Respondent Heaping of the Counts of Lifetime Sex Partners, Males and Females, United States and China

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Abstract

Demographic analyses using survey data are only as good as the data themselves. This is especially important with regard to data dealing with sensitive and/or private issues, such as sexual activity. This paper is an evaluation of data on the number of self-reported lifetime sexual partners (LSPs). We use several datasets to examine the extent of "count heaping" of males and females self-reporting their number of LSPs. We find a definite tendency to heap counts of LSPs at digits ending in 0 and in 5. We develop a Whipple's type measure of sex partner heaping and apply it to datasets from the U.S. and China to evaluate the amount of count heaping of opposite-sex and same-sex partners. We then suggest one way to correct the partner count data for heaping so they may be more reliably used as independent and dependent variables in demographic studies.

Introduction

John Graunt, who many believe to be the father of demography and statistics (Sutherland, 1963; Bogue, 1969; Boorstin, 1983; Poston, 2006), gave demography an important philosophical heritage, namely, the healthy skepticism of data. When examining the mortality data for London, he realized that his analysis of the causes of mortality could only be as good as the data themselves; this led him to question how the causes of death data were determined and collected in the *Bills of Mortality* (Graunt, 1662 [1939]). We experience a similar problem with regard to person responses dealing with sensitive and/or private issues, particularly those pertaining to sexual activity and behavior. This paper is an analysis of a subset of this kind of data, namely, the counts of the number of lifetime opposite-sex and same-sex sexual partners reported by respondents.

We begin our paper with a brief review of the literature dealing with survey responses to questions pertaining to lifetime sex partners. What do we know about the response patterns of such data and their quality? Next,

we examine the frequency distributions of counts of opposite-sex and same-sex lifetime sex partners from several nationally representative datasets for the U.S. and China. We adapt and apply to these data a method to evaluate the presence of heaping, namely, Whipple's index of age heaping. We show that the data from the U.S. and China on lifetime sex partners, both opposite-sex and same-sex, are seriously flawed with exceedingly high Whipple's heaping values. We then suggest ways to correct the count data on sex partners so they may be better used as independent variables and as dependent variables in demographic and sociological analyses.

Literature Review

A review of the literature dealing with counts of lifetime sexual partners introduces a number of questions and anomalies. For one thing, there is a wide range of average values of counts of LSPs, with males having higher average counts than females. To illustrate, Smith reported that the average number of lifetime sexual partners (LSPs) is 12.3 for males, and 3.3 for females (Smith 1991). British and French sample surveys yielded means of 9.9 and

11.0 for men, and 3.3 and 3.4 for women (ACFS 1982; Johnson, Wadsworth, Wellings, Bradshaw, and Field 1992). Researchers at American universities found results of 3.5 and 2.3 (Wiederman 1997), 6.0 and 2.9 (Wittrock 2004), 4.4 and 2.7 (Ostovich and Sabini 2004), and 3.8 and 2.5 (Brown and Sinclair 1999) for men and women respectively. There appear to be rather wide discrepancies in the numbers reported not only between the sexes, but also within the sexes (Smith, 1991).

Many researchers have attempted to explain the reporting discrepancies between the sexes. One possibility is that the data are reflecting a "good-faith" problem, where respondents are simply the victims of biased sampling. Good-faith explanations claim that hypersexual women or prostitutes are undersampled, thereby causing the discrepancies. Since the number of hypersexual women and prostitutes necessary to balance the scales is vanishingly unlikely, good-faith explanations are found wanting (Brewer, Potterat, Garrett, Muth, Roberts, Kasprzyk, Montano, and Darrow 2000; Brown and Sinclair 1999; Einon 1994)

Alternately, "bad-faith" explanations make the assumption that respondents are simply lying, exaggerating, or intentionally misreporting. There may also be response biases, including muddied definitions of "partners," or genuine difficulties in recalling past life events (Wiederman 1997). There may also be strategy differences, where some individuals actively enumerate their number of LSPs, while others utilize rough approximation heuristics or rate based approaches. It is believed that when respondents are asked to count LSPs, some may be mapping rough categorical approximations like "a few," "many," or "a bunch" or they may be endeavoring to provide definite numerical counts (Brown and Sinclair 1999).

What seems to be evident in the literature is that the "unassailable logic" indicating that men and women must have the same number of partners is unsupported by evidence. As one author has written, "someone is being economical with the truth," and it may well be true that "men are exaggerating their experience or women their virtue" (Einon 1994).

Whatever the reasons, it seems that self-reported data on sex partners may have problems of validity. The

question, then, is how flawed are they? Do men or women report more accurately? Does the format of the questioning have any effect? Unfortunately, there is no way to tell conclusively without a camera in every bedroom (or polygraphs for every survey respondent).

