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ENDGAMES

STATISTICAL QUESTION

What are odds?

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Researchers investigated the association between genitourinary infections that occur from the month before conception to the end of the first trimester and gastroschisis. A case-control study design was used. The mothers of 505 offspring with gastroschisis were identified as cases and mothers of 4924 healthy liveborn infants as controls. Women self reported urinary tract infections and sexually transmitted infections.[1]

A genitourinary infection was reported by 81 cases compared with 425 controls. The odds of genitourinary infection was 81/424 for cases and 425/4499 for controls (table⇓). A significant association was reported between self reported genitourinary infections just before conception until early pregnancy and gastroschisis (adjusted odds ratio 1.5, 95% confidence interval 1.1 to 1.9). The odds ratio was adjusted for maternal age, body mass index before conception, smoking, and Hispanic ethnicity.

Which of the following statements, if any, are true?

a) The odds of genitourinary infection is the probability that women had a genitourinary infection

b) For the cases, the odds of genitourinary infection indicates that 81 women had a genitourinary infection and 424 did not

c) The odds of genitourinary infection estimates the population at risk

Answers

Statement *b* is true, whereas *a* and *c* are false.

The odds of genitourinary infection is not the probability that women had a genitourinary infection (*a* is false). Odds are an alternative way of expressing probability. The odds of genitourinary infection was derived as the probability of having genitourinary infection divided by the probability of not having genitourinary infection. For the 505 cases, 81 women had a genitourinary infection and 424 did not. Therefore, for cases the odds of genitourinary infection was (81/505)÷(424/505)=(81/505)×(505/424)=81/424. Hence, for the cases, the odds of genitourinary infection was the number of women who reported a genitourinary infection divided by the number of women who did not—that is, the ratio of women with a genitourinary infection to those without (*b* is true). The odds of genitourinary infection for controls was calculated in a similar way—the ratio of the number of women with a genitourinary infection to those without: 425/4499.

The odds ratio provides a measure of the effects of genitourinary infection as a risk factor for gastroschisis. It is derived as the odds of genitourinary infection for cases divided by the odds for controls: (81/424)÷(425/4499)=(81/424)×(4499/425)=(81×4499)÷(424×425)=2.02. This is the unadjusted odds ratio and is obtained simply as the ratio of the cross products of the frequencies in the table. After statistical adjustment, the odds ratio was 1.5, indicating there was a 50% increase in odds of genitourinary infection for the cases relative to controls. Therefore, the risk of gastroschisis was increased if a genitourinary infection occurred between the month before conception and the end of the first trimester.

The odds of a genitourinary infection does not estimate the population at risk (*c* is false). As described above, the odds of genitourinary infection, whether for cases or controls, indicates as a ratio the number of women who self reported an infection compared with those who did not. To estimate the population at risk involves estimating the proportion of offspring born with gastroschisis in the population. This would be not only for the entire population but also those women with and without the risk factor—genitourinary infection in the month before conception until early pregnancy. It is not possible to estimate the population at risk from a case-control study. The number of cases and controls and the ratio of one group to the other were decided in advance by the researchers. Therefore, the proportion of offspring with gastroschisis in the study overall would not have estimated the proportion in the population. Subsequently, of those women who self reported genitourinary infections the proportion that had offspring with gastroschisis depended on the number of cases and controls chosen. This also applies to those women who did not have genitourinary infections.

Because it was not possible to estimate the population at risk of gastroschisis using the case-control study, the relative risk of gastroschisis for those women with genitourinary infections relative to those without could not be calculated. The relative risk, described in a previous question,[2] would have been the

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preferred measure of the effects of genitourinary infection as a risk factor for gastroschisis. However, the odds ratio derived from the case-control study estimates the population odds ratio and in turn the population relative risk. It has been proposed that the sample odds ratio is a good estimate of the population relative risk when the disease or outcome is rare in the population, typically when the prevalence is less than 10%.

Competing interests: None declared.

1 Feldkamp ML, Reefhuis J, Kucik J, Krikov S, Wilson A, Moore CA, et al. Case-control study of self reported genitourinary infections and risk of gastroschisis: findings from the national birth defects prevention study, 1997-2003. *BMJ* 2008;336:1420.
2 Sedgwick P, Marston L. Relative risks. *BMJ* 2010;341:c3983.

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Table

Table 1| Self reported genitourinary infections during the month before conception to end of first trimester for mothers of offspring born with gastrochisis (cases) and healthy live born babies (controls)

Genitourinary infection	Cases	Controls
Yes	81	425
No	424	4499
Total	505	4924