Descriptive Finding

Reexamining trends in premarital sex in the United States

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Abstract

BACKGROUND
In a heavily cited paper, Finer (2007) asserted that by age 30, 82% of US women born 1939–1948 engaged in premarital sex, increasing to 94% for those born 1969–1978. Using the same data, our age 30 estimates are 55% and 87% for women born 1939–1948 and 1969–1978. Our analyses thus document strikingly different levels and trends.

METHODS
We replicate Finer's single-decrement Kaplan–Meier estimates of premarital sex using Cycles 3–6 of the National Survey of Family Growth, the same data as analyzed by him. We then contrast such single-decrement estimates for both premarital sex and first marriage with estimates of the simple percentages in three states: an origin state in which women begin life as never-married virgins and two destination states for first sex and for first marriage, depending on which occurs first. These analyses provide an empirical illustration of the fact that single-decrement estimates cannot be interpreted as simple percentages for demographic processes involving multiple decrements.

RESULTS
Our cohort estimates document increases in the percent of US women who had premarital sex by age 25, rising from 53% to 75%, 83%, and 87% for those born 1939–1948, 1949–1958, 1959–1968, and 1969–1978, respectively.

CONTRIBUTION
Our cohort analyses reveal sharp increases in premarital sex for US women born between 1939 and 1968, with increases most rapid for those born in the 1940s and 1950s. Our findings also reemphasize a standard lesson from formal demography – that single-decrement

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life table estimates cannot be interpreted as simple percentages for a multiple-decrement demographic process.

1. Introduction

In a heavily cited paper, Finer (2007) reported single-decrement Kaplan–Meier estimates that he interpreted as showing that premarital sex has been close to universal for US women born as early as the late 1930s, asserting, for example, that "among those turning 15 between 1954 and 1963" (i.e., those born 1939–1948), "82% had had premarital sex by age 30" (Finer 2007: 73). Our age 30 estimate, for the same birth cohort and using the same data, is 55%, thus differing by a full 27 percentage points.

What accounts for this difference? The answer is not that Finer's single-decrement estimates are wrong or miscalculated, but rather that they cannot be interpreted as simple percentages. The core issue is that analyzing premarital sex with this data requires asking which of two events – sex or marriage – occurs first. The resulting problem thus involves competing risks (or, equivalently, multiple decrements), and standard texts note that under competing risks, single-decrement Kaplan–Meier estimates will require careful interpretation under highly nonintuitive counterfactuals. It is, however, straightforward to obtain estimates that are both simple and easy to interpret.

The contribution of this paper is thus twofold. A first is to correct the historical and empirical claims by Finer that premarital sex was close to universal even for US women born in the late 1930s and 1940s. By contrast, our analyses document that premarital sex increased sharply for US women born between 1939 and 1968 and that increases were most rapid for those born in the 1940s and 1950s. A second is to reemphasize a standard lesson from formal demography – that the single-decrement life table estimates reported by Finer cannot be interpreted as simple percentages when, as is the case here, the demographic process being analyzed involves multiple decrements.

The organization of this paper is as follows. We begin by replicating Finer's single-decrement Kaplan–Meier (1958) estimates for premarital sex and then illustrate that they cannot be interpreted as simple percentages. We then turn to a straightforward procedure that yields simple percentages that are easily interpreted. These estimates show that about half of US women born in the 1940s reported being sexually active while never-married and that premarital sex increased substantially in later birth cohorts.

2. Data and methods

Cycles 3–6 of the National Survey of Family Growth (NSFG), analyzed by both Finer and us, are a nationally representative survey of females aged 15–44. The surveys in Cycles 3–6 were conducted in 1982, 1988, 1995, and 2002, respectively, yielding a sample of 33,486 women. This data contains self-reports on the calendar month and year of first sexual intercourse and first marriage, thus providing data on the age at first sex and at first marriage to the nearest month. We, like Finer, report estimates using the NSFG sample weights.

