# Cancer risk in opposite-sex and same-sex twins

Twin pregnancies are characterized by simultaneous development of two fetuses that share the womb. An interest in opposite-sex (OS) twins, twin pairs consisting of one male and one female, comes from animal studies that showed that exposure to sex hormones is influenced by the position of the fetus in the womb. Studies in rodents have shown that female fetuses developing between males are masculinized in several anatomical, physiological and behavioral traits. Moreover, irrespective of sex, a fetus located between two male fetuses has higher blood concentrations of testosterone than a fetus located between two females. It has been suggested that a similar phenomenon occurs in human twins, and that especially OS females are exposed to higher levels of testosterone in the womb than same-sex (SS) twins and non-twin females. Similarly, SS males may be exposed to higher levels of testosterone than OS and non-twin males. There is growing evidence that the environment in the womb has an influence on cancer risk later in life, and it is suggested that increased exposure to testosterone might increase cancer risk.

This study included Danish and Swedish twins born since 1870 who were followed for cancer from 1943 to 2009, and it was based on Danish and Swedish twin and cancer registries. The purpose was to compare OS and SS twins with regard to sex-specific cancers and all cancer combined. Also, we investigated whether cancer risk in OS and SS twins, respectively, differed from the risk in the general population. If such differences exist, they would support the hypothesis that hormones are transferred between human twin fetuses and/or the hypothesis that certain cancers originate within the uterus.

A total of 18,001 cancers were found in 16,779 twins. Our study showed that there are no differences in the rate of occurrence of cancer between OS and SS twins, neither for the sex-specific cancers nor for cancer at all sites (Fig. 1).

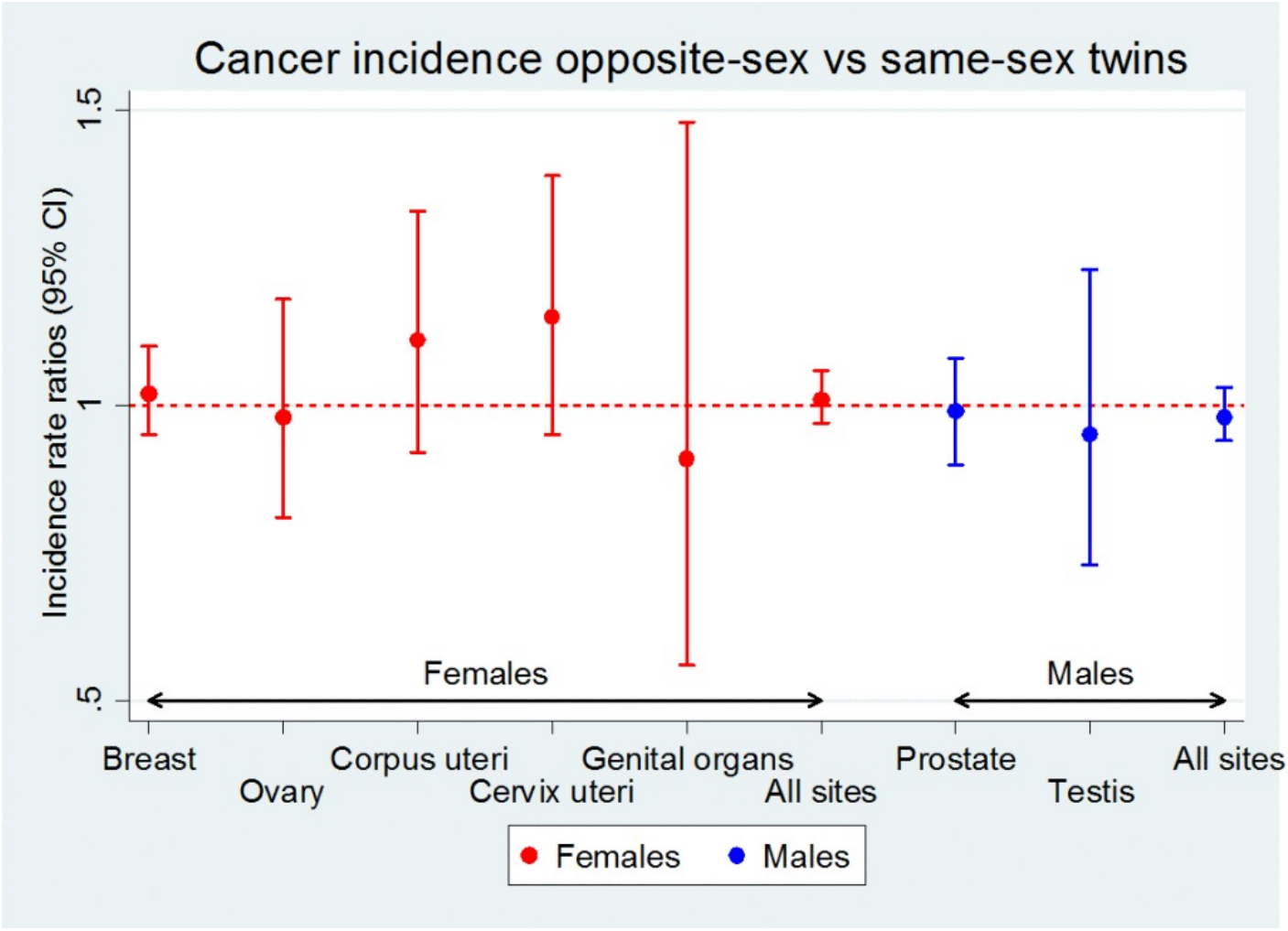


Fig. 1. Cancer risk for sex-specific and all-cause cancers in opposite-sex and same-sex twins born in Denmark and Sweden during 1870 to 2004 and followed from 1943 to 2009.

