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WOMEN'S SUFFRAGE, POLITICAL RESPONSIVENESS, AND CHILD SURVIVAL IN AMERICAN HISTORY*

GRANT MILLER

Women's choices appear to emphasize child welfare more than those of men. This paper presents new evidence on how suffrage rights for American women helped children to benefit from the scientific breakthroughs of the bacteriological revolution. Consistent with standard models of electoral competition, suffrage laws were followed by immediate shifts in legislative behavior and large, sudden increases in local public health spending. This growth in public health spending fueled large-scale door-to-door hygiene campaigns, and child mortality declined by 8–15% (or 20,000 annual child deaths nationwide) as cause-specific reductions occurred exclusively among infectious childhood killers sensitive to hygienic conditions.

I. INTRODUCTION

Women's choices appear to differ systematically from those of men (Byrnes, Miller, and Schafer 1999; Niederle and Vesterlund 2007). The underlying causes of these differences remain unclear, but a growing body of evidence suggests that women place relatively greater weight on child welfare and the provision of public goods (Thomas 1990, 1994; Duflo 2003). Such sex differences are now leading many to view the promotion of gender equality as a potent means of human development in poor countries (not simply an important end) (United Nations Population Division 2005). In particular, "empowering" women is believed to increase investments in children (World Bank 2001).

Despite recent interest, this issue is not new; a long history links the status of women with child well-being. For example, the nineteenth-century bacteriological discoveries of Ignaz Semmelweis, Louis Pasteur, Joseph Lister, Robert Koch, and others revolutionized scientific knowledge about disease, but it was decades before the public at large (and children in particular) enjoyed their most immediate benefits. Principal among them were the basics of

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good household hygiene: hand and food washing, water and milk boiling, meat refrigeration, and breastfeeding (Duffy 1990; Meckel 1990). In the United States, good household hygiene was promoted through large-scale door-to-door hygiene campaigns—and through charitable organizations and then government, women were their leading advocates (Meckel 1990; Skocpol 1992; Tomes 1998).[1] Public health historians clearly link the success of hygiene campaigns to the rising influence of women (Lemons 1973; Tomes 1998).

This paper investigates how a historical milestone in the advancement of American women—their enfranchisement—influenced child survival, drawing out new quantitative lessons where there is rich qualitative history. Specifically, it relates the sharp timing of state-level women's suffrage laws enacted between 1869 and 1920 to state-level trend breaks in the voting behavior of legislators, state and local public spending, and age- and cause-specific mortality. This approach has a number of attractive features. First, America's system of federalism created considerable variation across states and over time in laws governing women's suffrage. Second, although many related studies have focused on lump-sum transfers to women, many policies and programs that empower women have nuanced incentives with theoretically ambiguous consequences for children (Becker 1981).[2] Women's suffrage rights provide a salient example. Third, data from the early twentieth century United States are rich in comparison with developing country vital statistics, public finance records, and legislative roll call data.

In general, I find that the extension of suffrage rights to American women appears to have helped children benefit from the scientific breakthroughs of the bacteriological revolution. Consistent with standard models of electoral competition (Duverger 1954; Downs 1957; Shepsle 1991), politicians responded immediately to shifts in electoral preferences as voting rights were

1. According to Richard Easterlin (1999), "At first, the new knowledge was promoted especially by women reformers through voluntary organizations. But public health agencies assumed an increasing role. . . ." Explaining this shift in responsibility is a central objective of this paper.

2. Opponents of women's enfranchisement often supported their position with arguments about the potential neglect of children (Flexner and Fitzpatrick 1959). Many empirical studies of women's status and child welfare have grown from tests of unitary models of household behavior, focusing on lump-sum transfers targeted to women (Thomas 1990, 1994; Rangel 2006). Notable exceptions include Luke and Munshi (2007) and Qian (2008).

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extended to women.[3] Within a year of suffrage law enactment, patterns of legislative roll call voting shifted, and local public health spending rose by roughly 35%. These findings are consistent with historical accounts: describing the Sheppard–Towner Act of 1921 (a landmark federal public health appropriation immediately following the Nineteenth Amendment in 1920), Richard Meckel (1990) observes that "fear of being punished at the polls by American women, not conviction of the bill's necessity, seems to have motivated Congress to vote for it. As one senator admitted to a reporter from the *Ladies Home Journal*, 'if the members of Congress could have voted on the measure in their cloak rooms, it would have been killed as emphatically as it was finally passed out in the open'" (Selden 1922). Growth in public health spending, in turn, was critical for scaling up intensive door-to-door hygiene campaigns. Child mortality declined by 8–15% with the enactment of suffrage laws, and causes of death that responded were exclusively infectious killers of children sensitive to hygienic conditions (diarrheal diseases, diphtheria, and meningitis). Nationwide, these reductions translate into roughly 20,000 averted child deaths each year, explaining about 10% of the child mortality reduction between 1900 and 1930.[4]

A variety of informal validity tests bolster this paper's findings. Specifically, there is little evidence of (1) relative increases or decreases in "progressive" legislative behavior, public spending, or child mortality just before suffrage laws were enacted, (2) meaningful relationships between the timing of suffrage laws and the timing of other major Progressive Era events, (3) suffrage estimates differing between states choosing to grant suffrage rights to women and states having it imposed on them by the Nineteenth Amendment, (4) changes in "progressive" legislative behavior, public spending, or child mortality accompanying important women's rights initiatives not ultimately leading to voting rights (i.e., "placebo" experiments), (5) systematic relationships between suffrage laws and internal migration, or (6) confounding changes

3. There are important problems with the traditional Downsian framework (Besley 2007), but these do not imply that politicians are unresponsive to large shifts in voter preferences.

4. In 1900, one in five children did not survive to age five (U.S. Bureau of the Census 1906). By the 1930s, the probability of dying by age five had declined by 65%, and life expectancy at birth had risen from 47 to 63 (U.S. Bureau of the Census 1938; Preston and Haines 1991; Haines 2001). Much of this mortality decline is explained by reductions in infectious disease deaths as America underwent its epidemiological transition.

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in the composition of births or fertile age women. Taken together, this evidence suggests that the extension of suffrage rights to women may have itself been responsible for substantial improvements in child survival. Given the economic and epidemiological similarities between historical America and less developed countries today, I conclude by briefly considering this paper's implications for contemporary public health and development challenges.

II. Background

II.A. The Historical Advancement of American Women and the Women's Suffrage Movement

"Separate Spheres" Ideology and Women's Voluntary Organizations. With the rise of industrialization during the nineteenth century, the social and economic "spheres" of American men and women became more distinct and segregated as men were disproportionately drawn into jobs away from the home. Women responded to this segregation by seizing the civic possibilities of their separate sphere and building voluntary organizations to promote "feminine virtues"—both for their own benefit and for the good of society. Some were composed of elite urban women, but more often they were grounded in religion and joined middle-class women across numerous localities.[5] Despite their heterogeneity, women's voluntary organizations collectively capitalized on the perception of women's moral superiority as homemakers and caregivers to promote broad public welfare agendas. A term popularized by women's organizations—"municipal housekeeping"—provides a clear example of this strategy: "Woman's place is in the home... But Home is not contained within the four walls of an individual home. Home is the community. The city full of people is the Family" (Dorr 1910).[6] This "municipal housekeeping" ideology provided a philosophical foundation for the women's

5. Prominent voluntary organizations included the Women's Christian Temperance Union, the General Federation of Women's Clubs (GFWC), and the National Congress of Mothers (later to become the National Congress of Parents and Teachers, or the PTA).

6. When "men and women divide the work of governing and administering, each according to his special capacities and natural abilities," the city "will be like a great, well-ordered, comfortable, sanitary household. Everything will be as clean as in a good home. Every one, as in a family, will have enough to eat, clothes to wear, and a good bed to sleep on. There will be no slums, no sweat shops, no sad women and children toiling in tenement rooms. There will be no babies dying because of an impure milk supply. There will be no 'lung blocks' poisoning human

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suffrage movement in the late nineteenth and early twentieth centuries, and voluntary organizations supplied critical organizational infrastructure. They also provided a means of advancing a new child health and hygiene agenda during the Progressive Era (Smith-Rosenberg 1985; Skocpol 1992).

The Women's Suffrage Movement. The birth of the women's suffrage movement went hand in hand with the birth of women's voluntary organizations. Broad new ideals about women's public and private roles were manifest both in emerging voluntary organizations and in the agenda articulated by Lucretia Mott and Elizabeth Cady Stanton at the famous women's rights convention held in Seneca Falls, New York, during the summer of 1848. The end of the Civil War invigorated the women's suffrage movement as the emancipation of slaves and the (ostensible) extension of voting rights to black men in 1870 under the Fifteenth Amendment drew new public attention to the expansion of the electorate (Flexner and Fitzpatrick 1959).

State-level suffrage efforts during the late nineteenth century were poorly coordinated and generally proclaimed social justice as the basis for enfranchising women. There were several unanticipated early successes in the west (in the territories of Wyoming in 1869 and Utah in 1870 and later in Colorado and Idaho), surprising proponents and opponents alike (Flexner and Fitzpatrick 1959; DuBois 1998). However, these early victories were followed by a period of stagnation, leading to better coordinated local efforts and a more pragmatic appeal to municipal housekeeping as the rationale for enfranchising women (McCammon and Campbell 2001; King, Cornwall, and Dahlin 2005). The result was a new string of new successes: prior to the ratification of the Nineteenth Amendment in 1920, 29 of 48 states had extended suffrage rights to women. Figure I shows the timing of suffrage laws in American states, and Section III.A and the Data Appendix discuss the nuances of these laws.

Explaining the Spatial and Temporal Pattern of State-Level Women's Suffrage Laws. Understanding the timing of state-level suffrage laws is important for evaluating the validity of this paper's empirical strategy (as probed in greater detail in Section V). The most obvious pattern is geographic—all else equal, women

beings that landlords may pile up sordid profits. No painted girls, with hunger gnawing their empty stomachs, will walk in the shadows" (Dorr 1910).

