

Sex-rated statistics

David Spiegelhalter's new book explores human sexual activity through numbers. But there is nothing salacious about this extract. Instead, Spiegelhalter shows us how to sort quality stats from tawdry factoids, using a simple classification system

Turn to page 22 to reveal all →

Statisticians, contrary to popular opinion, are also human beings, and I hope I am not alone in being interested in the role that sex plays in our individual lives and society as a whole. But it is a challenging statistical task to find out what sexual behaviour is going on, although there are plenty of efforts, ranging from ponderously professional studies by demographers, sexual-health physicians and so on, to lurid speculations in the popular media about the sex lives of others. So when I was offered the opportunity to write a book in conjunction with a major exhibition, the *Institute of Sexology* at the Wellcome Collection in London, it seemed a good chance to use the topic to explore how to think critically about statistics.

To start at the beginning: what do we mean by “sex”? This may seem like a matter of individual opinion, but it assumed constitutional importance when US President Bill Clinton famously claimed on 26 January 1998 that “I did not have sexual relations with that woman, Miss Lewinsky”, a claim later repeated in a court deposition. It then became known that he had received oral sex from Monica Lewinsky, and Clinton was impeached for perjury in December 1998 – only the second time this had happened in US history. So did he or did he not have “sexual relations”?

That month the editor of the *Journal of the American Medical Association* (JAMA), George Lundberg, fast-tracked a paper by researchers from the Kinsey Institute for Research in Sex, Gender and Reproduction.¹ In 1991 over a thousand students had been randomly sampled from Indiana University, and 599 (58%) agreed to complete a history of their sexual activity and actually turned up to do so.

As part of the sex history, the students were asked: “Would you say you ‘had sex’ with someone if the most intimate behaviour you engaged in was ...?” Figure 1 shows the responses. Just about everyone considered vaginal intercourse was “sex” – the few men who answered “no” are presumably waiting for some extraordinary activity before they feel they have gone all the way. At the other extreme, only a few considered that kissing breasts counted as sex. Around 40% thought oral sex alone was “sex”, which means 60% thought it was not. So more than half would agree with President Clinton’s claim of innocence.

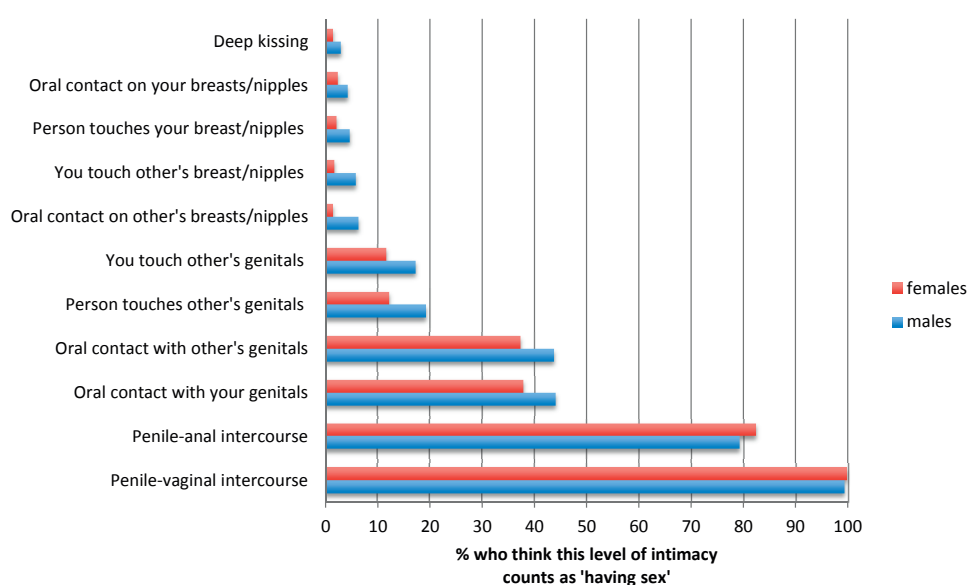


Figure 1. What 599 US students thought of as “having sex” in 1991. Source: Sanders and Reinisch¹

But how much weight should we assign to these results, and others like them? A quick online search will bring up more statistics about sex than you could ever wish for, but an experienced statistician will treat many of these with extreme scepticism. The problems are not to do with large margins of error – often the sample sizes are big – but with systematic biases in the way the data is collected. As such, I found it useful to make a simple classification of the plausibility of the numbers on a scale ranging from 4* (accurate) to 0* (just made up).

