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Changes in Risk Factors for Breast Cancer in Migrant Women

An Intergenerational Comparison Among Bangladeshis in the United Kingdom

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Migrant Studies: Uses, Advantages, and Limitations

Since the pioneer work by Boas a century ago (1912), migrant studies have been used as natural experimental models to assess the impact of diverse environments (biological and social) on human plasticity (Lasker 1995, 1969; Lasker and Mascie-Taylor 1988) (see the Box below). Such studies have compared migrants to sedentees (nonmigrants) with the aim of understanding how phenotypic, developmental, demographic, and behavioral patterns change after migration, as well as identifying factors in the new environment responsible for those changes.

Migration studies have aided research on the effects of urbanization, modernization, and westernization, in particular in the context of the nutritional and epidemiological transitions (Dufour and Piperata 2004; Ostby et al. 1989; Salmond, Prior, and Wessen 1989). Such studies have been invaluable in shedding light on the effects of biosocial/biocultural practices on disease risk as well as in describing intergenerational trends in health outcomes, such as type 2 diabetes mellitus (Gerber 1984; Misra and Vikram 2004; Serrano-Rios, Goday, and Martínez-Larrad 1999), obesity (Ramirez and Mueller 1980), hypertension (Agyemang, Bhopal, and Bruijn-

zeels 2004; James et al. 1985), cancer (Liao et al. 2003; Modan 1980; Nelson 2006; Shimizu et al. 1991; Smith et al. 2003; Ziegler et al. 1993), cardiovascular disorders (McKeigue et al. 1988), and asthma (Rottem, Szyper-Kravitz, and Shoenfeld 2005).

One of the main strengths of migrant study designs is that they enable the discrimination between genetic and developmental components of the phenotypic adaptations to a new environment. They provide an alternative to longitudinal studies to assess developmental effects, and in practical terms, conducted as cross-sectional designs, they can prove considerably less expensive and time-intensive, easier to implement, and potentially more cost effective than their long-term counterparts.

However, migrant designs are not without limitations. One major problem lies in determining which, from a complex array of environmental variables that differ between the localities of origin and destination, is responsible for effects found in the biological comparison of migrants and sedentees. Another limitation refers to the need to assess and control for variation due to selective migration, where migrants can differ from sedentees in a number of biological traits owing to the fact that migrants are not necessarily a random sample of the population represented by the

Characteristics of Migrant Studies

Migrant studies

- are natural experiments that allow us to investigate the impact of changes in environmental conditions on the phenotype;
- aid in identifying how much of the phenotypic variation in a population is related to developmental (plastic) adaptability and how much is due to genetic adaptation;
- are used to investigate how different biological and social environments affect phenotypic, developmental, demographic, and behavioral patterns; and
- provide a cost-effective alternative to longitudinal studies, especially in the case of long-lived human populations where the collection of data over sequential generations would be expensive and logistically and methodologically very complicated.

sedentees. Careful experimental design can help ameliorate such limitations (Lasker 1954).

In this chapter, quantitative and qualitative data collected during a migrant study are used to explore social and behavioral transformations associated with migration and their potential impact on health. Specifically, findings are used to illustrate how epidemiological risk factors for breast cancer are changing across generations in this population. Following earlier studies (Eaton et al. 1994; Ellison 1999; Greaves 2000; Strassman 1999), this analysis will focus on examining some reproductive and nonreproductive (energetic and dietary) variables that have previously been identified as established risk factors for breast cancer through their association with increased acute, chronic, and cumulative exposure to endogenous ovarian steroids (Bernstein 2002; Henderson et al. 1996; Kelsey, Gammon, and John 1993) (Table 5.1).

This analysis is not intended to be a basis for advancing epidemiological predictions regarding risk factors profiles for Bangladeshis in the United Kingdom, since the sample was small and did not represent the population at large. Nor is it intended as an exhaustive review of the factors that affect breast cancer epidemiology. Rather, the aim is to use the detailed information on individual reproductive and lifestyle histories that were collected for women of different generations to determine possible trends in risk factors in this migrant community. The advantages of our study design are that individuals can be unambiguously identified either as first- or second-genera-

Table 5.1. Endocrine-Related Risk Factors for Breast Cancer

1. Acute levels of circulating reproductive ovarian steroids during each menstrual cycle.*
2. Reproductive variables that impact the lifetime cumulative exposure of breast tissue to reproductive steroids:
   a) Age at menarche*
   b) Age at menopause*
   c) Age at first full-term pregnancy
   d) Parity
   e) Lactational practices
3. Nonreproductive variables that affect the levels of circulating ovarian steroids and/or menstrual regularity:
   f) Obesity and weight gain
   g) Diet
   h) Levels of physical activity

* Risk factors not analysed in this study.

tion, and the effect of age at migration and length of residency in the UK can be accounted for. This is in contrast to larger epidemiological surveys where migrant status is often confounded with ethnicity (Falk et al. 2002; Hirani and Primatesta 2001).

