A Appendix: For Online Publication

Figure A.1: Original health department record for Alabama and Louisiana

TABLE 17.—*Record of county health work*—Continued

ALABAMA—Continued

HOUSTON COUNTY

[Full-time work began Mar. 1, 1922]

Year	Director (name and professional degrees)	Actual period of operations	Number of personnel: Full time: Medical officers	Full time: Nonmedical officers	Full time: Inspectors	Full time: Nurses	Full time: Clerks	Full time: Others	Part time: Medical officers	Part time: Nonmedical officers	Part time: Inspectors	Part time: Nurses	Part time: Clerks	Annual appropriations (appropriated by cooperating agencies): Total budget	County	County towns	State	United States: Public Health Service	United States: Sheppard-Towner fund	Rockefeller Foundation	Other agencies
1922	T. E. Tucker, M. D.	Mar. 1-Dec. 31	1		1	1	1							$8, 250	$4, 166		$1, 042	$1	$625	$1, 041	$1, 375
1923	do.	Jan. 1-Dec. 31	1		1	1	1							9, 001	3, 500	$1, 500	2, 313	1	750	937	
1924	do.	do.	1			1	1				1			9, 000	3, 500	1, 500	2, 347		750	903	
1925	L. R. Poole, M. D.	do.	1		1	1	1							9, 180	3, 500	1, 500	3, 340		840		
1926	do.	do.	1		1	1	1							9, 260	3, 500	1, 500	3, 380		880		
1927	do.	do.	1		1	1	1							9, 000	3, 500	1, 500	3, 250		750		
1928	R. E. Neff, M. D.	do.	1		1	1	1							9, 300	3, 500	1, 500	3, 400		900		
1929	do.	do.	1		1	1	1							9, 748	3, 798	1, 500	4, 300			150	
1930	do.	do.	1		1	1	1							9, 800	5, 000	500	2, 500			1, 800	
1931	do.	do.	1		1	1	1							11, 800	5, 000	600	4, 783	1, 417			
1932	F. G. Granger, M. D.	do.	1		1	1	1							8, 000	2, 100		4, 550	850		500	
1933	do.	do.	1			1	1							6, 653	3, 500		1, 133			1, 000	1, 020

JACKSON COUNTY

[Full-time work began Mar. 15, 1925; ended May 10, 1927; reorganized Sept. 1, 1928]

Year	Director	Actual period of operations	FT Medical officers	FT Nonmedical officers	FT Inspectors	FT Nurses	FT Clerks	FT Others	PT Medical officers	PT Nonmedical officers	PT Inspectors	PT Nurses	PT Clerks	Total budget	County	County towns	State	Public Health Service	Sheppard-Towner fund	Rockefeller Foundation	Other agencies
1925	H. P. Burbage, M. D.	Mar. 15-Dec. 31.	1		1	1	1							$6, 911	$3, 958		$1, 449	$650	$475	$379	
1926	T. E. Tucker, M. D.	Jan. 1-Dec. 31	1		1	1	1							9, 000	5, 000		2, 000	1, 250	750		
1927	do.	Jan. 1-May 10	1		1	1	1							3, 470	833		1, 545	467	625		
1928	A. C. Bradham, M.D.	Sept. 1-Dec. 31.	1		1	1	1							3, 325	1, 667		1, 083	325		250	

TABLE 52.—*Record of parish health work*—Continued

LOUISIANA—Continued

MADISON PARISH

[Full-time work began Oct. 10, 1927]

Year	Director (name and professional degrees)	Actual period of operations	Number of personnel: Full time: Medical officers	Full time: Nonmedical officers	Full time: Inspectors	Full time: Nurses	Full time: Clerks	Full time: Others	Part time: Medical officers	Part time: Nonmedical officers	Part time: Inspectors	Part time: Others	Annual appropriations (appropriated by cooperating agencies): Total budget	Parish	Parish towns	State	United States: Public Health Service	United States: Sheppard-Towner fund	Rockefeller Foundation	Other agencies
1927	L. R. Craig, M. D.	Oct. 10-Dec. 31	1		1		1						$2, 000	$500		$500	$625		$375	
1928	do.	Jan. 1-Dec. 31	1			1	1						8, 000	2, 000		2, 000	2, 500		1, 500	
1929	T. G. Scott, M. D.	do.	1			1	1						8, 000	2, 000		2, 000	2, 500		1, 500	
1930	E. S. Freeman, M. D.	do.	1		1	1	1	1					8, 000	2, 625		2, 375	1, 875		1, 125	
1931	do.	do.	1		1	1	1	1					10, 500	2, 600	$400	3, 338	3, 600		562	
1932	do.	do.	1		2	1	1	1					11, 550	3, 100	1, 000	5, 275	1, 800		375	
1933	do.	do.	1		1	1	1	1					10, 400	3, 600	1, 000	5, 800				

MOREHOUSE PARISH

[Full-time work began Aug. 17, 1927]

Year	Director	Actual period of operations	FT Medical officers	FT Nonmedical officers	FT Inspectors	FT Nurses	FT Clerks	FT Others	PT Medical officers	PT Nonmedical officers	PT Inspectors	PT Others	Total budget	Parish	Parish towns	State	Public Health Service	Sheppard-Towner fund	Rockefeller Foundation	Other agencies
1927	J. W. Williams, M. D.	Aug. 17-Dec. 31	1		1	1	1						$4, 125	$1, 500		$937	$1, 219		$469	
1928	do.	Jan. 1-Dec. 31	1		1	1	1						11, 000	4, 000		2, 500	3, 250		1, 250	
1929	N. P. Liles, M. D.	do.	1		1	1	1						11, 000	4, 000		2, 500	3, 250		1, 250	
1930	do.	do.	1		1	1	1						11, 000	5, 125		2, 500	2, 438		937	
1931	do.	do.	1		1	1	1						11, 300	5, 200		2, 031	3, 600		469	
1932	do.	do.	1		2	1	1						10, 500	4, 600		2, 411	1, 800		1, 689	
1933	do.	do.	1		2	1	1						9, 485	3, 918		3, 091			2, 476	

SOURCE: CHD administrative records are retrieved from the *History of County Health Organizations in the United States* published in U.S. Public Health Bulletin 222.

Figure A.2: Original document recording health department activities

Compilation of data, by counties, on cooperative demonstration work in rural sanitation in the fiscal year 1926—Continued