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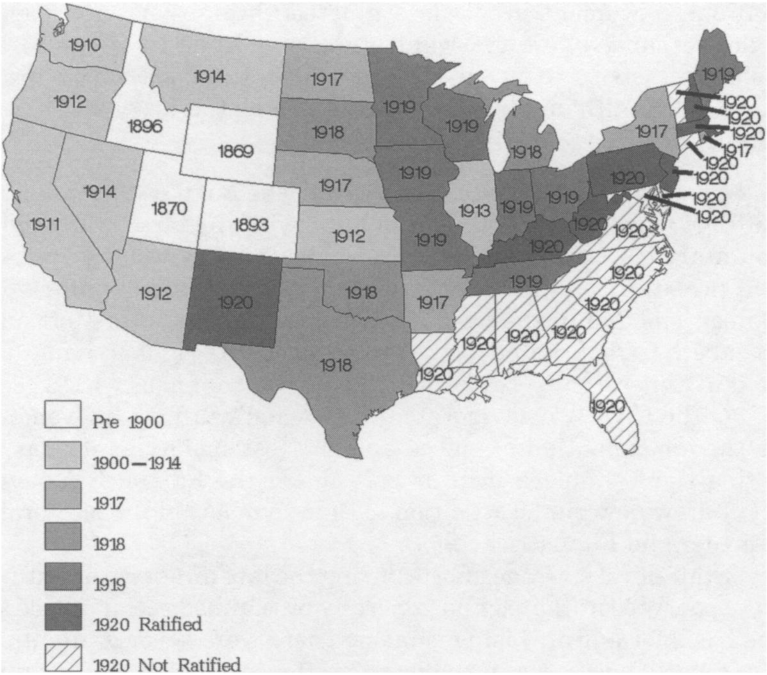

FIGURE I
The Timing of Women's Suffrage Rights in American States

Data obtained from Lott and Kenny (1999) and Cornwall (2003). Years shown are for first suffrage laws, which extended full suffrage rights to women with the exception of presidential-suffrage-only laws in Illinois, Indiana, Iowa, Maine, Minnesota, Missouri, Nebraska, North Dakota, Ohio, Rhode Island, Tennessee, Vermont, and Wisconsin and primary-suffrage-only laws in Arkansas and Texas.

in western states could vote before women elsewhere in America. Some historians suggest that frontier conditions were amenable to women's suffrage because women supported restrictions on common western vices (drunkenness, gambling, and prostitution) or because the harsh realities of frontier life made it impossible to maintain traditional gender roles (Brown 1958; Grimes 1967).[7] Many others argue that idiosyncratic circumstances in each state resulted in the vote for women (Larson 1971; Beeton 1986), citing rich historical evidence in support of this view.[8] Quantitative

7. The earliest efforts in western territories also sought to attract female settlers to offset gender imbalances among frontier populations (Marilley 1996).

8. Many historians invoke the remarkably poor correspondence between suffrage movement strength and the enactment of suffrage laws in support of this position, including (1) the absence of an organized movement in Wyoming (where the first suffrage law was passed); (2) the absence of a suffrage law in Connecticut (where the first state women's suffrage organization was established) prior to the

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studies yield strikingly inconclusive results.[9] The single robust correlate of suffrage law enactment emerging from these studies is the share of women working in nonagricultural occupations (King, Cornwall, and Dahlin 2005). Although this presumably reflects changing social norms about the role of women, it evolved very gradually over time (Smith and Ward 1985; Goldin 1990) and can be distinguished econometrically from abrupt year-to-year legislative changes governing women's right to vote.

II.B. Women, Hygiene Campaigns, and the "New Public Health"[10]

Early public health efforts targeting infants and children generally emphasized the provision of pure milk to mothers through local milk stations (Lee 2007; Ferrie and Troesken forthcoming). In 1906, however, a critical assessment of milk station activities led the Association for Improving the Condition of the Poor (and the New York Milk Committee) to conclude that providing clean milk to infants just scratched the surface of the potential health benefits of good hygiene—and that educating mothers about household hygiene more broadly was the most promising approach for improving infant and child survival (Phillips 1909). This conclusion heralded the beginning of a "new public health": milk stations and sanitary engineering had fulfilled much of their promise, and further health improvements depended critically on providing widespread information about the benefits of good personal and household hygiene.[11] This ideological shift was accompanied by demonstrated results; the widely publicized effectiveness of the New York Milk Committee's household hygiene modification program quickly led to copycat programs around the country (Meckel 1990).

Nineteenth Amendment; (3) equivalent suffrage organization membership in the West and the South (where suffrage efforts were most and least successful, respectively); (4) early suffrage mobilization in eastern states not followed by early suffrage law enactment; and (5) the correlation between movement strength and suffrage bill introduction not extending to bill passage (Baumgartner and Leech 1998; McCammon 2001; McCammon and Campbell 2001).

9. Marie Cornwall, Eric Dahlin, Brayden King, and Kendra Schiffman, "Moving Mountains: An Institutionalist Analysis of State-Level Woman Suffrage Legislative Success," unpublished manuscript presented and distributed at the Social Science History Association annual meeting in Chicago, IL, 2004.

10. This section draws heavily on Meckel (1990).

11. According to the newly formed federal Children's Bureau, "It is useless to send pure milk into a dirty home to be handled by an ignorant, dirty mother or older child. It is necessary to reach the mothers, not only to teach them how to care for their baby's milk, but also to convince them of the necessity of cleanliness" (U.S. Children's Bureau 1914). For additional information about the emphasis on household hygiene during the Progressive Era, see Ravenel (1921), Kramer (1948), and Tomes (1990).

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However, hygienic home modification required regular home visits and individualized health education. Charitable organizations were already conducting these activities on a small scale, but in 1910, the newly formed American Association for Study and Prevention of Infant Mortality argued that only government had the authority, resources, and centralized administrative capacity to effectively coordinate large-scale hygiene campaigns (AASPIM 1910).[12] What developed was public–private partnerships—local public funds supporting door-to-door hygiene campaigns that built upon the existing infrastructure of philanthropic organizations (Neff 1910; Meckel 1990). The ability to channel new public sector appropriations into standing charitable programs made rapid health improvement possible.

Although physicians and lay health workers were employed, community-based nurses were the backbone of household hygiene campaigns. Nurses were each assigned a district and made responsible for all families in that district with babies born between the end of May and the beginning of September (when infectious disease incidence and infant/child mortality rates peaked). Learning of a birth from either departmental records or door-to-door canvassing, nurses visited the new mother, examined the infant and other children in the household, encouraged breastfeeding, and provided intensive individualized education about hygienic practices. The nurse would continue visiting the household throughout the summer, monitoring hygienic conditions and the health of all household children. The growing "ideology of instructed motherhood" also created fertile soil for hygiene campaigns to succeed—nurses overwhelmingly reported that when the benefits of improved hygiene were demonstrated, mothers eagerly embraced them (Meckel 1990).[13]

Historians are relatively silent about the relationship between state-level women's suffrage laws and local hygiene campaigns, but they are outspoken about this relationship at the national level. A salient example is the case of the 1921 Sheppard–Towner Act, a landmark five-year public health appropriation

12. According to Richard Easterlin (1999), "In the case of infectious disease control . . . The most important decision-making units have been households and governments. . . . Of the two, governments have been more fundamental than households, because the adoption of new household methods required education programmes that were largely promoted by governmental agencies."

13. A 1914 Children's Bureau pamphlet on infant and child care became the best-selling publication ever issued by the Government Printing Office (Preston and Haines 1991).

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and the single most dramatic expansion of the federal Children's Bureau. Women's organizations lobbied hard for passage of the act, and the long-standing perception of women's superior morality made it difficult for legislators to ignore their demands (Skocpol 1992). Not coincidentally, it was passed immediately after all American women were given the right to vote under the Nineteenth Amendment in 1920—even before actual patterns of female voting had become clear. In the words of one historian, the "principal force moving Congress was fear of being punished at the polls. Politicians feared that women voters would cast a bloc vote or remain aloof from the regular parties" if their convictions about child welfare were not heeded (Lemons 1973).[14]

III. Data and Empirical Strategy

III.A. Data[15]

I obtained dates that women gained the legal right to vote in each state from Lott and Kenny (1999) and have supplemented these dates with more detailed information collected from the legislative archives of 48 states by Marie Cornwall and colleagues (Cornwall 2003). In this paper, I follow Lott and Kenny (1999) by not distinguishing partial and full suffrage rights, recognizing the flux of electoral rules during this period and uncertainty among politicians about the inevitability of full enfranchisement following partial suffrage laws.[16] Sensitivity analyses presented

14. Although Progressive Era data on women's actual voting behavior following enfranchisement are not available to the best of my knowledge, historians suggest that the widely anticipated "gender gap" in voting did not emerge as expected (expectations of systematic gender differences in voting are sufficient to produce the hypothesized changes). Politicians recognized this by the late 1920s, allowing the Sheppard–Towner Act to expire in 1929 (although new federal funds were again appropriated under the New Deal) (Harvey 1998). One rare piece of early data—a 1932 study conducted by the National League of Women Voters in 37 states—did find, however, that a larger share of women than men had voted for Norman Thomas (a socialist) in the 1932 presidential election (Robinson 1933). Analyzing data beginning in 1964, Edlund and Pande (2002) find that a gender gap in voting emerged in the 1970s.

15. See the Data Appendix for a more detailed description of the data used in this paper's analyses.

16. Although most laws passed before the Nineteenth Amendment extended full suffrage rights to women, some extended only partial rights (presidential- and primary-only voting rights). These partial suffrage laws were generally enacted in the Midwest shortly before the Nineteenth Amendment. Specifically, presidential-only suffrage laws were enacted in Illinois, Indiana, Iowa, Maine, Minnesota, Missouri, Nebraska, North Dakota, Ohio, Rhode Island, Tennessee, Vermont, and Wisconsin. Primary-only suffrage laws were enacted in Arkansas and Texas. This paper's results are not generally sensitive to how suffrage rights in these states are coded (see Appendix Table A.2). Given this and the historical suggestion that

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in Section V suggest that drawing this distinction does not substantially alter the conclusions drawn from this paper's analyses.

To investigate how women's suffrage was related to child survival, state-level mortality data by age/sex and by cause are needed. However, there was no national system of death records in the United States prior to 1933 (Haines 2001). The Bureau of the Census first established an official "Death Registration Area" in 1880 and began publishing its annual *Mortality Statistics* for death registration states (those deemed to have adequate death registration systems) in 1900 (U.S. Bureau of the Census 1906 through 1938; Haines 2001). The registration area grew from 10 states in 1900 to include all 48 states in 1933. Using the published historical series, I have constructed an unbalanced panel of annual state-level deaths by age/sex and by cause for the years 1900–1936.[17] Descriptive Statistics are shown in Panels A and B of Table I.

To explore how women's suffrage was related to the size and composition of public spending, I also matched local and state public finance data with the legislative records. For hygiene campaigns, local health department spending was most important. To examine how suffrage laws were related to changes in local public finance, I digitized annual nominal health-related spending data for all cities with populations exceeding 30,000 listed in the *Statistics of Cities* (1905–1908) and the *Financial Statistics of Cities* (1909–1913, 1915–1919, and 1921–1930).[18] The specific health-related spending categories that can be harmonized

local politicians commonly believed full suffrage to be imminent following partial suffrage laws, I use the dates of first suffrage laws of any type throughout the paper.

17. Conducting analyses with an unbalanced panel of state-level deaths raises the concern that entry into the death registration area might be correlated with the timing of women's suffrage laws (or their social, demographic, or economic determinants). To explore this possibility, regressions of registration area entry dates were run on state socioeconomic characteristics in 1900 (literacy, employment, manufacturing sector wages, and workforce share in the manufacturing sector), the dates of major Progressive Era events (laws governing women's suffrage, divorce/alimony rights, mother's pensions, minimum wage and maximum hours of work for women, prohibition, workers' compensation, child labor, and compulsory education), and the dates that GFWC chapters were founded in each state. The results suggest no statistically meaningful relationships (see Online Appendix Table 1). Online Appendix Table 2 shows states present in the unbalanced mortality sample by year relative to women's suffrage law enactment. Finally, Section V and Appendix Table A.2 present sensitivity analyses restricted to a constant sample of states as suffrage laws were enacted.