Breast Cancer Risk among South Asian Migrants in the United Kingdom

In the clinical literature, it is commonly perceived that women of South Asian origin (Indians, Pakistanis, and Bangladeshis) are at low risk for breast cancer. This perception is supported by available cancer mortality and incidence data. For example, standardized mortality rates for South Asians in the UK are approximately half those of the general population (Acheson 1998; Balarajan and Raleigh 1993; Barker and Barker 1990; Bhopal 2002; Wild and McKeigue 1997). Estimated age-standardized rates are also considerably lower than those of the native English population (46 per 100,000 vs. 73 per 100,000, respectively) (Winter et al. 1999). Interestingly, South Asians show lower incidence and higher survival rates from breast cancer than women in the general population. These differences are unrelated to differences in age at diagnosis, socioeconomic deprivation, or disease stage at presentation (Farooq and Coleman 2005; Silva et al. 2003).

Current evidence, however, indicates that trends are changing for the worse in migrant groups. Consistent with patterns observed in other migrant populations (Shimizu et al. 1991; Ziegler et al. 1993), breast cancer incidence in South Asian groups in the UK is moving in the direction of the host population and away from the low rates prevalent in the Indian subcontinent. For instance, age-standardized breast cancer rates for English South Asians (1990–92) are almost double those reported in the 1983–87 Bombay registry (Smith et al. 2003; Winter et al. 1999). Furthermore, breast cancer rates among South Asians have increased over the last ten years while having decreased among the rest of the population. In Leicester, a city with a large South Asian presence, the incidence ratios between 1990–99, adjusted for age and deprivation tertile, were 1.37 in South Asian versus 0.81 in non-Asian women (Smith et al. 2003). There is also evidence of an increased risk in young age groups including women born in the UK, and those who migrated to the UK during their childhood (Smith et al. 2003). A recent survey of England and Wales found that women of South Asian origin aged 20 to 29 years had higher breast cancer incidence rates than their non–South Asian counterparts (10.1 compared to 6.7 per 100,000) (Winter et al. 1999).

Although there are well-established communities of South Asian origin in other parts of the world (mainly in the USA, Canada, and Australia), epidemiological data on breast cancer trends for these migrant groups is scarce. The limited information available, however, is in agreement with the patterns observed for their counterparts in the UK—namely, higher incidence rates compared to those in the Indian subcontinent (Kamath et al. 1999), and lower incidence rates than in the white host population but increasing steadily over time (Jain, Mills, and Parikh-Patel 2005; Parikh-Patel, Mills, and Jain 2006). Studies on breast cancer risk factors among these

South Asian communities are lacking (Kamath et al. 1999), hence the focus of this chapter on the South Asian community in the UK.

Reproductive ecologists have argued that dramatic increases in cancer incidence observed among migrant populations, such as South Asians in the UK and other populations in transition (Shimizu et al. 1991; Thomas and Karagas 1987; Trichopolous et al. 1984; Ziegler et al. 1993), parallel the positive secular trends in growth and age at maturation characteristic of economic development and industrial modernization (Henderson and Bernstein 1991). They suggest that the numerous nutritional, health, and lifestyle changes that follow these economic transformations have shifted developmental patterns toward enhanced gonadal steroid production and increased lifetime exposure to these steroids, both of which are associated with higher risk for reproductive cancers (Ellison 1999). Along with the changes in developmental variables brought by improved living standards and general health of populations in transition, there are also important changes in behaviour in response to, and as a consequence of such socioeconomic changes. Such behavioral adjustments potentially influence cancer risk by affecting lifetime exposure to ovarian steroids. For example, a late age at first reproduction, low parity, and low incidence and duration of lactation in affluent groups of developed countries are associated with a higher lifetime risk for breast cancer (Henderson and Bernstein 1991; Kelsey, Gammon, and John 1993).

Population-based demographic and health surveys in the UK show that South Asians have reproductive and nutritional patterns recognized as protective factors against breast cancer—namely, high parity, early first birth (ONS 2002; OPCS 1993), a high prevalence of breast-feeding (Thomas 1997), and fiber-rich traditional diets (Kassam-Khamis, Judd, and Thomas 2000; Kassam-Khamis et al. 1999; Silva et al. 2002, 2004). In most cases, however, these findings reflect characteristics observed in South Asians as a *group.* The extent to which these patterns can be regarded as universal for all subgroups within the "South Asian" category and among different generations of such groups needs to be explored further.