Counties (or districts)	Baker, Ga.	Bernalillo, N. Mex.	Cape Cod Health District, Mass.	Cascade, Mont.	Chaves, N. Mex.	Colbert, Ala.	Crawford, Ill.	Decatur, Ga.	Dona Ana, N. Mex.	Dubuque, Iowa	Dunklin, Mo.
Period of work in fiscal year 1926	July 1, 1925, to June 30, 1926	July 1, 1925, to June 30, 1926	July 1, 1925, to June 30, 1926	July 1, 1925, to June 30, 1925	July 1, 1925, to June 30, 1926	July 1, 1925, to June 30, 1926	July 1, 1925, to Dec. 31, 1925	July 1, 1925, to June 30, 1926	July 1, 1925, to June 30, 1926	July 1, 1925, to June 30, 1926	July 1, 1925, to June 30, 1926
B. ACTIVITIES—continued											
6. Venereal-disease control:											
(a) Suspects examined	3	22	3	35	28	119	3	19	1	156	56
(b) Prophylactic treatments			1			5					
(c) Curative treatments	14	227	2	274		112	161	21		899	31
7. Tuberculosis control:											
(a) Number examined			39	101	2	35	15	5	2	51	36
(b) Positive			9	48	2	31	3	2	2	8	9
(c) Negative			30	53		4	12	3		43	27
(d) Placed in institutions				21							2
(e) Home visits			398	286	4	210	90		28	62	84
8. Persons treated for removal of hookworm	199							446			
9. Persons treated for prevention or cure of goiter				(1)						169	6
10. Schick tests				323							
11. Cows tuberculin tested		1,205	681		1,353	779			2,346	2,026	
12. Immunization:											
(a) Complete antityphoid inoculations	458	145	14	19	33	971	239	424	374	2	36
(b) Antismallpox vaccinations	589	2,276	498	1,022	2,444	292	3	1,988	473	3	207
(c) Complete diphtheria toxin-antitoxin inoculations	838	201	46	2,652	3			686	13	222	44
(d) Persons treated with antitoxin for immediate protection against diphtheria	13	57	45	2	21	2		5	25	72	1
13. Child hygiene:											
(a) Prenatal—											
(1) Cases given advice			50		18	71		1	172	65	37
(2) Examinations						14				55	13
(3) Office consultations			24	1		5					
(4) Group conferences			12			34				5	
(5) Home visits			114	5	20	81			176	380	
(6) Midwives instructed	11	37				27		27	50		
(b) Infant and preschool—											
(1) Babies and children examined	56	1	224	438	36	384	194	82	59	239	1,597
(2) Office consultations, mothers	3	3	54	80	46	6	3	60	5	13	158
(3) Group conferences with mothers	4		17	12		107	3	11			29
(4) Home visits	5	3	767	163	89	315	7	108	3,057	2,158	104
(c) School—											
(1) Children examined	617	2	2,476	6,161	1,645	2,134	1,835	3,870	98	7,075	6,198
(2) Found defective	340	2	1,299	5,193	728	913	697	1,641	44	5,143	4,406
(3) Defects found	451	3	1,469	9,792	958	1,136	859	2,188	48	7,829	6,967
(4) Consultations, parents (office and school)	2,874	3	110	143	410	12	9	1,984	80	301	300
(5) Home visits	1,727		2,148	324	265	157	16	803	4	860	397
(6) Talks to classes or drills in hygiene	119	17	156	64	156		61	216	46	97	90
(7) Exclusions for communicable disease		1,658	313	2,013	668	28	26	39	158	40	97
(d) Nutritional classes—(1) Cases attending										1,016	
14. Antimalaria work	(2)	(3)	(3)	(3)	(3)	(2)	(3)	(2)	(4)	(3)	(3)
15. Laboratory examinations:											
(a) Positive	141	353	68	405	458	138	48	488	103	352	40
(b) Negative	164	3,749	129	2,272	1,442	363	106	794	428	3,052	130
Total	305	4,102	197	2,677	1,900	501	154	1,282	531	3,404	170
C. RESULTS											
1. Sanitary privies installed:											
(a) Septic or L. R. S.										5	
(b) Water-tight vault											
(c) Bucket and box									2		
(d) Pit	78	99			49	317		377	154	5	84
Total	78	99			49	317		377	156	10	84
2. Privies restored to sanitary type	1	34	4	114	217	8	19	17	607	51	
3. Septic tanks installed	3	7	111	2	19	11		16	16	17	
4. New sewer connections	6	288	2	132	46	51		43	33	362	
5. New water connections	2	272	200	56	55			4	145	399	
6. Wells or springs improved	46	12		10	10		15	6	21	12	
7. Public milk supplies radically improved		11	1	1	14		5		39	25	
8. Treatments induced for correction of physical defects:											
(a) In infants			50		5	2	2	4	55		
(b) In preschool children			81	5	2	8		1	47	324	75
(c) In school children	21	2	401	1,950	65	252	70	252	23	1,895	1,145
(d) In adults			49		6	4			19		87
9. Nutritional cases improved			6	10	2	96	1	1	1,295	1,016	
10. Convictions for violation of sanitary laws		9	1		5	3				4	2
11. Nuisances corrected	6	3,123	77		1,673	563	8	6	856	609	34

[1] 68 per cent of school children and families using iodized salt. [2] Considerable. [3] None. [4] Little.

SOURCE: Data are retrieved from the *Cooperative Rural Health Work of the Public Health Service*, 1925-1928 and are available in various years of U.S. Public Health Reports.

Figure A.3: Example of advertisement in West Virginia

Gilmer County

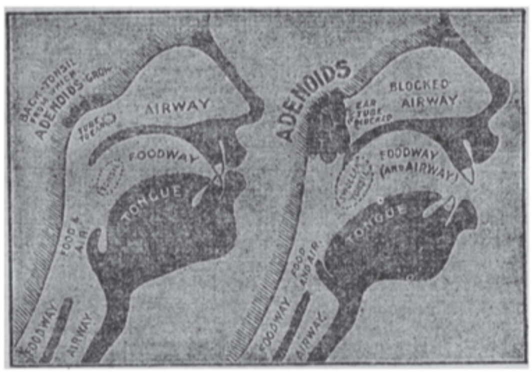
CLASS OF SERVICE		BOARD OF HEALTH
Health Education Child Welfare Tuberculosis Contagious Disease General Sanitation	**Healthogram**	Homer Sheets B. W. Craddock Dr E. O. Chimene, Field Agent, U. S. P. H. S.

THE TRUTH ABOUT TONSILS AND ADENOIDS

MOTHERS! FATHERS!

Study the picture and see how bad tonsils and adenoids deform the face. Are you going to let this happen to your child?

(NORMAL) (DISEASED)



Notice how the swollen tonsils block the passage to the ear—often causing deafness, ear disease and mastoid infection. Poison from little pockets in the tonsils may be carried to all parts of the body, and produce heart disease or rheumatism. Adenoids, by closing the air passage, cause deformities of the chest and make the development of tuberculosis easy.

STUPID CHILDREN

In school many children who are restless and seem stupid are often merely the victims of diseased tonsils and adenoids. They are unable to hear what the teacher says, their brains will not function properly because their body is suffering from want of air. Give these children a chance!

HOW THE COUNTY HEALTH DEPARTMENT CAN HELP YOU HELP THESE CHILDREN.

Every school child, and every child of pre-school age who is brought to a Child Health conference is examined, and if any defect is found the parent is notified. Visits are made to the home by the nurse, and the need of correction explained to the mother. Arrangements are being made for a tonsil and adenoid clinic in Glenville. If you wish to, have your child operated on at this clinic free, if you cannot afford to pay.

CONSULT THE COUNTY HEALTH DEPARTMENT!

Source: Figure is published in the *Cooperative Rural Health Work of the Public Health Service in the Fiscal Year 1925* from U.S. Public Health Reports.

Table A.1: Medical efforts of health departments, 1925-1928

	Mean	Std. Dev.
Child Exams (Per Child)	1.113	1.165
Prenatal Exams (Per Infant)	0.348	0.512
Infant Exams (Per Infant)	1.735	2.957
Vaccines	0.101	0.123
TB Control	0.053	0.133
Quarantines	0.046	0.075
Defects Corrected	0.020	0.024
Venereal Disease Control	0.019	0.059

NOTES: Table includes per capita medical services. Medical efforts are reported per capita for the rural population of the county. Infant, school children, and prenatal include efforts such as exams, consults, and home visits per the estimated population.

SOURCES: Data are retrieved from the *Cooperative Rural Health Work of the Public Health Service*, 1925-1928 and are available in various years of U.S. Public Health Reports. CHD administrative records are retrieved from the *History of County Health Organizations in the United States* published in U.S. Public Health Bulletin 222.

