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WOMEN'S PREFERENCES AND CHILD SURVIVAL IN AMERICAN HISTORY

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Abstract:

Women's preferences are thought to place greater weight on child welfare and the provision of public goods than do those of men. Empowering women is therefore seen as a potent means of increasing investments in children. This paper provides new evidence on how a historical milestone in the advancement of American women – their enfranchisement through suffrage rights – influenced infant and child mortality. I find that women's suffrage helped children to benefit from the scientific breakthroughs of the bacteriological revolution, increasing public health spending by 20% and decreasing child mortality by 8-15%. These results suggest two general conclusions: (1) Even in the presence of price effects, strengthening the expression of women's preferences can deliver large benefits to children, and (2) Although health improvement strategies in high-mortality environments generally focus on supply-side obstacles, demand-side approaches also deserve careful attention.

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Introduction

Women are thought to have preferences that systematically differ from those of men (Fuchs 1988 and 1989, Lott and Kenny 1999). The underlying causes of these differences remain unclear, but a growing body of evidence suggests that women place relatively more emphasis on child welfare and the provision of public goods (Thomas 1990 and 1994, Lundberg, Pollak, and Wales 1997, Case and Deaton 1998, Pitt and Khandker 1998, Edlund and Pande 2001, Duflo 2003, Chattopadhyay and Duflo 2004, Duflo and Topalova 2004, Rangel 2004). Such sex differences are now leading many to view promoting gender equality as a potent means of human development in poor countries (beyond being fundamentally important in its own right) (United Nations 1981, Longwe 1995, United Nations 1995, Duflo 2005, UN Population Division 2005).[1] In particular, empowering women is believed to increase investments in children (World Bank 2001).[2]

Despite recent interest, this issue is not new; a long history links the status of women with child well-being. For example, early twentieth century America witnessed large gains in women's rights and striking reductions in infant and child mortality (Preston and Haines 1991, U.S. Bureau of the Census 1900 to 1936, Goldin 1990, Goldin 2006). At their height, women's voluntary organizations advanced unprecedented child health and welfare agendas at the local, state, and national levels as the Children's Bureau was created in 1912 and the Sheppard-Towner Act was passed in 1921. The distillation of historical lessons about the expression of women's preferences and child survival is directly relevant to contemporary development challenges because of similarities in epidemiological conditions (other than HIV/AIDS), economic circumstances, and the relative standing of women.

This paper investigates how the widespread enfranchisement of women through suffrage rights influenced child survival in the historical United States, drawing out new quantitative lessons where there is rich qualitative history. Specifically, it relates the sharp timing of state-

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[1] There has also been renewed controversy about whether or not women's issues belong on child welfare agendas, especially when weighed against technological interventions known to promote child survival. For example, see discussions of the controversy surrounding outgoing UNICEF Executive Director Carol Bellamy (Sylva 2003 and Horton 2004

[2] Kofi Anan, Secretary General of the United Nations, recently argued that gender equality is a "prerequisite" for achieving other Millennium Development Goals on infant survival, education, and poverty reduction (United Nations 2005). This view is also reflected in the popular media: "It is now accepted in most institutions… that without an improvement in women's lives,… children will not go to school, childhood disease will persist and younger and younger children, living in the most destructive poverty, will be vulnerable to abuses of all kinds…" (The Atlantic On-Line, 9/02/03).

level women's suffrage laws enacted between 1869 and 1920 to state-level trend breaks in infant and child mortality and mediating changes in state and local public spending. This approach has a number of attractive features. First, America's system of federalism created enormous variation across states and over time in laws governing women's suffrage. This variation aids in the estimation of their consequences and permits a number of validity tests to address natural – but seemingly unfounded – concerns about the possibility of endogenous state-level legislation. Second, although many related studies have focused on lump-sum transfers to women, most policies and programs that empower women have price effects with theoretically ambiguous consequences for children (Becker 1981).[3] Women's suffrage rights provide a salient example. Third, data from the early twentieth century United States is unusually rich when compared with vital registries and public finance data available in developing countries today. Finally, unlike many activities which aim to improve women's standing by changing deeply-rooted social norms, this paper examines a means of empowering women which can readily be pursued through public policy.

In general, I find that the extension of suffrage rights to American women helped children to benefit from the scientific breakthroughs of the bacteriological revolution. Child mortality declined by 8-15% under women's suffrage, and that the only causes of death that responded to the laws were leading childhood infectious diseases (diphtheria, meningitis, and diarrheal disease). An important way that suffrage rights produced these child survival benefits was by increasing state and local public health spending by at least 20%. Widespread public health campaigns were a primary means of promoting important new health innovations based on recent scientific discoveries – simple hygienic health behaviors like water and milk boiling, food and hand washing, breastfeeding, and meat refrigeration (Duffy 1990, Meckel 1990). Overall, women's suffrage accounts for nearly 10% of the unprecedented child mortality decline between 1900 and 1930.

These findings are bolstered by a variety of corroborating validity tests. Specifically: (1) There is no evidence of relative increases or decreases in child mortality just before suffrage laws were enacted; (2) There are no meaningful relationships between state characteristics in 1900 and time until women's suffrage laws were passed or between the timing of suffrage laws

[3] Many empirical studies of women's status and child welfare have emphasized testing unitary models of household behavior, focusing on lump-sum transfers targeted to women (Thomas 1990 and 1994, Lundberg, Pollak, and Wales 1997, Duflo 2003, Rangel 2004). Notable exceptions are Qian (2005) and Luke and Munshi (2005).

and other state laws affecting women's status; (3) There is no evidence that suffrage effects differed between states choosing to allow women to vote and states having women's suffrage imposed on them by the 19th Amendment; and (4) There is no evidence of confounding changes in the composition of births or mothers after women began voting. Taken together, this evidence suggests that extending suffrage rights to women was causally responsible for large improvements in child survival – even in the presence of price effects.

Background

Women's Voluntary Organizations and the Women's Suffrage Movement

With the rise of industrialization in the United States, the social and economic "spheres" of men and women became more distinct and segregated as men were disproportionately drawn into jobs away from the home.[4] American 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 edification and for the good of the society. Some were comprised of elite, urban women, but more often they were grounded in religion and joined middle-class women across many localities. 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).[5]

Among the enormous diversity of women's organizations, three stand out. One of the early leaders was the Women's Christian Temperance Union, which sought to combat male irresponsibility on many fronts, including fighting prostitution, promoting temperance agendas in schools, running day nurseries for working mothers, supporting labor reforms to benefit

[4] The industrial revolution created new jobs for women, too – primarily young, unmarried women (Goldin 1990).
[5] A similar illustration: 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 beings that landlords may pile up sordid profits. No painted girls, with hunger gnawing their empty stomachs, will walk in the shadows" (Dorr 1910).

working-class families, and eventually, working for women's suffrage. Another prominent voluntary organization, the General Federation of Women's Clubs, began as a literary organization but eventually coalesced into an extensive network to advance a women's and children's issues. The Federation hosted large biennial conventions, published an official journal, maintained a national office, and created standing committees on civil service reform, education, home economics, pure food, library extension, public health, and industrial and child labor (Skocpol 1992). A third leader organized by the urban elite was the National Congress of Mothers (later to become the National Congress of Parents and Teachers, or the PTA).