No differences were found for the sex-specific cancers between OS twins and the general population, neither for females nor for males (Fig. 2). For SS males, the risk of prostate cancer was significantly increased (in other words, not due to chance). For the female sex-specific cancers, the only significant difference was a 14% lower risk of corpus uteri cancer in SS female twins compared with the general population. Cancer of all causes was reduced by 2-5% for OS and SS twins compared with the general population. The risk was decreased by 5% for OS males and by 3% for SS males and females. The 2% lower cancer risk for OS females was not statistically significant (Fig. 2).

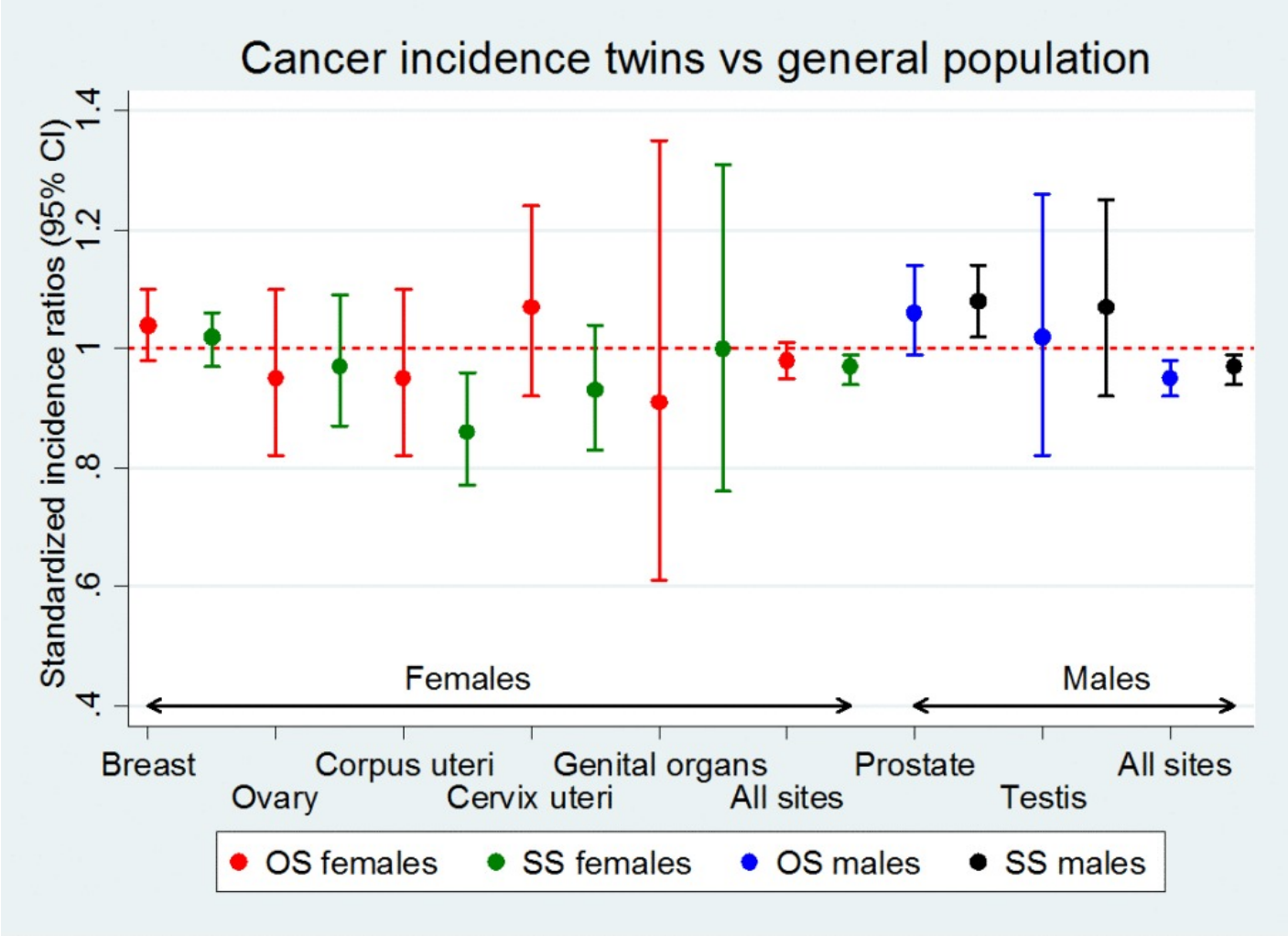


Fig. 2. Cancer risk for sex-specific and all-cause cancers in opposite-sex/same-sex twins and the general population born in Denmark and Sweden during 1870 to 2004 and followed from 1943 to 2009.

Our data suggest that having a male co-twin - which may entail higher exposure to testosterone within the uterus – does not increase the risk of sex-specific or all-cause cancers. Hence, our findings do not provide supporting evidence for the hypothesis of hormone transfer between human twins, nor for the hypothesis that cancers originate within the uterus. Furthermore, the study supports the assumption that being a twin is not a risk factor of cancer.

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## Publication

Risk of Sex-Specific Cancers in Opposite-Sex and Same-Sex Twins in Denmark and Sweden.
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