Table A.2: Census channels with family fixed effects

Panel A: Education and fertility

Dependent Variable:	Years Education	Graduate Eighth	Graduate High School	Has Child	Number of Children	
	(1)	(2)	(3)	(4)	(5)	(6)
CHD x Under 5	-0.026	0.002	-0.025***	0.006*	-0.053***	-0.099***
	(0.021)	(0.003)	(0.004)	(0.004)	(0.012)	(0.028)
N	1,308,846	1,308,846	1,308,846	1,358,552	1,358,552	370,273
Baseline FE	X	X	X	X	X	X
Controls	X	X	X	X	X	X
Household FE	X	X	X	X	X	X

Panel B: Labor force participation and migration

Dependent Variable:	Working	Unpaid Work	Location: On Farm	Location: Urban	Migrate County	Migrate State
	(1)	(2)	(3)	(4)	(5)	(6)
CHD x Under 5	0.003	0.002	0.007**	-0.014***	0.003	-0.009***
	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
N	1,358,337	1,358,552	1,358,552	1,358,552	1,358,552	1,358,552
Baseline FE	X	X	X	X	X	X
Controls	X	X	X	X	X	X
Household FE	X	X	X	X	X	X

NOTES: The reported coefficients reflect estimates of β from Specification 1. CHD is a binary variable that equals one if a CHD is present in county j and zero otherwise. Under five is an indicator variable that equals one if an individual is under five while the CHD is operating and zero otherwise. Controls include the homeownership status in base years, the number of siblings, and indicators for race. Baseline fixed effects include the 1920 county, the birth year, and tax-group-by-birth-year fixed effects. Data are a linked sample of census years 1920 to 1940 and includes men aged 18 to 40 in 1940. Robust standard errors are clustered at the county level with significance levels at the 10, 5, and 1 percent.

SOURCES: CHD administrative records are retrieved from the *History of County Health Organizations in the United States* published in U.S. Public Health Bulletin 222. Individual-level records are obtained from the IPUMS Restricted Complete Count U.S. Census.

B Conceptual Framework

The conceptual framework builds upon the work of Zivin and Neidell (2013), which takes the structure of Grossman (1972) and modifies the traditional representation of health as an investment good to a sequential investment setting. I recast this framework to an environment where parental investments in childhood directly impact adult health. Adult health is based on three factors: the disease environment in early childhood, the parental care in early childhood, and the subsequent educational choices. This section outlines the portion of the model necessary for intuition, with the full maximization relegated to Appendix Section B.3.

B.1 Health Production Function

The production of adult health for each child is a function of the parental choice of childhood education e and care c as well as the exogenous illness prevalence ϕ:

$$h = h(e, c, \phi) \tag{B.1}$$

where the health production function is increasing in e and c, and decreasing in ϕ.

Since CHD benefits are contained to early childhood, child health is established before making educational investments. I reexpress this dynamic process as a (static) reduced-form representation by re-writing adult health as a function of both the childhood health and the disease level (Zivin and Neidell (2013)). Within adult health, childhood health, x, is formed based on the parental care and the exogenous disease levels, rewritten as $x(c, \phi)$. Then, the educational investment relies on the final childhood health, expressed as $e(x)$.[40] Based on these adjustments, the adult health appears as a consumption of complements:

$$h = h(e(x), x(c, \phi)) \tag{B.2}$$

The primary focus of the production function is to clarify how exogenous shocks to illness levels, ϕ, will impact childhood health, x, and thereby adult health, h.

Consider an exogenous reduction in disease levels, ϕ. In this setting, there are two types of children, those who would have survived without the reduction in illness and those who would not have survived without the shock.[41] First, children who would have survived before the decline in illness unambiguously experience lower scarring in childhood. These children will have greater childhood health human capital, x, and higher adult health, h. Second, children who would have died before the decline in illness are now able to survive. These children survive, despite lower levels of care, c, and childhood health, x. Due to the reduced mortality selection, the lower childhood health, x, may result in lower levels of adult health, h. As the adult health of these children would have been absent from the population before the decline in illness, their survival may reduce average adult health.

To formally examine the relationship between the disease environment and adult health, the effect of the disease environment can be expressed as the total derivative of h with respect to ϕ:

$$\frac{dh}{d\phi} = \frac{dh}{dx}\frac{dx}{d\phi} = \left(\frac{\partial h}{\partial e}\frac{\partial e}{\partial x} + \frac{\partial h}{\partial x}\right)\left(\frac{\partial x}{\partial \phi} + \frac{\partial x}{\partial c}\frac{\partial c}{\partial \phi}\right) \tag{B.3}$$

where the relationship between adult health and illness levels, $\frac{dh}{d\phi}$, is composed of the relationship between adult health and child health, $\frac{dh}{dx}$, and the relationship between childhood health and the disease environment, $\frac{dx}{d\phi}$.

[40] Childhood health is increasing in parental care c and decreasing in illness episodes ϕ.

[41] This captures both scarring and selection or survival bias discussed in the literature, as in Bozzoli *et al.* (2009).

The relationship between child health and the disease environment, $\frac{dx}{d\phi}$, decomposes to $\frac{\partial x}{\partial \phi} + \frac{\partial x}{\partial c}\frac{\partial c}{\partial \phi}$. The first portion, $\frac{\partial x}{\partial \phi}$, represents the effect of the disease environment on childhood health (the biological component). The second portion, $\frac{\partial x}{\partial c}\frac{\partial c}{\partial \phi}$, describes the parental role in maintaining child health. If the disease environment is detrimental, or parental care is ineffective, then reducing ϕ will be unambiguously beneficial. In cases where care mediates the negative health effects of illness, reducing ϕ may only benefit children with low parental care and mortality selection may reduce overall health.

Now considering the relationship between adult and child health, $\frac{dh}{dx}$, the persistence of health from early to later life appears as $\frac{\partial h}{\partial e}\frac{\partial e}{\partial x} + \frac{\partial h}{\partial x}$. The first portion, $\frac{\partial h}{\partial e}\frac{\partial e}{\partial x}$, describes the degree to which education can compensate for the negative effects of scarring in childhood. The second portion describes the relationship between childhood and adult health, $\frac{\partial h}{\partial x}$. Here again, if education can compensate for negative health effects, then the role of reducing illness may be small. If, on the other hand, childhood health directly influences adult health through $\frac{\partial h}{\partial x}$, then individuals will benefit from the health investment through reduced scarring.

B.2 Model Implications

Within the conceptual framework, the effect of a reduction in illness levels, ϕ, on later-life income is ambiguous. The result depends on the relative response of each factor in Equation B.3 as well as the health effects of the CHD. First, poor childhood health may hinder the acquisition of human capital through $e(x)$ and would reduce either quantity or the quality of education. Second, scarring in childhood may directly impact adult health through childhood health x. Third, the relationship between parental care, childhood health, and education is dependent on preferences and prices. Parents may focus their investment on childhood health and fail to readjust education if the price of education is high or if the mitigating effect of education is small, $\frac{\partial h}{\partial e}\frac{\partial e}{\partial x}$.