The birth of women's voluntary organizations went hand-in-hand with the birth of the women's suffrage movement. Broad new ideals among women about their public and private roles became manifest both in new voluntary organizations and in the agenda articulated by Lucretia Mott and Elizabeth Cady Stanton at the women's rights convention held in Seneca Falls, New York during the summer of 1848. Although formal efforts were at first small, the end of the Civil War invigorated the women's suffrage movement as the emancipation of slaves and the extension of voting rights to black men under the 15th Amendment called new public attention to the issue of expanding the electorate (Flexner and Fitzpatrick 1959). In 1869, two new organizations emerged – a more radical suffrage organization focused on Constitutional change (The National Woman Suffrage Association, led by Elizabeth Cady Stanton and Susan B. Anthony) and a more moderate organization emphasizing state-level reforms (The American Woman Suffrage Association, led by Lucy Stone and Henry Blackwell). These and other suffrage groups lacked organization and cohesion, but twenty-nine of forty-eight states nevertheless granted women the right to vote between 1869 and the ratification of the Nineteenth Amendment in 1920 (Dubois 1998, Lott and Kenny 1999), which codified the right to vote for all women in America. Many state-level successes during this half-century came as a surprise both to proponents and opponents alike (Flexner and Fitzpatrick 1959, Dubois 1998).[6] Table 1 shows the timing of women's suffrage in each state.

Child Survival in Early Twentieth Century America

[6] For example, Wyoming's otherwise staunchly conservative governor at the time, John Campbell, signed a women's suffrage bill into law solely because of a little-known women's meeting which he enjoyed attending as a child in his hometown of Salem, Ohio (Flexner and Fitzpatrick 1959).

In the early 20th Century, infant and child mortality in the United States declined dramatically. In urban areas in 1900, one in five children born did not survive to age five (US Bureau of the Census 1900). By the late 1930s, the probability of dying by age five had declined by 65% (US Bureau of the Census 1936). Primarily because of increases in infant and child survival, life expectancy at birth rose from 47 to 63 (Preston and Haines 1991, Haines 2001). Much of this mortality decline is explained by reductions in infectious disease deaths (particularly tuberculosis, pneumonia, diarrheal disease, and diphtheria deaths) as America underwent its epidemiological transition. No other documented period in American history witnessed such sustained declines in infant and child mortality (Preston and Haines 1991).

Many studies have investigated the relative importance of various explanations for these striking health improvements, including: (1) economic innovation and nutritional gains, (2) large-scale public health interventions including clean water technologies, sanitation, refuse management, milk pasteurization, and meat inspection, and (3) improved personal hygiene and better health behaviors (hand and food washing, the boiling of milk, meat refrigeration, and breastfeeding, for example) (Meeker 1972, McKeown 1976, Condran and Crimmins-Gardner 1978, Szreter 1988, Wrigley and Schofield 1989, Ewbank and Preston 1990, Preston and Haines 1991, Thomas 1991, Fogel 1994, Elo and Preston 1996, Deaton and Paxson 2003, Cutler and Miller 2005). Given the emphasis that contemporary development agendas now place on the status of women, it is surprising that no empirical study has examined how women's suffrage or women's empowerment in general influenced child survival. In particular, historical accounts suggest that women played a leading role in the widespread promotion of better personal hygiene and health behaviors (Smith-Rosenberg 1985, Meckel 1990, Skocpol 1992). Despite its simplicity, improved household hygiene was a leading innovation produced by the nascent science of bacteriology.

Women and Child Health during the Progressive Era

Before the bacteriology revolution of the 1870s, the dominant view of communicable illness was the miasma theory of disease – a view positing that infectious disease was caused by poisonous, malevolent vapors or "miasmas" that are offensive to the smell (Duffy 1990). As breakthroughs in public health knowledge occurred in the late nineteenth and early twentieth centuries, communicating their implications to the American public was a serious challenge.

Rather than misguided interventions such as ventilation campaigns designed to combat poisonous miasmas, these new discoveries suggested a central role for basic household hygiene and better health behaviors in combating infectious disease (such as water and milk boiling, food- and hand-washing, breastfeeding, meat refrigeration, and infant and child growth monitoring).

Well-organized women's voluntary organizations provided the infrastructure and the concern for children necessary to mount new large-scale public health campaigns (Smith-Rosenberg 1985, Meckel 1990, Skocpol 1992). These efforts specifically targeted women as the agents most concerned with infant and child welfare within the household. Women's organizations built political campaigns as well at the local, state, and national levels to pressure government to finance more of this work (Smith-Rosenberg 1985, Skocpol 1992).[7] The longstanding perception of women's superior morality made it difficult for legislators to ignore their demands (Skocpol 1992).

One of the most important political achievements of women's organizations during the Progressive Era began in 1912 with the establishment of a federal Children's Bureau. Although small at first, the Children's Bureau grew rapidly, reaching many states and localities with its charge to "investigate and report… upon all matters pertaining to the welfare of children and child life among all classes of our people" (Children's Bureau 1914). Its most dramatic expansion came in 1921 under the Sheppard-Towner Act, which provided the Bureau with over one million dollars (in 1920s terms) each year for five years. The Act came just after all American women were given the right to vote under the 19th Amendment but 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). In the next seven years, the Children's Bureau coordinated a nationwide program that distributed "over 22 million pieces of literature, conducted 183,252 health conferences, established 2,978 permanent prenatal centers, and visited over 3 million homes" (Ladd-Taylor 1986).

[7] The most prominent organizations included the Women's Christian Temperance Union, the General Federation of Women's Clubs, and the National Congress of Mothers (later to become the National Congress of Parents and Teachers, or the PTA).

Data and Graphical Analysis

Data

To investigate how women's suffrage influenced child survival, state-level mortality data by age and sex and by cause is necessary. 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 (US Bureau of the Census 1900 to 1936, Haines 2001). As shown in Table 2, the registration area grew from ten states in 1900 to include all forty-eight states in 1933.[8] The published historical series was used to construct an unbalanced panel of annual state-level deaths in each registration area state by cause and by age and sex for years 1900-1936.[9] Descriptive Statistics are shown in Panels A and B of Table 3.

Conducting analyses with an unbalanced panel of state-level mortality data raises the potential concern that entry into the death registration area was correlated with the timing of women's suffrage laws or their social, demographic, or economic determinants. To explore this possibility, regressions of death registration entry dates were run on state-level characteristics in 1900 and on the timing of suffrage laws and other events related to women's status.[10] Table 4 shows these results. In general, there is no evidence of meaningful relationships between death registration area entry and events related to women's status (the timing of suffrage, divorce, alimony, or mother's pension laws or the establishment of state chapters of the General

[8] Delaware technically entered the death registration area in 1890 but does not appear in the annual *Mortality Statistics* until 1919.

[9] To the best of my knowledge, the state-level *Mortality Statistics* series have never before been digitized. This data is available upon request: ngmiller@stanford.edu. Specific causes of death reported consistently throughout the 1900-1936 period include typhoid fever, malaria, small pox, tuberculosis, measles, scarlet fever, whooping cough, diphtheria, influenza, meningitis, pneumonia, childbirth-related causes, diabetes, heart/circulatory disease, nephritis, cancer, violent accidents, and suicide.

[10] Because the annual mortality statistics are not available before 1900, I focus on suffrage laws that occurred in 1900 or later and state-level characteristics in 1900. Dates for the timing of state GFWC chapters and mothers' pension laws were obtained from Skocpol (1992). Specifically, for states s, I estimate: $l_s = \alpha + \sigma x_s + \varepsilon_s$, where l is the date of death registration entry and x is one of a variety of different state-specific covariates including women's suffrage dates. State characteristics in 1900 (literacy, employment, manufacturing sector wages, and the share of each state's workforce in the manufacturing sector) are available in the 1900 census and were provided by John Lott and Larry Kenny (United States Census Office 1902). All covariates cannot be included in the same regression because some characteristics are only present for the ten death registration area states in 1900. A parametric hazard model also yields estimates of σ for state characteristics in 1900 that are statistically indistinguishable from zero.

Federation of Women's Clubs) or baseline socio-economic and demographic conditions in 1900 (population, mortality, literacy, or economic measures of the manufacturing sector).

These state-level mortality statistics were then matched to information about when women gained the legal right to vote in each state as well as the timing of other state laws that may have influenced women's voting behavior (including the dates of alimony and divorce law changes). This state-level legislative data was obtained from John Lott and Larry Kenny and is summarized in Table 1 (Lott and Kenny 1999). Twenty-nine states extended the right to vote to women before Nineteenth Amendment to the Constitution was approved in 1920. Among the other nineteen states, seven approved the amendment and twelve had suffrage imposed on them.

