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The Significance of Lead Water Mains in American Cities: Some Historical Evidence

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I. Introduction

By the turn of the twentieth century, cities throughout the United States were using lead service mains to distribute water. For example, in 1900 the nation's five largest cities–New York, Chicago, Philadelphia, Saint Louis, and Boston–all used lead services to varying degrees (Baker 1897, pp. 42, 89, 170, 373, and 501). Despite the fact that many of these mains are still in use and that up to 20 percent of all lead exposure in young children comes from drinking water, the significance of lead service mains is poorly understood and there exists little scientific evidence that would allow us to precisely measure their effects on human health (United States, Environmental Protection Agency 2000).

The dearth of information and scientific study on lead services is unfortunate. It is well known that ingesting even small amounts of lead can adversely affect health and mental development, particularly among children (Needleman and Belinger 1991). Moreover, the Centers for Disease Control (1997) estimate that as many as 5 percent of all American children suffer from sub-clinical lead poisoning. There are, as a result, numerous studies exploring the health effects of exposure to lead through soil (Xintaras 1992), paint and house dust (Lanphear and Rogham 1997), industrial pollution (Trepka et al. 1997), leaded gasoline (Charney 1980), and work environments (Sata et al. 1998). The importance of lead dissolved from lead service mains has received much less attention, in part, because over time oxidation has created a protective coating over the interior walls of lead pipes and limited the levels of lead ingested through drinking water (Wisconsin Department of Natural Resources 1993). Nonetheless, it would be useful to know just how widespread lead water mains are, and how they have affected human health both today and in the past.

Accordingly, our goals in this paper are twofold. First, we explore how many cities in the United States used lead services during the late nineteenth and early twentieth century and we examine what factors influenced the choice to use lead mains. The results indicate lead service mains were pervasive: 70 percent of all cities with populations greater than

30,000 in 1900 used lead service mains exclusively or in combination with some other type of main. As for the correlates of lead usage, the probability of using lead water mains was positively correlated with city size, a Midwestern location, and public ownership (publicly-owned water companies used lead more often than did private water companies).

Second, we explore how the use of lead service mains affected morbidity around the turn of the twentieth century. Evidence on morbidity is derived from a large sample of Union Army veterans whose health was assessed when they applied for pensions. Overall, our results suggest that the use of lead water mains probably did have some adverse effect on human health, but for the general population, these effects do not appear to have been very serious. For example, Union-Army recruits living in cities that used lead service mains appear to have experienced more ailments associated with low levels of lead exposure, such as increased dizziness and hearing problems, but they did not suffer from more serious ailments associated with high levels of lead exposure, such as kidney problems.

Whatever implications these results might have for current policy, they should also interest historians and historical demographers. Some historians attribute the decline of Rome to the fact that the Romans used lead-lined water mains and lead-based vessels to distill alcohol and store water (Waldron and Stöfen 1974, pp. 4-6). More recent studies have explored the possibility that prominent historical figures such as U.S. president Andrew Jackson (Deppisch et al. 1999) and the painter Francisco de Goya died of lead poisoning (Ravin and Ravin 1998). On a broader scale, several recent studies document tremendous improvements in human health and life expectancy over the past century and a half (e.g., Costa 2000; Fogel 1986; and Fogel and Costa 1997). While the factors that contributed to this improvement are generally well known and include improved nutrition, investments in public water and sewer systems, the development of vaccines and antibiotics, etc., the relative and absolute importance of these various factors is much less clear. This paper helps to clarify the importance of one of these factors: the reduced risk of unhealthy levels of lead exposure.

II. The Use of Lead in Plumbing and Water Distribution Systems

In the late-nineteenth- and early-twentieth-century United States, lead was often used in the construction of water service mains. This section explains what service mains were, and some of the engineering concerns that prompted many cities to use lead services. Service mains were the pipes that connected individual homes and apartment buildings to street mains. The decision to install a service main was three dimensional, involving a choice about material, a choice about internal lining, and a choice about size. Services were made of iron, steel, or lead; if iron or steel, they were sometimes lined with lead or cement; and they typically ranged in size from three-quarters of an inch to one-and-one-quarter inches in diameter (Baker 1897).