Assume the disease exposure, ϕ, declines. The basic implications are as follows:

Implication 1 ***Reversal of Mortality Selection***: *Relatively large mortality reductions may allow children with lower levels of parental care (c) to survive. This reduction in mortality selection may decrease the population's average adult health (h).*

Implication 2 ***Scarring of Individual***: *Holding parental inputs constant:*

- *Individuals not affected by mortality selection will unambiguously be less detrimentally affected by the disease environment, ($\frac{\partial x}{\partial \phi}$), which translated into lower levels of scarring and thus improved child health (x).*
- *This reduction in scarring will hold for all individuals, regardless of selection, if scarring is large or parental care is ineffective ($\frac{\partial x}{\partial c}\frac{\partial c}{\partial \phi}$).*

Implication 3 ***Parental Care***: *In cases where parental care unambiguously increases (e.g., decrease in maternal mortality), child health will increase, with the magnitude depending on the effectiveness of parental care ($\frac{\partial x}{\partial c}\frac{\partial c}{\partial \phi}$).*

Implication 4 ***Education***: *At lower disease levels, the corresponding effect on educational attainment depends on the degree to which the return to education, a post-exposure intervention, is related to child health ($\frac{\partial h}{\partial e}\frac{\partial e}{\partial x}$).*

Implication 5 ***Substitutability***: *Parents will trade off early life care and the educational investment based on the ratio of the marginal cost to the marginal benefit to adult health (Equation B.11).*

For the empirical estimation, Implication 1 may reduce adult health and thereby income. Implications 2 and 3 will improve adult productivity and boost income. Implications 4 and 5 imply that parents will adjust their investment based on the price of each input and the responsiveness of education to childhood health.

B.3 Maximization

The maximization problem is considered through the parent who trades off adult health of the child with consumption. In a one child household, parents maximize their utility:

$$U(Z, h) \tag{B.4}$$

which is composed of consumption (Z) and adult health (h).

The household budget is based on the income Y allocated over expenditures on consumption goods Z, the investment in the child's education e, and the care of the child c:

$$p_e e + p_c c + Z = Y \tag{B.5}$$

where the price of each good j is p. Thus the price of parental investment in education is p_e and the price of the parental care is p_c. Based on the utility and the budget constraint, the parental constrained optimization appears as:

$$\max_{e,Z,c} \mathcal{L} = U(Z, h) + \lambda(Y - p_e e - p_c c - Z) \tag{B.6}$$

The first order conditions are:

$$\frac{\partial \mathcal{L}}{\partial Z} = \frac{\partial U}{\partial Z} - \lambda = 0 \tag{B.7}$$

$$\frac{\partial \mathcal{L}}{\partial e} = \frac{\partial U}{\partial h}\frac{\partial h}{\partial e} - \lambda p_e = 0 \tag{B.8}$$

$$\frac{\partial \mathcal{L}}{\partial c} = \frac{\partial U}{\partial h}(\frac{\partial h}{\partial e}\frac{\partial e}{\partial x}\frac{\partial x}{\partial c} + \frac{\partial h}{\partial x}\frac{\partial x}{\partial c}) - \lambda p_c = 0 \tag{B.9}$$

$$\frac{\partial \mathcal{L}}{\partial \lambda} = Y - p_e e - p_c c - X = 0 \tag{B.10}$$

From the first order conditions (Equation B.8 and B.9), care for sick child and the educational investment will be traded-off based on the ratio of the marginal cost to their marginal benefit to adult health:

$$\frac{\frac{\partial h}{\partial c}}{\frac{\partial h}{\partial e}} = \frac{p_c}{p_e} \tag{B.11}$$

Therefore, the parental optimal choice of care and education will depend on the exogenous variables, the illness level and the price of each input. This is expressed as $c = c^*(\phi, p_e, p_c)$ and $e = e^*(\phi, p_e, p_c)$.

C County-level CHD Adoption

OLS Estimates of County-level Adoption

The main empirical strategy employs variation in CHD timing, CHD location, and the age of exposure to capture the persistent effect of improved health. I ensure that this natural experiment is somewhat exogenously administered by establishing that CHD arrival year is uncorrelated with the pre-adoption characteristics of CHD counties. I am especially concerned about the arrival timing of the health department as my primary identification strategy relies on comparisons between individuals in earlier-treated and later-treated counties. Because I use county fixed effects in my baseline analysis, I am less concerned about time-invariant differences between adopting and non-adopting counties. However, I still show the multivariate results for treatment with a CHD.

Following the literature,[42] I test whether county demographic characteristics predict the timing of the CHD. More specifically, I test whether the 1900 and 1910 census characteristics of adopting counties predict the *arrival year* of the health department. I examine whether the arrival year of the health department in county j is predicted by a set of demographic controls:

$$\mathrm{CHD}_{js} = \beta_0 + \mathbf{X}_j'\gamma + \eta_s + \epsilon_{js} \tag{C.1}$$

where the timing (year) of a CHD in county j and state s is considered over a set of demographic characteristics from the census years, $\mathbf{X}_j'$, and state fixed effects, η_s.

Figure C.1 shows the estimates from a multivariate regression of CHD timing over both the 1900 and the 1910 census controls from Equation C.1.[43] The red line shows the linear regression for 1910 characteristics and the blue lines show the 1900 characteristics. County characteristics fail to predict CHD adoption. The only exception is for the log of county-level taxation. Especially notable is that county adoption can not be predicted by the urban-rural split, the racial composition, or medical doctors within the county. I show both the 1900 and the 1910 controls to address the fact that one health department did arrive earlier than 1910, in 1908, but the majority of CHDs arrived after 1910.

Table C.1 also shows the exact estimates along with the F-statistic, the R-squared, and the number of observations for each regression. Columns (1) and (2) show binary treatment, Columns (3) and (4) show the 1900 characteristics and arrival year, Columns (5) and (6) show the arrival year over the 1910 county characteristics. Aside from county taxation levels, in Column (6), the log of population appears to weakly predict CHD adoption, but the log of population fails to be significant in Column (5), in the bivariate regressions, or in the 1900 characteristics. The R-squared values in Table C.1 appear similar to the values in related work (Bailey and Goodman-Bacon, 2015) and are between 0.3 and 0.4.

Throughout the tables and figures, the demographic characteristics have been standardized to plot the coefficients on the same graph. The coefficients can thus be interpreted in standard deviations. To be more specific, for 1910, a one standard deviation increase in the log of property taxes induces an almost two standard deviations earlier entry of the CHD. For the log of population, there is a one-to-one relationship. A one standard deviation increase in population will produce a one standard deviation later entry of the CHD.

Because county taxation significantly predicts timing and location of adoption in the multivariate regressions, I test whether each demographic control can predict adoption while solely controlling for log of county taxation. These estimates are shown below in Figure C.2. The results in the bivariate regressions are similar to the multivariate regressions and display that CHD entry is only predicted by the log of taxation. The results here corroborate findings in Hoehn-Velasco (2018), where county taxation was the only predictor of adoption in a Cox proportional hazard model.

To address the issue of county-level taxation significantly predicting adoption, in my baseline estimation,

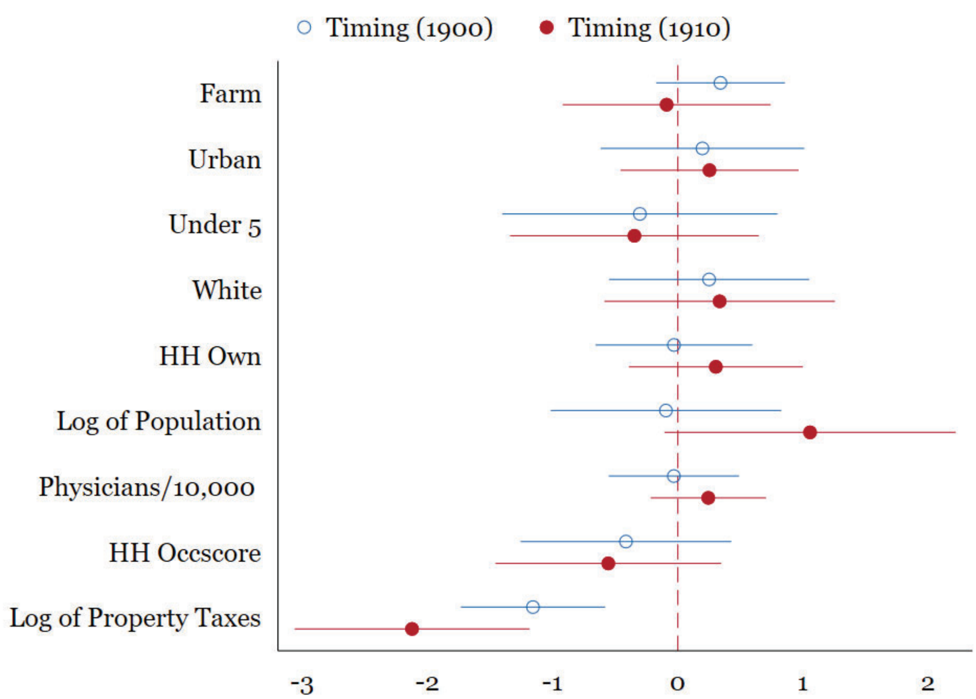
[42]See empirical strategy in Bailey and Goodman-Bacon (2015).