The inclusion of different sub-ethnic groups under one heading has been partly the result of the characteristics and limitations of the datasets. Specifically, these relate to the criteria used for identifying and classifying individuals with respect to their ethnic background and migrant status. For instance, until the introduction of the ethnicity question in the 1991 UK census (Sillitoe and White 1992), all individuals of Indian, Bangladeshi, or Pakistani origin were indistinctly classified under the category of "South Asian" based on either their country of birth (Gill et al. 2005) or, when such information was not available, their family name (Nanchahal et al. 2001). Similarly, country of origin was the only indicator of an individual's migrant status, which, by definition, failed to identify all UK-born second- and subsequent generation groups of South Asian ancestry and thereby biased data sets toward overseas-born individuals (Gill et al. 2005).

The origin and reasons behind the use of such classification criteria are beyond the scope of this chapter. However, it is crucial to recognize that, in some data sets in

the UK, a number of subgroups of rather different cultural, genetic, environmental, and socioeconomic backgrounds and migration status lie grouped under the common term "South Asian." A similar problem occurs in the USA, where the term "Southeast Asian" is used to designate subgroups of Indian, Bangladeshi, and Pakistani origin. This hidden variation needs to be acknowledged when estimating disease risk and epidemiological trends from these sources, as the relative significance of specific risk factors for a number of health conditions, including breast cancer, are likely to vary within and between ethnic categories (Bhopal 2002; Bhopal et al. 1999).

The recent adoption by census and health agencies of a new standard for ethnic group categories that is set on cultural characteristics, as well as the inclusion of a range of variables such as language, religion, and length of residency (Aspinall 2000; Gerrish 2000), has overcome some of the earlier shortcomings and is generating detailed data sets that, it is hoped, will instill an increased analytical rigor in ethnic-specific epidemiological and health policy–related analyses.

Currently, the number of studies aimed at addressing differences in risk factors and disease incidence among precisely defined ethnic groups is still scant (Bhopal 2002; Bhopal et al. 1999; Hayes et al. 2002; Kassam-Khamis, Judd, and Thomas 2000; McKeigue 1992; Silva et al. 2002), but some epidemiological data on breast cancer are already available (McCormack et al. 2004). In a population-based case-control study of first-generation South Asian migrants, McCormack and collaborators (2004) gathered information on country of origin, religious and linguistic background, and breast cancer risk factors for Indian, Bangladeshi, and Pakistani women. Researchers found significant variation in breast cancer risk between South Asian ethnic subgroups, which was not fully explained by reproductive differences but was partly accounted for by diet and body size. Findings of significant variation in dietary habits and nutritional intake among South Asian subgroups in the UK complement and indirectly support these findings (Kassam-Khamis, Judd, and Thomas 2000; Sevak et al. 2004; Wharton, Eaton, and Wharton 1984). Specific dietary regimes such as long-term vegetarianism often associated with religious beliefs and characteristic of specific subgroups, may be associated with a reduction in breast cancer risk (Silva et al. 2002, 2004).

It is clear from these studies, that "South Asians" should not be considered as a homogeneous group with respect to breast cancer risk. Furthermore, this variation is largely related to "lifestyle factors" such as diet and reproductive patterns that characterize and set apart each ethnic subgroup. Acknowledging the existence of a strong cultural component to disease risk is of crucial importance for both understanding disease etiology in a given subpopulation and for designing culturally sensitive public health policy measures.

Some cultural aspects such as average age at first birth, breast-feeding patterns, and dietary intake are possible to include in large-scale prospective epidemiological studies. However, the interactions between risk factors, social variables affecting risk factors, and changes of risk over time are best appreciated in small-scale, detailed,

ethnographic research. It is here that biological anthropologists employing a biocultural approach can make a unique, practical, and valuable contribution to studying risk factor determinants of particular diseases. In this chapter, a case study conducted among Bangladeshi migrant women in London is presented as an example of this type of research.

The Bangladeshi Migrant Study

The original aim of our research was to determine how different environmental conditions experienced during childhood and adolescent development affect levels of adult reproductive function (Núñez-de la Mora et al. 2007). To this end, a cross-sectional migrant study was initiated to compare hormonal profiles of healthy women of reproductive age and similar genetic background who, by moving from a country of poor living standards such as Bangladesh to one of significantly higher standards such as the UK, had been exposed to contrasting environmental conditions during different phases of their life cycle.

The migrant study groups were first-generation Bangladeshi women who migrated to the UK as adults (n=62), first-generation Bangladeshi women who moved to the UK as children (n=51), and second-generation women of Bangladeshi descent born in the UK (n=34). A group of nonmigrant Bangladeshi women (n=52) and one of white British women living in the same London neighborhoods as the Bangladeshi women (n=50) were used as references in the hormonal comparisons. Except for the occasional short visit to Bangladesh, all first- and second-generation women had lived uninterruptedly in the UK since migration or since birth, respectively (Table 5.2).