The choices about material, lining, and size, were influenced by the following five variables: cost of pipe; malleability; propensity for external corrosion; propensity for internal corrosion; and toxicity. Table 1 ranks the most common pipe types in terms of these variables. As for the first variable, the cost of materials, a small (three-quarter inch) iron or steel pipe that was neither galvanized nor lined was the best choice. The primary drawback of this choice, however, was that small untreated iron pipes were subject to corrode and burst sooner than other alternatives. Because replacing broken service mains often required digging up paved streets and working around other infrastructure such as gas and sewer mains, the costs of reduced main life often overwhelmed whatever savings could have been reaped from reduced materials costs. As for the second variable, malleability, lead was a relatively soft and pliable metal and was the best choice. Malleability reduced labor costs by making it easier for plumbers to bend the service main around existing infrastructure and obstructions (*Engineering News*, September 28, 1916, pp. 594-96).

As for the third variable, external corrosion, service mains were subject to corrosion from the outside, and mains laid in salt marsh, cinder fill, or clay experienced faster degradation than those laid in sand or gravel. Holding soil type constant, steel and iron services, whether plain or galvanized, experienced faster corrosion than lead services. If local authorities wanted to minimize the number of times services burst from external corrosion and required replacement, lead was the best choice. As for the fourth variable, internal corrosion, service mains were subject to corrode from the inside as a result of contact with stagnant water. Interior corrosion was a concern because it weakened the pipe and increased the risk of a rupture, and because rust deposits built up and clogged the main. Before 1910, there was no effective technique for cleaning out rust-filled mains other than by digging them up and cleaning them out directly or by replacing the mains. Lead, lead-lined, and cement-lined service mains exhibited the least internal corrosion. Another strategy for minimizing the problem of internal corrosion was to expand the size of the main, for the simple reason that the larger the diameter of the main the more rusted-material necessary to clog the main (*Engineering News*, September 28, 1916, pp. 594-96).

As late as 1916, most engineers believed the benefits of using lead mains outweighed the potential costs. A prominent engineering journal explained:

> Lead is in many respects the most satisfactory material to use for service pipes. Its pliability and its comparative freedom from corrosive action make it almost ideal from a mechanical standpoint. The cost of lead pipe of sufficient thickness to safely withstand the pressure is more than the cost of many other materials used for services, but in a paved street the greater duration of life probably more than compensates for the extra cost, and in places where the streets are occupied by other pipes and conduits the ease of getting over and under these obstructions with a flexible pipe is a great advantage (*Engineering News*, September 16, 1916, p. 595).

The same journal went to confront, but then minimize, concerns about lead poisoning:

> The most serious objection to the use of lead pipe for services is the possibility that the water may dissolve enough lead from the pipe to cause lead poisoning. It is certain that many cases of lead poisoning have been caused by the use of lead services. On the other hand, lead has always been

used for services in most of the large places without any unfavorable effects (*Engineering News*, September 28, 1916, p. 595).

Beyond lead service mains, lead pipes were also used widely in household plumbing and in the solder used to connect iron pipes. The same features that made lead attractive for services also made it attractive for plumbing. Specifically, lead was malleable and allowed plumbers to fit pipes around existing fixtures, and it did not corrode like iron.

III. Limiting Exposure to Lead Through Lead Service Mains and Lead Plumbing

Today, the Environmental Protection Agency (2000) recommends three steps to minimize the amount of lead in drinking water. First, households should flush their pipes before drinking the water. Because the amount of lead that dissolves into water is positively related to the time it sits in the pipes, running faucets for two minutes clears most lead-contaminated water. Second, households should use only cold water for drinking and cooking because hot tap water contains higher lead levels. Third, households should have their water tested to accurately measure its lead levels. According to the EPA, testing is especially important for individuals and families living in large apartment complexes, because flushing may not be effective in high-rise buildings with lead-soldered plumbing.

It is not clear how many families at the turn of the century were aware of these simple preventive measures. Prominent engineering journals such as the *Engineering News* (September 28, 1916, p. 595) argued that it was difficult to predict how much lead dissolved into water from water mains and recommended testing drinking water for lead content as the only safe guide to assessing levels of exposure:

> It seems practically impossible to determine definitely in advance what the effect of any water on lead pipe will be, as the laboratory results fail in many cases to show the action which will occur in actual practice. Tests of service pipes in use for a considerable period are the only safe guides.