[43]Note that variables have been standardized so that the estimates can be plotted on the same axis for ease of visualization of statistical significance.

I include the taxation level interacted with birth year fixed effects. I then provide estimates with the log of taxes interacted with birth year trends. I also test whether including trends for birth year interacted with the log of the population affect the results (due to the results in Table C.1 Column (6)). With all three adjustments, the income gains remain between two and five percent.

I finally confirm that health conditions do not predict the arrival timing of the CHD. To show that health conditions do not predict adoption, I use a panel data set, including the census controls, mortality rates, and a binary variable for CHD presence. In Table C.2, when controlling for county fixed effects and demographic controls, neither the county-level mortality rate nor the infant mortality can predict the arrival of the health department in the subsequent year. Similar findings can also be found in Hoehn-Velasco (2018).[44]

Figure C.1: 1910 and 1900 county characteristics and health department entry



Notes: The graph displays the relationship between 1900 (and 1910) population controls and CHD entry between 1908 to 1933. Lines represent the 95 percent confidence intervals on the point estimates. Population controls have been standardized to plot coefficients on the same graph. State fixed effects are included. Robust standard errors are clustered at the state level with significance levels at the 10, 5, and 1 percent. For bivariate regressions of the results see Figure C.2. For the full table of results, including treatment and the hazard rate, see Table C.1.

Sources: CHD administrative records are retrieved from the *History of County Health Organizations in the United States* published in U.S. Public Health Bulletin 222. Vital statistics are from the U.S. Vital Statistics for rural counties. County-level data on property taxes, property values, and public debt are available in census publications entitled *Wealth, Public Debt, and Taxation* for years 1912, 1922, and 1932. County-level demographic characteristics are calculated from the IPUMs Restricted Complete Count Census data.

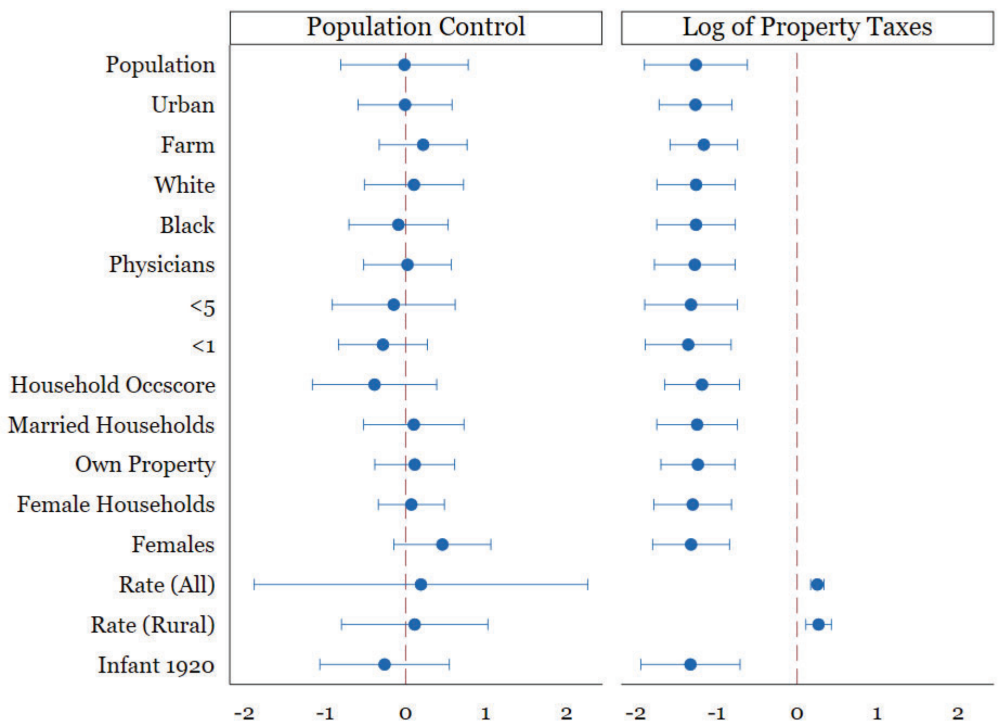
[44]Using an event-study design, Hoehn-Velasco (2018) shows that pre-adoption mortality rates do not increase or decrease in the years leading up to the CHD.

Table C.1: Adoption of health department and county characteristics

	Treatment		Timing 1900		Timing 1910	
	(1)	(2)	(3)	(4)	(5)	(6)
Urban	0.002	-0.010	0.054	0.197	0.254	0.254
	(0.017)	(0.016)	(0.386)	(0.402)	(0.361)	(0.352)
Under 5	-0.002	-0.001	-0.209	-0.303	-0.522	-0.347
	(0.020)	(0.019)	(0.539)	(0.543)	(0.521)	(0.491)
White	-0.032	-0.018	0.222	0.250	0.553	0.335
	(0.032)	(0.034)	(0.366)	(0.395)	(0.392)	(0.455)
Log of Population	-0.015	-0.006	0.012	-0.095	0.994	1.058*
	(0.025)	(0.025)	(0.478)	(0.455)	(0.624)	(0.575)
HH Occscore	0.012	0.005	-0.510	-0.415	-0.501	-0.556
	(0.012)	(0.012)	(0.390)	(0.416)	(0.372)	(0.445)
Log of Property Taxes	0.088**	0.077**	-1.243***	-1.158***	-2.104***	-2.125***
	(0.036)	(0.036)	(0.330)	(0.285)	(0.466)	(0.463)
Farm		-0.023		0.341		-0.089
		(0.022)		(0.254)		(0.410)
HH Own		-0.020		-0.031		0.304
		(0.022)		(0.309)		(0.344)
Physicians/10,000		-0.011		-0.032		0.244
		(0.012)		(0.257)		(0.228)
Observations	2,722.00	2,722.00	700.00	700.00	725.00	725.00
Adjusted R-sq.	0.32	0.32	0.36	0.36	0.38	0.38
F-statistic	5.27	4.53	7.78	6.45	10.37	11.65
State FE	X	X	X	X	X	X

NOTES: The table displays the 1910 (and 1900) population controls and CHD entry between 1908 to 1933 in a multivariate OLS regression model. Columns (1)-(2) show treatment and Columns (3)-(6) show the timing. Population controls have been standardized. State fixed effects are included. Robust standard errors are clustered at the state level with significance levels at the 10, 5, and 1 percent. SOURCES: CHD administrative records are retrieved from the *History of County Health Organizations in the United States* published in U.S. Public Health Bulletin 222. Individual-level records are obtained from the IPUMS Restricted Complete Count U.S. Census.

