

hypothesized as one explanation for the observed Black-White differences in breast cancer survival.^{6,8,16,18} The present data provide further evidence that receptor negative breast cancer in Black women may be a contributing factor to their survival disadvantage. Future studies of Black-White differences in breast cancer survival should account for tumor estrogen receptor status.

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Bowel Function and Breast Cancer in US Women

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Abstract: We studied bowel function in relation to 123 breast cancer cases among 7,702 women from the US NHANES I Epidemiologic Follow-up Study. Results suggest a slight increased risk of breast cancer for both decreased frequency of bowel movements (relative risk = 1.5, 95% confidence interval = 0.8, 2.7) and firm stool consistency (RR = 1.8, 95% CI = 1.0, 3.2.) These observations are consistent with an hypothesized association between constipation and increased risk of breast cancer. (*Am J Public Health* 1989; 79: 73-75.)

Introduction

There is indirect evidence that bowel function may be related to breast cancer risk. Petrakis and King found severe constipation (fewer than three bowel movements per week) to be associated with cytologic abnormalities in epithelial cells from breast fluid,¹ which are related to epithelial dysplasia in breast tissue.² Atypical proliferative breast disease is a significant risk factor for breast cancer in women;

we, and others, have shown the risk to increase with increasing degree of epithelial atypia.^{3,4}

Putative mutagens and carcinogens have also been detected in nipple aspirates of breast fluid.⁵ Although the precise origin and mechanism of carcinogen delivery to the breast tissue are unknown, involvement of fecal mutagens, bowel function, and the enterohepatic circulation has been hypothesized. Intestinal bacteria produce carcinogens and mutagens, presumably through their actions on dietary constituents and/or bile acids.⁶⁻⁸ Breast secretory (apocrine) epithelia selectively absorb and concentrate substances from the circulation originating from the gastrointestinal tract.^{1,6,9}

Constipation, which results in greater contact time of stool in the intestine and hard stool consistency, may increase formation and absorption of fecal mutagens into the enterohepatic circulation and delivery to breast tissue.^{10,11} We describe the first study relating aspects of bowel function directly to the risk of breast cancer in a cohort of women in the first National Health and Nutrition Examination Survey (NHANES I) Epidemiologic Follow-up Study.

Methods

NHANES I and its augmentation survey were conducted by the National Center for Health Statistics (NCHS) from 1971 to 1975.^{12,13} These surveys provided cross-sectional information on medical history, anthropometric, biochemical, clinical, demographic, and nutritional factors in a large sample selected to represent the non-institutionalized popu-

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TABLE 1—Adjusted Relative Risks (RR) for Breast Cancer in Relation to Bowel Function

Bowel Function	Cases (N)	Non-cases (N)	Age-adj. RR	95% CI	Multi-adj. ^a RR	95% CI
Bowel problems						
Diarrhea	3	330	0.5	0.2, 1.7	0.6	0.2, 1.9
No Trouble	89	5642	(1.0)	—	—	—
Constipation	31	1597	1.0	0.7, 1.5	1.1	0.7, 1.6
Stool Frequency						
>1 × Day	12	698	1.1	0.6, 2.0	1.1	0.6, 2.0
1 × Day	79	5257	(1.0)	—	—	—
4–6 × Week	15	801	1.3	0.7, 2.2	1.3	0.7, 2.3
≤4 × Week	16	841	1.4	0.8, 2.4	1.5	0.8, 2.7
Stool Consistency						
Loose	4	266	1.3	0.5, 3.5	1.3	0.5, 3.6
Normal	53	4977	(1.0)	—	—	—
Firm	18	840	1.7	1.0, 2.9	1.8	1.0, 3.2

^aadjusted for current age, age at menarche, age at first birth, age at menopause, body mass index, socioeconomic status and family history

lation of the US. Children ages 1 to 5 years, women ages 20–44 years, the elderly (aged 65 years and over), and low-income individuals were oversampled. Details of a follow-up study of 14,407 adults (25 years or older) conducted between May 1982 and August 1984 were provided by Huntley, *et al.*¹⁴ Of the original participants, 12,554 were successfully traced and reinterviewed (14 percent by proxy). Follow-up data included additional interview information, weight and blood pressure measurements, hospital and nursing home records, and death certificate information.

One hundred twenty-three (123) verified cases of breast cancer were identified in the NHANES I follow-up cohort. Women with self-reported breast cancer only (N = 36) were not considered as cases and conservatively included in the control group. There were 7,643 women in the cohort who did not develop breast cancer.

During the baseline interview, participants had been asked several questions about usual bowel habits: usual frequency (once per week or less, two to three times per week, four to six times per week, once per day, two to three times per day, or four or more times per day); characterization of frequent “bowel problems” (no trouble, frequent constipation or diarrhea, or both), and frequency of laxative use. Information regarding usual consistency of the stool (normal, loose, firm, or mixed) was asked only at follow-up.