18. I use samples with cities present in all years, but the results are insensitive to including cities that enter and exit during the period 1905–1930 as well.

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TABLE I
DESCRIPTIVE STATISTICS

	1900 Mean (standard deviation)	1910 Mean (standard deviation)	1920 Mean (standard deviation)	1930 Mean (standard deviation)
Panel A: Age-specific annual mortality rate per 1,000 in each age interval in death registration states				
Total	17.31	13.78	13.00	11.42
	(1.97)	(3.36)	(1.52)	(1.62)
Under age 1	163.49	119.89	95.10	70.82
	(31.42)	(37.38)	(16.92)	(18.64)
Age 1–4	18.78	11.89	9.28	5.83
	(4.82)	(3.79)	(1.78)	(2.17)
Age 5–9	4.49	3.29	2.84	1.92
	(0.76)	(0.76)	(0.37)	(0.39)
Age 10–14	2.98	2.36	2.34	1.62
	(0.26)	(0.54)	(0.27)	(0.33)
Age 15–19	4.96	3.68	4.13	2.95
	(0.40)	(0.79)	(0.71)	(0.80)
Age 20–24	6.72	5.24	5.81	4.14
	(0.51)	(1.13)	(1.38)	(1.39)
Age 25–29	7.53	5.94	6.65	4.73
	(0.61)	(1.34)	(1.52)	(1.71)
Age 30–34	7.80	6.76	7.52	5.24
	(1.06)	(1.71)	(1.49)	(1.91)
Age 35–39	8.95	7.83	8.06	6.23
	(1.36)	(1.71)	(1.44)	(1.98)
Age 40–44	10.25	9.09	8.80	7.96
	(1.72)	(2.05)	(1.44)	(2.27)
Age 45–49	12.04	11.18	10.32	10.20
	(2.38)	(2.40)	(1.62)	(2.45)
Age 50–54	15.96	14.43	13.84	14.06
	(3.78)	(3.53)	(2.12)	(3.07)
Age 55–59	22.52	20.53	19.46	19.47
	(4.32)	(4.89)	(2.62)	(3.62)
Age 60–64	30.72	28.77	27.44	28.27
	(4.62)	(7.00)	(3.14)	(4.14)
Age 65–69	46.13	42.94	42.12	42.22
	(7.12)	(10.34)	(4.52)	(4.60)
Age 70–74	68.90	63.50	65.27	63.55
	(6.69)	(14.91)	(6.50)	(6.15)
Age 75–79	103.99	98.47	98.05	96.42
	(9.35)	(21.21)	(7.51)	(8.06)
Age 80–84	162.81	149.31	151.57	144.94
	(10.69)	(31.09)	(9.90)	(8.93)
Age 85–89	232.45	210.05	215.75	205.75
	(20.59)	(45.78)	(13.50)	(17.23)

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TABLE I
(CONTINUED)

	1900 Mean (standard deviation)	1910 Mean (standard deviation)	1920 Mean (standard deviation)	1930 Mean (standard deviation)
Panel A: Age-specific annual mortality rate per 1,000 in each age interval in death registration states				
Age 90–94	322.33	290.66	306.21	286.05
	(32.18)	(78.83)	(37.45)	(33.71)
Age 95+	431.91	358.44	333.78	333.60
	(43.84)	(123.09)	(52.89)	(63.28)
Panel B: Cause-specific annual mortality rate per 1,000 total population in death registration states				
Typhoid fever	0.30	0.24	0.09	0.06
	(0.09)	(0.11)	(0.05)	(0.05)
Malaria	0.06	0.01	0.05	0.03
	(0.04)	(0.01)	(0.11)	(0.08)
Smallpox	0.00	0.00	0.01	0.00
	(0.00)	(0.01)	(0.02)	(0.00)
Measles	0.14	0.10	0.08	0.04
	(0.11)	(0.07)	(0.04)	(0.04)
Scarlet fever	0.08	0.10	0.04	0.02
	(0.03)	(0.07)	(0.03)	(0.01)
Whooping cough	0.12	0.12	0.13	0.06
	(0.03)	(0.05)	(0.05)	(0.03)
Diphtheria	0.35	0.18	0.13	0.05
	(0.13)	(0.07)	(0.05)	(0.03)
Influenza	0.37	0.14	0.75	0.22
	(0.20)	(0.08)	(0.25)	(0.09)
Meningitis	0.43	0.14	0.06	0.04
	(0.09)	(0.05)	(0.02)	(0.05)
Diabetes	0.12	0.15	0.15	0.17
	(0.03)	(0.05)	(0.05)	(0.06)
Circulatory disease	1.58	1.27	1.36	1.96
	(0.29)	(0.57)	(0.39)	(0.56)
Pneumonia	1.47	1.26	1.30	0.85
	(0.30)	(0.43)	(0.30)	(0.18)
Diarrhea under age 2	1.14	0.83	0.41	0.23
	(0.35)	(0.36)	(0.16)	(0.19)
Nephritis	0.82	0.87	0.87	0.88
	(0.25)	(0.29)	(0.21)	(0.28)
Suicide	0.10	0.15	0.10	0.16
	(0.02)	(0.05)	(0.04)	(0.07)
TB lungs	1.64	1.21	0.99	0.67
	(0.32)	(0.45)	(0.35)	(0.46)
TB other	0.21	0.19	0.13	0.08
	(0.06)	(0.06)	(0.04)	(0.03)

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TABLE I
(CONTINUED)

	1900 Mean (standard deviation)	1910 Mean (standard deviation)	1920 Mean (standard deviation)	1930 Mean (standard deviation)
Panel B: Cause-specific annual mortality rate per 1,000 total population in death registration states				
Cancer	0.69	0.72	0.81	0.91
	(0.13)	(0.24)	(0.25)	(0.30)
Accidents and violence	0.74	0.87	0.78	0.92
	(0.14)	(0.29)	(0.12)	(0.17)
Panel C: Nominal annual city government spending (in 1,000s)				
Total cost payments	N/A	$2,441	N/A	$6,812
		($9,547)		($27,100)
Charities, hospitals, and corrections cost payments	N/A	$176	N/A	$509
		($819)		($2,215)
Health conservation and sanitation cost payments	N/A	$241	N/A	$657
		($982)		($3,056)
Total outlays	N/A	$1,535	N/A	$3,594
		($5,923)		($12,300)
Charities, hospitals, and corrections outlays	N/A	$108	N/A	$213
		($318)		($610)
Health conservation and sanitation outlays	N/A	$158	N/A	$432
		($366)		($1,383)
Panel D: Real annual state government spending and revenue per capita				
Total revenue	$16.51	$17.79	N/A	$43.36
	($7.05)	($7.69)		($20.06)
Total spending	$14.94	$18.05	N/A	$43.99
	($8.12)	($7.30)		($15.78)
Property tax revenue	$3.51	$9.18	N/A	$8.91
	($1.07)	($10.23)		($6.94)
Transportation spending	$0.88	$2.61	N/A	$18.67
	($0.70)	($3.38)		($9.22)
Education spending	$2.46	$5.63	N/A	$10.79
	($1.06)	($3.12)		($7.10)
Social services spending	$2.23	$2.42	N/A	$3.68
	($0.96)	($1.22)		($1.40)

Note: Decennial mortality data by age (in Panel A) and by cause (in Panel B) are from the U.S. Bureau of the Census's decennial *Census of Population and Housing* (and are the same mortality statistics reported in the Bureau of the Census's annual *Mortality Statistics*). Municipal public finance data (Panel C) are from the U.S. Bureau of the Census's *Financial Statistics of Cities Having a Population of Over 30,000*, which are unavailable for 1900 and 1920. State public finance data (Panel D) are from Sylla, Legler, and Wallis ICPSR Study # 9728 (1900 and 1910) and the U.S. Bureau of the Census's *Financial Statistics of States* (1930), which are unavailable for 1920.

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across years include health conservation and sanitation spending; health conservation and sanitation infrastructure investment; charities, corrections, and hospital spending; and charities, corrections, and hospital infrastructure investment. Local funds supporting public–private hygiene campaigns (that built on existing charitable infrastructure) are primarily captured by spending for charities, corrections, and hospitals. Descriptive statistics for city-level public finance data are shown in Panel C of Table I.

State spending was also important for bolstering local health department activities. Annual information about real state spending and revenue between 1900 and 1930 in broad sectoral categories was provided by Larry Kenny and John Lott (Lott and Kenny 1999). State health board spending captured by the social service spending category was commonly directed toward establishing or strengthening city public health departments. Descriptive statistics for the state-level public finance data are shown in Panel D of Table I.

Finally, although many key public health appropriations during the Progressive Era were made at the local and state level, local and state legislative roll call data have not been systematically compiled to the best of my knowledge (and many important public health spending decisions are made at the committee and subcommittee level). Nevertheless, legislative responses to women's suffrage laws should also be evident at the federal level. I obtained roll call data for all votes brought to the Senate and House floors between 1900 and 1930 (during the 56th through 71st Congressional sessions) from the Voteview database compiled by Keith Poole and Howard Rosenthal (www.voteview.com). Because women's voluntary organizations were leading promoters of the Progressive Era reform agenda, each Senate and House bill was coded according to whether or not it was broadly consistent with this agenda. Votes were then aggregated across legislators and bills to the state-year level for each chamber, yielding the share of possible votes cast by legislators that were "progressive."

III.B. Empirical Strategy

Exploiting rich spatial and temporal variation in the timing of state-level women's suffrage laws after 1900, I use a simple difference-in-difference approach to estimate changes in public spending, progressive voting among legislators, and mortality by age/sex and cause associated with suffrage rights. Specifically, for

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states s and years y, I estimate equations of the general form

$$\ln(d_{sy}) = \alpha + \beta v_{sy} + \delta_y + \delta_s + \delta_s \times t + \varepsilon_{sy}, \quad (1)$$

where d is an outcome of interest (public spending, progressive voting, or deaths by age/sex or cause) in state s and year y, v is a dummy variable indicating whether or not women could legally vote, δ_s and δ_y are state and year fixed effects, and $\delta_s \times t$ represents state-specific linear time trends. The parameter of interest in this simple specification is β.

In this econometric framework, only the timing of state suffrage laws is assumed to be exogenous. Fixed differences across states, common factors varying nonlinearly over time (such as the establishment of the Children's Bureau in 1912), and state-specific differences that vary linearly over time are all purged from the estimate of β. Only trend breaks in the outcomes of interest that coincide precisely with the timing of women's suffrage laws are captured by this parameter. The validity of the identifying assumption is explored in detail in Section V.

A brief note on the use of deaths rather than death rates as dependent variables is also warranted. Because state-level population counts by age are not available annually between decennial population censuses, annual mortality rates cannot be constructed directly from annual deaths. Population projection techniques commonly used by demographers can be used to estimate denominators for these rates, but they are essentially sophisticated methods of interpolation that employ no additional intercensal information. The inclusion of state fixed effects and state-specific time trends therefore accomplishes the same general objective.