Figure C.2: County characteristics and year of arrival (bivariate)



Notes: The graph displays the demographic characteristics and CHD entry between 1908 to 1933 in bivariate regressions. Each point represents the estimated coefficient on the population control, with the estimation including controls for the state fixed effects and the log of taxation. Lines represent the 95 percent confidence intervals on the point estimates. Population controls have been standardized to plot coefficients on the same graph. Robust standard errors are clustered at the state level with significance levels at the 10, 5, and 1 percent.

Sources: CHD administrative records are retrieved from the *History of County Health Organizations in the United States* published in U.S. Public Health Bulletin 222. Vital statistics are from the U.S. Vital Statistics for rural counties. County-level data on property taxes, property values, and public debt are available in census publications entitled *Wealth, Public Debt, and Taxation* for years 1912, 1922, and 1932. County-level demographic characteristics are calculated from the IPUMs Restricted Complete Count Census data.

Table C.2: Adoption of health department and mortality

	Lagged Rate and CHD Adoption							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
L.Overall Mortality (all)	-0.0008	0.0004						
	(0.0006)	(0.0007)						
L.Overall Mortality (rural)			-0.0001	0.0004				
			(0.0004)	(0.0004)				
L.Infant Mortality (all)					-0.0004	-0.0002		
					(0.0008)	(0.0007)		
L.Infant Mortality (rural)							-0.0006	-0.0005
							(0.0007)	(0.0007)
Observations	55,898.00	55,896.00	55,886.00	55,884.00	38,408.00	38,401.00	38,376.00	38,369.00
Adjusted R-sq.	0.11	0.13	0.11	0.13	0.08	0.09	0.08	0.09
F-statistic	15.46	13.23	15.47	13.17	19.80	14.85	19.69	14.71
County FE	X	X	X	X	X	X	X	X
Year FE	X	X	X	X	X	X	X	X
Controls		X		X		X		X

Notes: The table presents the estimates from an OLS estimation of CHD entry over a panel of mortality data from 1900-1936. The estimates reflect the adoption of a CHD in county j in year t based on county-level mortality in $t-1$. Controls include the fraction of residents on farms, in urban areas, under 5, who are white, who own their homes, as well as the average occupational score for household heads, the log of the population, and the physicians per 10,000. County and year fixed effects are included in each regression. Robust standard errors are clustered at the county level with significance levels at the 10, 5, and 1 percent. Sources: CHD administrative records are retrieved from the *History of County Health Organizations in the United States* published in U.S. Public Health Bulletin 222. Vital statistics are from the U.S. Vital Statistics for rural counties. Individual-level records are obtained from the IPUMS Restricted Complete Count U.S. Census.

D State-level CHD Adoption

States that operated CHDs were principally in the West and South, with exceptions in select Midwestern states. Initially, the lopsided distribution throughout the nation appears related to the health conditions in the adopting states. On a more careful survey of the background literature, however, the adoption throughout these regions is instead based on the structure of local government. In New England and the majority of the Midwestern states, the town or township is the main political unit, and these towns are the principal providers of local public goods, which include sanitary administration (Chapin (1900)).[45] In the South and West, on the other hand, 'the county board of health has...been established to look after the sanitary interests of the people outside of the incorporated municipalities' (Chapin (1900)). This difference in the organization of local government, appears to be the primary force affecting the adoption of the county-level movement in health.[46] In states that are the exception to the rule, including Ohio and Michigan, legislation was passed that required the organization of county-level services. This legislation was intended to create more efficient organizations that could operate with enough scale to be effective against illness.[47]

While it is true that townships in the North set up town-level services, these services were often ineffective due to the weak finances of the small populations. Rather than the county-level being subpar to the town level, it was "generally agreed that the county is the smallest feasible unit from the standpoint of efficiency of service and administration. In most sections, the use of the county makes it possible to abandon the large number of ineffective organizations found in villages and townships" (Lancaster *et al.* (1937)).

To test whether the strength of local government differs across treated and untreated states, I compare the taxation power of state and local governments. Taxation is the clearest measure of the influence of government and captures both the wealth and revenue. Table D.1 shows the share of taxes and the per capita value of taxes across CHD and non-CHD states. In treated states, the share of the tax burden from municipal governments is lower, while the county level is higher. This difference across the relative taxation levels reveals the difference in power structure across adopting and non-adopting states. County governments are relatively stronger in areas that adopted, while municipal governments are stronger in states that did not. Adopting states, however, are no less wealthy and have similar tax revenue at the state level of governance.

A second check on state adoption tests whether CHD states have different, or even better, state boards of health. It is possible that adopting states may have had a higher propensity toward the provision of public health than non-adopting states. To test whether this is the case, the pre-adoption strength of the state boards of health is taken from Chapin (1916), which reports the quality and expenditures of each state. Across adoption, there is no difference in the quality of the state board, the per capita prior expenditures on health, or the measure of how the state board is elected. Treatment is not selected based on the structure or expenditure of the state board

[45]The regional differences in the political divisions was not a new occurrence, and evolved, beginning with the local government in the colonial era (Chapin (1900) pp. 6).

[46]These states include the New England states, Illinois, Iowa, Michigan, Minnesota, New Jersey, New York, Ohio, Pennsylvania, and Wisconsin.

[47]"The Michigan township was made a health authority in 1846 when, as one investigator put it, 'diseases were thought to arise from smells and cemeteries, and when anyone able to detect an odor or manage a cemetery could have qualified as a health officer." Such tiny areas, many of them too poor to perform their other functions without state assistance, are unable to afford the personnel or the equipment needed to carry out a health program of any sort—and a health program is commonly regarded as of much less importance than, for example, education or roads. The health officers employed are more often than not untrained, serve in their spare time, are paid only nominal salaries, and are quite unconvinced of the value of the scientific health measures recommended by the state department which exercises a nominal supervision over them. Of the 1,160 township health officers in Michigan, 660 are not physicians, while in Indiana townships many of them are paid as little as ten dollars a year. The post is a minor avocation of its holder and the work consists in most places of "an occasional quarantine, an abatement of a nuisance, and a lighting of fumigators following quarantine' (pp. 336 Lancaster *et al.* (1937)).

of health.

Table D.1: State adoption

	No CHD	CHD	Difference
	Mean	Mean	b
Share Taxes			
Share County Taxes	0.23	0.39	-0.16*
Share Municipal Taxes	0.61	0.43	0.18*
Share State Taxes	0.16	0.18	-0.02
Board of Health			
Quality	315.70	279.42	36.28
Gov. Appoints	0.20	0.34	-0.14
P.C. Prior Health Exp.	0.05	0.05	0.00
Per Capita			
P.C. Property Value	1,115.88	959.78	156.11
P.C. Total Taxes	23.24	20.92	2.32
N	10	38	48

Notes: For the state boards of health, quality measures are out of 1,000. The per capita expenditures represent the total spending on health by the state boards of health in 1914. Governor appointment is an indicator for whether the state governor appoints the health officer in each state. Significance levels at the 10, 5, and 1 percent.

Sources: CHD administrative records are retrieved from the *History of County Health Organizations in the United States* published in U.S. Public Health Bulletin 222. County-level demographic characteristics are calculated from the IPUMs Restricted Complete Count Census data. County-level data on property taxes, property values, and public debt are available in census publications entitled *Wealth, Public Debt, and Taxation* for years 1912, 1922, and 1932. Information on state health departments is published in *A Report on State Public Health Work: Based on a Survey of State Boards of Health* by Charles V. Chapin.

E Linking methodology

E.1 Characteristics of linked sample

The primary sample of interest begins with men living in rural areas in 1920. Of these men, 29% are matched to the 1940 sample of individuals. Individuals fail to be linked for several reasons. First, they have a common name combination, which makes records impossible to distinguish. Second, the person may be deceased in the 1940 census and thus unable to locate. Third, misreporting of names, place of birth, birth year, or race are common occurrences, and despite data cleaning, these misstatements rule out record linking.