To better understand how women's suffrage may have effected child survival by altering the size or composition of public spending, state and local public finance data was also matched to the mortality statistics and legislation data. Annual information about state revenue and spending was provided by John Lott and Larry Kenny (Lott and Kenny 1999).[11] The specific categories of revenue and spending that are comparable over time include: total public expenditure; total revenue; property tax revenue; current and capital expenditures on elementary and secondary schools; current expenditures on charities, hospitals, and corrections; and current and capital expenditures on highways. Descriptive statistics for the state-level public finance data are shown in Panel C of Table 3.

<DESCRIBE MUNICIPAL PUBLIC SPENDING DATA FROM THE *STATISTICS OF CITIES* AND *FINANCIAL STATISTICS OF CITIES* HERE.>

State public finance information is also not available for all states for all years between 1900 and 1936. As with the mortality statistics, a potential concern is that the availability of this data is correlated with women's suffrage or its determinants. To test this concern, probit specifications were used to estimate how the presence of public finance data in each state and year is correlated with state characteristics in 1900 (population, mortality, literacy, and economic measures of the manufacturing sector), the timing of state laws (women's suffrage, poll tax and literacy test laws, and alimony and divorce laws), and the timing of the establishment of state

[11] Lott and Kenny (1999) obtained the state-level public finance data from the *Financial Statistics of States* for 1915 and later and from John Wallis for earlier years.

chapters of the General Federation of Women's Clubs.[12] Table 5 shows marginal probabilities obtained from these probit specifications suggesting the absence of any meaningful relationships with the presence of state public finance data.

Finally, for analyses of how fertility responded to women's suffrage, the 1% sample of the 1940 population census made available through the Integrated Public Use Microdata Series (IPUMS) by the University of Minnesota's Population Center was used.

Graphical Analysis

Before pursuing more formal statistical analyses, simple event study graphs provide insight into the relationship between women's suffrage and child survival. Because annual time series of deaths are noisy and the timing of women's suffrage varied considerably over time, it is appropriate to remove non-linear time effects common to all states in constructing event study graphs. Also, because state-level population measures by age are not available annually between 1900 and 1936, annual mortality rates cannot be constructed using annual deaths. To account for this, it is also necessary to condition annual age-specific deaths on state-level fixed effects and state-specific time.[13] To make these adjustments, residuals were obtained from regressions for states s and years y in the annual mortality statistics:

(1) $ln(d_{sy}) = \alpha + \delta_y + \delta_s + \delta_s \times y + \varepsilon_{sy}$

where d is age-specific deaths reported consistently over time in each age group (0-1, 1-4, 5-9, 10-14, and 15-19), δ_y and δ_s represent year and state fixed effects, and $\delta_s \times y$ represents state-specific linear time trends.[14]

Defining year 0 as the year that each state enacted a women's suffrage law, Figure 1 shows plots of residual means for each year -5 through +5 relative to the first year of suffrage. In general, they suggest that abrupt mortality reductions of 5-10% occurred for both boys and girls of all ages in the precise years that suffrage laws were passed. Because death rates were much higher at younger ages, these graphs imply that averted deaths were concentrated in the younger

[12] Probit specifications of the following form were estimated for states s and years y: $\Pr(p_{sy}=1) = \alpha + X_s{}'\Omega + \varepsilon_{sy}$, where p is a dichotomous indicator of whether or not state public finance data is available for state s in year y and is X a vector of state-specific covariates.

[13] Using annual state-level mortality statistics from the 1960s and 1970s when state-level population measures – and therefore mortality rates – are available, I have conducted analyses that confirm the equivalence of using raw mortality rates and deaths conditional on state fixed effects and state-specific time trends. These analyses are available upon request.

[14] The natural logarithm of deaths is used because of its right-skewed distribution.

ages. The correspondence between the sharp timing of women's suffrage laws and mortality trend breaks – as well as the absence of rising or falling mortality just before the laws were adopted – suggests that the laws were causally related to infant and child mortality declines.[15]

Empirical Strategy and Main Results

Empirical Strategy

Exploiting the plausibly exogenous timing of state-level women's suffrage laws, I use a difference-in-difference strategy to estimate more formally the mortality reductions shown in Figure 1. Specifically, I estimate equations of the following general form for states *s* and years *y*:

(2) $$ln(d_{sy}) = \alpha + \beta v_{sy} + \delta_s + \delta_y + \delta_s \times y + X_s{}'\Omega + \varepsilon_{sy}$$

where *d* is age-specific deaths in state *s* and year *y* in each child age group reported consistently between 1900 and 1936 (0-1, 1-4, 4-9, 10-14, etc.), *v* is a dummy variable indicating whether or not women could legally vote in state *s* and year *y*, δ_s and δ_y represent state and year fixed effects, $\delta_s \times y$ represents state-specific linear time trends, X is a vector of state-level economic and demographic characteristics in 1900, and the parameter estimate of interest is the estimate of β.

In this difference-in-difference framework, only the timing of state suffrage laws is assumed to be exogenous. Fixed differences across states, common factors varying non-linearly over time (such as the establishment of the Children's Bureau in 1912, the ratification of the 19th Amendment in 1920, or the passage of the Sheppard-Towner Act in 1921), and state-specific differences that vary linearly over time are all purged from the estimate of β.[16] Only trend breaks in child mortality that coincide precisely with the timing of women's suffrage laws identify the effects of interest. The validity of the identifying assumption is explored in detail under *Validity Tests*; no evidence of endogenous law enactment is found.

Main Results

[15] Relative declines in suffrage just before laws were passed might imply that pre-existing trends are mistaken for suffrage effects, while relative increases in suffrage just before laws were passed might imply that mean reversion is mistaken for suffrage effects. Some mortality declines in year -1 are due to how suffrage years were coded. If a law was passed in the latter part of a year, this year was coded as year -1 in Figure 1. More formal analyses presented under *Validity Tests* confirms the absence of meaningful relative increases or decreases in mortality just before suffrage laws were enacted.
[16] The results are also not sensitive to the inclusion of state-specific polynomials in equation 2.

Table 6 shows estimates of β obtained by estimating equation 1 for deaths in each age interval separately for females and males. Each row corresponds to a separate regression with the dependent variable shown at the left of the row. Because the dependent variables (age-specific deaths) are in logarithmic form, the coefficient estimates can roughly be interpreted as percent changes. In general, women's suffrage is associated with mortality reductions for children at all ages between age one and age nineteen, but not for infants in their first year of life or for adults at any age.[17] In contrast with contemporary evidence on women's empowerment developing countries, there are no meaningful gender differences in the survival consequences of women's suffrage (Duflo 2003, Qian 2005).

These child mortality reductions are large, with point estimates ranging from 8% and 15%. Because child mortality is concentrated at young ages, the largest absolute child survival gains occurred at young ages. To put these estimates in context, between 1900 and 1930, mortality rates in death registration states fell by 72% for children between ages 1 and 4, 59% for children 5 to 9, 48% for children 10 to 14, and 42% for children 15 to 19. The proportion of these declines explained by the women's suffrage estimates shown in Table 6 are 5%, 10%, 13%, and 10%, respectively, in each age interval.[18]

To explore how mortality reductions associated with women's suffrage changed over time, variants of equation 2 were re-estimated with additional suffrage dummy variables for several fixed time lags after the enactment of suffrage laws. As discussed later under *Validity Tests*, there is no evidence that the composition of births or surviving adult caregivers changed under women's suffrage. Instead, any changing suffrage effects over time are probably due to changes in the composition of surviving children or to behavioral responses to the disease environment (Dow, Holmes, Philipson, and Sala-i-Martin 1999, Philipson 2000). Table 7 shows results for time lags of 3 and 6 years and for time lags of 5 and 10 years.[19] In general there is

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[17] The absence of infant mortality effects is not surprising given the poor state of early twentieth century obstetrics (even relative to other specialties). Midwives delivered a large share of babies but were incapable of managing common complications of childbirth and were uninformed about hygienic practices (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 and may have deteriorated; maternal mortality rates did not begin declining until the mid-1930s (Thomasson and Treber 2004). Public health campaigns emphasizing health behavior at home did little to address birth conditions.

