beginning in 1983. The observed increase mainly came from ductal carcinoma *in situ* and from those aged 40 years and over, with the largest contribution coming from those between the ages of 50 and 79 years. The observed increase seems to have either slowed or levelled off in both Caucasians and Blacks in recent years. These results are consistent with the use pattern and the reported effect of mammography screening [5–8]. Over the past decade, the proportion of women who have ever had mammographic screening has increased as cited by Dodd [4] and by Taylor and associates [12]: in 1978, a survey by Liebermann Research, Inc., revealed that 13% of women aged 30–49 years and 17% older than 50 years had ever had a mammogram. In 1983, a Gallup Organisation survey indicated that those percentages had increased to 40% and 41%. By 1990, 64% of women aged 40 years and older reported ever having had the mammogram in the Mammography Attitudes and Usage Survey. In 1992, this figure increased to 74%. Therefore, these results are qualitatively consistent with the idea that mammography screening is largely responsible for the recent upsurge in female breast cancer incidence in this population.

Several small studies have reported the percentage of female breast cancer cases first detected by mammography screening. Of 200 female breast cancer cases studied by McWhorter and Eyre in Utah [13], 29.5% were first discovered by mammography screening, 55.5% were first found by the patient and 15% were found by the physician. A study from Switzerland [14] reported that, of 376 registered cases, 9% were discovered through mammography, 58% were detected by the patients themselves, and 22% by medical examination. In another study, Glass and Hoover [15] also reported that only 9% of 178 invasive breast cancer patients diagnosed in 1985 were first detected by mammography screening. A recent population-based survey study by one of the investigators (Dr Beth A. Jones, unpublished data) found that, in Connecticut, approximately 22% of breast cancer cases were first detected by mammography screening. While these studies suggest that methods other than mammography screening may also have contributed to the observed increase of female breast cancer, one cannot necessarily conclude that mammography screening has a relatively small impact on the observed time trend of female breast cancer when compared to medical examination or breast self-examination, since most of the studies included only invasive breast cancer cases. For invasive breast cancer, it is not surprising to see a higher percentage of cases first detected by medical examination, since disease symptoms usually lead patients to visit their physicians, and thus be diagnosed as later stage disease. However, if carcinoma *in situ* is also considered, the proportion of cases attributable to mammography screening would be much higher.

While the merits of mammography screening for women older than 50 years have become widely accepted, its value for women under the age of 50 years is controversial, particularly for the age group 40–49 years. The value of mammography screening in this age group can be assessed by (a) examining whether breast cancer mortality has been decreasing in this age group as it has in older age groups, (b) assessing the benefit/risk ratio from mammography screening and (c) examining the effect of mammography screening on detecting breast cancer.

Recent reports from the Health Insurance Plan (HIP) of Greater New York Study [16, 17] and the Swedish Two-County Trial [18] have provided persuasive evidence that

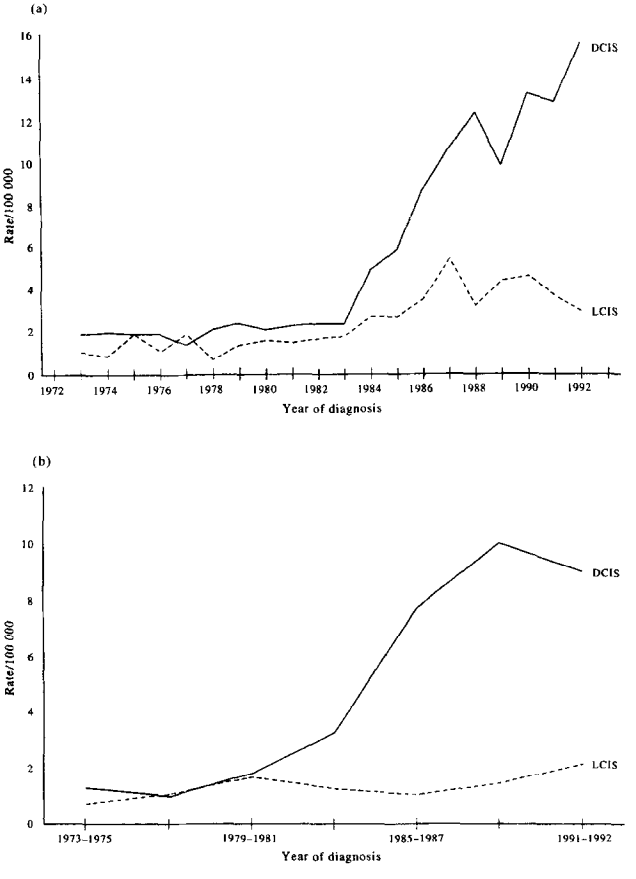

Figure 2. Age-adjusted incidence rates (per 100 000) of breast carcinoma *in situ* by histology (DCIS, ductal carcinoma *in situ*; LCIS, lobular carcinoma *in situ*) for (a) Caucasian and (b) Black females in Connecticut, 1973–1992.