Table E.1 Panel A presents summary statistics across the linking. Across the means, the linked sample has fewer nonwhite individuals and fewer men located in the South. Whites are typically easier to link between Census years, which is similar in the related linking literature. Of the regions reported, the South has the lowest linkage, especially when compared to the West or Midwest. This is likely due to several factors, including the high number of blacks, the size of states, as well as differences in naming practices across regions.

Table *2* displays the likelihood of linking individuals based on permanent characteristics. Columns (1)-(2) test the basic linking characteristics, Column (3) adds interaction of the baseline controls with the indicator for the health department, and Columns (3)-(4) add the number of siblings and whether an individual is located on a farm. I add these two characteristics due to the fact that they are expected to vary across linked and unlinked samples.[48] Over the five columns, the characteristics of individuals, do vary across the linkage, particularly race and region.

This lack of representativeness is standard in linked samples, and the focus is instead on whether the treatment assignment is systematically related to the linking methodology.[49] To test this, in Columns (2), (3), and (4), I include the CHD assignment. Over the reported specifications, the indicator for treatment assignment does *not* appear to be systematically related to the record linkage. Therefore, even though the characteristics of individuals are not comparable across the linking, the difference does not vary over exposure to a CHD. Exceptions to this statement are notable in Column (3). The interaction terms suggest that there may be differential linking over specific characteristics by health department status. In particular, age is negatively linked by health department status, which may have to do with differential mortality. Region is also selected by health department status, in particular, health department individuals in the Northeast are less likely to be linked. This bias in linking by health department status means that in health department counties, more individuals from the Midwest relative to the Northeast will be linked, and younger versus older individuals will be linked. Over the remainder of characteristics, the linking is similar across health department status.

E.2 Algorithm Performance

To link individuals across data sources years, the literature standard relies on the reported permanent characteristics of individuals. For my approach, these characteristics include:

[48] In Bailey *et al.* (2018) the authors find that "'linked individuals tend to have fewer siblings, be native-born, have native-born parents, be married, and live in urban areas."' Since the present study considers native-born men in rural areas, only siblings, and whether located on a farm are factors most likely to affect linking.

[49] For a more elaborate discussion of issues related to linked samples see Bailey *et al.* (2018).

- Birth state
- Gender
- First name
- Last name
- Race
- Birth year (within three years)

Of these characteristics, not all are required to be exact matches. Permanent characteristics may vary over census years due to both expected errors in the census data, as well as variations in reporting over time. Errors in the data arise both from person to enumerator misreporting, as well as the transcription of the text records to digital records. Individuals may also report their permanent characteristics differently depending on the year of the Census. For instance, individuals may report nicknames in childhood and switch to their proper names in adulthood.

To account for these errors or changes in reporting my preferred linking methodology follows ten steps shown in Table E.2. To see how well my linking methodology performs with related methods, I compare my preferred linking methodology, outlined above in Table E.2, with two alternative algorithms. The first, more conservative linking methodology does not replace proper names for nicknames (excludes Step 4). The second, more standard linking process, replaces phonetic equivalents for individual names.

To compare the three linking methods: preferred, conservative, and traditional, I compare the resulting samples across four metrics:[50]

1. Comparison of results (specific to this paper): if my main results are similar across algorithms, there is less concern over the particular method chosen.
2. Match rate: the share of records matched from the original sample.
3. Representativeness of the sample: linked samples are biased towards groups of individuals that have fewer reporting errors and have unique names. These groups include individuals who are white, have higher incomes, and live in urban areas are easier to match.
4. Match quality: to account for poor matches, the linked data is assessed for Type I errors (see Bailey *et al.* (2018)). In other words, the number or percent of incorrectly linked individuals.

The literature standard is to outline the linking performance based on (2) and (3). Bailey *et al.* (2018), however, makes an important critique, that we also care about the quality of the match. To assess quality, I rely on one of the analyses in Bailey *et al.* (2018) and compare linked individuals across the reported birthplaces of their parents. This parental birthplace should be time-invariant and is not used to link individuals across Census years. Currently, the parental place of birth is not well reported in the 1940 sample. To quantify (4), I test the 1920 Census linked to the 1930 Census using the same three algorithms.

Before moving into the standard comparisons of linked samples (metrics 2-4), I first evaluate the algorithms based on my main results (metric 1). Testing Equation 1 on the three samples reveals that coefficients only vary slightly depending on the sample. Table E.4 shows the baseline results over the three linking procedures: preferred, conservative, and traditional. The effect varies slightly between the specifications. With each linking methodology, the theme of the results is the same; income improves by 2-5% with CHD exposure. The similarity in estimates between the three samples alleviates concern over the results being dramatically affected by the choice of the algorithm.

Next, I assess the algorithms based on the linking percentage (2) as well as the representativeness of the samples (3). Table E.1 reports the summary statistics over samples produced by the three different algorithms.

[50]Following Bailey *et al.* (2018).

In Panel A, the use of proper names gives an end linkage of 29 percent. For the conservative approach, using names as reported, the linking percentage is 28. Finally, for the traditional approach, using phonetic spellings, I achieve a linking percentage of 37. This traditional approach achieves the highest linking percentage but is likely due to inaccurately matched individuals. Based on Bailey *et al.* (2018), the phonetic spelling results in type I errors that inflate the match rate.

For sample representativeness, metric (3), I compare the three samples with both summary statistics that compare the means across the linkage as well as a logit regression testing the likelihood of linking based on permanent characteristics. In the summary statistics displayed in Table E.1, the means of the three samples differ from the original sample in consistent ways. The preferred linking and the conservative linking in the top two panels are slightly more representative as compared with the traditional linking. Turning to the likelihood of linking in Table E.3, the results are similar. The preferred method is more representative in region, while the conservative method is slightly more representative in race. Both the conservative and preferred method are more representative than the traditional approach in Panel C.

Finally, metric (4) is evaluated using the 1920-30 sample. Following Bailey *et al.* (2018), I assess the linking quality using the reported parental birthplaces. I consider individuals an incorrect link if their parent's reported birthplace differs across both mother and father. In the samples, the traditional method has the highest error rate of almost 16 percent of the sample. The conservative sample has the lowest error rate, 14 percent, and the preferred has an error rate of 15 percent. For all three of the algorithms, my Type I error rate is 0.14-0.16, while the majority of the papers are between 0.2 and 0.35. A portion of the lower error rate may be due to the use of the 1920-30 sample, the particular selection criteria applied, or the fact that the sample is limited to native-born children.

From the four metrics assessed, the conservative and preferred algorithms are preferable to the traditional linking method. The more traditional approach results in a higher linking percentage, but this percentage suffers from low-quality links. Over the conservative and traditional methods, the results appear fairly similar, with a slight trade-off in error rate between the two. The conservative method returns fewer incorrect links while the preferred method returns a higher linking percentage with only a small increase in the Type I error rate. Regardless of the choice of the algorithm, for this paper, the results maintain their magnitude and significance.