In what follows below, we replicate Finer's Kaplan–Meier estimates of cohort trends in premarital sex for NSFG women born 1939–1948, 1949–1958, 1959–1968, 1969–1978, and 1979–1988 at exact ages 15, 18, 20, 25, 30, 35, 40, and 44. We then contrast these estimates with the percent of NSFG women in three states – an origin state in which women begin life as never-married virgins, and two destination states for sex or marriage, depending on which occurred first. We then calculate the simple (weighted) percentage in these three states at exact age *t* by conditioning on NSFG women who were exact age *t* or older at survey, thus dropping those younger than exact age *t* at the time of NSFG survey. Conditioning on those age *t* or older at survey ensures that we have the full history with respect to first sex and first marriage through exact age *t*. The resulting estimates are thus simple to calculate and provide the observed percent in the above three states. Statistically, multiple-decrement procedures such as the associated single-decrement life table obtained from standard multiple-decrement life tables (Preston, Heuveline, and Guillot 2001) will yield estimates that will converge to the above observed percentages as *n* $\to \infty$.

Stated more formally, competing risks occur when there are K possible transitions from a common origin state. The competing-risk framework then posits something akin to an omniscient observer who has knowledge of the K random variables $T_1, T_2, \ldots, T_K$ for the times of all K possible transitions for each individual, while, by contrast, what is seen by the nonomniscient observer is $T = \min(T_1, T_2, \ldots, T_K)$. This then implies that were the first transition to be eliminated, what would then be observed would be $T^{(-1)} = \min(T_2, \ldots, T_K)$, with a previously latent event now manifest for some. This further implies that what would be observed after eliminating all but the Kth transition would be the single random variable, T_K, for the event time for destination state K. Thus, the single-decrement Kaplan–Meier estimates reported by Finer are interpretable, but only under the above "cause-eliminated" counterfactual in which all other possible transitions (in this case, marriage) have been eliminated (Cox and Oakes 1984; Preston, Heuveline, and Guillot 2001; Crowder 2012).

When is it important to distinguish between single- and multiple-decrement demographic processes? Preston and colleagues note that "empirically, multiple-decrement processes are far more common than single-decrement processes" because all-cause mor-

tality will function as a competing risk for many of the outcomes studied by demographers, thus implying that "for a real cohort, [all-cause] mortality is the only single-decrement process" (Preston, Heuveline, and Guillot 2001: 66). However, they also note conditions under which the presence of multiple decrements can be ignored as when the combined risks are small in magnitude for the multiple decrements other than that of substantive interest. This implies that Finer's Kaplan–Meier estimates of premarital sex will be close to the true percent engaging in premarital sex at ages at which marriage was infrequent. As our results below document, this holds at very early ages but not at later ages at first marriage. Finally, note that the cross-sectional design of the NSFG does not let us account for the competing risk of all-cause mortality, but the resulting biases are not likely to be sizable because all-cause mortality was relatively low for the population of US females aged 15–44 and born in 1939–1988.

3. Results

Table 1 replicates a core set of Finer's single-decrement Kaplan–Meier estimates from his Table 3. Estimates are in close agreement, differing by at most four percentage points. There are also minor differences in estimates marked as "NA" that we suspect arise from slightly different conventions used when small numbers of women remain at risk. (The convention we use throughout is to regard an estimate as "NA" if, at exact age *t*, five or fewer women remained at risk.)

Table 1: **Single-decrement Kaplan–Meier estimates by birth cohort and selected ages of premarital sex. Self-reports by females, National Survey of Family Growth, Cycles 3–6**

		Kaplan–Meier estimate at exact age							
	Birth cohort	**15**	**18**	**20**	**25**	**30**	**35**	**40**	**44**
Finer	1939–1948	4	26	48	73	82	84	85	88
Replication		3	25	44	71	81	83	83	NA
Finer	1949–1958	6	39	65	86	91	93	93	94
Replication		6	41	66	86	91	93	93	94
Finer	1959–1968	10	50	72	88	92	93	93	NA
Replication		11	51	72	88	93	94	94	NA
Finer	1969–1978	13	59	76	89	94	NA	NA	NA
Replication		16	61	77	90	95	NA	NA	NA
Finer	1979–1988	14	54	74	NA	NA	NA	NA	NA
Replication		16	57	75	NA	NA	NA	NA	NA

Note: NA = not applicable.