We do not find any evidence in the literature, however, dealing with the problem of heaping of the counts of respondents' lifetime sex partners. There is some mention of why heaping may occur; this is found in studies that claim that some respondents may use rough approximation heuristics or rate based strategies in answering questions about their numbers of LSPs, instead of providing actual counts. But there is no specific mention per se in the literature, as far as we know, even in the best and most complete quantitative analysis of human sexuality (Laumann, et al., 1994), of any research showing that frequency distributions of LSP counts are not always evenly distributed. We can, however, develop methods to seek out evidence of this kind of consistent irregularity that would point to a potential problem with lifetime sex partner data. Once we have evaluated the data for those

inconsistencies, we would then be better able to proceed in light of any observed irregularities.

Similar problem in demography

There is a similar problem in another field of demographic inquiry; we refer here to the problem of "age heaping" which is sometimes encountered in analyses of data dealing with age distributions (Poston, 2005). If a population tends to report certain ages (for example, ages ending in 5 or 0), at the expense of other ages, this tendency is referred to as age heaping. Age heaping occurs more frequently in populations with lower levels of education, and with an attendant lack of high-quality vital data records. A related concept, digit preference, occurs when respondents have a preference for ages having the same terminal digit. According to Shryock and Siegel (1976), "the causes and patterns of age or digit preference vary from one culture to culture, but preference for ages ending in '0' and in '5' is quite widespread," particularly in the Western world. Alternately, in Korea and in China and some other East Asian countries, there is sometimes found a

preference for ages ending in ‘3’ because the numeral 3 sounds similar to the word for ‘life’.”

The concept of digit avoidance is the opposite of digit preference, and is evident when the distributions do not cluster around , but instead avoid, particular digits. In the U.S., for example, the number 13 is often avoided because of superstitious connotations. In Korea and China, the numeral 4 is avoided because it sounds similar to the character for “death.” Some hotels in the U.S. do not have floors numbered 13, nor do some hotels in South Korea and China have floors numbered 4. In some cultures, there may be a combination of digit avoidance and preference evident in data distributions (Poston, 2005; Poston et al., 2000).

There are several techniques used by demographers to evaluate the degree of digit preference or avoidance, e.g., indexes developed by Whipple (Shryock and Siegel, 1976), Myers (1940), Bachi (1951), Carrier (1959), and Ramachandran (1967). According to Shryock and Siegel (1976) and Hobbs (2004), however, they are all fairly similar, and that the more well-known Whipple’s index of age heaping is usually preferred as a general indicator of heaping.

Whipple's Index of Age Heaping (WA) is an arithmetic measure used to evaluate the extent of preference for reported ages ending in the digits 0 or 5. Based on the underlying assumption of rectangularity in a dataset (meaning that the number of individuals, for example, whose age ends in the digit 1 is approximately the same as the number of individuals in the dataset whose age ends in the digit 2, and so on), WA varies from a low score of 100, meaning that there is no preference for the terminal digits 0 or 5, to a high score of 500, meaning that the only ages reported in the dataset are ages ending in the digits 0 and 5 (Hobbs 2004). Whipple's Index of Age Heaping (WA) is calculated as follows:

$$WA = \frac{\sum(P_{25}+P_{30}+\cdots P_{55}+P_{60})}{\frac{1}{5}\sum(P_{23}+P_{24}+P_{25}+\cdots P_{60}+P_{61}+P_{62})} \times 100 \qquad (1)$$

As can be seen in formula (1), WA focuses on the age range of 23 to 62; this is pretty much an arbitrary decision. The ages of early childhood and old age are excluded since, frequently, they are more influenced by other types of errors and issues than digit preference; also, "the assumption of equal decrements from age to age

is less applicable" at the older ages (Shryock and Siegel 1976: 117; Hobbs 2004).

The United Nations (1990) has stated that WA scores between 100 and 105 indicate that the age distribution data are considered to be "highly accurate," while scores in the range between 105-110 are deemed to represent "fairly accurate" data. Age distribution data with WA scores between 110 and 125 are considered to be "approximate," and data with Whipple's scores from 125-175 are categorized as "rough." Data with Whipple's index values of greater than 175 are considered to be "very rough" (United Nations, 1990; Poston 2005).

If a country has a WA value for males, say, of 150, this would mean the numbers of 23-62 year old males in the population who were counted in that country's census or survey with ages ending in 0 and 5 overstate an unbiased population (that is, one in which there is no age heaping on 0 or 5) by 50 percent (cf., Shryock and Siegel 1976: 117).

Others have used the general Whipple's methodology and have developed variations. For instance, Poston et al

(2000) adapted Whipple's index to examine the presence of age heaping at ages ending in the digit 3, and applied this method to age data for South Koreans, given the preference among East Asians for the number "3" because, as already noted, it has the same sound as the word for "life." They discovered that there was significant heaping on ages ending in 3, for both Korean women and men.