Detailed quantitative information on sociodemographic variables, reproductive and migration histories, lifestyle, health, and diet was collected through closed-ended

Table 5.2. Groups in the Bangladeshi Migrant Study

Group	Description
Adult migrants	First-generation Bangladeshi women who migrated to the UK as adults (post-menarche)
Children migrants	First-generation Bangladeshi women who migrated to the UK as children (pre-menarche)
Second-generation migrants	Women born in the UK of Bangladeshi parents
Sedentee women	Nonmigrant Bangladeshi women resident in Sylhet, Bangladesh
White women	White British women born and living in the same London neighborhoods as their Bangladeshi counterparts

questionnaires administered on a one-to-one basis. These data were used to make intergroup comparisons of the social, cultural, and biological changes sequential to the migration experience and to substantiate the interpretation of the hormonal results.

Bangladeshi migrant women were contacted through local schools, community centers, mosques, and sport centers in the boroughs of Tower Hamlets and Camden in London, where the majority of the Bangladeshi population is concentrated (ONS 2002). As part of the recruitment process in London, a series of workshops on reproductive health were offered at community centers in these neighborhoods. This provided a space to meet and talk to women of different ages, who had been in the UK different lengths of time, and to women at various levels of exposure to the host culture. Interviews were conducted at home, since many women felt more confident and comfortable in their residences. This allowed for a closer, more intimate and personal relationship with each of the participants. Invitations to share meals and tea and to stay at family reunions or even attend weddings were common. In the midst of family life, there were plenty of opportunities to talk about issues that concern women, both young and old, in Bangladesh and London. This gave great insight into the intergenerational differences in perceptions about many aspects of life, such as those involving religion, ethnic and cultural identity, marriage, the roles of women, and aspirations regarding family and professional life. All this information over the course of three years was steadily weaved into our knowledge from first-hand experience of the community and members' interactions with their host culture and with relations back in Bangladesh. This proved to be the richest source of information on how lifestyles are changing and how socioeconomic variables affect everyday life of women and their community—information that would not have been evident from the quantitative data alone. Such insights form the basis of many of the arguments in the discussion of the quantitative findings obtained through the questionnaires.

Sociodemographic Characteristics of Bangladeshis in the United Kingdom

The Bangladeshi communities in the UK typically exhibit large family sizes with a very high proportion of young people, low socioeconomic status, high dependence on local authority housing, low levels of education, and a high proportion of unskilled employment (Eade, Vamplew, and Peach 1996). However, our quantitative results revealed differences in socioeconomic indicators between overseas and UK-born migrant groups that reflect their different degrees of acculturation and social integration. Specifically, among the British-born groups there are signs of a shift toward nuclear, smaller and less crowded households, longer house tenure, and social and economic mobility. In relation to issues concerning women, there is evidence for higher educational attainment and employment, and along with this wider participation in economic activities, larger financial responsibilities in the family. Similarly, there is evidence of changes in marital patterns and social interactions away from traditional norms. It would appear that among the new generations, the roles and

situation of women in the Bangladeshi communities are changing in a more radical way than those of their male counterparts. Specifically, young women in this community have acquired new responsibilities outside the home in addition to those expected from them as traditional family carers (Núñez-de la Mora 2005). Some of the consequences of these changes for issues related to lifestyle, family dynamics, and reproductive decision making in the context of women's health risk factors are discussed below.

Breast Cancer Risk Factors Studied among Young Bangladeshi Women in London

Reproductive Risk Factors

1. Age at first birth. There is a linear increase in breast cancer risk with increasing age at first birth that is independent of other known factors (Kelsey, Gammon, and John 1993). It is thought that the protective effect of early age at first full pregnancy is mediated in two ways: 1) by driving final differentiation of the breast tissue and reducing the risk of further mutations; and 2) by permanently increasing the levels of sex hormone binding globulin (SHBG), thus reducing the amount of circulating free estrogens readily available to receptors in the breast tissue (Bernstein 2002).

A Kaplan-Meier survival function analysis found significant differences in *estimated* age at first birth between migrant groups, with significantly older ages (average 4.8 years) at first birth for UK-born generations. Similarly, the period elapsed between menarche and first reproduction was significantly different between groups, with longer waiting times (average 4.5 years) for UK-born women. Additionally, data from the sociodemographic questionnaire revealed that marriage is being delayed among younger generations compared to older first-generation women, presumably as a result of more women entering formal employment and having longer educational careers.