4*: numbers that we can believe

We can get concrete evidence of some of the consequences of sex from official statistics, and as it is a legal obligation to register a birth or marriage or abortion, these numbers should be reliable. So, for example, in England and Wales, we can be confident that:

- 48% of births in 2012 were formally “illegitimate”.
- In 1973, one in twenty 16-year-old girls got pregnant.
- For every 20 girls born, 21 boys are born.
- In 1938, at least half of brides under 20 were pregnant when they got married.
- The peak rate for divorce is 7 years after marriage.

A whole story could be told about each of these statistics – for example, the final one shows the “seven-year itch” is true! But not all numbers are so believable.

3*: numbers that are reasonably accurate

Nobody (yet) is under any compulsion to answer intrusive questions about their sex life, and so we are never going to be able to get 4* data about private activities. So we have to ask thousands of people about their behaviour and opinions, and try to do it well enough to be able to trust the answers.

It makes a big difference how the people are chosen. Suppose I want to know what proportion of people have sex before they are 16. I tell you that out of 1000 young people, 30% say they did (this is about the current British estimate). If these 1000 people had been chosen at random, with everyone in the population having an equal chance of being chosen, and they told the truth, then we can be 95% confident the true underlying proportion of young people who had sex before 16 lies between 27% and 33%: this relatively small margin of error is due to the play of chance in whom we happened to ask.

However, if these 1000 young people had been interviewed, say, coming out of clubs on a Saturday night, or had responded to an online survey in a lads’ magazine, then I would have no idea what the error might be,

except to suspect it might be large. Instead of pure random error, we have systematic bias.

But there are good surveys, such as the British National Survey of Sexual Attitudes and Lifestyles (Natsal),² properly conducted using random sampling and making repeated attempts to get information from individuals, using methods shown to maximise truthful reporting.

For example, recent Natsal statistics about Britain include:

- The age at which the average woman (i.e. the median) first had sex dropped from 19 for those born around 1940 to 16 for those born around 1980.
- The average opposite-sex couple aged 16–44 reported having sex three times in the last four weeks, and this has steadily dropped over the last 20 years – it was five times in 1990.
- Around 80% of 25–34-year-olds said they had oral sex last year.
- One in five 16–24-year-old women reported a sexual experience with another woman, greatly increased from 1990.

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Most of these results I would label as 3* numbers, which I would judge to be accurate to within a relative 25%.

But there is one particularly controversial statistic. Take a moment, and count how many (opposite-sex) partners you have had in your life, using the standard Natsal definition of having had “vaginal intercourse, oral or anal sex” (unlike for Clinton, all these now count as “sex”). Maybe there are none, or a small list you can easily recall by name: or maybe you need to count on your fingers (and possibly toes), or perhaps you may need to make a rough