A Whipple-type method for sex partner heaping

With the above in mind, a method similar to Whipple's age heaping method may be developed to evaluate the presence of the heaping at digits ending in 0 and 5 of the counts of lifetime sex partners. We first need to demonstrate why we are proposing to develop a method to measure heaping of the counts of sex partners at digits ending in 0 and 5.

We present in Figures 1-7 frequency distributions of count data on lifetime sex partners from several large nationally representative datasets. Figure 1 is the distribution of life time opposite-sex sex partners reported by U.S. males and females, using data from the National Survey of Family Growth, continuous cycle, 2006-

2008 (Martinez et al., 2010). A cursory examination of the two frequency distributions in Figure 1 reveals a most interesting pattern: the pattern is not smooth as one might expect a distribution showing the count of sex partners might ought to be. There are large numbers of individuals (sexual virgins) who report zero partners, and even more who report a single partner. For us, the points of particular interest are the small LSP spikes at 5, 10, 15, 20, 25, and so on. This should not be. LSP counts should not heap at digits ending in 0 and 5. One would expect that there should be almost as many individuals with 20 partners as there are 19, and almost as many with 21 partners as with 20. But the data do not support this conjecture. Unless individuals for some reason yearn to achieve a number of partners divisible by five, and then choose to somehow race to acquire five more partners, there are very interesting aberrations in these data for both males and females.

We find exactly the same tendency for sex partner count heaping in the two distributions shown in Figure 2, which are also counts of life time opposite-sex sex partners reported by U.S. males and females, but these are

data from an earlier cycle, Cycle 6, of the National Survey of Family Growth conducted in 2002 (Mosher et al, 2005).

Similarly, in Figure 3 we see heaping in digits ending in 0 and 5 for the counts of sex partners before marriage as reported by Chinese males, with data from the China Health and Family Life Survey, 1999-2000 (Parish et al., 2007).

Figures 4-7 use data from the combined General Social Surveys for the pooled years of 1972 to 2008 (Cushing-Daniels and Yeung, 2009). Figure 4 is a frequency distribution of counts of opposite-sex sex partners reported by women, Figure 5 is a similar distribution for men, Figure 6 is a frequency distribution of the counts of same-sex sex partners reported by women, and Figure 7 is a similar distribution for men. In all four figures using data from the pooled General Social Surveys, we see evidence of the counts heaping at digits ending in 0 and in 5. In all the figures, the counts for women are less than those for men, a finding that we have already noted is well-reported in the literature (Smith, 1991). Nevertheless, there is a definite tendency for both males

and females to heap their counts on digits ending in 0 and 5.

We have taken the Whipple's Index shown above in formula (1) and have adapted it for our analysis of the heaping of counts of sex partners. Our Whipple's Measure of Sex Partner Heaping (WS) is as follows:

$$WS = \frac{\sum(P_5+P_{10}+\cdots P_{40}+P_{45})}{\frac{1}{5}\sum(P_3+P_4+P_5+\cdots P_{45}+P_{46}+P_{47})} \times 100 \qquad (2)$$

WS measures the extent to which there is a preference for counts of sex partners to be numbers with digits ending in 0 or in 5 for sex partner counts between 3 and 47. First we note than we have developed the WS formula (see formula (2) above) so that it only applies to persons with counts of sex partners between 3 and 47. This was an arbitrary decision on our part to restrict the range of sex partner counts between these two values. First, we decided that counts of sex partners do not begin to be "large" until after count 2. Second, we took the WS calculation only as far as count 47 because none of the respondents reported counts of 48 or 49, and because many surveys use "50 and over" sex partners as the end of the frequency distribution. Since these datasets have a maximum count of sex partners of 50, there is an automatic heaping at count

50 that we did not want to influence the calculation of our Whipple's value, so we have not used count-50 in our calculations of WS.

A Whipple's Index of Sex Heaping (WS) value may be interpreted in a similar way as a Whipple's Index of Age Heaping (WA) value. To illustrate, a WS value of 150 for males would indicate that the number of males enumerated in the social survey with more than 2 but fewer than 48 lifetime sex partners who stated that their count of LSPs was a number ending in 0 or in 5 overstates an unbiased frequency distribution of LSP counts, that is, one in which there is no LSP count heaping on numbers ending in 0 or 5, by 50 percent.

We have calculated values of the Whipple's Index of Sex Heaping (WS) for males and females with data from several high quality and nationally representative datasets. The WS values are reported in Table 1.