IV. Results

IV.A. Political Responsiveness to Women's Suffrage

Historical accounts suggest that women's enfranchisement improved child survival through its impact on public spending and that local public health spending growth fueled the Progressive Era's unprecedented door-to-door hygiene campaigns. This section provides direct evidence on how public spending and legislative behavior changed with suffrage laws, and Section IV.B then traces these changes in political economy through to child health outcomes.

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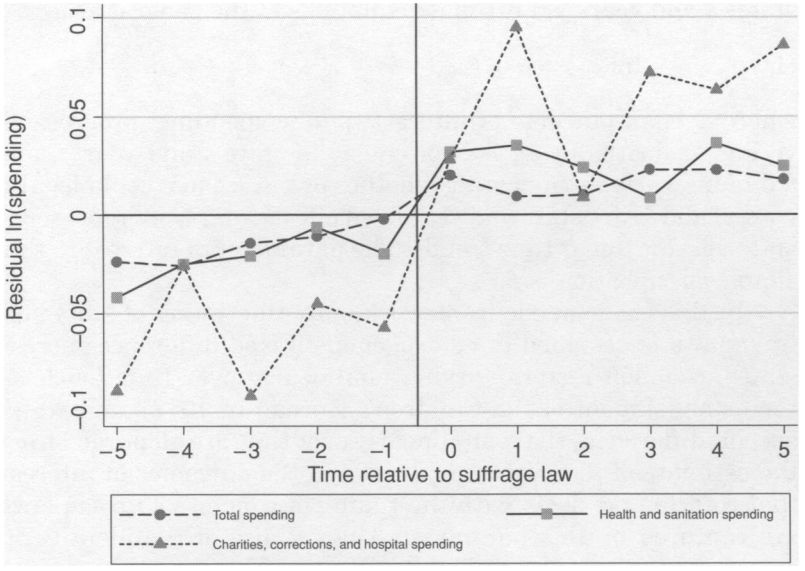

FIGURE II

Municipal Public Spending and Women's Suffrage Law Timing

Municipal public finance data from the U.S. Bureau of the Census's *Statistics of Cities Having a Population of Over 30,000* and *Financial Statistics of Cities Having a Population of Over 30,000*. Residual means shown relative to the year of women's suffrage laws in each state (year 0) obtained by estimating equation (1) without the suffrage dummy variable and with city rather than state fixed effects.

Public Spending. Assuming that the policy preferences of men and women differ, standard models of electoral competition predict that the extension of voting rights to women should cause politicians' support-maximizing policy positions to shift immediately to better reflect women's preferences. These immediate shifts should be based on politicians' *expectations* of how women will vote—even before women's voting patterns are actually observed. Following historical accounts, I first investigate changes in the size and composition of municipal public spending related to public health and hygiene. Using residual city public finance measures obtained by estimating equation (1) without the suffrage dummy (and with city rather than state fixed effects), Figure II plots residual means for the five years preceding and following suffrage law enactment (indexed to the year that women gained voting rights in each state—defined as year 0). It shows no relative increase or decrease in local spending prior to suffrage laws, followed by sharp increases that coincide precisely with the laws. The

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immediacy of these increases is consistent with theoretical predictions.[19] Although hygiene campaign spending is not detailed in the historical public finance data, the primary category capturing hygiene spending is spending for charities, corrections, and hospitals. As noted earlier, this is because hygiene campaigns grew as public–private partnerships with public funds scaling up preexisting efforts through charitable infrastructure, and are therefore reflected in charity spending.[20]

To examine changes in the size and composition of municipal spending parametrically, variants of equation (1) (with city rather than state fixed effects) were estimated with local public finance measures as dependent variables. Because the dependent variables are in logarithmic form, the coefficient estimates can be interpreted roughly as percent changes. Panel A of Table II shows these results. Women's suffrage is associated with an 8% increase in total municipal spending, a 6% increase in spending on health conservation and sanitation, and strikingly, a 36% increase in spending for charities, hospitals, and corrections.[21] Appendix Table A.1 also shows the dynamics of these increases over time. Panel B of Table II then reports estimates for state spending. The enfranchisement of women is associated with a 24% increase in state social service spending, but not with changes in any other state public finance measure.[22] Although state spending was not directly targeted toward hygiene campaigns, state health boards played important roles in developing the capacity of local public health departments.

Voter Turn-Out and Legislative Roll Call Behavior. The public finance changes shown in Figure II and Table II—which were

19. Lee, Moretti, and Butler (2004) provide evidence that political selection was more salient than political competition in the U.S. House of Representatives between 1946 and 1995. Given that suffrage laws do not always occur in election years, this paper's results are more consistent with political competition. These two mechanisms are not mutually exclusive, however, and lead to the same eventual outcomes.

20. Hospitals made negligible contributions to population health until the development of sulfa drugs in the 1930s, and it is doubtful that corrections spending would influence only childhood infectious diseases sensitive to hygienic conditions (see the mortality results presented in Section IV.B).

21. Table II also shows a large increase in infrastructure investment for charities, corrections, and hospitals, but many cities are missing data for this variable.

22. State social service spending includes appropriations for hospitals, charities, corrections, and state health boards. Given that social service spending is a small share of total spending, increases in total spending are presumably difficult to detect. Lott and Kenny (1999) report a significant increase in total state spending.

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TABLE II
WOMEN'S SUFFRAGE LAWS AND MUNICIPAL AND STATE PUBLIC FINANCE

Dependent variable	Estimate (standard error)	N	R^2
Panel A: Municipal public finance			
ln(total spending)	0.079***	3,661	0.97
	(0.029)		
ln(health conservation and sanitation spending)	0.061*	3,661	0.94
	(0.036)		
ln(charities, hospitals, and corrections spending)	0.360***	3,454	0.92
	(0.105)		
ln(total infrastructure investment)	0.012	3,658	0.85
	(0.086)		
ln(health conservation and sanitation infrastructure investment)	0.152	3,629	0.70
	(0.114)		
ln(charities, hospitals, and corrections infrastructure investment)	0.580**	1,462	0.71
	(0.276)		
Panel B: State public finance			
ln(total revenue)	0.010	673	0.89
	(0.084)		
ln(property tax revenue)	0.070	579	0.94
	(0.209)		
ln(total spending)	−0.057	688	0.87
	(0.088)		
ln(highway spending)	0.300	667	0.90
	(0.215)		
ln(education spending)	0.137	689	0.75
	(0.157)		
ln(social service spending)	0.206***	688	0.84
	(0.071)		

Note: Municipal public finance data from the U.S. Bureau of the Census's *Statistics of Cities Having a Population of Over 30,000* and *Financial Statistics of Cities Having a Population of Over 30,000*; state public finance data from Sylla, Legler, and Wallis ICPSR Study #9728 and the U.S. Bureau of the Census's *Financial Statistics of States*. Estimates and standard errors (in parentheses, clustered by state) shown for the women's suffrage law dummy variable obtained by estimating equation (1) (controlling for state and year fixed effects and state-specific linear time trends, with city fixed effects subsitituted for state fixed effects in the municipal public finance regressions). The municipal public finance sample contains city-year observations from years 1905–1909, 1909–1913, 1915–1919, and 1921–1930; the state public finance sample contains state-year observations from years 1900–1919 and 1921–1930. Spending ("cost payments") is defined as "payments of cities and other municipalities for their expenses, interest, and outlays, less amounts which have been returned or are to be returned by reason of error or otherwise." Infrastructure investment ("outlays") are defined as "the costs of property, including land, buildings and equipment, and public improvements more or less permanent in character."
*$p < .10$.
**$p < .05$.
***$p < .01$.

instrumental in bringing the hygienic benefits of the bacteriological revolution to the American public—reflect changes in legislative behavior. This section provides direct evidence on changes in the political economy of states, building on evidence provided by Lott and Kenny (1999) that state-level voter participation among

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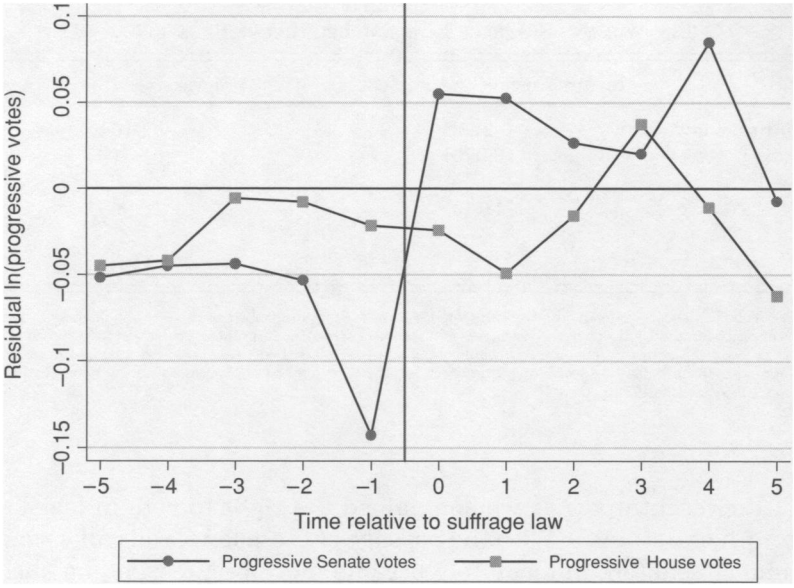

FIGURE III

"Progressive" Legislative Votes and Women's Suffrage Law Timing

Legislative roll call data from the Voteview database; coding of progressive voting done by author as described in the data appendix. Residual means shown relative to the year of women's suffrage laws in each state (year 0) obtained by estimating equation (1) without the suffrage dummy variable.

adults age 21+ increased by 44% the year after women were enfranchised. This pattern of electoral participation is consistent with expectations among legislators that female voting would be an important strategic consideration in selecting support-maximizing policy positions.

Political responses should be directly evident in the voting behavior of legislators. To further test the prediction of immediate changes in political behavior, I use congressional roll call data. My specific hypothesis is that as women gained the right to vote in individual states, congressional representatives from those states should have immediately altered their roll call voting to better reflect perceived women's preferences. Because bills pertaining to local public health and hygiene are seldom introduced at the federal level, I instead assess the consistency of congressional voting with the broad Progressive Era reform agenda promoted by highly visible women's voluntary organizations.

Figure III (constructed the same way as Figure II) shows progressive voting among legislators in the Senate and the House

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TABLE III
WOMEN'S SUFFRAGE LAWS AND LEGISLATIVE BEHAVIOR

	ln("progressive" Senate votes)	ln("progressive" House votes)
Suffrage law	0.228***	0.010
	(0.079)	(0.051)
N	1,110	1,399
R^2	0.83	0.95

Note. Legislative roll call data from the Voteview database; coding of progressive voting done by author as described in the Data Appendix. Estimates and standard errors (in parentheses, clustered by state) shown for the women's suffrage law dummy variable obtained by estimating equation (1) (controlling for state and year fixed effects and state-specific linear time trends). The Voteview sample contains state-year observations from the years 1900–1930.
*$p < .10$.
**$p < .05$.
***$p < .01$.

of Representatives as women gained the right to vote in legislators' home states.[23] With the passage of these laws, roll call voting among senators immediately became more progressive; no such response is evident in the House. Although the reason for this difference in behavioral response by legislative body is unclear, the overall pattern is again generally consistent with theoretical predictions.[24] Parametric estimates of β in equation (1) for the entire period 1900–1930 (shown in Table III) suggest that women's suffrage was associated with a 23% increase in progressive voting in the Senate. Appendix Table A.1 also shows the dynamics of this shift in legislator progressiveness over time.