Although no data are available on contraceptive use, these findings suggest that intergenerational differences in reproduction decision making may affect breast cancer risk. With a decreasing age at menarche (data not shown) and a delay in the start of the reproductive career among younger generations of British-Bangladeshis, the lapse of uninterrupted menstrual cycles (in the absence of oral contraceptive use) could potentially put this group at comparatively higher risk.

2. Parity. Pregnancy has a dual effect on breast cancer, involving a short-term increase in risk followed by a long-term protective effect (Bruzzi et al. 1988). Pregnancy is associated with high levels of estrogens, progesterone, and prolactin. These high hormone levels induce breast cell differentiation as well as cell proliferation, and this could explain the biphasic effect of pregnancy on breast cancer: pregnancy may be protective by reducing the pool of susceptible stem cells through differentiation, or conversely, it may promote breast cancer by inducing proliferation of cells that have

already suffered malignant transformation (Bernstein 2002). Nevertheless, there is ample evidence for a protective effect of high parity on breast cancer risk independent of age at first birth (Albrektsen et al. 1994; Kelsey, Gammon, and John 1993; Yuan et al. 1988).

All women in this study were of reproductive age (18–39 years old), but many had not begun childbearing. Small sample sizes and unfinished reproductive spans prevent too many generalizations, but available data suggest that the reproductive patterns among all three migrant groups in this study are, regardless of the effect of time since migration or age at migration, in line with high fertility rates previously reported in population-based surveys of Bangladeshis in the UK (Summerfield and Babb 2003). For example, at the time of data collection, the proportion of women with three or more children was approximately 50 percent in all three migrant groups (57 percent, 46 percent, and 50 percent for adult migrants, child migrants, and second-generation women, respectively) compared to only 17 percent for white women.

Our data on socioeconomic variables indicate that although young British-Bangladeshi generations are in many respects moving away from the traditional customs of older generations, high fertility rates appear to remain. Future work, with second-generation women who have completed their reproductive life spans, will ascertain whether there are any significant differences in total fertility rates compared to the previous generation. This would determine whether younger Bangladeshi generations will continue to benefit from the protective effect of high fertility characteristic of their older counterparts.

3. Lactation. There is convincing evidence that lactation reduces breast cancer risk among women by suppressing ovarian function and reducing the lifetime cumulative exposure to ovarian hormones through periods of lactational amenorrhoea (Enger et al. 1997; Newcomb et al. 1994; Yuan et al. 1988).

Our results show that breast-feeding incidence, calculated as the proportion of study participant's offspring who were ever breast-fed, is highest for the Bangladesh-born offspring of adult migrants (100 percent). (Note that some participant women already had children at the time of migration.) No significant differences in incidence were found between babies born in the UK to either group of first-generation migrants (range 76–83 percent). Adult migrant women who gave birth in both countries were less likely to breast-feed their England-born than Bangladesh-born babies (76 percent vs. 100 percent, respectively). For all migrant groups, neither number of years of education nor mother's age among primiparous women affected breast-feeding incidence.

Duration of breast-feeding was measured as the length of time (in months) for which breast-feeding continued. There were no significant differences in breast-feeding duration among UK-born offspring of women of all three migrant groups (range 7.8–4.8). However, adult migrants who gave birth in Bangladesh breast-fed their

offspring on average twice as long as Bangladeshi women who gave birth in the UK. For example, within-subject comparisons show that Bangladesh-born children were breast-fed on average ten months longer than their UK-born siblings.

Although average differences in breast-feeding duration between migrant groups living in the UK were not significant, data on breast-feeding prevalence at different ages reveals contrasting patterns between groups. Breast-feeding prevalence was taken as the proportion of all babies who were wholly or partially breast-fed at specific ages. In our sample, the proportion of women who breast-fed for over fifteen months among first-generation migrants in London was 23 percent and 22 percent for adult and child migrants, respectively, and decreased to only 6 percent among second-generation women (contrast with 41 percent for sedentee women in Bangladesh and 8 percent for the white women group) (Núñez-de la Mora et al. 2005).

These results, although limited owing to small sample sizes, argue for an important modification in breast-feeding patterns among Bangladeshi migrants in the UK. The variables implicated in such changes are likely to be many and varied in nature and probably relate to changes in family structure and lifestyle that have resulted from adapting to a different socioeconomic system and culture. As mentioned earlier, such changes have been particularly radical for females. Many first-, and most second-generation women have acquired extra family roles in addition to traditional ones. Time and energy have to be allocated between activities outside the home and domestic ones. With an increasing number of women in employment, many of them providing a large proportion of the family income, constraints typically associated with a decreasing incidence and shorter duration of breast-feeding have emerged for the Bangladeshi community (Núñez-de la Mora 2005). The disappearance of the extended family also has meant that housework and childcare are no longer shared with other female members but, instead, become the responsibility of a single woman. Given the fact that most British-Bangladeshi families are at the lower end of the economic spectrum, paid childcare or extended unpaid maternity leaves that might contribute to an increase in breast-feeding duration in this community are not realistic options.