The last column of the top two rows of Table 1 show WS values with data from the 2006-2008 National Survey of Family Growth; these WS values are based on the data shown in Figure 1. Males have a WS value of 194.5, and females have a value of 153.6. For males in the U.S. in the 2006-08 period, the number of them with more than 2 but fewer than

48 lifetime sex partners who stated in the NSFG that their count of LSPs ended in 0 or in 5 overstates an unbiased frequency distribution of LSP counts, i.e., one in which there is no LSP count heaping on numbers ending in 0 or 5, by 94.5 percent. Female counts overstate an unbiased distribution by almost 54 percent.

The next two rows of Table 1 provide WS values with data from an earlier cycle of the NSFG, Cycle 6, conducted in 2002. Again, males and females have high Whipple's scores for the heaping of lifetime sex partners (also see Figure 2).

We show in the next two lines of Table 1 the WS values for males and females using data from the National Health and Social Life Survey, conducted in the U.S. in 1992 (Laumann et al., 1994). This is deemed to be the most extensive and nationally representative survey of sexuality ever conducted in the United States. Respondents were asked about their numbers of opposite-sex sex partners since the age of 18. The WS value for males is 219.4, and 154.5 for females. The male value of 219.4 indicates that among U.S. males in 1992 who reported having between 2 and 47 sex partners since the age of 18, the numbers of them who claimed that their counts of sex partners ended in 0 or in

5 overstate an unbiased frequency distribution of sex partner counts by more than 119 percent.

We next provide WS values for males and females with data from the China Health and Family Life Survey conducted in 1999-2000 (Parish et al., 2007). In this survey married respondents were asked about their number of sex partners before marriage. The WS value for males is 179.2 (also see Figure 3), indicating a very high presence of partner count heaping in digits ending in 0 and 5. The female value is 0; this owes to the fact that the range and variability of the female data are small, and that no respondent reports having 5 or 10 partners before marriage, and none report greater than 10 partners. There is no partner heaping for the Chinese females because not many Chinese females had many partners and none had 5 or 10 partners.

Finally, the last four rows of Table 1 present WS values for males and females pertaining to the counts of opposite-sex and of same-sex sex partners; these four WS values use data from the pooled General Social Surveys for the combined years of 1972 to 2008 (Cushing-Daniels and Yeung, 2009). Once again, males and females report high WS values for the counts of both same-sex partners and opposite sex partners (also see the graphed frequency

distributions of these counts in Figures 4-7). The two male WS scores are both well above 200, and the two female values are also sizable, although not as large as those for the males.

These analyses indicate clearly that count data on the numbers of sex partners, either opposite-sex or same-sex partners, provided by both males and females, are seriously flawed. There is extensive heaping of the counts on digits ending in 0 and 5.

How serious is the extent of partner count heaping? We mentioned earlier that when evaluating the seriousness of age heaping in national populations, the United Nations considers Whipple's age heaping index values of 125-175 to be showing that the age data for the population may be categorized as "rough," and that Whipple's values greater than 175 to be "very rough" (United Nations, 1990; Poston 2005). Of the twelve WS values reported in Table 1, eleven are greater than 125, and six are above 175. Our investigation suggests that survey data on sex partner counts should probably not be used in their present form in statistical analyses. We turn in the last section of this paper to suggested approaches for modifying the sex partner count data.

Approaches for modifying survey data on sex partner counts

Data on counts of sex partners are frequently used in demographic and sociological studies as independent and as dependent variables. When used as an independent variable, the number of sex partners may be employed to predict such outcomes as number of children ever born. In other studies, one's number of sex partners is used as a dependent variable and has been predicted by such individual characteristics as age, poverty, race and Hispanic origin (Smith, 1991).

In this section of our paper we undertake several analyses using the number of sex partners variable as an independent variable, and then as a dependent variable. We first introduce a modified or transformed version of the sex partners variable.

We are endeavoring here to produce a metric that takes into account the values of the numbers of partners shown in the real data, but overcomes the excessive amounts of heaping at digits ending in 0 and 5. One way to produce an alternate metric of the count of sex partners in which

there is no heaping is to transform the partner count data into an ordinal variable, as follows:

0 = 0 sex partners

1 = 1-9 sex partners

2 = 10-19 sex partners

3 = 20-29 sex partners

4 = 30-39 sex partners

5 = 40-49 sex partners

6 = 50 or more sex partners

The above ordinal metric represents increasing numbers of sex partners with higher values of the metric, but does so without heaping.

We are now (as of September 17, 2010) using the NSFG data for males and females, for 2006-2008, to undertake several statistical analyses, using the original partnering data, and also using the transformed partnering data, as follows:

1. Predicting the number of sex partners with various individual characteristics such as age, poverty, race and Hispanic origin; the data we are using on sex partners are the actual count responses in the NSFG

data; Poisson regression equations are estimated separately for males and females.