IV.B. Mortality by Age / Sex and Cause

My ultimate interest is in tracing changes in American political economy linked to women's suffrage through to changes in child survival. Using residuals obtained by estimating equation (1) without the suffrage dummy, Figure IV plots residual means for age-specific mortality by sex for years relative to women's enfranchisement. In general, it shows rapid mortality declines for

23. The direct election of senators began in 1913 with the ratification of the Seventeenth Amendment.

24. Lott and Kenny (1999) report an increase in "liberal" voting in both the House and Senate with women's suffrage. One possible explanation for progressive voting results varying by chamber is that because members of the House represent smaller areas, they know their constituents better than do senators—and better anticipated that a "gender gap" in voting would not emerge as originally expected. For a historical analysis of this recognition in the late 1920s, see Harvey (1998). I thank Pam Nickless for suggesting this explanation.

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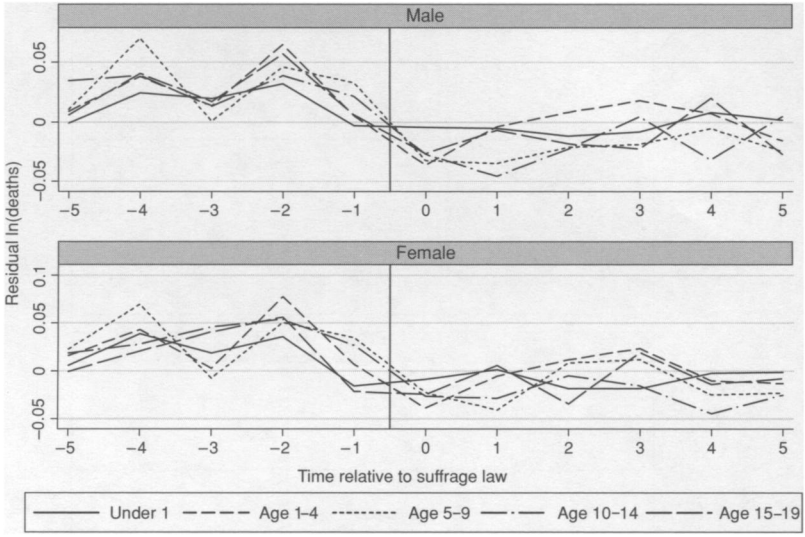

FIGURE IV

Deaths by Age and Sex and the Timing of Suffrage Laws

Mortality data from the U.S. Bureau of the Census's annual *Mortality Statistics*. Residual means shown relative to the year of women's suffrage laws in each state (year 0) obtained by estimating equation (1) without the suffrage dummy variable.

both boys and girls when suffrage legislation was enacted.[25] The timing of these reductions is again consistent with the proposition that suffrage led to abrupt increases in local public health spending that fueled the Progressive Era's unprecedented door-to-door hygiene campaigns.

Figure V shows parametric estimates of β obtained by estimating equation (1) for deaths by sex in each age interval reported consistently over time between 1900 and 1936 (0–1, 1–4, 4–9, 10–14, etc.). Women's suffrage is generally associated with mortality reductions for children at all ages between age one and age nineteen, but not for infants (defined as those under age one) or for adults at any age.[26] In contrast with contemporary evidence on

25. Deaths under age 1 appear somewhat lower the year before suffrage laws, but Online Appendix Table 3 shows that this drop is not statistically meaningful. More generally, there is no statistically meaningful association between suffrage laws and infant deaths reported in the main results (see Figure V).

26. Because most infant deaths are birth-related and are concentrated in the neonatal period (the first 28 days following birth), the absence of statistically meaningful infant mortality estimates is not surprising given the rudimentary state of early-twentieth-century obstetrics (even relative to other specialties). Midwives delivered a large share of babies, but were incapable of managing common

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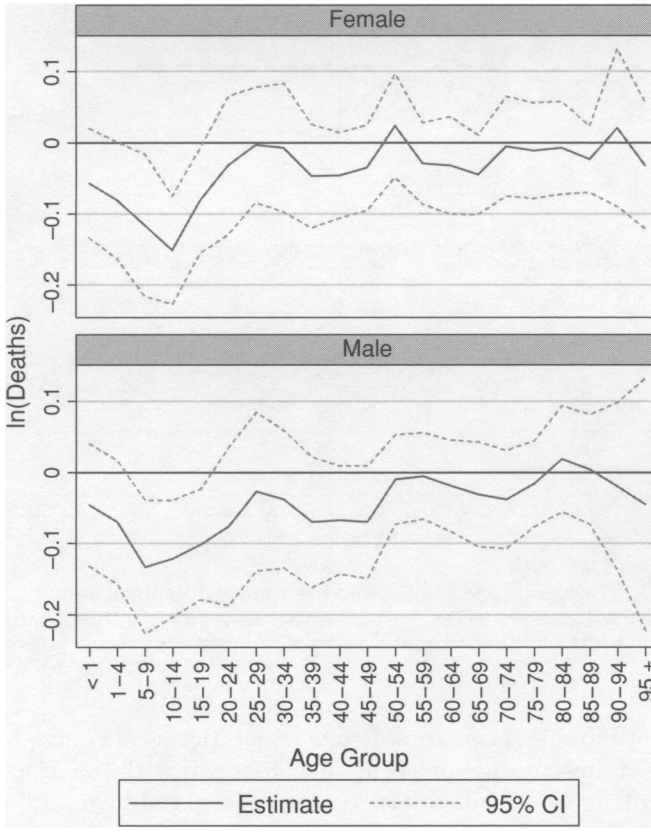

FIGURE V

Women's Suffrage Laws and Mortality Estimates by Age and Sex

Mortality data from the U.S. Bureau of the Census's annual *Mortality Statistics*. Estimates and 95% confidence intervals (standard errors clustered by state) for β obtained by estimating equation (1) with state-year observations for deaths by sex in each age interval reported consistently over time between 1900 and 1936 (0–1, 1–4, 4–9, 10–14, etc.).

shifts in women's bargaining power within the household in developing countries, there are no meaningful gender differences in

complications of childbirth and managed hygiene poorly in birth settings (Meckel 1990; Preston and Haines 1991). Despite the large shift of childbirth from home to hospital between 1900 and 1930, birth conditions did not improve during this period; maternal mortality rates did not decline *in absolute terms* until the mid-1930s (Melissa Thomasson and Jaret Treber, From Home to Hospital: The Evolution of Childbirth in the United States, 1927–1940, unpublished manuscript, Miami University, 2004). Public health campaigns emphasizing hygiene within homes did not address birth conditions.

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the survival gains associated with women's suffrage (Duflo 2003; Qian 2008). Appendix Table A.1 then shows the dynamics of age-specific reductions in death over time.

These child mortality reductions are large, with point estimates ranging from 8% to 15%.[27] Because child mortality is heavily concentrated at young ages, the great majority of absolute gains in child survival occurred at young ages. To place these estimates in context, mortality rates in death registration states fell by 72% for children aged 1 to 4 and 59% for children aged 5 to 9 between 1900 and 1930. The proportions of these declines explained by the estimates in Figure V are 5% and 10%, respectively.[28] In absolute terms, these reductions imply approximately 20,000 averted child deaths nationwide each year relative to mortality before suffrage laws were enacted.[29]

I then investigate specific causes of death that declined as women gained the right to vote. State-level mortality data disaggregated both by age and by cause are reported erratically between 1900 and 1936, but changes in cause-specific mortality at all ages can reasonably be attributed to children given that I find little evidence of adult mortality change. Moreover, certain infectious diseases explicitly reported were notorious child-killers that did not strike adults. Table IV shows suffrage estimates obtained by re-estimating equation (1) with cause-specific deaths as dependent variables. The only causes of death that responded to suffrage laws were diarrheal diseases (under age two—a reporting anomaly), meningitis, and diphtheria, with reductions of 11%, 23%, and 24%, respectively. All three were leading infectious killers of children (but not adults) during the Progressive Era, and importantly, all three can be effectively combated through good household hygiene.[30]

27. Excluding states in which women were unable to vote until the Nineteenth Amendment was ratified in 1920 yields the same pattern of results.

28. To calculate these shares, the fraction of years women could vote in each state between 1900 and 1930 was used to weight the mortality reductions shown in Figure V. See Table I for levels and changes in mortality by age and cause during this period.

29. This number is obtained by multiplying mean age-specific deaths the year before suffrage laws were enacted at ages for which statistically significant estimates are shown in Figure V by the corresponding point estimates in Figure V, multiplying by 48 to obtain implied nationwide magnitudes at each age, and then summing across ages.

30. Meningitis is an inflammation of the membrane surrounding the brain and spinal column generally caused by any of roughly fifty types of bacteria. Good household hygiene was the best prevention at the time (it is transmitted by respiratory droplets and other bodily fluids), although there were some early therapeutic successes with intrathecal equine meningococcal antiserum before the advent of

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TABLE IV
WOMEN'S SUFFRAGE LAWS AND CAUSE-SPECIFIC MORTALITY

Dependent variable	Estimate (standard error)	N	R^2
ln(typhoid deaths)	−0.058	1,109	0.97
	(0.070)		
ln(malaria deaths)	−0.067	911	0.96
	(0.130)		
ln(smallpox deaths)	−0.237	690	0.55
	(0.233)		
ln(measles deaths)	−0.061	1,094	0.73
	(0.133)		
ln(scarlet fever deaths)	0.174	1,107	0.89
	(0.162)		
ln(whooping cough deaths)	−0.052	1,108	0.90
	(0.090)		
ln(diphtheria deaths)	−0.241*	1,106	0.95
	(0.125)		
ln(influenza deaths)	−0.089	1,109	0.97
	(0.085)		
ln(meningitis deaths)	−0.234**	1,107	0.93
	(0.097)		
ln(pneumonia deaths)	−0.050	1,109	0.99
	(0.042)		
ln(diarrhea deaths under age 2)	−0.114*	1,109	0.98
	(0.065)		
ln(TB deaths)	−0.044	1,109	1.00
	(0.042)		
ln(childbirth deaths)	0.001	1,109	0.98
	(0.053)		
ln(heart disease deaths)	−0.002	1,109	0.99
	(0.030)		
ln(diabetes deaths)	0.038	1,108	0.99
	(0.042)		
ln(nephritis deaths)	−0.003	1,109	0.99
	(0.034)		
ln(cancer deaths)	−0.014	1,109	1.00
	(0.030)		
ln(accidents/violent deaths)	−0.022	1,109	0.99
	(0.041)		
ln(suicide deaths)	−0.029	1,109	0.99
	(0.030)		
ln(childhood infectious disease deaths)	−0.175***	7,323	0.81
	(0.078)		
ln(other deaths)	−0.067	9,782	0.88
	(0.046)		

Note. Mortality data from the U.S. Bureau of the Census's annual *Mortality Statistics*. Single cause estimates and standard errors (in parentheses, clustered by state) shown for the women's suffrage law dummy variable obtained by estimating equation (1) (controlling for state and year fixed effects and state-specific linear time trends) for each individual cause of death using the unbalanced mortality sample with state-year observations, 1900–1936. Grouped cause estimates and standard errors (in parentheses, clustered by state) in the bottom two rows are obtained by regressing ln(deaths) on individual cause dummy variables, cause-specific linear time trends, state fixed effects, and year fixed effects separately for infectious childhood diseases (diphtheria, meningitis, diarrhea under age 2, measles, scarlet fever, smallpox, and whooping cough) and other causes (typhoid fever, malaria, pneumonia, diabetes, circulatory disease, Bright's disease/nephritis, cancer/tumors, accidents/violent deaths, and suicide) using the unbalanced sample of cause-state-year observations, 1900–1936.