Table E.1: Summary statistics across linking, 1920-40

Panel A: Preferred

	Linked		Not Linked		Difference
	Mean	Std. Dev.	Mean	Std. Dev.	b
Age	29.12	5.87	29.12	5.81	0.00
White	0.90	0.30	0.81	0.40	0.10***
Black	0.10	0.30	0.19	0.39	-0.09***
# Siblings	3.07	2.24	3.15	2.30	-0.08***
On Farm	0.56	0.50	0.58	0.49	-0.02***
Rural	0.86	0.34	0.88	0.32	-0.02***
West	0.10	0.30	0.09	0.28	0.01***
South	0.42	0.49	0.55	0.50	-0.12***
Northeast	0.15	0.35	0.12	0.33	0.03***
Midwest	0.33	0.47	0.24	0.43	0.09***
N	3,380,425		8,182,875		11,563,300

Panel B: Conservative

	Linked		Not Linked		Difference
	Mean	Std. Dev.	Mean	Std. Dev.	b
Age	29.11	5.87	29.13	5.82	-0.02***
White	0.90	0.30	0.81	0.39	0.09***
Black	0.10	0.30	0.19	0.39	-0.09***
# Siblings	3.07	2.24	3.14	2.30	-0.07***
On Farm	0.57	0.50	0.58	0.49	-0.01***
Rural	0.88	0.33	0.87	0.33	0.00***
West	0.10	0.30	0.09	0.29	0.01***
South	0.42	0.49	0.54	0.50	-0.12***
Northeast	0.15	0.36	0.12	0.33	0.03***
Midwest	0.33	0.47	0.24	0.43	0.08***
N	3,233,672		8,329,628		11,563,300

Panel C: Traditional

	Linked		Not Linked		Difference
	Mean	Std. Dev.	Mean	Std. Dev.	b
Age	29.10	5.86	29.14	5.81	-0.04***
White	0.90	0.30	0.79	0.40	0.10***
Black	0.10	0.30	0.20	0.40	-0.10***
# Siblings	3.10	2.25	3.14	2.30	-0.03***
On Farm	0.58	0.49	0.58	0.49	-0.00***
Rural	0.88	0.32	0.87	0.33	0.01***
West	0.10	0.30	0.09	0.28	0.01***
South	0.43	0.50	0.56	0.50	-0.12***
Northeast	0.14	0.35	0.12	0.32	0.02***
Midwest	0.32	0.47	0.23	0.42	0.09***
N	4,334,669		7,228,631		11,563,300

Notes: The above table shows the difference in means between linked and unlinked samples. Data are a linked sample of census years 1920 to 1940 and includes men aged 18 to 40 in 1940. Robust standard errors are clustered at the county level with significance levels at the 10, 5, and 1 percent. The three linking methods include: (1) the traditional approach, which uses the phonetic spelling of the last name, (2) the conservative linking approach, which uses first names as reported, and (3) the preferred method, which replaces nicknames with proper equivalents.

Sources: Individual-level records are obtained from the IPUMS Restricted Complete Count U.S. Census.

Table E.2: Linking methodology

Step 1	Select 1920 sample, including rural men in 38 treatment states.
Step 2	Separate men into birth states.
Step 3	Split given name into middle and first.
Step 4	Replace nicknames with proper equivalents.
Step 5	Link 1920 with 1940 using race, first name, and last name.
Step 6	Choose linked individual with the closest age.
Step 7	Drop those with more than three year difference in age (within 3 years).
Step 8	Break ties with middle name.
Step 9	Exclude duplicate links.
Step 10	Linking percentage – 30 percent.

Table E.3: Probability of linking men, 1920-40

	Panel A: Preferred	*Panel B: Conservative*	*Panel C: Traditional*
	(1)	(1)	(1)
Age	1.001***	1.000	1.000
	(0.000)	(0.000)	(0.000)
White=1	3.803***	3.842***	3.894***
	(0.289)	(0.284)	(0.289)
Black=1	2.131***	2.195***	2.076***
	(0.162)	(0.163)	(0.155)
West=1	0.884***	0.855***	0.869***
	(0.018)	(0.018)	(0.018)
South=1	0.668***	0.670***	0.669***
	(0.006)	(0.008)	(0.008)
Northeast=1	0.894***	0.932*	0.873***
	(0.028)	(0.034)	(0.029)
N	11,563,300	11,563,300	11,563,300

Notes: The above table represents a logit estimation on the individual characteristics affecting the linking of Census samples. Data are a linked sample of census years 1920 to 1940 and includes men aged 18 to 40 in 1940. Robust standard errors are clustered at the county level with significance levels at the 10, 5, and 1 percent. The three linking methods include: (1) the traditional approach, which uses the phonetic spelling of the last name, (2) the conservative linking approach, which uses first names as reported, and (3) the preferred method, which replaces nicknames with proper equivalents. Exponentiated coefficients reported.

Sources: Individual-level records are obtained from the IPUMS Restricted Complete Count U.S. Census.

Table E.4: Program effect across linking methodologies

Panel A: Preferred

Log of:	Income							Occscore	Hourly Wage
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
CHD x Under 5	0.047***	0.045***	0.050***	0.015***	0.043***	0.015***	0.046***	0.015***	0.026***
	(0.007)	(0.006)	(0.007)	(0.005)	(0.005)	(0.005)	(0.009)	(0.002)	(0.005)
N	2,266,698	2,266,696	2,266,690	2,266,690	2,266,690	2,266,690	765,511	2,243,251	1,842,251
Baseline FE	X	X	X	X	X	X	X	X	X
Controls		X	X	X	X	X	X	X	X
1940 County FE			X	X	X	X			
Birth Yr x Trend				X					
Log(Tax) x Trend					X	X			
Log(Pop) x Trend						X			
Household FE							X		

Panel B: Conservative

Log of:	Income							Occscore	Hourly Wage
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
CHD x Under 5	0.050***	0.047***	0.050***	0.015***	0.045***	0.015***	0.047***	0.016***	0.026***
	(0.007)	(0.006)	(0.007)	(0.006)	(0.005)	(0.006)	(0.009)	(0.003)	(0.005)
N	2,188,390	2,188,388	2,188,385	2,188,385	2,188,232	2,188,232	727,156	2,165,739	1,776,959
Baseline FE	X	X	X	X	X	X	X	X	X
Controls		X	X	X	X	X	X	X	X
1940 County FE			X	X	X	X			
Birth Yr x Trend				X					
Log(Tax) x Trend					X	X			
Log(Pop) x Trend						X			
Household FE							X		

Panel C: Traditional

Log of:	Income							Occscore	Hourly Wage
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
CHD x Under 5	0.050***	0.047***	0.052***	0.015***	0.044***	0.015***	0.041***	0.015***	0.027***
	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)	(0.008)	(0.002)	(0.005)
N	2,921,787	2,921,783	2,921,780	2,921,780	2,921,565	2,921,565	1,105,702	2,891,537	2,369,425
Baseline FE	X	X	X	X	X	X	X	X	X
Controls		X	X	X	X	X	X	X	X
1940 County FE			X	X	X	X			
Birth Yr x Trend				X					
Log(Tax) x Trend					X	X			
Log(Pop) x Trend						X			
Household FE							X		

NOTES: The reported coefficients reflect estimates of β from Specification 1. CHD is a binary variable that equals one if a CHD is present in county j and zero otherwise. Under five is an indicator variable that equals one if an individual is under five while the CHD is operating and zero otherwise. Controls include the homeownership status in base years, the number of siblings, and indicators for race. Data are a linked sample of census years 1920 to 1940 and includes men aged 18 to 40 in 1940. Robust standard errors are clustered at the county level with significance levels at the 10, 5, and 1 percent. The three linking methods include: (1) the traditional approach, which uses the phonetic spelling of the last name, (2) the conservative linking approach, which uses first names as reported, and (3) the preferred method, which replaces nicknames with proper equivalents.

SOURCES: CHD administrative records are retrieved from the *History of County Health Organizations in the United States* published in U.S. Public Health Bulletin 222. Individual-level records are obtained from the IPUMS Restricted Complete Count U.S. Census.