2. Predicting the number of sex partners with the same individual characteristics as in #1; the sex partnering data we are using, however, are now the transformed ordinal data on sex partners; ordered logistic regression equations are estimated separately for males and females.
3. Using the number of sex partners as an independent variable along with other independent variables measuring characteristics of the respondent to predict one's number of children ever born (CEB); the data we are using on sex partners are the actual count responses in the NSFG data; Poisson regression equations are estimated separately for males and females.
4. Using the number of sex partners as an independent variable along with variables representing other characteristics of the respondent to predict one's number of children ever born; the sex partner data we are using here are the transformed ordinal data on sex partners; Poisson regression equations are estimated separately for males and females.

Our analyses, which we have conducted and are now analyzing and writing up, show that when used as an independent variable, the effects of the number of sex partners on an outcome such as CEB are not the same when the sex partner data are the actual counts compared to when the sex partner data are transformed into ordinal categories. Similarly, we show that when predicting the count of the number of sex partners, the regression coefficients of such independent variables as age, poverty status, race and Hispanic origin on the number of sex partners vary depending on how sex partner counts is measured. Our statistical analyses reported here show clearly that the results from studies of counts of sex partners as a dependent variable or as an independent variable differ depending on how the partnering variable is measured. Analyses using sex partnering data need to consider whether the actual partnering count data are flawed by excessive heaping on digits ending in 0 and 5, and, if so, to take this liability into account.

Conclusions

The results reported in this paper are interesting and very important for analyses using a variable measuring the number of sex partners. But it is also important to note some possible limitations. Most critically, the evaluation of data for digit preference or heaping at particular numbers of sex partners does not necessarily evaluate the quality of the data. Instead, our use of Whipple's type indexes simply measures the degree to which respondents prefer particular digits in the course of their estimations or counts. In addition, the possibility remains, however unlikely, that individuals do indeed could be striving to achieve numbers of LSPs that have 0 or 5 as their terminal digits, and that once such a digit is reached they either end their search for additional partners or race to the next number divisible by five. We realize that it is very unlikely that such tendencies toward the irregularities found in the distributions exist, and that the partner count heaping is real. Accordingly, we need to be cognizant of this possibility and to evaluate data on sexual partner counts critically.

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Table 1.
Values of Whipple's Index of Sex Partner Heaping,
Males and Females,
United States and China, Various Years

Dataset	Sample Population	Whipple's Index of Sex Heaping (WS)
NSFG (continuous) – males (Figure-1)*	lifetime partners	194.5
NSFG (continuous)-females (Figure-1)*	lifetime partners	153.6
NSFG Cycle 6 – males (Figure-2)**	lifetime partners	158.0
NSFG Cycle 6 – females (Figure-2)**	lifetime partners	163.4
NHSLS – males***	partners since 18	219.4
NHSLS – females***	partners since 18	154.5
China, CHFLS– males (Figure-3)****	partners before marriage	179.4
China, CHFLS-females****	partners before marriage	000.0
GSS - females who have sex with males (Figure-4)*****	lifetime partners	179.2
GSS - males who have sex with females (Figure-5)*****	lifetime partners	241.6
GSS - females who have sex with females (Figure-6)*****	lifetime partners	138.0
GSS - males who have sex with males (Figure-7)*****	lifetime partners	250.0

*NSFG (continuous), National Survey of Family Growth, 2006-08 (Martinez et al., 2010)
**NSFG Cycle 6, National Survey of Family Growth, 2002 (Mosher et al, 2005)
***NHSLS, National Health and Social Life Survey, 1992 (Laumann et al., 1994)
****CHFLS, China Health and Family Life Survey, 1999-2000 (Parish et al., 2007)
*****GSS, General Social Surveys (pooled) 1972-2008 (Cushing-Daniels and Yeung, 2009)

Figure 1: Frequency distributions of the counts of the number of lifetime same-sex sexual partners, Males and females, United States, 2006-2008