* $p < .10$.
** $p < .05$.
*** $p < .01$.

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Because cause-specific deaths are noisy, I also pool across causes to construct aggregate disease categories: childhood infectious diseases (the ones most sensitive to hygiene) and other diseases.[31] The bottom two rows of Table IV show estimates obtained by using cause–state–year observations to regress ln(deaths) on a women's suffrage dummy, cause-specific dummies, cause-specific time trends, and state and year fixed effects. Women's suffrage is associated with an 18% decline in childhood infectious diseases but not with the changes in other deaths.

V. Informal Validity Tests and Robustness[32]

Natural concerns with this paper's empirical strategy include the possibility of endogenous state-level suffrage legislation, progressive legislators enacting many progressive laws simultaneously, and confounding changes in the composition of state populations. This section presents a range of tests that investigate—but generally fail to corroborate—such concerns.

First, I assess whether or not there were relative decreases in child mortality, cause-specific mortality, state and local public spending, or progressive voting just before women's suffrage laws were adopted (which might reflect differentially liberalizing state policy environments.) To test for trend breaks at various points prior to the passage of laws, dummy variables denoting intervals two, four, and six years before suffrage were included in variants of equation (1). For all dependent variables found to be related to women's suffrage, the resulting estimates are statistically indistinguishable from zero (as shown in Online Appendix Table 3).

Second, I investigate how suffrage law dates were related to social, economic, and demographic conditions in 1900 (literacy, employment, manufacturing wages, and workforce share in

sulfa drugs and modern antibiotics. Diphtheria is an upper respiratory tract illness caused by airborne bacteria. A partially effective antitoxin became available in the 1890s, but its use was not widespread, and a vaccine was not developed until 1924; sulfa drugs became the most effective modern therapy. Specific types of diarrheal disease are not reported in the historical mortality statistics (other than typhoid fever); the best preventive household measures were hand and food washing and water and milk boiling.

31. Childhood infectious diseases include diphtheria, meningitis, diarrhea under age two, measles, scarlet fever, smallpox, and whooping cough. All other causes include typhoid fever, malaria, pneumonia, diabetes, circulatory disease, Bright's disease/nephritis, cancer/tumors, violent accidents, and suicide.

32. The results described in this section but not included in the paper are available online as supplementary appendix materials at www.stanford.edu/~ngmiller.

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manufacturing), the dates of other major Progressive Era laws (governing divorce/alimony rights, mother's pensions, minimum wage and maximum hours of work for women, prohibition, and workers' compensation), and the dates when GFWC chapters were established in each state. Online Appendix Figure 1 suggests no discernable relationship between suffrage laws and other major Progressive Era events (suggesting that progressive reforms were not temporally clustered), and Online Appendix Table 4 also generally suggests no relationship with other state-level laws or characteristics in 1900.

Third, if changes in state social or political environments fostered both women's suffrage and better child health—or if reformers enacted many progressive changes simultaneously—estimates of β in equation (1) should differ between states that voluntarily extended suffrage to women and those that had it imposed on them by the Nineteenth Amendment. Following Lott and Kenny (1999), I define voluntary states as those that passed state-level suffrage laws or that voted to ratify the Nineteenth Amendment. Online Appendix Table 5 shows interaction terms between women's suffrage and a dummy variable for voluntary suffrage. All are insignificant, suggesting statistically identical estimates in voluntary and mandatory states.

Fourth, if this paper's major results were due to unobserved state-level social liberalization over time, there should also be detectable changes during other women's rights efforts not ultimately resulting in suffrage laws. Online Appendix Table 6 shows results obtained by replacing suffrage dummy variables with dummies for *failed* (but in many cases promising) women's rights campaigns (ballot referenda and campaigns lobbying state constitutional conventions). None are statistically meaningful.[33]

Fifth, the enactment of suffrage laws could have induced internal migration, altering the composition of residents in states with suffrage rights relative to those without them. Using IPUMS 1% population census samples from 1900, 1910, and 1920, Online Appendix Table 7 reports estimates obtained by regressing the share of state residents who report being born in that state on cumulative years of women's suffrage and other state-level

33. The single exception is deaths among females aged 15–19 with constitutional conventions (and the point estimate for female deaths at ages 15–19 in Figure V is itself not statistically different from zero). The data used to analyze failed women's rights initiatives were obtained from Marie Cornwall (Cornwall 2003) and are described in the Online Appendix.

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socioeconomic characteristics.[34] Little evidence of confounding patterns of internal migration emerges.

Sixth, I consider confounding fertility responses to suffrage laws.[35] Exploiting the fact that any fertility response should vary by women's age when suffrage rights were introduced (and not be present at all among women first able to vote after menopause), I use the IPUMS 1% 1940 population census sample to make comparisons simultaneously among women the same age but born in different states and among different-aged women born in the same state.[36] Online Appendix Figure 2 shows the resulting estimates, suggesting little econometric evidence that women's fertility responded to suffrage laws.

Finally, I assess the robustness of the results using a variety of alternative specifications as shown in Appendix Table A.2 (Online Appendix Tables 8–11 show results for a broader set of dependent variables). Because Figure I suggests a regional pattern of suffrage laws, column (2) reports suffrage estimates obtained by including census region × year fixed effects in equation (1). The results are not generally consistent with unobserved regional shocks (not identified in the historical literature) explaining the paper's basic findings. Column (3) reports estimates from equation (1) with standard errors calculated to allow spatial correlation according to geographic distance between states, following Conley (1999), suggesting that doing so does not substantially

34. These are proportion of urban residents; proportion of home ownership; mean household size; mean number of own children per household; proportion of the population at ages 0–4, 5–14, 15–24, 25–44, and over 45; proportion of males; proportion of married residents; population shares white, black, and native American; literacy rate among those aged 10+; labor force participation rate among those aged 16+; and mean Duncan socioeconomic index score.

35. This concern is not relevant to mortality among older children, and the absence of changes in adult mortality suggests that the composition of potential mothers did not change.

36. Because the Bureau of the Census's birth registration area was not established until 1915 and was incomplete until 1933, fertility responses to suffrage laws must be investigated using population census data. My approach is based on women's state of birth rather than state of residence. Using individual ever-married sample-line women w born in states s and who were age a in the 1940 population census (and who were in a five-year age interval i = 15–19, 20–24, . . . , 50–54 when a suffrage law was enacted in their state of birth), I estimate $b_{was} = \alpha + \Sigma_i \beta_i v_{ias} + \delta_s + \delta_a + \delta_s t + \varepsilon_{was}$, where b is the number of lifetime births reported by each woman, v is a dummy variable indicating whether or not a woman could first legally vote in a given age interval i, δ_s and δ_a represent state and age (or birth cohort) fixed effects, and $\delta_s \times t$ represents state-specific linear time (or age) trends. Because lifetime births can reasonably be modeled as count data and the distribution of lifetime births is left-censored at zero, I estimate this equation by maximum likelihood using a negative binomial model.

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alter the inferences drawn.[37] Column (4) assesses the results' sensitivity to conditioning on time-varying state level covariates. They are generally robust to the inclusion of these covariates, although many state socioeconomic characteristics are available only for decennial census years.[38] Column (5) reports estimates obtained by recoding partial suffrage states as not enfranchising women until full-suffrage rights were extended (generally 1920); column (6) shows results obtained by excluding states enfranchising women in 1920; and column (7) shows estimates from samples restricted to states present in the mortality data at least five years before suffrage law enactment. With a handful of exceptions, the paper's main findings are robust across these alternative specifications.

VI. Conclusions

This paper argues that the extension of suffrage rights to American women allowed children to benefit more fully (or rapidly) from the scientific breakthroughs of the bacteriological revolution. Simple hygienic practices—including hand and food washing, water and milk boiling, meat refrigeration, and renewed emphasis on breastfeeding—were among the most important innovations of this revolution in knowledge about disease. Communicating their importance to the American public required large-scale door-to-door hygiene campaigns, which women championed at first through voluntary organizations and then through government. Consistent with the predictions of standard models of electoral competition, support-maximizing politicians responded immediately to perceived changes in the distribution of electorate

37. Specifically, I allow for spatial correlation among states within one standard deviation of each other in the distribution of distance between state centroids (using code posted at http://faculty.chicagogsb.edu/timothy.conley/research/gmmcode/x_ols.ado).

38. Interpolation is used to obtain data for intercensal years. These variables combine extensive data assembled by Michael Haines (made available as ICPSR Study # 2896) and Adriana Lleras-Muney (posted at http://www.princeton.edu/~alleras/papers/state2.dta) and include population over age 10 in gainful occupations, population over age 10 in clerical occupations, total population, urban population (in cities with 25,000 or more), total black population, total male population, fraction of girls aged 10–15 enrolled in school, fraction of boys aged 10–15 enrolled in school, total illiterate population over age 10, average value per acre of farmland and buildings, average acres per farm, population density, population share foreign born, rural surface road mileage per 1,000 population, value of all crops, and total number of farms.

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policy preferences as women gained the right to vote. The result was greater local public health spending that fueled hygiene campaigns, leading to fewer deaths from leading infectious childhood killers of the day.[39]

Given the common failures of health education campaigns in developing countries today, further research is needed to reconcile contemporary difficulties with this historical success. A wide variety of candidate explanations are possible. First, relative to other types of health behaviors such as avoiding sexual contact, reducing diets high in saturated fats, and quitting smoking, hygienic behaviors may not entail large behavioral costs. Second, in an environment of competing risks, complementary sanitary reforms (such as drinking water disinfection) occurring during this period raised the return to simple hygienic health behaviors. Third, the absence of curative measures a century ago strengthened incentives for prevention (i.e., less moral hazard). Fourth, effective health education campaigns are generally labor-intensive, and labor inputs in this setting were particularly inexpensive.[40] Fifth, there was considerable latent demand for child health. As Meckel (1990) notes, the emphasis on maternal health education was strongly reinforced by the emerging "cult of motherhood" (Ladd-Taylor 1986).