Another factor associated with the economic disadvantage prevalent in most Bangladeshi households is overcrowding. The lack of privacy associated with high household densities was often mentioned by women as an important deterrent to breast-feeding. Exposure to the host culture through everyday life and the media may also contribute to a modification of feeding choices, since there is a striking difference in breast-feeding behaviour of adult migrant women depending on the country where they gave birth. The same women breast-feeding in different environments show radically different patterns more consistent with the prevailing ones in the country of the offspring's birth.

Overall, these findings suggest that changes related to the experience of migration have had an impact on breast-feeding behavior, most notably in the second-generation group. The most apparent change is not in the overall incidence but rather in the reduction in average duration and prevalence of breast-feeding among British-

born Bangladeshi women. In terms of breast cancer risk, the protective effect of long durations of breast-feeding and the suppression of ovarian function are likely to be undermined among young generations of women.

Nonreproductive Risk Factors

1. Obesity and weight gain. Two aspects of the body mass index—obesity and weight gain as an adult—are associated with a higher breast cancer risk among postmenopausal women (Hunter and Willet 1996). The increased risk in heavy postmenopausal women can be attributed to higher levels of circulating estrogen in these women, since the main source of endogenous estrogen after menopause is the conversion of the androgen precursor androstenedione to estrone in adipose tissue. Obesity is also related to reduced levels of SHBG (steroid-hormone binding globulin) and, therefore, to a higher tissue availability of free estrogens (Bernstein 2002). The International Agency for Research on Cancer estimates that 25 percent of breast cancer cases worldwide are due to overweight/obesity and a sedentary lifestyle. The preponderance of epidemiologic studies indicates that women who are overweight or obese have a 50–250 percent greater risk for postmenopausal breast cancer (McTiernan 2003).

We found a high prevalence of overweight condition ($25 \leq BMI < 30$) and obesity ($BMI \geq 30$) among the Bangladeshi migrants who participated in our study. For instance, overweight rates were 36, 20, and 31 percent for adult migrants, child migrants, and second-generation women, respectively. Overall rates for obesity were 24, 27 and 23 percent for child migrants, adult migrants, and second-generation women, respectively. These figures are similar to those reported for South Asian women in the UK, but considerably higher than those reported for females of the general UK population in equivalent age groups (likely as a result of small sample size) (Erens, Primatesta, and Prior 2001).

Obesity was found to be fairly prevalent among both the younger and the oldest age categories in the migrant groups. In the age group closest to menopause (36+), over two-thirds of migrant women had $BMI > 25$. Among migrant groups, there was a strong effect of parity on BMI; in all groups the highest proportion of parous women was at least one BMI category higher than their non-parous counterparts. However, we found a relatively high proportion of child migrants (25 percent) and second-generation women (45 percent) who were already overweight before childbearing. This may be taken as evidence of detrimental changes in lifestyle occurring among Bangladeshis growing up in the UK. A more Western lifestyle may be partly responsible for these changes where modification of dietary patterns and a more sedentary lifestyle result. It is also plausible that the high prevalence of obesity in this group is an illustration of the "thrifty phenotype" phenomenon (see Godfrey and Hanson, Chapter 7) common among groups in economic transition, whether migrant or not (Adair and Prentice 2004; Yudkin 1996). The high prevalence of diabetes and cardiovascular diseases reported for Bangladeshis living in the UK (Erens, Primatesta, and Prior 2001; McKeigue et al. 1988) may support this hypothesis.

If the weight trends for premenopausal women reported here were to continue into later ages, a large proportion of first- and second-generation Bangladeshi women may likely enter menopause with a high BMI. This could translate into potentially higher risk for postmenopausal breast cancer for women in all three migrant groups.

2. Diet. Epidemiological studies have produced rather inconsistent and inconclusive results concerning the role of dietary intake and the risk of breast cancer (Hunter and Willet 1996; Silva et al. 2004; Tavani et al. 2006; Willett 2001). However, data from the literature on dietary quality and steroid metabolism point to a suppressive effect of low-fat/high-fiber diets on steroid hormone levels (Dorgan et al. 2003; Goldin et al. 1994; Rose, Lubin, and Connolly 1997), thus contributing to a reduced breast cancer risk. Additionally, it has been suggested that breast cancer risk may be affected not so much through a high dietary fat intake *per se* but rather through the effects on body weight and composition. Thus, healthy dietary habits over the life course can be considered as protective by leading to a stable and desirable body weight.