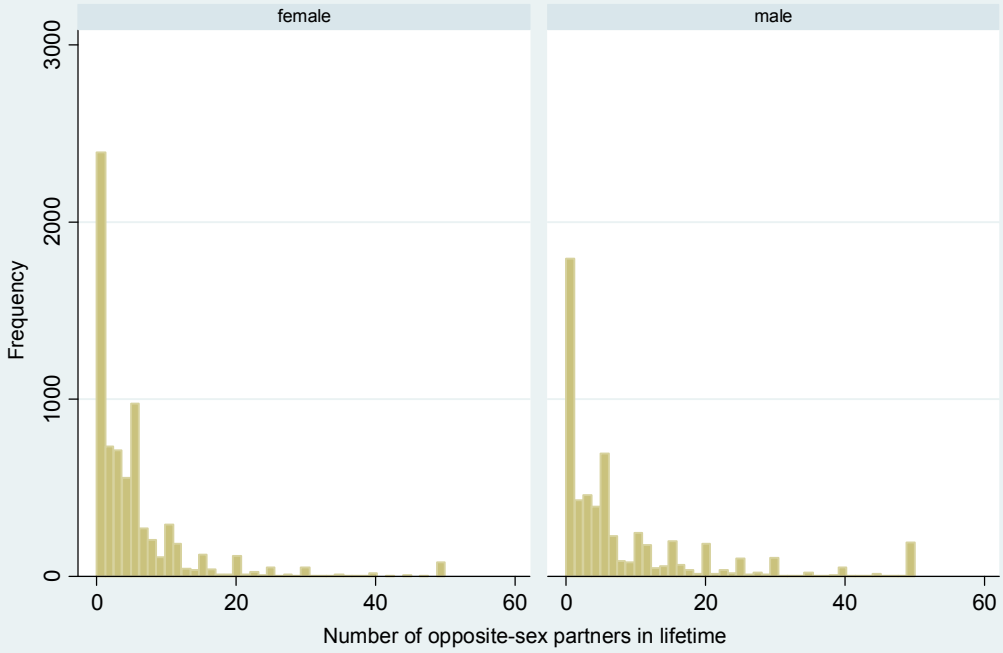


Figure 2: Frequency distribution of the counts of the number of lifetime opposite-sex sex partners, Males and females, United States, 2002

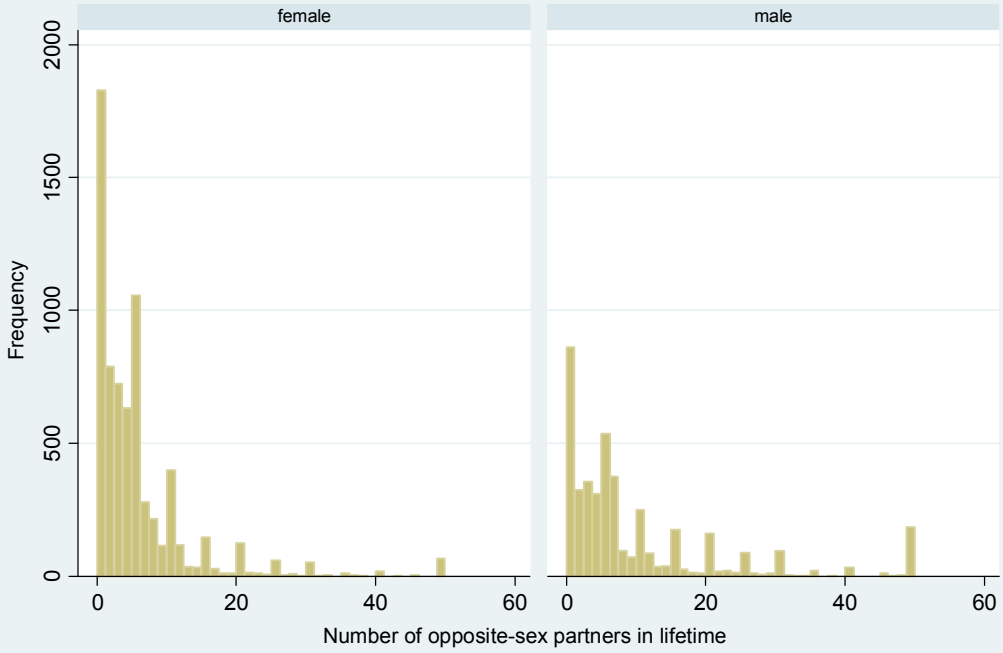


Figure 3: Frequency distribution of the counts of the number of opposite-sex sex partners before marriage, Males, China, 1999-2000