[18] The fraction of years women could vote in each state between 1900 and 1930 was used to weight the mean mortality reductions shown in Table 6. The share of the decline at ages 1-4 is calculated for girls only, which is significant at the $p<0.10$ level.

[19] The results are not sensitive to the specific lag structure chosen.

little evidence of changing suffrage effects over time, and the primary suffrage estimates shown in the first row of each panel are robust to different lag structures. The exception is that survival gains may have eroded for children over age ten a decade after suffrage laws were enacted. This result could suggest that public health interventions pursued under women's suffrage were substitutes for other private health behaviors. Given the absence of lagged effects at younger ages, however, it more likely reflects that those initially saved at younger ages were relatively weak and therefore more likely to die at older ages.

Although state-level mortality data by both age and cause is reported erratically between 1900 and 1936, cause of death effects can reasonably be attributed to children given the absence of evidence that adult mortality changed under women's suffrage. Table 8 shows suffrage estimates obtained by re-estimating equation 2 using cause-specific deaths as dependent variables. It suggests that child mortality declined because of decreases in deaths due to meningitis and most likely diphtheria and diarrhea. Meningitis mortality declined by 23%, while diphtheria deaths declined by 24% and diarrheal deaths under the age of 2 declined by 11%.[20] All three were leading infectious killers of children in early Twentieth Century America, and importantly, all three can be effectively combated by hygienic household health behaviors and public health measures of the day.[21]

How Did Suffrage Reduce Child Mortality?

An intuitive explanation for how women's suffrage improved child survival is through its impact on public spending. Before the development of sulfa drugs and antibiotics in the late 1930s and 1940s, many health gains attributable to the late Nineteenth century bacteriological revolution were achieved through simply hygienic health behaviors. These simple practices (such as water and milk boiling, food- and hand-washing, breastfeeding, meat refrigeration, and infant and child growth monitoring) were publicized and promoted through large-scale state and

[20] As shown in Table 8, the diphtheria and diarrhea estimates are statistically significant at the $p<0.10$ level.

[21] Meningitis is an inflammation of the membrane surrounded the brain and spinal column caused by any of roughly fifty types of bacteria. Good household hygiene was the best prevention at the time (it is transmitted by blood and bodily fluids), although there were some early therapeutic successes with intrathecal equine meningococcal antiserum and then the first sulfa drugs before the advent of modern antibiotics. Diphtheria is an upper respiratory-tract illness caused by airborne bacteria. An effective anti-toxin became available in the 1890s, but its use was not widespread; sulfa drugs became the most effective modern therapy. Specific types of diarrheal disease are not well defined in the historical mortality statistics (other than typhoid fever); the best preventive measures other than municipal-level drinking water disinfection were hand and food washing and water and milk boiling.

local public health and health education campaigns (Duffy 1990). The evidence presented in Table 8 on causes of death that responded to women's suffrage (meningitis, diphtheria, and diarrheal disease) is consistent with an explanation based on increased health spending and improvements in hygienic practices. Intensifying health campaigns should also be evident in available public finance data, too.

To explore changes in the size and composition of public finance, variants of equation 2 were re-estimated using state and local public revenue and public spending data by type of expenditure. Table 9 shows results for state spending. There are no statistically meaningful changes in total state spending or total state revenue under women's suffrage, although both point estimates are large and positive. Transportation and education spending also did not change, but social service spending (hospitals, charities, and corrections) increased by an about 24%. Table 10 shows results for municipal spending.[22] <DISCUSS MUNICIPAL SPENDING RESULTS HERE.> Taken together, Tables 9 and 10 suggest that women's suffrage was associated with very large increases in public health spending.

Validity Tests

Natural concerns with the empirical strategies employed by this paper are the possibility of endogenous state-level suffrage legislation and confounding changes in the composition of births and mothers. This section presents a range of tests that investigate – and fail to corroborate – such concerns.

First, I formally estimate whether or not there were relative increases or decreases in child mortality, cause-specific mortality, or public health spending just before women's suffrage laws were adopted (staggered across states and over time in the same pattern as the laws). Relative increases might suggest that estimates of β in equation 2 mistakenly capture mean reversion, while relative decreases might imply that suffrage laws were adopted in response to changing conditions in states related to the status of women and infant and child health. To test for mortality trend breaks just prior to passage of laws, lead dummy variables that turn on two, four, and six years before suffrage (t = 2, 4, and 6) were added to equation 2: $ln(d_{sy}) = \alpha + \gamma v_{sy-t} +$

[22] Lott and Kenny (1999) provide evidence suggesting that women's suffrage increased total public spending. Given that social service spending is a small share of total spending, increases in total spending may be difficult to detect.

$\beta v_{sy} + \delta_s + \delta_y + \delta_s \times y + X_s'\Omega + \varepsilon_{sy}$.[23] Table 11 shows estimates of γ. As suggested by Figure 1, all are statistically indistinguishable from zero.

Second, I investigate how state-level social, economic, and demographic conditions in 1900 (the first year included in the analyses under *Empirical Strategy and Main Results*) and the timing of other state laws affecting women's status are related to suffrage dates. Specifically, for states *s,* I estimate: $l_s = \alpha + \sigma x_s + \varepsilon_s$, where l is the date of suffrage law enactment and x is one of a variety of different state-specific covariates. Table 12 shows estimates of σ obtained from separate regressions. There are no meaningful relationships between the timing of women's suffrage laws and baseline conditions in 1900 (population, deaths, literacy, employment, manufacturing sector wages, the share of each state's workforce in the manufacturing sector) or the timing of other events related to women's status (the establishment of state chapters of the General Federation of Women's Clubs, alimony and divorce law changes, and the establishment of mothers' public pensions).[24] The timing of suffrage laws therefore does not generally appear related to a broad array of social, economic, and demographic measures.

Third, if there were state-level political climates that fostered both women's suffrage and better child health, child mortality reductions should differ between states that voluntarily granted suffrage and those who had it imposed on them by the 19th Amendment. Following Lott and Kenny (1999), I define voluntary states as those that passed state-level suffrage laws or voted for the 19th Amendment.[25] Creating a dummy variable *c* for states choosing suffrage, I then incorporate it and its interaction with women's suffrage into equation 2: $ln(d_{sy}) = \alpha + \beta v_{sy} + \rho c_s + \pi(v_{sy} \times c_s) + \delta_s + \delta_y + \delta_s \times y + X_s'\Omega + \varepsilon_{sy}$. Table 13 shows estimates of π. Consistent with the identifying assumption, there is no evidence that child mortality effects differed between states that chose women's suffrage and those on whom it was imposed.

Fourth, I consider whether or not changes in the composition of births might produce the illusion of child mortality reductions under women's suffrage. The absence of meaningful

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[23] The results are not sensitive to the specific lead structure chosen.

[24] A parametric hazard model also produces estimates that are statistically indistinguishable from zero. The timing of suffrage laws is positively correlated with total state population in 1900 at the p<0.10 level. This relationship is not statistically meaningful by traditional measures; any bias introduced into the main analyses would be detected as meaningful changes in mortality just before the adoption of suffrage laws. As discussed under *Validity Tests* and shown in Table 11, there is no such evidence.