In constructing the estimates in Table 1, both we and Finer compared the sex and marriage data to determine which occurred first. If marriage occurred first, both we and Finer censored a woman's sexual intercourse history at her age at first marriage because, as Finer notes correctly, marriage removes such a woman from the risk of premarital sex.

We now turn to Table 2, which shows concretely why Finer's single-decrement Kaplan–Meier estimates are not interpretable as simple percents. Panel A repeats our Kaplan–Meier estimates of premarital sex from Table 1 for the 1939–1948 birth cohort, but we now also apply the same Kaplan–Meier estimation procedure to first marriage. As in Table 1, if marriage occurred first, we censored a woman's first sexual intercourse history at her age at first marriage because marriage removes such a woman from the risk of premarital sex; conversely, if first sexual intercourse occurred first, we censored a woman's first marriage history at her age at first sex because sex removes such a woman from the risk of being a virgin at marriage. The resulting single-decrement estimates for marriage and sex thus address, respectively, who did and did not delay sex until marriage (Wu, Martin, and England 2017). Starting at age 21.4, the estimates in Panel A sum to more than 100, thus showing that these single-decrement Kaplan–Meier estimates cannot be interpreted as simple percentages.

Table 2: **Alternative estimates by selected ages of who did or did not delay sex until marriage. Self-reports by females born 1939–1948, National Survey of Family Growth, Cycles 3–6**

a) Single-decrement Kaplan–Meier estimates by selected ages of who did or did not delay sex until marriage.

| | Delayed sex until marriage? | | |
Exact age	No	Yes	Sum
15.0	3.4	0.4	3.8
18.0	24.8	8.3	33.1
20.0	44.0	29.6	73.6
21.4	54.7	45.5	100.2
25.0	70.9	74.8	145.7
30.0	81.0	86.6	167.6
35.0	82.6	88.2	170.8
40.0	83.3	89.1	172.4
44.0	NA	NA	NA

Table 2:   (Continued)

b) Percent by selected ages who: (i) were never-married virgins, (ii) did not delay sex until marriage, or (iii) delayed sex until marriage

Exact age	Never-married virgin	Delayed sex until marriage?		Sum	*n*
		No	Yes		
15.0	96.2	3.4	0.4	100.0	2928
18.0	68.9	24.1	7.0	100.0	2928
20.0	39.3	39.8	21.0	100.1	2928
21.4	24.5	46.4	29.1	100.0	2928
25.0	7.2	52.7	40.1	100.0	2928
30.0	2.5	54.6	42.9	100.0	2928
35.0	2.0	53.4	44.6	100.0	2663
40.0	1.4	51.8	46.8	100.0	1651
44.0	0.0	53.4	46.6	100.0	207

Note: NA = not applicable.

Panel B resolves this apparent anomaly by estimating the percent in three states – an origin state in which women begin life as never-married virgins and two destination states for sex or marriage, depending on which occurs first. As noted above and to ensure full exposure to risk, Panel B limits samples at exact age *t* to those age *t* or older at NSFG survey. Because the NSFG draws a cross-sectional sample of women aged 15–44 at each survey, women born between 1939 and 1948 are found in the 1982 NSFG survey only. As a result, estimates in Panel B are based on the entire sample of 2,928 NSFG women born in 1939–1948 through age 30, but restricting samples to those exact age *t* or older at survey means that samples become smaller at later ages and will reflect those born earlier in the 1939–1948 birth cohort. Note that by construction, the estimates in Panel B will be simple percentages that answer the question of who did and did not delay sex until marriage. We see that at exact age 15, most in this cohort reported being never-married virgins, with women then transitioning to one of the two destination states and with more than half reporting sex while never-married by age 25.