Such lukewarm recommendations notwithstanding, it seems unlikely that most families would have been sufficiently concerned about lead in drinking water to motivate them to have had their water tested, or even to have flush their pipes regularly. Recent studies suggest people were much more concerned about bacteriological pollution (e.g., typhoid) than they were about industrial and chemical pollution of water. Some experts even believed that a minimal level of industrial contaminants in water could be beneficial because it killed off otherwise harmful bacteria (Melosi 2000, pp. 241-46). Moreover, it was not until the 1930s that states began passing laws regulating the amount of lead present in plumbing and water distribution systems, and it was not until 1986 that Congress banned the use of lead-based solder in plumbing (United States, Environmental Protection Agency 2000; and Wisconsin, Department of Natural Resources 1993). Finally, lead-based interior paints were marketed well into the mid-twentieth century (Markowitz and Rosner 2000).

IV. The Frequency and Correlates of Lead Usage

At the turn of the twentieth century, the use of lead service mains was widespread, particularly in large cities. This can be seen in two independent samples of cities. In 1916, the New England Water-Works Association surveyed 304 cities and towns, largely in the New England area, and found that 95 (31 percent) of these cities used lead or lead-lined services exclusively (*Engineering News*, September 28, 1916, p. 594). Another sample, predicated on the sample of Union Army recruits described below (see also Fogel 2000), is more geographically diverse and includes 797 cities and towns observed in 1900 from all over the United States. Of these cities, 209 (26 percent) used lead or lead-lined services exclusively; 137 (17 percent) used lead or lead-lined services in conjunction with some other material type, such as galvanized iron or cement-lined iron; and 451 (57%) used no lead. Table 2, which breaks down the usage of lead service mains by city size, suggests a strong positive correlation between lead usage and city size. For the largest cities, those with populations greater than 300,000, only 1 of 16 used no lead in its system of service mains. In contrast, for cities with populations less than 8,000, the majority (67 percent) used no lead whatsoever.

To more fully identify the correlates of using lead service mains, we estimate variants on the following ordered-probit model:

(1) $$L_i = \beta_0 + \boldsymbol{X_i} \boldsymbol{\beta_1} + \epsilon_i ,$$

where, L_i is an indicator variable which equals 2 if city i used lead service mains exclusively as of 1900, 1 if city i used lead services in conjunction with some other material, and 0 if it used no lead services; $\boldsymbol{X_i}$ is a vector of city characteristics that might have been correlated with main type, including city size, age of water system, region dummies, ownership of local water company (i.e, whether public or private), and measures of the development of other public infrastructure; and ϵ_i is a random error term. Equation (1) is estimated using data for all cities with populations greater than 30,000 as of 1902, and for which the relevant data are available. Data on service mains and ownership of local water systems are from Baker (1897); other data are from the *Census* of 1900 and the *Statistics of Cities: 1902*. We restrict the sample to cities with populations greater than 30,000 because data for these large cities are more easily acquired. In subsequent work, we intend to expand the sample to include smaller cities and towns.

Table 3 presents descriptive statistics, predicted signs, and the regression results. There are few notable descriptive statistics. Most large cities (i.e., those with populations greater than 30,000) used lead exclusively or in combination with some other type of service main; 77 percent of all large cities had public water companies; the typical large city constructed its waterworks before 1870; and nearly half of all large cities (49 percent) were located in the Northeast.

Predicted signs are as follows. The coefficient on public ownership should be positive. Because private water companies were often vulnerable to political expropriation in the future, they would have been more reluctant than public companies to invest in lead service mains, which were more expensive and more durable than iron mains (Troesken 1997). The coefficient on the year the waterworks were built should be negative, because over time American society grew increasingly sensitive to the risks of lead and lead poisoning. For example, during the late eighteenth and early nineteenth century, doctors used lead acetate to treat bleeding and diarrhea; whiskey distilleries used lead tubing to distill alcohol; and households frequently used vessels with a high lead content to cook and store drinking water. By 1900, such dubious practices had grown much less common, though as noted in the previous section, they certainly had not disappeared (Aufderheide et al. 1981; and Deppisch et al. 1999).