[25] The states that did not enact suffrage laws before 1920 but voted for the 19th Amendment were Kentucky, Massachusetts, New Hampshire, New Jersey, New Mexico, Pennsylvania, and West Virginia (Lott and Kenny 1999).

suffrage effects on adult mortality shown in Table 6 suggests that the composition of potential mothers did not change.[26] This concern is also not relevant to child mortality at older ages. However, women's suffrage may have produced incentives for women to have fewer children – by lowering the relative price of child quality or by raising the relative price of time spent at home, for example (Becker and Lewis 1973). Changes in fertility under suffrage laws would lend credibility to this potential concern. Because the Bureau of the Census' birth registration area was not established until 1915, fertility responses to suffrage laws must be investigated using population census data.

Exploiting the fact that any fertility effects should vary by women's age when suffrage laws were enacted (and not be present at all among women first able to vote after menopause), I simultaneously make comparisons both (i) between women the same age born in different states and (ii) between women of different ages born in the same state.[27] Using individual sample-line women w born in states s and who were age a in the 1940 population (and who were in a five-year age interval i 15-19, 20-24, …, 50-54 when a suffrage law was passed in their state of birth), I estimate:

(3) $$b_{was} = \alpha + v_i'\beta + \delta_s + \delta_a + \delta_s \times a + \varepsilon_{was}$$

where b is the number of lifetime births reported by each woman, v is now a vector of age interval-specific dummy variables indicating whether or not a woman could first legally vote in each age interval i, δ_s and δ_a represent state and age fixed effects, $\delta_s \times a$ represents state-specific linear time (or age) trends, and the parameter estimates of interest are those comprising β. Because lifetime births can reasonably be considered count data and the distribution of lifetime births is left-censored at zero, equation 3 was estimated by maximum likelihood estimation using a negative binomial model. Estimates of β are shown in Table 14. There is no evidence that women's fertility responded to suffrage laws.

Conclusion

The extension of suffrage rights to American women allowed children to benefit more fully from the scientific breakthroughs of the bacteriological revolution. Some of the most

[26] This is also consistent with other findings that maternal mortality did not begin to decline in absolute terms until the 1930s (Thomasson and Treber 2004).
[27] This approach based on women's state of birth (rather than state of residence) is essentially an intent-to-treat analysis.

beneficial innovations due to this transformation were simple ones – water and milk boiling, food- and hand-washing, breastfeeding, and meat refrigeration. However, communicating them to the American public required widespread public health campaigns. As women began voting, public health spending increased by 20% or more, and deaths due to leading childhood killers such as diphtheria, meningitis, and diarrheal diseases declined substantially. This paper finds that women's suffrage accounts for nearly 10% of the unprecedented child mortality decline between 1900 and 1930.

Debate continues today in international health and development circles about the appropriate role of women's issues on child welfare agendas. The findings presented in this paper offer at least two insights. First, even in the presence of theoretically ambiguous price effects, the stronger expression of women's preferences can deliver large benefits for children. Second, tension between spending on technological innovations to improve child survival and broader efforts to advance the standing of women may be unwarranted. In early twentieth century America, technological child health innovations and the promotion of gender inequality were in fact complementary as women became leading advocates (and practitioners) of simple health behaviors with important child survival benefits. In developing countries today, over 10 million children die each year – many of them from preventable causes (WHO 2002, Black, Morris, and Bryce 2003). Because the appropriate use of existing technologies is not limited by supply-side obstacles alone (Thornton 2005), demand-side factors also deserve careful consideration. Promoting gender equality may be an important means of encouraging the adoption of beneficial but under-used health technologies.[28]

[28] This may especially be true for environments in which women's investments in children are likely to have the greatest child health benefits – contexts of poor economic conditions and prevalent infectious disease (Ewbank and Preston 1990, Henriques, Strauss, and Thomas 1991, Dasgupta 1993, Elo and Preston 1996, Basu 1998, Cleland and Kaufmann 1998, Hobcraft 2000, Kishor 2000, Deaton and Paxson 2003).

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Figure 1: Residual Age-Specific Mortality and the Timing of Women's Suffrage Laws

Table 1: The Timing of Women's Suffrage in American States

State	Year of Women's Suffrage	Choose Suffrage?	State	Year of Women's Suffrage	Choose Suffrage?
Alaska	1920	No	Nebraska	1917	Yes
Arizona	1912	Yes	Nevada	1914	Yes
Arkansas	1917	Yes	New Hampshire	1920	Yes*
California	1911	Yes	New Jersey	1920	Yes*
Colorado	1893	Yes	New Mexico	1920	Yes*
Connecticut	1920	No	New York	1917	Yes
Deleware	1920	No	North Carolina	1920	No
Florida	1920	No	North Dakita	1917	Yes
Georgia	1920	No	Ohio	1919	Yes
Idaho	1896	Yes	Oklahoma	1918	Yes
Illinois	1913	Yes	Oregon	1912	Yes
Indiana	1919	Yes	Pennsylvania	1920	Yes*
Iowa	1919	Yes	Rhode Island	1917	Yes
Kansas	1912	Yes	South Carolina	1920	No
Kentucky	1920	Yes*	South Dakota	1918	Yes
Louisiana	1920	No	Tennessee	1919	Yes
Maine	1919	Yes	Texas	1918	Yes
Maryland	1920	No	Utah	1870	Yes
Massachusetts	1920	Yes*	Vermont	1920	No
Michigan	1918	Yes	Virginia	1920	No
Minnesota	1919	Yes	Washington	1910	Yes
Mississippi	1920	No	West Virginia	1920	Yes*
Missouri	1919	Yes	Wisonsin	1919	Yes
Montana	1914	Yes	Wyoming	1869	Yes

*Denotes a state that had not extended suffrage rights to women before 1920 but ratified the 19th Amendment

Table 2: States' Year of Entry into the Death Registration Area

State	Year of Death Registration Area Entry	State	Year of Death Registration Area Entry
Alaska	1925	Nebraska	1920
Arizona	1926	Nevada	1929
Arkansas	1927	New Hampshire	1890
California	1906	New Jersey	1880
Colorado	1906	New Mexico	1929
Connecticut	1890	New York	1890
Deleware	1890	North Carolina	1910
Florida	1919	North Dakita	1924
Georgia	1922	Ohio	1909
Idaho	1922	Oklahoma	1928
Illinois	1918	Oregon	1918
Indiana	1900	Pennsylvania	1906
Iowa	1923	Rhode Island	1890
Kansas	1914	South Carolina	1916
Kentucky	1911	South Dakota	1906
Louisiana	1918	Tennessee	1917
Maine	1900	Texas	1933
Maryland	1905	Utah	1910
Massachusetts	1880	Vermont	1890
Michigan	1900	Virginia	1913
Minnesota	1910	Washington	1908
Mississippi	1919	West Virginia	1925
Missouri	1911	Wisonsin	1908
Montana	1910	Wyoming	1922