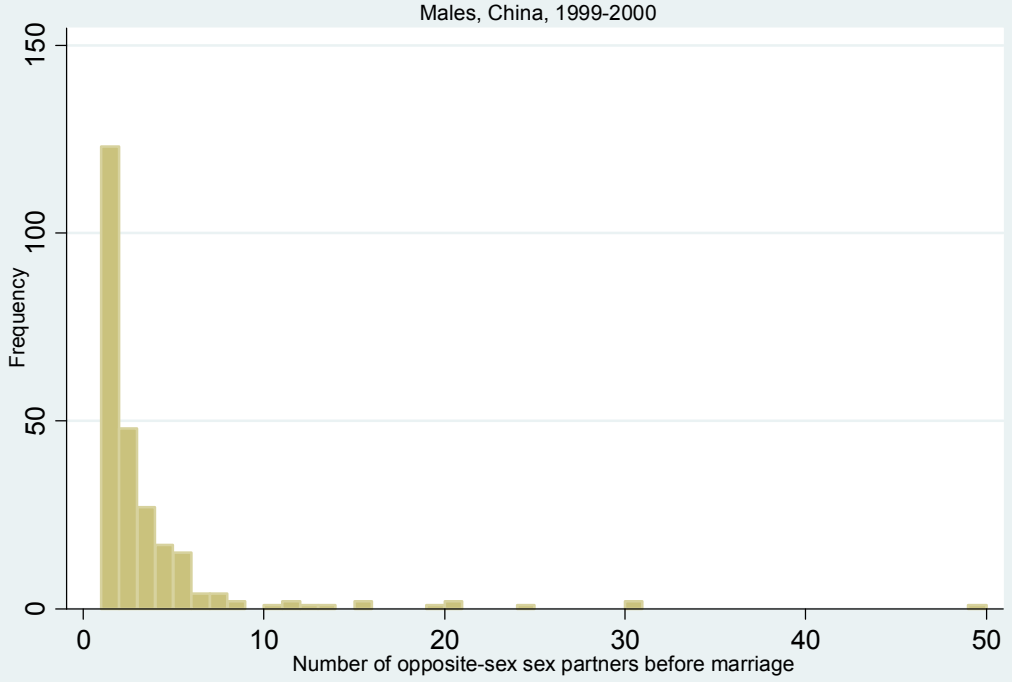
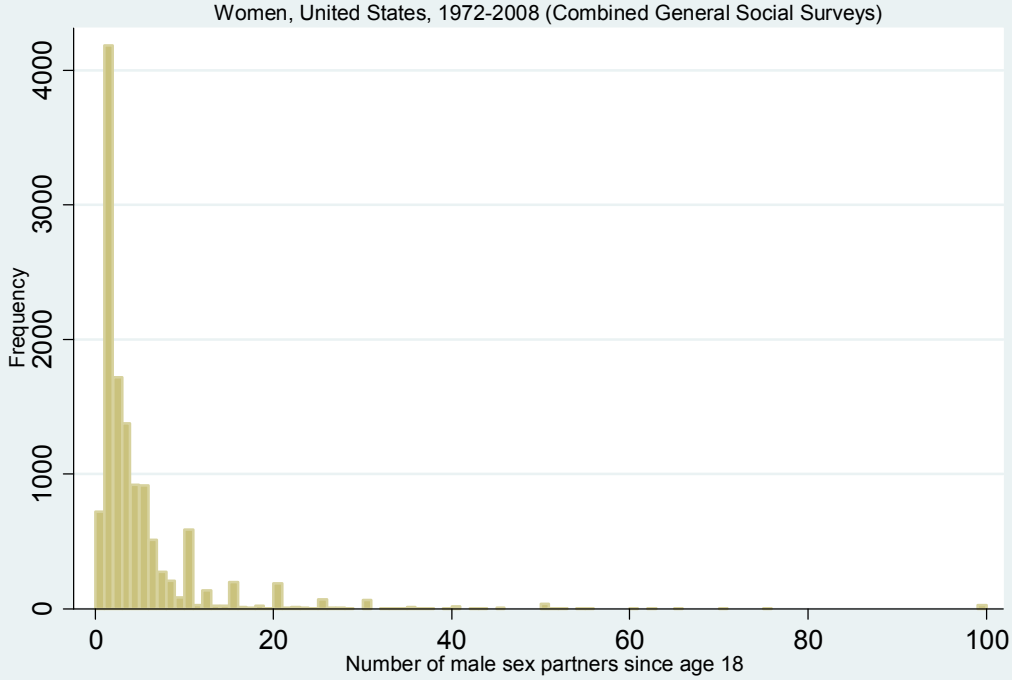


Figure 4: Frequency distribution of the number of lifetime opposite-sex sex partners, Women, United States, 1972-2008 (Combined General Social Surveys)



