

Could Circadian Disruption be Playing a Role in the Worldwide Increase in Breast Cancer?

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The global impact of breast cancer is large and growing. It seems clear that something about modern life is the culprit, yet there is so far a lack of satisfactory explanations for most of the increases in risk as societies industrialize. Support has developed for a possible role of 'circadian disruption', particularly from an altered lighted environment due to increasing use of electricity to light the night. Lighting during the night of sufficient intensity can disrupt circadian rhythms, including reduction of circulating melatonin levels. Reduced melatonin may increase breast cancer risk through several different mechanisms including possible increased estrogen production and/or altered estrogen receptor function, in addition to an experimentally demonstrated direct oncogenic effect of melatonin. The genes that drive the circadian rhythm are emerging as central players in gene regulation throughout the organism, particularly for cell cycle regulatory genes and the genes of apoptosis. Aspects of modern life that can disrupt circadian rhythms during the key developmental periods (e.g., in utero and during adolescence) may be particularly harmful. Accumulating evidence has generally supported the theory. Women who have an occupation requiring work in the evening or at night are at higher risk; blind women have been reported to be at reduced risk; and a new study from Finland has found that women who sleep longer than average (9 or more hours per night) have lower risk of breast cancer. If artificial lighting does affect breast cancer risk, then there are specific changes in the technologies and application of lighting in the modern world that could effectively mitigate these adverse effects.

Take-home points

1. Breast cancer incidence is increasing worldwide, and mortality is increasing in areas with historically lower risk. The reasons for these increases are a mystery.
2. A major change in the human environment over the last 100 years is to increasing levels of 'light-at-night' from the introduction and increasing use of electric lighting as societies industrialize.
3. Light has a profound effect of the circadian rhythm of certain hormones (e.g., melatonin), and on the functioning of the clock genes in the suprachiasmatic nuclei. Such changes have been shown to have a large impact of mammary cancer in experimental models, including the growth of human-derived breast cancer in the nude rat.