Table 3: Descriptive Statistics

	1900		1910		1920		1930	
Panel A: Age-Specific Annual Mortality Rate per 1,000 in Each Age Interval in Death Registration States								
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Total	17.31	(1.97)	13.78	(3.36)	13.00	(1.52)	11.42	(1.62)
Under Age 1	163.49	(31.42)	119.89	(37.38)	95.10	(16.92)	70.82	(18.64)
Age 1-4	18.78	(4.82)	11.89	(3.79)	9.28	(1.78)	5.83	(2.17)
Age 5-9	4.49	(0.76)	3.29	(0.76)	2.84	(0.37)	1.92	(0.39)
Age 10-14	2.98	(0.26)	2.36	(0.54)	2.34	(0.27)	1.62	(0.33)
Age 15-19	4.96	(0.40)	3.68	(0.79)	4.13	(0.71)	2.95	(0.80)
Age 20-24	6.72	(0.51)	5.24	(1.13)	5.81	(1.38)	4.14	(1.39)
Age 25-29	7.53	(0.61)	5.94	(1.34)	6.65	(1.52)	4.73	(1.71)
Age 30-34	7.80	(1.06)	6.76	(1.71)	7.52	(1.49)	5.24	(1.91)
Age 35-39	8.95	(1.36)	7.83	(1.71)	8.06	(1.44)	6.23	(1.98)
Age 40-44	10.25	(1.72)	9.09	(2.05)	8.80	(1.44)	7.96	(2.27)
Age 45-49	12.04	(2.38)	11.18	(2.40)	10.32	(1.62)	10.20	(2.45)
Age 50-54	15.96	(3.78)	14.43	(3.53)	13.84	(2.12)	14.06	(3.07)
Age 55-59	22.52	(4.32)	20.53	(4.89)	19.46	(2.62)	19.47	(3.62)
Age 60-64	30.72	(4.62)	28.77	(7.00)	27.44	(3.14)	28.27	(4.14)
Age 65-69	46.13	(7.12)	42.94	(10.34)	42.12	(4.52)	42.22	(4.60)
Age 70-74	68.90	(6.69)	63.50	(14.91)	65.27	(6.50)	63.55	(6.15)
Age 75-79	103.99	(9.35)	98.47	(21.21)	98.05	(7.51)	96.42	(8.06)
Age 80-84	162.81	(10.69)	149.31	(31.09)	151.57	(9.90)	144.94	(8.93)
Age 85-89	232.45	(20.59)	210.05	(45.78)	215.75	(13.50)	205.75	(17.23)
Age 90-94	322.33	(32.18)	290.66	(78.83)	306.21	(37.45)	286.05	(33.71)
Age 95+	431.91	(43.84)	358.44	(123.09)	333.78	(52.89)	333.60	(63.28)
Panel B: Cause-Specific Annual Mortality Rate per 1,000 Total Population in Death Registration States								
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Typhoid Fever	0.30	(0.09)	0.24	(0.11)	0.09	(0.05)	0.06	(0.05)
Malaria	0.06	(0.04)	0.01	(0.01)	0.05	(0.11)	0.03	(0.08)
Smallopox	0.00	(0.00)	0.00	(0.01)	0.01	(0.02)	0.00	(0.00)
Measles	0.14	(0.11)	0.10	(0.07)	0.08	(0.04)	0.04	(0.04)
Scarlet Fever	0.08	(0.03)	0.10	(0.07)	0.04	(0.03)	0.02	(0.01)
Whooping Cough	0.12	(0.03)	0.12	(0.05)	0.13	(0.05)	0.06	(0.03)
Diphtheria	0.35	(0.13)	0.18	(0.07)	0.13	(0.05)	0.05	(0.03)
Influenza	0.37	(0.20)	0.14	(0.08)	0.75	(0.25)	0.22	(0.09)
Meningitis	0.43	(0.09)	0.14	(0.05)	0.06	(0.02)	0.04	(0.05)
Diabetes	0.12	(0.03)	0.15	(0.05)	0.15	(0.05)	0.17	(0.06)
Circulatory Disease	1.58	(0.29)	1.27	(0.57)	1.36	(0.39)	1.96	(0.56)
pneumonia	1.47	(0.30)	1.26	(0.43)	1.30	(0.30)	0.85	(0.18)
Diarrhea under 2	1.14	(0.35)	0.83	(0.36)	0.41	(0.16)	0.23	(0.19)
Nephritis	0.82	(0.25)	0.87	(0.29)	0.87	(0.21)	0.88	(0.28)
Suicide	0.10	(0.02)	0.15	(0.05)	0.10	(0.04)	0.16	(0.07)
TB Lungs	1.64	(0.32)	1.21	(0.45)	0.99	(0.35)	0.67	(0.46)
TB Other	0.21	(0.06)	0.19	(0.06)	0.13	(0.04)	0.08	(0.03)
Cancer	0.69	(0.13)	0.72	(0.24)	0.81	(0.25)	0.91	(0.30)
Accidents and Violence	0.74	(0.14)	0.87	(0.29)	0.78	(0.12)	0.92	(0.17)
Panel C: Real Annual State Government Spending and Revenue Per Capita								
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Total Revenue	$16.51	($7.05)	$17.79	($7.69)	N/A	N/A	$43.36	($20.06)
Total Spending	$14.94	($8.12)	$18.05	($7.30)	N/A	N/A	$43.99	($15.78)
Property Tax Revenue	$3.51	($1.07)	$9.18	($10.23)	N/A	N/A	$8.91	($6.94)
Transportation Spending	$0.88	($0.70)	$2.61	($3.38)	N/A	N/A	$18.67	($9.22)
Education Spending	$2.46	($1.06)	$5.63	($3.12)	N/A	N/A	$10.79	($7.10)
Social Services Spending	$2.23	($0.96)	$2.42	($1.22)	N/A	N/A	$3.68	($1.40)

Note: Public finance data is available for an insufficient number of states to calculate descriptive statistics in 1920

Table 4: Correlates of Death Registration Area Entry Dates

Independent Variable	Estimate	Standard Error	N	R^2
Year of Women's Suffrage	-0.169	(0.178)	48	0.02
Population in 1000s, 1900	-0.001	(0.001)	48	0.03
Total Mortality Rate per 1000, 1900	-0.043	(1.384)	10	0.37
Year of State Alimony/Divorce Law	0.097	(0.244)	11	0.02
Percent of the Native White Population 21+ Illiterate, 1900	49.596	(61.056)	45	0.02
Per Capita Capital Investment in Manufacturing, 1900	-11.306	(21.534)	45	0.01
Per Capita Wage in Manufacturing, 1900	-0.048	(0.088)	45	0.01
Year of State GFWC Chapter	0.068	(0.060)	48	0.13
Year of State Mother's Pension Law	-0.040	(0.993)	40	0.00

Notes: *p<0.10, **p<0.05, ***p<0.01; GFWC: General Federation of Women's Clubs

Table 5: Correlates of Non-Missing State Public Finance Data

Independent Variable	Estimate	Standard Error	N	R^2
Year of Women's Suffrage	0.002	(0.001)	1109	0.00
Year Joined Death Registration Area	-0.001	(0.002)	1109	0.00
Population in 1000s, 1900	0.000	(0.000)	1109	0.00
Total Deaths, 1900	0.000	(0.000)	370	0.00
Year of State Alimony/Divorce Law	0.000	(0.000)	1109	0.00
Percent of the Native White Population 21+ Illiterate, 1900	-0.180	(0.503)	1081	0.00
Per Capita Capital Investment in Manufacturing, 1900	0.225	(0.249)	1081	0.00
Per Capita Wage in Manufacturing, 1900	0.001	(0.001)	1081	0.00
Year of State GFWC Chapter	-0.003	(0.005)	1109	0.00
Year of State Mother's Pension Law	-0.016	(0.011)	949	0.00

Notes: *p<0.10, **p<0.05, ***p<0.01; Standard errors clustered at the state level shown in parentheses; All estimates are marginal probabilities from probit specifications calculated at the mean of the independent variable for state government social spending; GFWC: General Federation of Women's Clubs