This paper's findings also suggest at least two broader conclusions relevant to contemporary development challenges. One is that strengthening the expression of women's preferences can improve child health and welfare beyond the special case of lump-sum transfers targeted to women. Unlike such transfers, many policies and programs seeking to "empower" women introduce nuanced incentives with theoretically ambiguous consequences for children (Becker 1981). As a case in point, opponents of women's suffrage in the United States often supported their position by invoking the potential neglect of children (Flexner and Fitzpatrick 1959).

The other is that demand-oriented health improvement strategies may deserve more careful attention. In developing

39. Although this paper's estimated mortality reductions are large, more powerful forces appear to have been at work during the early twentieth century. Cutler and Miller (2005) report larger mortality reductions in American cities linked to drinking water disinfection, for example.

40. Campaign organizers recruited school nurses to work during the summer, provided the desirable contemporary equivalent of residency training to otherwise unpaid doctors, and enlisted large cadres of volunteers.

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countries today, over 10 million children die each year from preventable causes (World Health Organization 2002; Black, Morris, and Bryce 2003). Although international health efforts have traditionally emphasized shifting the supply of health technologies outward, demand for these technologies is also puzzlingly low in many contexts (Bonair, Rosenfield, and Tengvald 1989; Scrimshaw 2001). Promoting gender equality may be an important means of increasing household demand for simple, highly beneficial health technologies.

APPENDIX I[41]

A. *Women's Suffrage Dates—Legislation, Constitutional Conventions, and Referenda*

As shown in Figure I, 29 states extended the right to vote to women before Nineteenth Amendment was approved in 1920. Among the other 19 states, 7 approved the amendment and 12 had suffrage imposed on them. Dates of state-level women's suffrage laws were obtained from Lott and Kenny (1999) and supplemented with extensive archival project data provided by Marie Cornwall that were collected from the legislative archives of the 48 continental states (with support from the National Science Foundation through Grants NSF 0095224 and NSF 9876519) (Cornwall 2003). The Lott and Kenny (1999) data provide first suffrage law dates but do not distinguish between full and partial suffrage laws. However, the Cornwall data do make this distinction. Presidential-only suffrage laws were enacted in Illinois, Indiana, Iowa, Maine, Minnesota, Missouri, Nebraska, North Dakota, Ohio, Rhode Island, Tennessee, Vermont, and Wisconsin (Michigan passed a presidential-only law and then a full suffrage law the following year before the Nineteenth Amendment). Primary-only suffrage laws were enacted in Arkansas and Texas.

Several validity tests also examine unsuccessful state-level efforts to enfranchise women. These efforts generally took the form of lobbying leading up to state constitutional conventions and ballot initiatives/referenda. On constitutional conventions, Marie Cornwall and colleagues identified all constitutional conventions held in states between 1848 and 1919 and coded each

41. Additional supplemental information about the data used in this paper's analyses is available online at www.stanford.edu/~ngmiller.

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according to whether or not a suffrage proposal was introduced at the convention. On referenda, the Cornwall data identify every year during this period that a state held a referendum on the question of woman suffrage. Votes for and against enfranchisement were recorded for each referendum as available.

B. *Historical Mortality Statistics*

No national system of death records existed in the United States prior to 1933 (Haines 2001). However, the Bureau of the Census established an official "death registration area" in 1880 and began publishing its annual *Mortality Statistics* for death registration states (those deemed to have adequate death registration systems) in 1900 (U.S. Bureau of the Census 1900–1936, Haines 2001). As Online Appendix Figure 3 shows, the registration area grew from 10 states in 1900 to include all 48 states in 1933 (U.S. National Office of Vital Statistics 1954). (Delaware technically entered the death registration area in 1890 but does not appear in the annual *Mortality Statistics* until 1919.)

I have digitized these published mortality statistics for all registration area states for all years 1900–1936 by age and sex and by cause. For males and females, specific age groups are under 1 (infant mortality), 1–4, 5–9, . . . , 90–94, and 95+. The causes of death followed consistently over time are typhoid fever, malaria, smallpox, measles, tuberculosis, scarlet fever, whooping cough, meningitis, diarrhea (under age two), diphtheria, influenza, pneumonia, puerperal fever and childbirth-related complications, diabetes, heart disease, kidney disease, cancer, accidents, suicide, and all other causes. Because of changes over time in the Bureau of the Census's cause of death reporting, some conservative assumptions were also necessary to harmonize this information across the years 1900–1936.

In addition to quality control efforts in the data entry work (double entry and spot checking), I also verified that summations across age- and cause-specific deaths equaled provided totals. This process revealed a small number of inconsistencies in the printed historical mortality tables, which are summarized in the Online Appendix.

C. *Historical Municipal Public Finance Data*

Annual data on nominal municipal-level health-related spending were digitized for cities with populations exceeding 30,000

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using the *Statistics of Cities* for the years 1905–1908 and the *Financial Statistics of Cities* for the years 1909–1913, 1915–1919, and 1921–1930. The specific categories of health-related city spending harmonized across years include health conservation and sanitation cost payments; health conservation and sanitation outlays; charities, corrections, and hospital cost payments; and charities, corrections, and hospital outlays. Total cost payments and total outlays were collected and included as well. The U.S. Bureau of the Census (1914) defined cost payments as "payments of cities and other municipalities for their expenses, interest, and outlays, less amounts which have been returned or are to be returned by reason of error or otherwise." Outlays are defined as "the costs of property, including land, buildings and equipment, and public improvements more or less permanent in character." Throughout the paper I refer to cost payments as "spending" and outlays as "infrastructure investment." Although more disaggregated data are provided in some years (health conservation and sanitation separately rather than combined, for example), the categories constructed are the most disaggregated that can be harmonized across all years.

Missing data also cannot be distinguished from true zeros. For cities present in a given year, if all empty cells are assumed to reflect missing data rather than true zeros, variable-specific missing data rates do not exceed 10%—with the exception of outlays for charities, corrections, and hospitals, for which missing data rates can exceed 70% (analyses of this outlay category should therefore be interpreted with caution and do not make a substantive contribution to this paper's findings). The Online Appendix summarizes the number of cities present in each year.

D. Historical State Public Finance Data

Historical information about annual state revenue and spending in real 1967 dollars per capita was provided by John Lott and Larry Kenny and is the same state public finance data used in Lott and Kenny (1999). This data harmonizes state public finance information from a large archival project conducted by Richard Sylla, John Legler, and John Wallis with support from National Science Foundation (see Sylla, Legler, and Wallis ICPSR Study #9728, "Sources and Uses of Funds in State and Local Governments, 1790–1915") with data from the *Financial Statistics of States* for the years 1915–1919 and 1921–1931. It also includes

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pre-1915 data provided by John Wallis from Arkansas, California, Connecticut, Florida, Georgia, Idaho, Iowa, Kentucky, and West Virginia not available in ICPSR Study #9728.

The specific categories of per capita revenue and spending that are comparable over time include total public spending, public revenue, property tax revenue, transportation spending (which combines current and capital expenditures on highways), education spending (which combines current and capital expenditures on elementary and secondary schools), and social service spending (which combines current expenditures on state health boards, charities, hospitals, and corrections).

E. Voteview Congressional Roll Call Data

Key public health appropriations during the Progressive Era were primarily made at the state and especially the local level. To the best of my knowledge, state and local legislative roll call data have not been systematically compiled (and critical appropriations decisions are made at the committee and subcommittee level anyway). Nevertheless, legislative responses to women's suffrage laws should also be evident at the federal level in the Senate and the House of Representatives. I therefore obtained roll call data for all votes brought to the Senate and House floors roughly between 1900 and 1930 (for the 56th through the 71st congressional session) from the publicly available Voteview database (www.voteview.com) maintained by Keith Poole. These data include the date that each bill was brought to a vote, how each representative voted on each bill, the home state of each representative, and a brief description of each bill's substantive legislative proposal.

Because women's voluntary organizations were outspoken advocates of the Progressive Era reform agenda, each Senate and House bill was coded according to whether or not it was broadly consistent with this agenda. In deciding whether or not a bill was progressive, I adopted the following definition of progressivism taken from http://www.digitalhistory.uh.edu/modules/progressivism/index.cfm: "Progressivism is an umbrella label for a wide range of economic, political, social, and moral reforms. These included efforts to outlaw the sale of alcohol; regulate child labor and sweatshops; scientifically manage natural resources; ensure pure and wholesome water and milk; Americanize immigrants or restrict immigration altogether; and bust or regulate

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trusts. Drawing support from the urban, college-educated middle class, progressive reformers sought to eliminate corruption in government, regulate business practices, address health hazards, improve working conditions, and give the public more direct control over government through direct primaries to nominate candidates for public office, direct election of senators, the initiative, referendum, and recall, and women's suffrage." Using this definition, each bill was specifically coded as progressive, anti-progressive, or neither. Agreement between the two individuals coding these bills in a 10% sample of all bills was approximately 75%.

Next, the share of all possible votes cast by representatives from each state in each year that were coded as progressive was calculated. Using legislator by bill observations, each representative's vote was first coded as "Yea," "Nay," "Not voting," or "Other." Yea includes "Yea," "Paired Yea," and "Announced Yea," and Nay includes "Nay," "Paired Nay," and "Announced Nay." A vote was considered progressive if it was a Yea vote for a progressive bill or a Nay vote for an anti-progressive bill. Using each legislator's home state, votes were then aggregated across legislators and bills to the state–year level, yielding the number of progressive votes cast by legislators from each state in each year. Dividing these numbers by the total possible number of votes yields the share of votes that were progressive for each state and year by legislative body. The total possible number of votes was calculated to account for legislator deaths and states gaining statehood between 1900 and 1930.