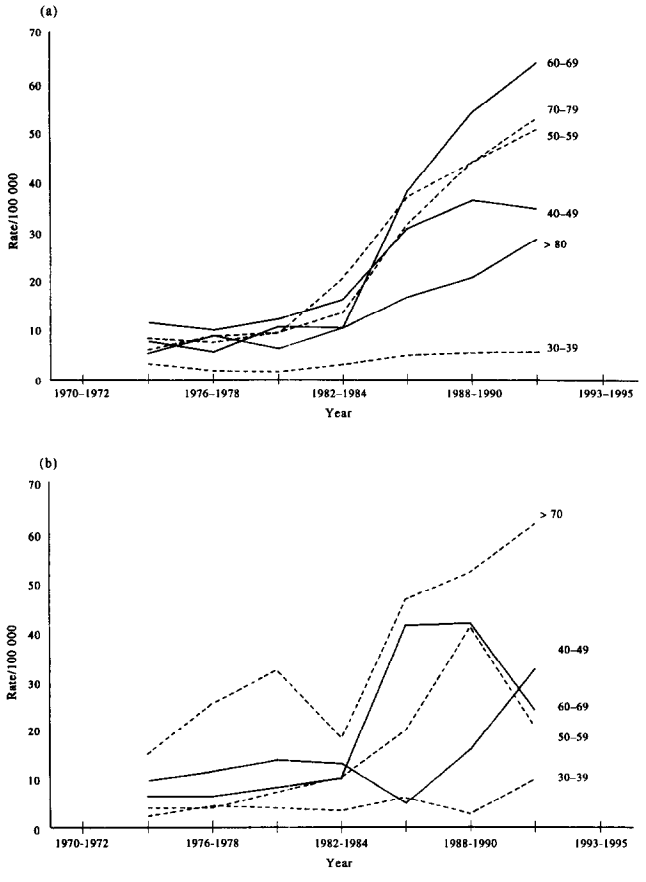

Figure 3. Age-specific incidence rate (per 100 000) of breast carcinoma *in situ* by histology for (a) Caucasian and (b) Black females in Connecticut, 1973–1992.

mammography screening has reduced the mortality rates of breast cancer among those aged 40–49 years. The Breast Cancer Detection Demonstration Project (BCDDP) [19] has also reported an excellent survival rate for those detected by mammography screening alone for the age group 40–49 years. A recent meta-analysis of 7 randomised trials by Smart and associates [20] has also reported a 24% mortality reduction for women aged 40–49 years. Recent studies also show that the benefits from any rational annual mammography screening programme substantially outweigh the risks [21, 22]. Our results clearly show that the age group 40–49 years experienced a rapid rise in incidence beginning at the same time that the rates increased in older age groups. These results, coupled with the reported decrease in breast cancer mortality in those of 40–49 years from previous breast screening studies, suggest that mammography screening could be having a major impact on detecting early cancers. Considering the potential benefits from early detection and the relatively low carcinogenic potential of modern screening mammography, possibly increasing a woman's lifetime risk of developing breast cancer from approximately 9.3% to between 9.315% and 9.4% [20], we feel that routine mammography screening in the age group 40–49 years is potentially beneficial, and the results from ongoing large studies should provide evidence to understand the magnitude of its effect better.

It should also be noted that, in Caucasians, we observed a decrease in rates among those aged 40–49 years for the last study period. This decrease coincided with the recent increasing debate regarding the benefit/risk ratio from mammography screening. It is unclear whether the decrease in incidence in this age group is because fewer women went for mammography screening in recent years due to the highly publicised debate regarding the efficacy of mammography in this age group. This would be a tragedy since the result would be that more breast cancers occurring in this age group will be diagnosed with late stage disease.

In conclusion, this study found a marked increase in female breast carcinoma *in situ* beginning in 1983. However, the increase, has slowed or levelled off in recent years. The observed increase mainly came from ductal carcinoma *in situ* and from those aged 40 years and over. These observations are consistent with the use pattern and the reported effect of mammography screening. Therefore, these results directly implicate mammography screening as being largely responsible for the recent sharp increase in female breast cancer in this population. This study also shows that the age group 40–49 years experienced a rapid increase in rate beginning at the same time the increase was observed in older age groups. In Caucasians, a decrease in rate was observed in this age group in recent years, but the reason for the decrease is unknown. It could reflect the fact that fewer women went for mammography screening in recent years due to the highly publicised debate regarding the efficacy of mammography in this age group.

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