The traditional Bangladeshi diet consists of rice as a staple and pulses. In Sylhet, the region in Bangladesh from which the majority of women in this study originate, many varieties of fish, and to a lesser extent, lamb are also important dietary components. The consumption of cooked vegetables is relatively high, while consumption of raw leafy vegetables and fruits is rare. Dairy products are not prominent in the diet except for yogurt and sweetmeats on special occasions. Overall, the traditional Bangladeshi diet could be regarded as relatively healthy on the basis of its high fiber, non-starch polysaccharides (NSP), and omega fatty acid content (Kassam-Khamis, Judd, and Thomas 2000; Silva et al. 2002; Zannath and Edholm 2004).

Despite the challenges of adjusting to a radically new lifestyle after migration, results from the diet questionnaire in our study demonstrate that food habits among first-generation Bangladeshi migrants in London are similar to those prevalent in Bangladesh. However, the second generation already shows signs of a more westernized diet as well as different eating habits (Núñez-de la Mora et al. 2004).

The data suggest that, with more women attending higher education and joining the workforce, family routines and time budgets are changing. This reflects changes in the structure and character of family meals. The need for convenient, time-saving alternatives to the time-consuming traditional multicourse meals is reflected in the higher consumption of canned and frozen foods. There is evidence of Western foods that are calorically dense and nutritionally poor in quality being steadily introduced into the diet, often under the influence of young, more acculturated children who are attracted to fast foods and ready meals. Similarly, there is a trend across generations (especially among younger women) to eat outside the home. Student and employees reported eating lunch regularly at fast-food places that serve *halal* dishes. Moreover, among many child migrants and second-generation women there is an increased consumption of soft drinks instead of water during mealtimes. A higher consumption of processed foods, sweets, and chocolates in these groups also contributes to a higher

intake of carbohydrates and salt. These dietary trends may partly account for the increased prevalence of obesity among young migrants discussed previously.

In regard to the traditional diet, a lower intake of pulses, fresh fruits, and vegetables was found among children and second-generation migrants, as was a significant reduction in fish intake, particularly among the latter. Instead, second-generation women are eating red meat (lamb) much more frequently than their first-generation counterparts. This may be as a result of their improved economic situation. Despite these unfavorable changes, there are some in a healthier direction. For example, younger generations of child migrants and second-generation women are eating more brown and whole-grain bread, preparing less fried food, and drinking less full-fat milk than adult migrant groups.

In summary, our results show that the traditional Bangladeshi diet, which is high in complex carbohydrates and unsaturated fatty acids from pulses, vegetables, and fish, is shifting toward one rich in energy-dense foods among younger generations. These changes in quality not only undermine the protective characteristics of the diet itself but could also directly contribute to an increased risk of breast cancer through their damaging effects on body weight.

3. Levels of physical activity. There is evidence for a reduced risk of breast cancer associated with lifetime physical activity in pre- and postmenopausal women (Friedenreich and Rohan 1995; McTiernan 2000; McTiernan et al. 1998). For instance, it has been estimated that women who engage in three to four hours per week of moderate to vigorous levels of exercise have a 30–40 percent lower risk for breast cancer than sedentary women (McTiernan 2003).

Physical activity is considered a factor for breast cancer because of its potential effect on: 1) delaying age at menarche (Bernstein 2002; Kelsey, Gammon, and John 1993); 2) ovarian function, by suppressing ovulation and reducing circulating steroid levels (Ellison and Lager 1986; Jasienska and Ellison 1998; Jasienska, Thune, and Ellison 2000); and 3) lowering BMI and preventing weight gain (McTiernan 2003).

For most Bangladeshi women, household work and walking represent the only type of physical activity undertaken. Analogous to recent data (Erens, Primatesta, and Prior 2001), walking as a physical activity is decreasing in the young generations of our study group. For example, while 87 percent of adult migrants reported walking daily for more than twenty minutes, only 59 percent of second-generation women did so. This reduction in walking appears to be accompanied by an increase in driving among second-generation women. In terms of household work, Bangladeshi women tend to assume all responsibility for chores. Unless second-generation households are able to afford household help, levels of this activity among different generations are unlikely to change.

Given the poor tradition of physical exercise and sports activities among Muslim women, it is unlikely that Bangladeshi migrants would be able to take advantage of the protective effects of a lifetime of intense exercise. However, based on observations

and informal conversations during recruitment, it appears that younger women will be more likely to get involved in sport and exercise activities as they become more exposed to Western perceptions of fitness and body image. In London neighborhoods with a high Bangladeshi population, there are community and sport centers that cater to Muslim women and offer female-only swimming and exercise classes. These discrete changes may, in the long-term, increase physical activity levels among British-Bangladeshi women and contribute to lowering high BMIs, which in turn may translate in reduced cancer risk.

