Family-based Breast Cancer Prevention Efforts in Adolescence

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Family history is 1 of the strongest predictors of most cancers.[1] Yet primary cancer prevention efforts are often not targeted toward individuals at greatest risk. This contrasts with a growing practice of targeting secondary prevention efforts and screening guidelines to those at greatest risk. The lack of targeted primary prevention behavioral interventions likely reflects the reality that all individuals are susceptible to cancer regardless of their family history and that most, if not all, individuals can substantially benefit from reducing cancer risk factors (eg, smoking, lack of physical activity, unhealthy diets, excessive weight gain) for optimal health and to lower chronic disease burden generally. We suspect, however, that another reason why cancer prevention efforts are not targeted toward those at highest risk is because of the lack of awareness that those at highest risk can benefit from cancer prevention interventions that target modifiable factors, and that their risk is not solely from genes. Using the example of breast cancer, we highlight the limited but growing evidence that even in women at highest risk, modifiable factors still contribute to cancer risk. We then discuss the benefits of considering family-based approaches to complement existing population approaches to cancer prevention.

Growing evidence suggests that many of the modifiable risk factors that increase breast cancer also do so in those with a family history of breast cancer. For example, even in women at the highest risk of breast cancer due to mutations in *BRCA1* and *BRCA2* carriers, age of onset has been shown to be delayed for girls engaged in adolescent physical activity compared with more inactive girls,[2] and breast cancer risk has been associated with risk in carriers who smoked compared with those who do not.[3] Even within families that have strong family histories, sisters with breast cancer differ from their unaffected sisters in a number of biomarkers that are associated with environmental changes throughout life including markers of DNA repair phenotype, DNA methylation levels, and oxidative stress markers (as reviewed in Terry et al[1]). The American Cancer Society (ACS) suggests that all women engage in weekly physical activity of 150 minutes of moderate physical activity, drink fewer than 7 alcoholic beverages per week, and maintain a BMI of <25. When we examined whether adherence to these ACS guidelines was also relevant to high risk women in a family-based cohort, we observed that adherence to ACS guidelines was associated with a 40% lower

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mortality rate.[4] Even in the absence of stronger effects from modifiable factors in individuals at higher risk, similar relative risks means that those at higher absolute risk will have a greater absolute effect from successful cancer prevention efforts. Thus, reducing risk by 30% to 50%, the range of many of the behavioral risk factors and breast cancer, translates into a much larger absolute risk reduction in individuals with a family history.

If those at higher risk of breast cancer can also benefit from cancer prevention messages, particularly regarding alcohol consumption, maintaining a healthy BMI, and exercise, the question remains about the best way to deliver these cancer prevention messages to those at higher absolute risk of breast cancer based on their family history? Cardiovascular and other chronic diseases have used family-based interventions in adulthood to prevent disease in family members who are at heightened risk.[5] Targeting family members for chronic disease prevention may be a useful strategy as family members may be more motivated, capitalizing on the "teachable moment," and also at higher risk from either shared environment, shared genes, or both. This approach could also work for breast and other cancer prevention if women are given the information about recommendations for physical activity, healthy weight, and reduced alcohol consumption for their family members at the time of their diagnosis. Although family interventions have been used in selected cancers like colon, evidence for breast cancer is more limited. For example, a mother–adult daughter intervention on weight loss supported improvements in behavioral interventions targeting those at higher risk but also demonstrated some of the challenges of the mother–adult daughter dyad for behavioral interventions.[6] We suggest that a major difference that needs to be considered between cardiovascular family-based interventions and cancer interventions is the induction time of the disease. With diseases of shorter induction times, interventions later in life can be more effective at reducing risk. In person, family-based interventions for cardiovascular diseases also can be implemented for the spouse and other relatives living nearby as all individuals are at risk, whereas in-person family-based interventions for diseases that are more prevalent in 1 sex need to rely on having relatives living nearby.

We suggest instead that breast cancer family-based interventions consider the role of the mother–daughter dyad during adolescence when the family members are living together and when many behavioral risk factors are patterned.[7] There are several reasons for considering expanding breast cancer prevention efforts within families and across the female life span to childhood and adolescence. There is increasing evidence to suggest that childhood is a key period of carcinogenic vulnerability and that childhood exposures are associated with breast cancer risk and as a result cancer prevention efforts must start decades earlier.[8] Additionally, although genetic testing for predisposition to breast cancer is not recommended during childhood, many parents discuss genetic and familial risk with their children. Research has revealed that most adolescent girls growing up in breast cancer families are aware of their risk for breast cancer in adulthood and there are things that they can do at their age to prevent cancer.[9] Thus, as many health and risk behaviors begin (eg, tobacco and alcohol intake, sexual activity, oral contraceptive use) or become established (eg, diet, exercise) in adolescence early communication about risk for adult cancer has the opportunity to provide a teachable moment.[10] Health and risk behaviors in preadolescence relate to the adoption and maintenance of health and risk behaviors throughout life.[10] Thus, prevention efforts to enhance health behaviors at this critical time when they are being established has the potential to increase the likelihood that preventive health and risk behaviors will be sustained throughout the life span.

At the same time, we need to better understand the impact of adolescents being aware of their risk for adult cancer as chronic psychosocial stressors impact psychological and physical health, and increased risk for breast cancer might constitute a chronic stressor for parents and offspring. Equally important, data suggest that the chronic stress of growing up in a family at risk for breast cancer could negatively impact immunologic host-responses, which might prevent cancer, and psychosocial distress can be associated with greater risk behaviors (eg, tobacco, alcohol use).[10] Family or dyadic interventions may also be particularly effective given that the mother's adjustment to breast cancer and/or breast cancer risk and family general function and communication are associated with daughter adjustment and distress.[10] Thus, we believe that the potential is great to increase cancer prevention efforts by starting earlier in life and that family-based studies to complement other community prevention efforts will be critical to developing and testing effective cancer prevention efforts for all individuals including those at highest risk.

ABBREVIATION

ACS: American Cancer Society

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