Table 6: The Effect of Women's Suffrage Laws on Age-Specific Deaths by Sex

Dependent Variable	Estimate	Standard Error	N	R^2
ln(Female Deaths Under Age 1)	-0.057	(0.039)	1062	0.99
ln(Female Deaths Age 1-4)	-0.081*	(0.042)	1062	0.99
ln(Female Deaths Age 5-9)	-0.116**	(0.051)	1062	0.98
ln(Female Deaths Age 10-14)	-0.151***	(0.039)	1062	0.98
ln(Female Deaths Age 15-19)	-0.081**	(0.038)	1062	0.99
ln(Female Deaths Age 20-24)	-0.032	(0.050)	1062	0.99
ln(Female Deaths Age 25-29)	-0.003	(0.041)	1062	0.99
ln(Female Deaths Age 30-34)	-0.007	(0.046)	1062	0.99
ln(Female Deaths Age 35-39)	-0.047	(0.037)	1062	0.99
ln(Female Deaths Age 40-44)	-0.046	(0.031)	1062	0.99
ln(Female Deaths Age 45-49)	-0.035	(0.031)	1062	0.99
ln(Female Deaths Age 50-54)	0.024	(0.037)	1062	0.99
ln(Female Deaths Age 55-59)	-0.029	(0.029)	1062	0.99
ln(Female Deaths Age 60-64)	-0.032	(0.035)	1062	0.99
ln(Female Deaths Age 65-69)	-0.045	(0.029)	1062	0.99
ln(Female Deaths Age 70-74)	-0.005	(0.036)	1062	0.99
ln(Female Deaths Age 75-79)	-0.011	(0.034)	1062	0.99
ln(Female Deaths Age 80-84)	-0.007	(0.033)	1062	0.99
ln(Female Deaths Age 85-89)	-0.023	(0.024)	1062	0.99
ln(Female Deaths Age 90-94)	0.021	(0.057)	1062	0.98
ln(Female Deaths Age 95+)	-0.032	(0.045)	1054	0.96
ln(Male Deaths Under Age 1)	-0.046	(0.044)	1062	0.99
ln(Male Deaths Age 1-4)	-0.070	(0.044)	1062	0.99
ln(Male Deaths Age 5-9)	-0.133***	(0.048)	1062	0.98
ln(Male Deaths Age 10-14)	-0.121***	(0.042)	1062	0.98
ln(Male Deaths Age 15-19)	-0.101**	(0.040)	1062	0.99
ln(Male Deaths Age 20-24)	-0.076	(0.057)	1062	0.99
ln(Male Deaths Age 25-29)	-0.027	(0.057)	1062	0.99
ln(Male Deaths Age 30-34)	-0.038	(0.049)	1062	0.99
ln(Male Deaths Age 35-39)	-0.070	(0.047)	1062	0.99
ln(Male Deaths Age 40-44)	-0.067	(0.039)	1062	0.99
ln(Male Deaths Age 45-49)	-0.070	(0.040)	1062	0.99
ln(Male Deaths Age 50-54)	-0.010	(0.032)	1062	0.99
ln(Male Deaths Age 55-59)	-0.005	(0.031)	1062	0.99
ln(Male Deaths Age 60-64)	-0.019	(0.033)	1062	0.99
ln(Male Deaths Age 65-69)	-0.031	(0.038)	1062	0.99
ln(Male Deaths Age 70-74)	-0.038	(0.035)	1062	0.99
ln(Male Deaths Age 75-79)	-0.016	(0.031)	1062	0.99
ln(Male Deaths Age 80-84)	0.019	(0.038)	1062	0.99
ln(Male Deaths Age 85-89)	0.004	(0.039)	1062	0.99
ln(Male Deaths Age 90-94)	-0.020	(0.060)	1062	0.97
ln(Male Deaths Age 95+)	-0.045	(0.090)	1060	0.93

Notes: *p<0.10, **p<0.05, ***p<0.01; Standard errors clustered at the state level shown in parentheses

Table 7: The Effect of Women's Suffrage Laws on Age-Specific Deaths by Sex over Time

Panel A: 3- and 6- Year Time Lags

	ln(Deaths Under 1)		ln(Deaths 1-4)		ln(Deaths 5-9)		ln(Deaths 10-14)		ln(Deaths 15-19)		ln(Deaths 20-24)	
Independent Variable	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Women Vote	-0.049	-0.055	-0.075*	-0.085**	-0.131***	-0.113**	-0.126***	-0.137***	-0.100**	-0.086**	-0.068	-0.036
	(0.041)	(0.038)	(0.044)	(0.040)	(0.046)	(0.049)	(0.043)	(0.038)	(0.038)	(0.033)	(0.051)	(0.047)
Women Vote +3	-0.002	-0.009	-0.002	-0.009	0.004	-0.016	0.022	-0.041	-0.008	0.009	-0.052	0.004
	(0.026)	(0.024)	(0.029)	(0.032)	(0.033)	(0.035)	(0.028)	(0.031)	(0.025)	(0.030)	(0.031)	(0.028)
Women Vote +6	-0.021	-0.001	-0.036	-0.034	0.017	-0.005	0.003	0.024	-0.005	-0.016	-0.030	-0.016
	(0.023)	(0.023)	(0.029)	(0.029)	(0.031)	(0.031)	(0.029)	(0.027)	(0.028)	(0.025)	(0.038)	(0.036)
N	1062	1062	1062	1062	1062	1062	1062	1062	1062	1062	1062	1062
R^2	0.99	0.99	0.99	0.99	0.98	0.98	0.98	0.98	0.99	0.99	0.99	0.99

Panel B: 5- and 10-Year Time Lags

	ln(Deaths Under 1)		ln(Deaths 1-4)		ln(Deaths 5-9)		ln(Deaths 10-14)		ln(Deaths 15-19)		ln(Deaths 20-24)	
Independent Variable	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Women Vote	-0.046	-0.050	-0.073	-0.083**	-0.122**	-0.104**	-0.097**	-0.129***	-0.084**	-0.079**	-0.060	-0.028
	(0.043)	(0.039)	(0.044)	(0.041)	(0.047)	(0.049)	(0.041)	(0.036)	(0.040)	(0.034)	(0.049)	(0.049)
Women Vote +5	-0.016	0.003	-0.048*	-0.043	0.007	-0.020	0.029	0.007	-0.024	-0.015	-0.041	-0.021
	(0.024)	(0.024)	(0.027)	(0.029)	(0.031)	(0.031)	(0.026)	(0.031)	(0.031)	(0.023)	(0.047)	(0.032)
Women Vote +10	0.002	0.021	-0.005	-0.002	0.031	0.033	0.065**	0.062*	0.049*	0.006	0.047	0.014
	(0.023)	(0.023)	(0.032)	(0.037)	(0.037)	(0.041)	(0.027)	(0.036)	(0.025)	(0.027)	(0.034)	(0.021)
N	1062	1062	1062	1062	1062	1062	1062	1062	1062	1062	1062	1062
R^2	0.99	0.99	0.99	0.99	0.98	0.98	0.98	0.98	0.99	0.99	0.99	0.99

Notes: *p<0.10, **p<0.05, ***p<0.01; Standard errors clustered at the state level shown in parentheses

Table 8: The Effect of Women's Suffrage Laws on Cause-Specific Deaths

Dependent Variable	Estimate	Standard Error	N	R2
ln(Typhoid Deaths)	-0.058	(0.070)	1109	0.97
ln(Malaria Deaths)	-0.067	(0.130)	911	0.96
ln(Small Pox Deaths)	-0.237	(0.233)	690	0.55
ln(Measles Deaths)	-0.061	(0.133)	1094	0.73
ln(Scarlet Fever Deaths)	0.174	(0.162)	1107	0.89
ln(Whooping Cough Deaths)	-0.052	(0.090)	1108	0.90
ln(Diphtheria Deaths)	-0.241*	(0.125)	1106	0.95
ln(Influenza Deaths)	-0.089	(0.085)	1109	0.97
ln(Meningitis Deaths)	-0.234**	(0.097)	1107	0.93
ln(Pneumonia Deaths)	-0.050	(0.042)	1109	0.99
ln(Diarrhea Deaths Under Two)	-0.114*	(0.065)	1109	0.98
ln(TB Deaths)	-0.044	(0.042)	1109	1.00
ln(Childbirth Deaths)	0.001	(0.053)	1109	0.98
ln(Heart Disease Deaths)	-0.002	(0.030)	1109	0.99
ln(Diabetes Deaths)	0.038	(0.042)	1108	0.99
ln(Nephritis Deaths)	-0.003	(0.034)	1109	0.99
ln(Cancer Deaths)	-0.014	(0.030)	1109	1.00
ln(Accidents/Violent Deaths)	-0.022	(0.041)	1109	0.99
ln(Suicide Deaths)	-0.029	(0.030)	1109	0.99

Notes: *p<0.10, **p<0.05, ***p<0.01; Standard errors clustered at the state level shown in parentheses