Conclusion

The Bangladeshi migrant community in the UK is experiencing social, cultural, and biological transformations that are relevant for public health. The intergenerational changes in the reproductive and lifestyle factors related to breast cancer risk described here, point to *increased* risk for malignancy in younger migrant generations. Our work, although focusing on a small sample, indicates that the Bangladeshis in the UK should no longer be seen as a low-risk group for breast cancer.

Some developmental risk factors—younger age at menarche, older age at menopause, increased height, and enhanced ovarian function—are also associated with improved health and positive energetic conditions experienced by migrants growing and maturing in the UK (Núñez-de la Mora et al. 2007). For women born in such affluent conditions such "built-in" factors carry a detrimental risk for breast cancer (Okasha et al. 2003) and are unlikely to be reversed in the migrant population.

These facts underline the need for public health programs aimed at promoting awareness of reducing breast cancer risk by focusing on those risk factors that are modifiable. Theoretically, all behavioral risk factors should be modifiable; however, in practice, those related to reproductive patterns are linked to and constrained by complex socioeconomic and cultural processes that are generally beyond the control of the individual. Some of the reproductive patterns that would confer a protective effect for breast cancer risk (e.g., high parity and early age at first birth) are at odds with demographic control measures and population trends as well as with young migrant generations' experience of life in the UK. In fact, as recorded in this study, these reproductive variables tend to move in precisely the opposite direction as women gain access to educational and job opportunities. Thus, diet and physical activity are the most likely candidates for influencing breast cancer risk (McTiernan 2003). These behaviors are affected by a complex array of external factors, but, in contrast with reproductive behaviors, they are already of high priority in the public health agenda. However, as the findings of this and previous research demonstrate, the effort to influence diet and physical activity requires diligent development of programs and policies that are culturally and linguistically appropriate for the target community. This ensures not only the efficacy but also the sustainability of these interventions.

This case study demonstrates how, through a holistic approach, bio-anthropology can contribute detailed and specific information and insight into the particularities of a given community. Such analytic exercises offer an opportunity to identify the differences in risk behaviors among ethnic groups derived from their specific cultural and socioeconomic characteristics. Moreover, through studies of this kind, which contrast various generations within the same migrant group, it is possible to document changes in risk factor patterns and analyze how these relate to processes of acculturation. A better understanding of this heterogeneity will prevent inaccurate group generalizations regarding perceived lower levels of breast cancer risk among South Asian women and will help public health disease-prevention initiatives to aim at clearer targets.

Our results invite us to reflect on how an environment that may be considered "adverse" in terms of the availability, quality, and/or adequacy of resources, such as that in Bangladesh, may in fact be conducive to behavioral and biological characteristics that are protective against a particular condition, in this case, breast cancer. Conversely, an environment that, under the same criteria, would be commonly regarded as favorable, such as that in the UK, may promote biological and lifestyle changes that can increase risk for breast cancer. The idea that an affluent environment can prove damaging for some aspects of health is somehow counterintuitive. However, it constitutes one of the underlying arguments of the explanation for the increased prevalence of chronic and degenerative conditions observed in the westernized world and in populations in transition. The field of "diseases of affluence" will thus require adjustments to the way we think about health risks and demand a more precise understanding of the relationship between changing environments and the corresponding health outcomes.

Appendix
Breast Cancer Risk Among South Asians: Heterogeneity, Trends, and Prevention

- Women of South Asian origin (Indians, Pakistanis, and Bangladeshis) living in Western countries (e.g., UK, USA, Canada) are currently at lower risk for breast cancer than the general host population. However, breast cancer incidence in South Asian groups in these countries is moving in the direction of the host populations and away from the low rates prevalent in their countries of origin in the Indian subcontinent.
- The heterogeneity of South Asian populations has rarely been acknowledged in the context of breast cancer risk, but available evidence suggests significant variation in risk for this malignancy among these ethnic subgroups (Indians, Pakistanis, and Bangladeshis).
- This study documents how some elements of the nutritional and reproductive patterns typically recognized as characteristic of South Asian populations, and

as protective factors against cancer (such as early age at first birth, prolonged breast-feeding, and high parity), are in fact changing across generations as a result of social, cultural, and biological transformations.
- Among Bangladeshi migrant women in London, trends in age at first birth, lactational and dietary practices, and prevalence of obesity, point on the whole to increased risk in younger migrant generations.
- Although, theoretically, most breast cancer risk factors are malleable, in practice, efforts must concentrate in diet and physical activity as the most realistic candidates for influencing breast cancer risk.

More comparative studies are needed to further assess differences in prevalence of breast cancer risk factors among distinct ethnic groups and across generations. Small-scale, biocultural research offers a valuable opportunity for this.

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