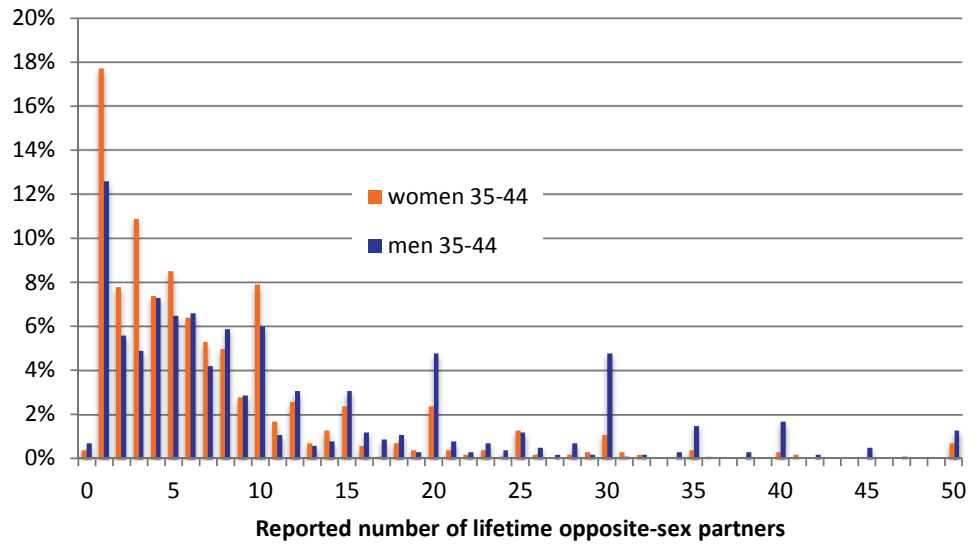


Figure 2. Reported number of lifetime opposite-sex partners for men and women aged 35–44, Natsal-3 in 2010, based on around 2000 interviews

estimate as the memory of faces and bodies blur into one of those composite pictures.

Figure 2 shows the responses for 35–44-year-olds in Natsal-3 in 2010, representing people born around 1970. The most common response is 1 – about one in six people in this age range report having only had sex with one person. The median response (the one half-way along the distribution) was 8 for men and 5 for women. Note the “spikes” in the graph: there is a strong tendency to use round numbers for counts greater than 10, with peaks on 20, 25 and so on, suggesting that a rough estimate was being made rather than individual people remembered. The right tail of the distribution has been cut off: 6% of men and 1.4% of women reported more than 50 lifetime partners, and two men and one woman said 500, which was presumably a very rough guess indeed.

Overall, the mean number of lifetime opposite-sex partners reported by men to Natsal-3 was 14, which was twice the number reported by women. This is mathematically impossible, but it is a regular finding in surveys that men report a higher number of partners than women. There have been lists of reasons given for this, from missing prostitutes in the surveys to “social desirability” bias. I do not think there is a single explanation: in particular, males may just be vaguer in their recall and either consciously or unconsciously exaggerate their numbers, and women may under-report to fit in with social norms or due to not counting negative experiences.

2*: numbers that could be out by quite a long way

Many sex surveys, both past and present, have not used random sampling but have tried to find volunteers who cover a wide range of experience. Alfred Kinsey, perhaps the most famous sex researcher, obsessively collected 18 000 detailed sex histories in 1940s and 1950s America.³ Some of Kinsey’s headline claims that brought him notoriety are as follows:

- 37% of men had had a homosexual experience resulting in orgasm.
- 50% of husbands had had extramarital sex.
- 50% of women were not virgins when they got married.
- 70% of men had had sex with prostitutes.
- 16% of men brought up on farms had had sex with animals.

I would rate many of his results as 2*, which means they might be used as very rough ballpark figures, but may only be accurate to within a relative 50%. Modern surveys based on internet panels may not be much more accurate.

In 1950 the American Statistical Association sent a team of statisticians to report on Kinsey’s methods. Of course they had to experience the notorious Kinsey interview, which means that somewhere in

the Kinsey archives lurk the sex histories of Fred Mosteller, Bill Cochran and John Tukey, who irritated Kinsey by telling him: "I would trade all your 18 000 case histories for 400 in a probability sample."

1*: numbers that are unreliable

Even further down the scale come numbers that may be so biased as to be essentially useless as generalisable statistics, even if they do portray valid, and vivid, experiences. The classic examples are the surveys carried out by Shere Hite, which were crucially important in the women's movement of the 1970s and 1980s. Her *Women and Love* in 1987 was based

on 100 000 questionnaires and 4500 responses,⁴ but she heavily promoted her statistics, which included:

- 84% of women were emotionally unsatisfied with their relationships.
- 95% reported forms of "emotional and psychological harassment" from their men.
- 70% of women married for more than 5 years were having affairs.