Comparing Panels A and B shows that estimates resemble one another at early ages but then diverge sharply at later ages, with discrepancies resulting from the competing risk nature of this problem. As noted above, Finer's single-decrement Kaplan–Meier estimates are interpretable as probabilities, but only under a convoluted counterfactual that supposes that marriage has been eliminated, thus yielding the probability of premarital sex, but only among those who will continue to remain never-married (Wu, Martin, and England 2017). The error arises when interpreting the estimates in Panel A as simple percents, thus ignoring the critical counterfactual condition 'among those who will continue to remain never-married.'

Table 3 provides corrected estimates of the percent of US women who engaged in

premarital sex by birth cohort and age. As in Panel B of Table 2, Table 3 limits samples at exact age *t* to those age *t* or older at NSFG survey to ensure full exposure to risk. As previously, samples at later ages are smaller and comprised of NSFG respondents born earlier within a given ten-year cohort, which in turn results in minor fluctuations in some estimates at later ages. The results show that roughly 55% of US women born 1939–1948 reported that they were sexually active while never-married. Premarital sex then increased substantially for those born 1949–1958 and 1959–1968, but then plateaued for those born 1969–1978 and 1979–1988, reaching levels of around 86%–87%. What is clear is that the estimates in Table 1 and 3 differ markedly, with the single-decrement Kaplan–Meier estimates in Table 1 leading Finer to conclude that 88% to 94% were sexually active prior to marriage for those born between the late 1930s and the late 1970s, but with the corrected estimates in Table 3 showing sharp increases in premarital sex from around 55% for those born in the late 1930s and 1940s to around 86%–87% for those born in the 1960s and 1970s.

Table 3: **Percent by birth cohort and selected ages of premarital sex. Self-reports by females, National Survey of Family Growth, Cycles 3–6**

Birth cohort	Percent reporting premarital sex by exact age							
	15	18	20	25	30	35	40	44
1939–1948	3	24	40	53	55	53	52	53
	(2928)	(2928)	(2928)	(2928)	(2928)	(2663)	(1651)	(207)
1949–1958	6	40	62	75	76	77	77	76
	(9400)	(9400)	(9400)	(9108)	(7500)	(4943)	(2190)	(558)
1959–1968	11	51	70	83	86	85	82	NA
	(11997)	(11076)	(10010)	(7663)	(5102)	(2651)	(863)	(3)
1969–1978	16	62	77	87	87	NA	NA	NA
	(6680)	(5509)	(4604)	(2746)	(1032)	(0)	(0)	(0)
1979–1988	16	58	76	NA	NA	NA	NA	NA
	(2481)	(1482)	(1008)	(0)	(0)	(0)	(0)	(0)

Notes: NA = not applicable. Sample *n*'s reported in parentheses. Estimated percentages at exact age *t* are restricted to those who were age *t* or older at NSFG survey; hence, samples become smaller at later ages and will be comprised of those born earlier within a given ten-year birth cohort.

4. Conclusion

Our reexamination of trends in premarital sex documents sharp increases for successive birth cohorts of US women from levels of around 55% for those born in the 1940s to levels of roughly 86%–87% for those born in the 1960s and 1970s, corresponding to an

increase of 32 percentage points. These estimates differ markedly from those of Finer (2007), who interpreted his estimates as showing that premarital sex was nearly universal in these birth cohorts: 88% for those born in the 1940s, and 93%–94% for those born in the 1950s, 1960s, and 1970s, for an increase of only six percentage points. We show that these starkly different conclusions about levels and trends arise from Finer's interpretation of estimates obtained from a single-decrement Kaplan–Meier procedure. Our results thus underscore the care that must be exercised when interpreting estimates from single-decrement procedures when, as is the case here, analyzing premarital sex requires a competing-risk framework that asks which of two events – sex or marriage – occurs first.

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