

### Risk and Relative Risk Exercises #3

*These exercises are originally from the University of Auckland Statistics Department (provided at the AMA Saturday workshop, 18 August 2012).*



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Reports on autism and parental age have yielded conflicting results on whether mothers, fathers, or both, contribute to increased risk. A study carried out by researchers from the University of California aimed to examine the effect of one parent's increasing age within a narrow interval of the other parent's age.

One of the main differences between this study and the study quoted above was the proportion of older mothers. The Israeli cohort had 588 mothers over the age of 40, while the Californian cohort had 113,080 mothers over the age of 40. The objective of the study was to examine the relationship between the mothers' and the father's age at the birth of child and the rate of autism.

The results of the Californian study, carried out among almost 5 million children born between 1990 and 1999 were published in the Autism Research. Cases of children with autism were diagnosed prior to the age of 6. Some results are shown:

Mother's Age Group	Autism	No autism	Total
< 25	2 689	1 713 971	1 716 660
25 – 29	3 304	1 406 234	1 409 538
30 – 34	3 576	1 161 890	1 165 466
35 – 39	2 089	541 102	543 191
≥ 40	501	112 579	112 579
Total	12 159	4 935 776	4 947 935

- (a) For children from mothers aged under 25 at the birth of their child:
- What was the probability that a randomly selected child had autism?
  - What was the risk of having autism?
- (b) For children from mothers aged 25 to 29 at the birth of their child, what was the risk of having autism?
- (c) For children from mothers aged 40 or more at the birth of their child, what was the risk of having autism?
- (d) (i) Calculate the relative risk for mothers in the under 25 age group of having an autistic child compared to mothers in the 25 – 29 age group.
- Interpret this relative risk.
  - Calculate the relative risk for mothers in the 40 or more age group of having an autistic child compared to mothers in the 25 – 29 age group.
  - Interpret this relative risk.
- (e) (i) Do mothers aged less than 25 have an increased or decreased risk of having an autistic child relative to those aged 25 to 29?
- Calculate the percentage change in risk relative to the baseline risk.
  - Interpret this percentage change in risk.

### Answers to Risk and Relative Risk Exercises #3

Reports on autism and parental age have yielded conflicting results on whether mothers, fathers, or both, contribute to increased risk. A study carried out by researchers from the University of California aimed to examine the effect of one parent's increasing age within a narrow interval of the other parent's age. One of the main differences between this study and the study quoted above was the proportion of older mothers. The Israeli cohort had 588 mothers over the age of 40, while the Californian cohort had 113,080 mothers over the age of 40. The objective of the study was to examine the relationship between the mothers' and the father's age at the birth of child and the rate of autism.



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The results of the Californian study, carried out among almost 5 million children born between 1990 and 1999 which were published in Autism Research, are shown in the table below.

Mother's Age Group	Autism	No autism	Total
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- (a) For children from mothers aged under 25 at the birth of their child:
- What was the probability that a randomly selected child had autism?  
 $2689/1716660 = 0.00157$
  - What was the risk of having autism?  $0.00157$
- (b) For children from mothers aged 25 to 29 at the birth of their child, what was the risk of having autism?  $3304/1409538 = 0.002344$
- (c) For children from mothers aged 40 or more at the birth of their child, what was the risk of having autism?  $501/113080 = 0.00443$
- (d) (i) Calculate the relative risk for mothers in the under 25 age group of having an autistic child compared to mothers in the 25 – 29 age group.  $0.00157/0.002344 = 0.67$
- (ii) Interpret this relative risk. **Mothers aged under 25 are about 0.67 times as likely (i.e. 33% less likely) to give birth to an autistic child as those aged 25 to 29.**
- (iii) Calculate the relative risk for mothers in the 40 or more age group of having an autistic child compared to mothers in the 25 – 29 age group.  $0.00443/0.002344 = 1.89$
- (iv) Interpret this relative risk. **Mothers aged over 40 are 1.89 times more likely (or almost twice as likely) to give birth to an autistic child as those aged 25 to 29.**
- (e) (i) Do mothers aged less than 25 have an increased or decreased risk of having an autistic child relative to those aged 25 to 29? **Decreased**
- (ii) Calculate the percentage change in risk relative to the baseline risk.  
 $(0.00443 - 0.002344) \div 0.002344 = 0.89 = 89\%$
- (iii) Interpret this percentage change in risk. **There is an 89% increase in the chances of giving birth to an autistic child for women aged over 40 compared to those for women aged 25 to 29.**