She received harsh criticism. Don Rubin, then chairman of the Harvard Department of Statistics, said: "So few people responded, it's not representative of any group, except the odd group that

chose to respond." Her statistics not only seemed rather implausible and out of line with other surveys, but were also just too neat to be true. Take, for example, her conclusion that "70% of women married 5 years or more are having sex outside their marriages" – when broken down by ethnicity, the proportions quoted were White (70%), Black (71%), Hispanic (70%), Middle Eastern (69%), Asian American (70%), Other (70%). Such close agreement in proportions, particularly when some of the subgroups are very small, is essentially impossible.

Other 1* statistics include the claim from the "Trojan US Sex Census" that people in Los Angeles have sex 135 times a year.

Why are more boys born at the end of wars?

Even 4* statistics can generate mysteries. Figure 3 shows the sex ratio in England and Wales from 1838 to the present day: I have never seen this plotted before, and it is one of the most extraordinary graphs I can think of.

These are not just random fluctuations: for some reason the ratio of boys to girls has systematically changed over the last 175 years. There is a deep trough around the late 1800s, and also some dramatic peaks during and just after the First World War (1914–1918), with a sharp rise to 106 in 1919, and also a peak around and just after the Second World War (1939–1945), with the sex ratio in 1944 (106.5) being the highest since records began. The USA also saw its highest sex ratios during and just after the Second World War, with hitting 105.9 in 1946.⁶

But why should more boys be born at the end of wars? Is some mystical force replacing the males lost in warfare with new baby boys, ready to do their bit when the time comes? In fact the "Trivers–Willard

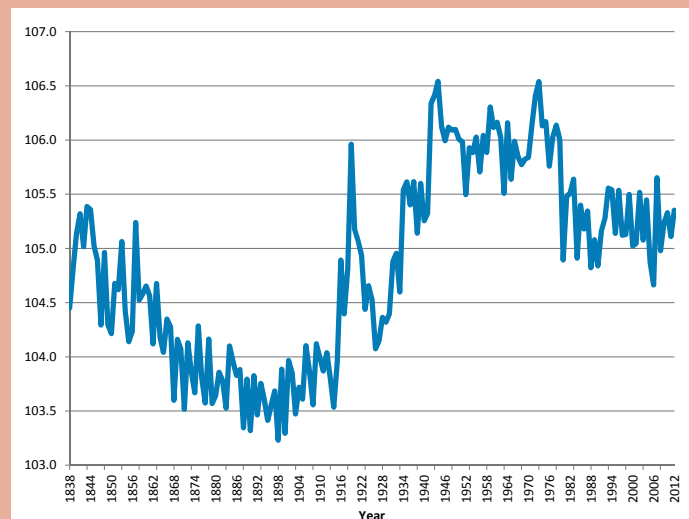


Figure 3. The number of boys born for every 100 girls in England and Wales between 1838 and 2012. The peaks and troughs are noted. Source: Office for National Statistics.⁵

hypothesis" – the theory that evolution has led to mammals adjusting their sex ratio to the gender most favoured by the parents' condition – has been cited as a possible reason. But I believe it is down to sexual behaviour.

Almost everything you can think of has been found to have some relation to the sex ratio: race, mother's and father's age, birth order, handedness, stress, exposure to chemicals and so on. In particular, it is claimed that slightly more boys are born to younger parents, early on in marriage, and to those who conceive quickly, underlying which is the common factor politely termed "increased coital rate". And what happens during and just after major wars? Sex is enthusiastically crammed into brief periods of leave or is intensely experienced in the exhilaration of being reunited following demobilisation.