Adjusted relative risks of breast cancer were calculated for bowel problems, bowel frequency, stool consistency, and laxative use using proportional hazards models from the SAS statistical procedure¹⁵ PHLM. Risk factors for breast cancer included in the multivariate models were current age as a continuous variable, age at menarche (<12, 12–13, ≥14), age at birth of the first child (<21, ≥22, nulliparous),* age at menopause, (≤45, >45, premenopausal), body mass index (<30.0, ≥30.0), socioeconomic status as poverty index ratio (<3.75, ≥3.75), and family history (one or more first-degree relatives with breast cancer; negative or positive). Reference categories for each of these variables are the first ones listed in each case. Missing data indicators were included in the Cox regression models in order to retain cases with data missing for specific variables only. Weight/stature^{1,5} was employed as the body mass index in this study due to its high

*Young age at first birth is highly correlated with increased parity, and the association of high parity with low risk of breast cancer has been explained by its association with young age at birth of the first child.¹⁶

correlation with weight and independence from stature across age groups in this population sample.¹⁷ Body mass index was chosen as a reliable index of body size that is of proven interest as a risk factor for breast cancer, and has strong significance for the complex inter-relationships between nutrition, body size, and breast cancer.^{10,18}

Results

Laxative use was not a significant risk factor for breast cancer in the cohort (RR = 1.03, 95% CI = 0.91, 1.12) and it was not included in the final models. Table 1 reports relative risks of breast cancer for bowel problems, stool frequency, and stool consistency, adjusted for age and multiple risk factors. While a history of frequent diarrhea appeared to be associated with lower risk (RR = 0.5), the confidence interval was wide, based upon this number of cases. Self-reported constipation was not a predictor of adjusted breast cancer risk. However, the relative risk of breast cancer appeared to increase with decreased frequency of bowel movements. Firm consistency of stool was also associated with increased risk of breast cancer (RR = 1.8, 95% CI = 1.0, 3.2). Including multiple breast cancer risk factors (in addition to age) into the models somewhat increased the strength of the associations between breast cancer risk and both decreased stool frequency, and firm stool consistency. Excluding the 36 cases of non-verified breast cancer from the analysis, rather than including them in the control group, did not alter these results.

Discussion

Taken together these results suggest a slightly increased risk of breast cancer in women with less frequent and firm stools. Although these differences were not all “statistically significant” at $p < 0.05$, relative risks were at or above 1.5 with lower limits of the confidence intervals close to or including 1.0. These observations are consistent with a model of bowel function, breast and apocrine gland function, and breast cancer described by Petrakis, *et al.*^{1,9} and recently critically reviewed.^{10,11} However, our analyses were based upon self-reported bowel habits which could not be defined in totally objective terms. The self-reporting of “bowel problems” was not quantified in terms of stool frequency and consistency and is probably the least reliable measure,

perhaps accounting for the absence of risk associated with self-reported constipation.

Self-reporting of other bowel habits may also contribute to subjective misclassification of participants which would operate against the observation of any true relations between bowel function and breast cancer that may exist. Other limitations of these data include the fact that self-reporting of stool consistency was obtained at follow-up, rather than at baseline, and that other breast cancer risk factors not included in the model could have been confounders.

Further investigations into the relations between breast and apocrine gland function, bowel function and pre-neoplastic and neoplastic breast conditions are necessary to confirm the observed associations, and to elucidate the etiologic components of this model of breast carcinogenesis. Such investigations should focus on collection of dietary information and biologic samples (blood, breast fluid, stool), together with information on established breast cancer risk factors, in a defined population of women.

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X-Ray Examinations during Pregnancy: National Natality Surveys, 1963 and 1980

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Abstract: Based on 1963 and 1980 National Natality Surveys, the rate of medical x-ray examinations during pregnancy per 100 mothers fell 34.2 percent. A decrease in chest x-ray examinations accounted for almost all of the decline in total x-ray examinations. The reductions were greater for older mothers and those who were not White. While the number of births fell from 4,071,000 in 1963 to 3,612,000 in 1980, the number of pelvimetry examinations actually increased by 45,000. (*Am J Public Health* 1989; 79:75-77.)

Introduction

The sensitivity of the fetus to ionizing radiation has been well documented.¹⁻⁴ The per rad increased risk of childhood leukemia has been estimated to be between 1.3 and 2.8 times the national incidence.¹⁻² This increase is substantially larger than the increase expected from an equivalent dose administered to an adult population.³

Given the increased awareness during the 1960s and 1970s of the danger of fetal exposure to ionizing radiation, many observers predicted a decline in fetal dose from medical diagnostic procedures that utilize ionizing radiation.⁵ Ultrasound became increasingly available during the 1970s, and was widely believed to have reduced fetal dose.⁶ The precise health effects of fetal exposure to ultrasound are unknown, but some animal studies have suggested that the fetus may be adversely affected.⁷

We utilized data from the 1963 and 1980 National Natality Surveys (NNS) to obtain information about exposure to ionizing radiation among mothers who had live births.⁸

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