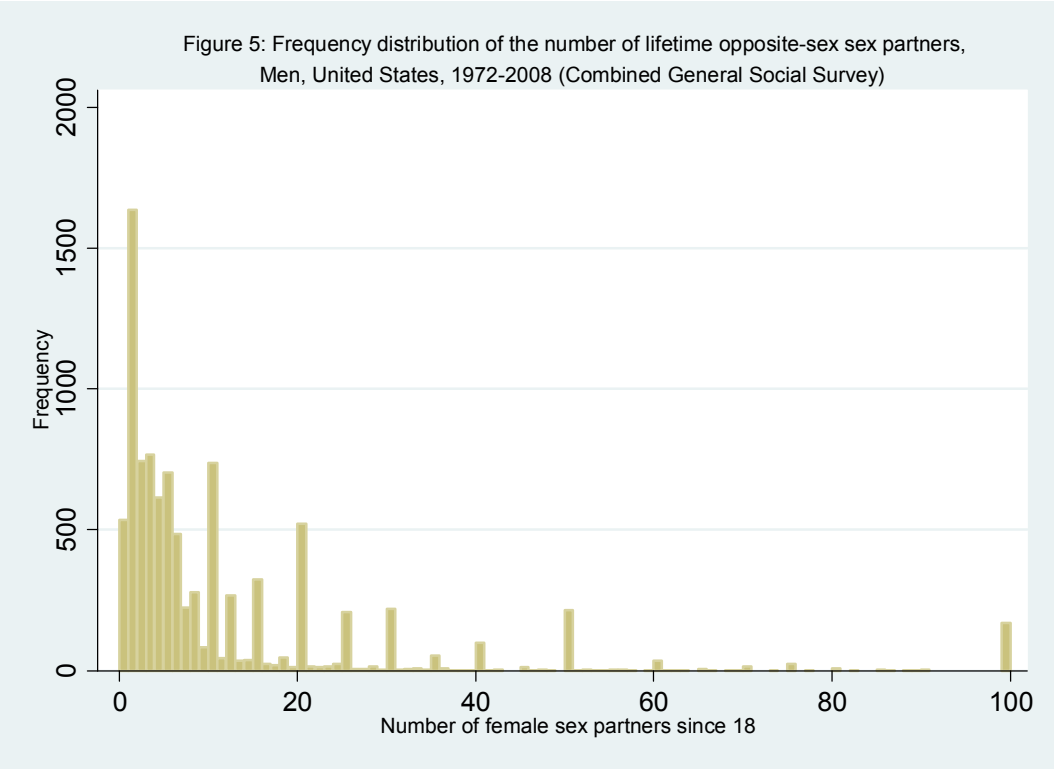


Figure 5: Frequency distribution of the number of lifetime opposite-sex sex partners,
Men, United States, 1972-2008 (Combined General Social Survey)
Frequency
0
500
1000
1500
2000
0
20
40
60
80
100
Number of female sex partners since 18

Figure 6: Frequency distribution of the number of lifetime same-sex sex partners,
Women who report having sex with women, United States, 1972-2008 (Combined General Social Surveys)

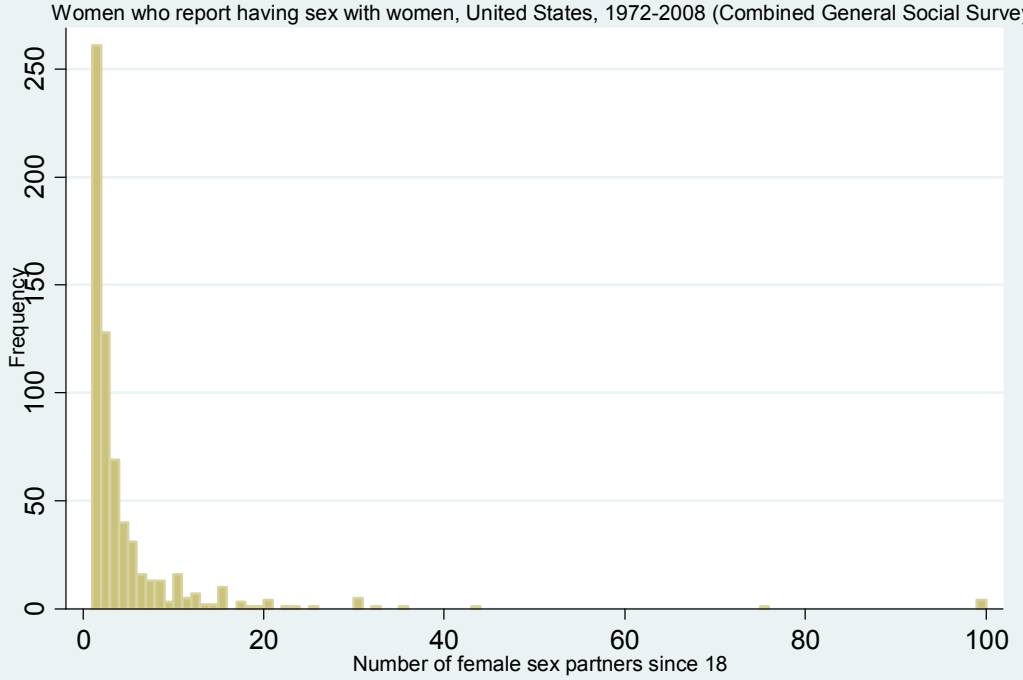


Figure 7: Frequency distribution of the number of lifetime same-sex sex partners,
Men who report having sex with men, United States, 1972-2008 (Combined General Social Surveys)