But why should intense sex lead to more boys? William James has been arguing for around 40 years that the sex of the foetus is influenced by the hormone levels of the parents at around the time of conception, and in particular that the sex ratio varies over the monthly cycle, with conceptions early, and possibly also late, on in the cycle having a greater tendency to be males.⁷ If couples have a lot of sex they are more likely to conceive early on in the cycle, as the chances will be higher that the woman would already be pregnant by the time her peak fertility arrived.

Whatever the reason for the association between sexual intensity and the sex ratio, it should also hold that if there is less sex going on, there would be more girls and the sex ratio would drop. Look again at Figure 3, and see what happens over the Victorian era: the steadily dropping sex ratio suggests that the historical nadir of British sexual activity occurred around 1898. This claim reinforces the theory that the steady decline in fertility during the late 1800s, in spite of little use of artificial contraception, was largely due to abstinence from sex, or "continence" as it was known. And then peaks of sexual intensity occurred at the end of wars with the returning troops, and again in 1973 which was clearly a time of intense sexual activity in the young – there was a surge of teenage pregnancy and the age at marriage reached its lowest ever point.



Image: ~User33e319b_208/iStock/Thinkstock

0*: numbers that have just been made up

We now get to the rock bottom: numbers that get trotted out as part of an argument or to entertain, but have no supporting evidence. The sort of thing you might hear in the pub, on a radio phone-in, or in parliament:

- Men think of sex every 7 seconds.
- The average amount of time spent kissing for a person in a lifetime is 20 160 minutes.
- There are 25 000 trafficked “sex slaves” in the UK.
- Expending an ounce of semen is the same as losing 40 ounces of blood.

These I would rate as 0*: thought-provoking but utterly unreliable. And most misleading of all, of course, is the claim by Philip Larkin that sexual intercourse began in 1963 (“which was rather late for me”), but perhaps we should grant him some poetic licence.

A month after the publication of the study showing only 40% of students thought oral sex counted as “sex” (to which I would give 3*), the US Senate voted on Clinton’s impeachment, and split in almost exactly the same way as the students: 45 Senators said Clinton was guilty of perjury, and that he did really have sex with Lewinsky, and 55 said he was not guilty and that he was not lying when he said he did not have sex. Clinton survived the vote and has become an elder statesman, while George Lundberg was not so fortunate: he was sacked as editor of JAMA for fast-tracking the paper.

So, open discussion of sex statistics can be bad for your career. Let us hope this is not a reproducible finding.

References

1. Sanders, S. A. and Reinisch, J. M. (1999) Would you say you “had sex” if ...? *Journal of the American Medical Association*, **281**(3), 275–277.
2. Mercer, C. H., Tanton, C., Prah, P., Erens, B., Sonnenberg, P., Clifton, S. *et al.* (2013) Changes in sexual attitudes and lifestyles in

Britain through the life course and over time: Findings from the National Surveys of Sexual Attitudes and Lifestyles (Natsal). *Lancet*, **382**(9907), 1781–1794.

3. Kinsey, A. C., Pomeroy, W. B. and Martin, C. E. (1948) *Sexual Behavior in the Human Male*. Indiana University Press.

4. Hite, S. (1987) *The Hite Report: Women and Love: A Cultural Revolution in Progress*. New York: Knopf.

5. Office for National Statistics (2013) *Births in England and Wales, 2012* [Internet]. Available from: bit.ly/1g2G1Lk

6. Mathews, T. J. and Hamilton, B. E. (2005) Trend analysis of the sex ratio at birth in the United States. *National Vital Statistics Reports*, **53**(20).

7. James, W. H. and Valentine, J. (2014) A further note on the rises in sex ratio at birth during and just after the two World Wars. *Journal of Theoretical Biology*, **363**, 404–411.

David Spiegelhalter is a statistician and Winton Professor for the Public Understanding of Risk at Cambridge University. He has been confirmed as RSS President from 2016. His book *Sex by Numbers* is out now, published by Profile Books. Extracts from the book are republished with permission