Table 9: The Effect of Women's Suffrage Laws on State Government Spending and Revenue

Dependent Variable	Estimate	Standard Error	State and Year Fixed Effects	Linear State Time Trends	N	R^2
ln(Total Revenue)						
	0.398	(0.288)	Yes	No	673	0.71
	0.010	(0.084)	Yes	Yes	673	0.89
ln(Property Tax Revenue)						
	0.018	(0.352)	Yes	No	579	0.84
	0.070	(0.209)	Yes	Yes	579	0.94
ln(Total Spending)						
	0.379	(0.300)	Yes	No	688	0.69
	-0.057	(0.088)	Yes	Yes	688	0.87
ln(Highway Spending)						
	0.407	(0.386)	Yes	No	667	0.72
	0.300	(0.215)	Yes	Yes	667	0.90
ln(Education Spending)						
	0.051	(0.111)	Yes	No	689	0.71
	0.137	(0.157)	Yes	Yes	689	0.75
ln(Social Service Spending)						
	0.239***	(0.089)	Yes	No	688	0.76
	0.206***	(0.071)	Yes	Yes	688	0.84

Notes: *p<0.10, **p<0.05, ***p<0.01; Standard errors clustered at the state level shown in parentheses

Table 10: The Effect of Women's Suffrage Laws on Municipal Government Spending and Revenue

Table 11: The Effect of the Period Prior to Women's Suffrage Laws on Age-Specific Deaths by Sex

	1-2 Years Before Law		1-4 Years Before Law		1-6 Years Before Law	
Dependent Variable	Estimate	Standard Error	Estimate	Standard Error	Estimate	Standard Error
ln(Male Deaths Under 1)	-0.002	(0.028)	0.041	(0.066)	0.068	(0.070)
ln(Male Deaths 1-4)	0.038	(0.035)	0.086	(0.074)	0.114	(0.077)
ln(Male Deaths 5-9)	-0.005	(0.044)	0.033	(0.072)	0.082	(0.081)
ln(Male Deaths 10-14)	-0.024	(0.027)	-0.007	(0.069)	0.017	(0.070)
ln(Male Deaths 15-19)	-0.003	(0.030)	0.034	(0.061)	0.024	(0.047)
ln(Female Deaths Under 1)	-0.029	(0.023)	0.025	(0.063)	0.047	(0.068)
ln(Female Deaths 1-4)	0.049	(0.040)	0.083	(0.079)	0.117	(0.084)
ln(Female Deaths 5-9)	0.022	(0.043)	0.058	(0.074)	0.092	(0.092)
ln(Female Deaths 10-14)	-0.022	(0.035)	0.017	(0.068)	0.020	(0.054)
ln(Female Deaths 15-19)	-0.031	(0.027)	0.021	(0.052)	0.058	(0.042)
ln(Diphtheria Deaths)	-0.110	(0.096)	-0.049	(0.104)	0.129	(0.117)
ln(Meningitis Deaths)	0.050	(0.087)	0.058	(0.113)	0.006	(0.111)
ln(Diarrhea Deaths Under Two)	-0.056	(0.054)	0.001	(0.075)	0.119	(0.090)
ln(Social Service Spending)	0.129	(0.106)	-0.038	(0.159)	-0.053	(0.145)

Notes: *p<0.10, **p<0.05, ***p<0.01; Standard errors clustered at the state level shown in parentheses

Table 12: Correlates of Women's Suffage Law Timing

Independent Variable	Estimate	Standard Error	N	R^2
Year Joined Death Registration Area	-0.114	(0.120)	48	0.02
Population in 1000s, 1900	0.002*	(0.001)	48	0.07
Total Mortality Rate per 1000, 1900	0.071	(0.233)	10	0.01
Year of State Alimony/Divorce Law	0.184	(0.279)	11	0.05
Percent of the Native White Population 21+ Illiterate, 1900	0.449	(0.400)	45	0.03
Per Capita Capital Investment in Manufacturing, 1900	-10.297	(14.148)	45	0.47
Per Capita Wage in Manufacturing, 1900	-0.080	(0.057)	45	0.04
Year of State GFWC Chapter	-0.085	(0.337)	48	0.00
Year of State Mother's Pension Law	1.335	(0.835)	40	0.06

Notes: *p<0.10, **p<0.05, ***p<0.01; GFWC: General Federation of Women's Clubs

Table 13: How the Effect of Women's Suffrage Laws on Deaths Differed between Voluntary and Mandatory States

Dependent Variable	Estimate	Standard Error	N	R^2
ln(Male Deaths Under 1)	0.000	(0.094)	1062	0.99
ln(Male Deaths 1-4)	0.021	(0.104)	1062	0.99
ln(Male Deaths 5-9)	0.135	(0.099)	1062	0.98
ln(Male Deaths 10-14)	0.079	(0.085)	1062	0.98
ln(Male Deaths 15-19)	0.024	(0.075)	1062	0.99
ln(Female Deaths Under 1)	-0.001	(0.092)	1062	0.99
ln(Female Deaths 1-4)	0.030	(0.099)	1062	0.99
ln(Female Deaths 5-9)	0.108	(0.098)	1062	0.98
ln(Female Deaths 10-14)	0.131	(0.090)	1062	0.98
ln(Female Deaths 15-19)	0.004	(0.067)	1062	0.99
ln(Typhoid Deaths)	-0.014	(0.118)	1109	0.97
ln(Malaria Deaths)	-0.044	(0.192)	911	0.96
ln(Small Pox Deaths)	0.366	(0.312)	690	0.55
ln(Measles Deaths)	0.319	(0.211)	1094	0.73
ln(Scarlet Fever Deaths)	-0.211	(0.211)	1107	0.89
ln(Whooping Cough Deaths)	0.145	(0.132)	1108	0.90
ln(Diphtheria Deaths)	0.060	(0.151)	1106	0.95
ln(Influenza Deaths)	0.018	(0.131)	1109	0.97
ln(Meningitis Deaths)	0.167	(0.160)	1107	0.93
ln(Pneumonia Deaths)	0.000	(0.107)	1109	0.99
ln(Diarrhea Deaths Under Two)	-0.002	(0.131)	1109	0.98
ln(TB Deaths)	-0.079	(0.089)	1109	1.00
ln(Childbirth Deaths)	-0.067	(0.109)	1109	0.98
ln(Heart Disease Deaths)	-0.098	(0.089)	1109	0.99
ln(Diabetes Deaths)	-0.133	(0.097)	1108	0.99
ln(Nephritis Deaths)	-0.079	(0.090)	1109	0.99
ln(Cancer Deaths)	-0.042	(0.084)	1109	1.00
ln(Accidents/Violent Deaths)	-0.048	(0.091)	1109	0.99
ln(Suicide Deaths)	0.031	(0.079)	1109	0.99

Notes: *p<0.10, **p<0.05, ***p<0.01; Estimates shown for the interaction between a dummy variable for states voluntarily choosing suffrage and the presence of a women's suffrage law; Standard errors clustered at the state level shown in parentheses

Table 14: The Effect of Women's Suffrage Law Enactment at Various Ages on Women's Lifetime Fertility

Suffrage Law Enacted in State of Birth at Age 15-19	-0.088
	(0.079)
Suffrage Law Enacted in State of Birth at Age 20-24	-0.044
	(0.069)
Suffrage Law Enacted in State of Birth at Age 25-29	-0.049
	(0.068)
Suffrage Law Enacted in State of Birth at Age 30-34	-0.041
	(0.059)
Suffrage Law Enacted in State of Birth at Age 35-39	-0.029
	(0.055)
Suffrage Law Enacted in State of Birth at Age 40-44	-0.014
	(0.059)
Suffrage Law Enacted in State of Birth at Age 45-49	0.010
	(0.031)
N	191,231

Notes: *p<0.10, **p<0.05, ***p<0.01; Standard errors clustered at the state level shown in parentheses