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APPENDIX II: WOMEN'S SUFFRAGE LAWS AND OUTCOMES OVER TIME

Dependent variable	4–6 years before suffrage	1–3 years before suffrage	0–4 years after suffrage	5+ years after suffrage	*F*-statistic, 1–3 and 4–6 years before suffrage	*F*-Statistic, 0–4 and 5+ years after suffrage
ln("progressive" Senate votes)	0.041	0.012	0.227*	0.246	0.13	2.61*
	(0.088)	(0.133)	(0.128)	(0.173)	(.88)	(.08)
ln(total municipal spending)	0.005	0.045	0.135***	0.145**	1.55	5.45***
	(0.023)	(0.028)	(0.049)	(0.063)	(.23)	(.01)
ln(municipal health conservation and sanitation spending)	0.024	0.065	0.159	0.123	0.56	3.80**
	(0.046)	(0.075)	(0.102)	(0.123)	(.57)	(.03)
ln(municipal charities, hospitals, and corrections spending)	0.148	0.123	0.650***	0.811***	1.09	7.61***
	(0.113)	(0.174)	(0.177)	(0.210)	(.35)	(.00)
ln(state social service spending)	0.107	0.070	0.310*	0.232	0.22	2.01
	(0.266)	(0.256)	(0.179)	(0.180)	(.80)	(.14)
ln(diphtheria deaths)	0.099	−0.114	−0.342*	−0.412	1.40	2.94*
	(0.112)	(0.148)	(0.205)	(0.261)	(.25)	(.06)
ln(meningitis deaths)	−0.159	−0.212	−0.536**	−0.355	0.82	5.87***
	(0.124)	(0.181)	(0.272)	(0.218)	(.44)	(.01)
ln(diarrhea deaths under age 2)	0.083	0.028	−0.199*	−0.209*	1.17	3.59**
	(0.078)	(0.090)	(0.108)	(0.119)	(.32)	(.03)
ln(female deaths under age 1)	0.043	0.033	−0.053	−0.052	0.52	0.30
	(0.058)	(0.065)	(0.070)	(0.074)	(.60)	(.74)
ln(female deaths age 1–4)	−0.015	0.011	−0.132	−0.107*	0.68	3.60**
	(0.105)	(0.094)	(0.090)	(0.065)	(.51)	(.03)
ln(female deaths age 5–9)	0.059	0.049	−0.146	−0.157	0.14	2.98*
	(0.087)	(0.092)	(0.102)	(0.113)	(.87)	(.06)

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APPENDIX II
(CONTINUED)

Dependent variable	4–6 years before suffrage	1–3 years before suffrage	0–4 years after suffrage	5+ years after suffrage	F-statistic, 1–3 and 4–6 years before suffrage	F-Statistic, 0–4 and 5+ years after suffrage
ln(female deaths age 10–14)	0.028	0.044	−0.135**	−0.128*	0.30	3.71**
	(0.050)	(0.058)	(0.062)	(0.076)	(.74)	(.03)
ln(female deaths age 15–19)	−0.003	0.025	−0.114**	−0.135**	0.38	3.19**
	(0.052)	(0.052)	(0.058)	(0.065)	(.69)	(.05)
ln(male deaths under age 1)	0.037	0.048	−0.019	−0.029	0.28	0.14
	(0.064)	(0.070)	(0.074)	(0.080)	(.76)	(.87)
ln(male deaths age 1–4)	−0.012	0.019	−0.129	−0.116*	0.68	3.26**
	(0.092)	(0.086)	(0.080)	(0.070)	(.51)	(.04)
ln(male deaths age 5–9)	0.063	0.017	−0.154**	−0.137	1.01	3.42**
	(0.065)	(0.077)	(0.079)	(0.099)	(.37)	(.04)
ln(male deaths age 10–14)	0.058	0.026	−0.142	−0.134	0.84	3.23**
	(0.069)	(0.080)	(0.089)	(0.098)	(.44)	(.05)
ln(male deaths age 15–19)	0.028	0.023	−0.108*	−0.137**	0.19	4.03**
	(0.049)	(0.059)	(0.057)	(0.068)	(.83)	(.02)

Note. Municipal public finance data from the U.S. Bureau of the Census's *Statistics of Cities Having a Population of Over 30,000* and *Financial Statistics of Cities Having a Population of Over 30,000*; state public finance data from Sylla, Legler, and Wallis *ICPSR Study # 9728* and the U.S. Bureau of the Census' *Financial Statistics of States*; legislative roll call data from the Voteview database (coding of progressive voting done by author as described in the data appendix); mortality data from the U.S. Bureau of the Census's annual mortality statistics. Estimates and standard errors (in parentheses, clustered by state; p-values corresponding to the F-statistics shown in parentheses in the last two columns) shown for dummy variables denoting time periods relative to women's suffrage laws (controlling for state and year fixed effects and state-specific linear time trends, with city fixed effects subsitituted for state fixed effects in the municipal public finance regressions). The municipal public finance sample contains city-year observations from years 1905–1909, 1909–1913, 1915–1919, and 1921–1930; the state public finance sample contains state-year observations from years 1900–1919 and 1921–1930; the Voteview sample contains state-year observations from years 1900–1930; the unbalanced mortality sample contains state-year observations from years 1900–1936.

*$p < .10$.
**$p < .05$.
***$p < .01$.

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APPENDIX III: ROBUSTNESS TESTS

Dependent variable	Main estimate (1)	w/ region* year fixed effects (2)	w/ spatial standard errors (3)	w/ time-varying state-level covariates (4)	Recoding partial suffrage states (5)	w/o 1920 suffrage states (6)	All states present in mortality data 5 years before suffrage (7)
ln("progressive" Senate votes)	0.228***	0.225**	0.228***	0.192**	0.293***	0.213**	0.169
	(0.079)	(0.090)	(0.072)	(0.073)	(0.091)	(0.098)	(0.182)
ln(total municipal spending)	0.077**	0.062**	0.077**	0.088***	0.090*	0.098**	0.036
	(0.031)	(0.029)	(0.034)	(0.029)	(0.050)	(0.035)	(0.037)
ln(municipal health conservation and sanitation spending)	0.063*	0.037	0.063	0.084**	0.096*	0.089*	0.185***
	(0.036)	(0.034)	(0.041)	(0.035)	(0.052)	(0.048)	(0.025)
ln(municipal charities, hospitals, and corrections spending)	0.451***	0.303***	0.451***	0.301***	0.468**	0.401***	0.345**
	(0.115)	(0.087)	(0.115)	(0.093)	(0.183)	(0.113)	(0.135)
ln(state social service spending)	0.206***	0.101*	0.206***	0.184***	0.202**	0.199*	0.158
	(0.071)	(0.065)	(0.066)	(0.060)	(0.090)	(0.107)	(0.124)
ln(diphtheria deaths)	−0.241*	−0.242***	−0.241*	−0.283**	−0.345**	−0.279*	−0.083
	(0.125)	(0.072)	(0.135)	(0.128)	(0.145)	(0.145)	(0.149)
ln(meningitis deaths)	−0.234**	−0.236**	−0.234**	−0.052	−0.344***	−0.209*	−0.191*
	(0.097)	(0.109)	(0.099)	(0.106)	(0.105)	(0.124)	(0.103)
ln(diarrhea deaths under age 2)	−0.114*	−0.084	−0.114**	−0.125**	−0.103**	−0.092**	−0.176**
	(0.065)	(0.072)	(0.051)	(0.063)	(0.046)	(0.034)	(0.073)
ln(female deaths under age 1)	−0.057	−0.037	−0.057*	−0.061	−0.059	−0.009	−0.088
	(0.039)	(0.039)	(0.031)	(0.037)	(0.042)	(0.038)	(0.057)
ln(female deaths age 1–4)	−0.081*	−0.067	−0.081**	−0.102**	−0.094**	−0.083**	−0.110**
	(0.042)	(0.045)	(0.033)	(0.040)	(0.049)	(0.039)	(0.055)
ln(female deaths age 5–9)	−0.116**	−0.098*	−0.116**	−0.149***	−0.133***	−0.100**	−0.102*
	(0.051)	(0.056)	(0.049)	(0.056)	(0.049)	(0.047)	(0.068)
ln(female deaths age 10–14)	−0.151***	−0.081**	−0.151***	−0.162***	−0.142***	−0.085**	−0.132**
	(0.039)	(0.041)	(0.036)	(0.040)	(0.037)	(0.040)	(0.056)

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APPENDIX III
(CONTINUED)

Dependent variable	Main estimate (1)	w/region* year fixed effects (2)	w/ spatial standard errors (3)	w/ time-varying state-level covariates (4)	Recoding partial suffrage states (5)	w/o 1920 suffrage states (6)	All states present in mortality data 5 years before suffrage (7)
ln(female deaths age 15–19)	−0.081**	−0.092**	−0.081***	−0.083**	−0.074*	−0.053*	−0.106**
	(0.038)	(0.042)	(0.030)	(0.036)	(0.046)	(0.029)	(0.047)
ln(male deaths under age 1)	−0.046	−0.050	−0.046	−0.057	−0.042	0.011	−0.095
	(0.044)	(0.039)	(0.041)	(0.044)	(0.049)	(0.045)	(0.057)
ln(male deaths age 1–4)	−0.070	−0.080*	−0.070*	−0.096**	−0.091**	−0.042*	−0.077
	(0.044)	(0.045)	(0.037)	(0.047)	(0.047)	(0.047)	(0.062)
ln(male deaths age 5–9)	−0.133***	−0.075*	−0.133***	−0.160***	−0.149***	0.025	−0.111*
	(0.048)	(0.042)	(0.043)	(0.052)	(0.049)	(0.055)	(0.065)
ln(male deaths age 10–14)	−0.121***	−0.065*	−0.121***	−0.145***	−0.120***	−0.075*	−0.108**
	(0.042)	(0.033)	(0.036)	(0.041)	(0.045)	(0.041)	(0.054)
ln(male deaths age 15–19)	−0.101**	−0.078*	−0.101**	−0.095**	−0.096**	−0.071*	−0.143***
	(0.040)	(0.041)	(0.034)	(0.041)	(0.044)	(0.039)	(0.056)

Note. Municipal public finance data from the U.S. Bureau of the Census's *Statistics of Cities Having a Population of Over 30,000* and *Financial Statistics of Cities Having a Population of Over 30,000*; state public finance data from Sylla, Legler, and Wallis, *ICPSR Study #9728*, and the U.S. Bureau of the Census's *Financial Statistics of States*; legislative roll call data from the Voteview database (coding of progressive voting done by author as described in the Data Appendix); mortality data from the U.S. Bureau of the Census's annual *Mortality Statistics*. The municipal public finance sample contains city-year observations from years 1905–1909, 1909–1913, 1915–1919, and 1921–1930; the state public finance sample contains state-year observations from years 1900–1919 and 1921–1930; the Voteview sample contains state-year observations from years 1900–1930; the unbalanced mortality sample contains state-year observations from years 1900–1936. All estimates and standard errors (in parentheses, clustered by state except for column (3)) shown for the women's suffrage law dummy variable are obtained by estimating equation (1), including state and year fixed effects, and state-specific linear time trends (with city fixed effects substituted for state fixed effects in the municipal public finance regressions). Column (2) includes census region × year dummy variables; column (3) reports standard errors calculated allowing spatial correlation among states within one standard deviation of each other in the distribution of distance between states (following Conley [1999]); column (4) includes time-varying state covariates (population over age 10 in gainful occupations, population over age 10 in clerical occupations, total population, urban population (in cities with 25,000 or more), total black population, total male population, fraction of girls ages 10–15 enrolled in school, fraction of boys ages 10–15 enrolled in school, total illiterate population over age 10, average value per acre of farmland and buildings, average acres per farm, population density, population share foreign born, rural surface road mileage per 1,000 population, value of all crops, and total number of farms); column (5) reports estimates obtained by recoding partial suffrage states as having enfranchised women when full rights were extended; column (6) excludes 1920 suffrage states; and column (7) restricts the samples to states present in the mortality data at least 5 years before suffrage laws were enacted (California, Connecticut, Indiana, Kentucky, Massachusetts, Maryland, Maine, Michigan, Minnesota, Missouri, North Carolina, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Virginia, Vermont, and Wisconsin).

*$p < .10$.
**$p < 0.05$.
***$p < 0.01$.

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