Population, percentage of roads paved, and miles of sewer mains per 1,000 persons all should be positively correlated with the use of lead because they make malleability and durability more attractive–recall that on both of these characteristics lead service mains (as opposed to iron or cement lined) ranked high (see Table 1). For example, in a city where most roads were paved, it was costly to have a service pipe burst because replacing the service also would have required digging up the pavement. A city with few paved roads would not have confronted such costs. Finally, the attractiveness of lead would have varied depending on the city's climate, soil quality, and corrosiveness of water. These factors are captured by the regional dummies.

When significant, the estimated coefficients are consistent with these predictions. Cities with public water companies, cities located in the Midwest, and cities with populations greater than 80,000, were all more likely to have used lead service mains than other cities. There is also some very weak evidence that cities with waterworks built before 1880 were more likely to have installed lead service mains.

V. The Health Effects of Lead

Lead affects multiple systems in the human body, including the central and peripheral nervous system, the gastrointestinal tract, the kidneys, and the hematological system (blood). Although further study is required, recent studies suggest lead might also adversely affect the human immune system (e.g., Cohen et al. 1989; Fischbein et al. 1993; Sata et al. 1998). Which of these systems is affected and to what degree, depends on how much lead is ingested and the overall size and health of the person exposed. Table 4 summarizes the effects of lead. At low levels of exposure (blood levels less than 20 :g Pb/dl), lead causes subtle changes in body chemistry and manifests itself in comparatively mild symptoms such as dizziness and hypertension in adults and developmental delays in children. At intermediate levels of exposure (blood levels between 20 and 40 :g Pb/dl), lead has more serious effects, including peripheral neuropathies, infertility in men, and increased systolic blood pressure in adults and reduced hemoglobin synthesis and vitamin D metabolism in children. At high levels of exposure (blood levels between 40 and 100 :g Pb/dl), lead causes nephropathy (chronic or acute kidney failure), frank anemia, and reduced hemoglobin synthesis in adults, and colic, nephropathy, and encephalopathy in children. At extremely high levels (blood levels exceeding 100 :g Pb/dl), lead will cause death.

Historically, it might have been difficult for doctors to accurately diagnose mild to moderate cases of lead poisoning. Deppisch et al. (1999) suggest that President Andrew Jackson’s complaints of a severe and debilitating “rheumatism” in his right hand were consistent with peripheral neuropathy caused by lead poisoning. Because lead affects the gastrointestinal tract and can cause abdominal pain, anorexia, cramps, nausea, vomiting, and constipation, Jackson’s many laments in this area also could have been related to exposure to toxic metals such as mercury or lead. Finally, it is possible that complaints about gout were related to plumbism (Ravin and Ravin 1999; Perazella 1996; Soliway et al. 1994).

VI. How the Use of Lead Water Mains Affected the Health of Union Army Veterans

To assess the impact of lead service mains on human health we employ data from a large sample of Union Army recruits compiled by researchers affiliated with the University of Chicago (Fogel 2000). These data have been used in numerous published studies and readers unfamiliar with the data are directed to Fogel (2000) for a thorough description of the sample. The are only two significant differences between our study and previous work. First, it is necessary for us to supplement the Union Army data with information about the type of water mains used in the various towns where Union Army veterans resided. Data on the types of mains used (e.g., lead or galvanized iron) are from Baker (1897). Second, given the nature of the problem, we must restrict the sample to Union Army recruits living in cities or towns with reliable information about its public water system, and in particular, information about the types of services mains used to distribute water. We use the recruits address as of 1900 as his city of residence.[1]

After restricting the data this way, we are left with a sample of 2,215 recruits. The sample is geographically diverse, with recruits living in forty different states as of 1900, though the Midwest and the Northeast are over-represented. Thirty-seven percent of the recruits lived in cities or towns using no lead water mains whatsoever; 27 percent lived in cities or towns using both lead and iron mains; and 36 percent lived in cities or towns using lead mains exclusively. (Complete descriptive statistics are provided in an appendix.)

The analysis that follows focuses on the following lead-related ailments: dizziness; ear problems; deafness; memory loss; kidney tenderness and pain; and kidney disease. We focus on these diseases and ailments because we were able to have them properly coded and cleaned in time for the conference. Other ailments and symptoms related to lead exposure, such as bleeding gums, constipation, and rheumatism in the extremities, require additional cleaning and will be studied in subsequent versions of this paper.

Given the discussion in Section IV, one might expect Union Army recruits living in cities with lead water mains, compared to recruits in cities with iron mains, to exhibit more

[1]This ignores the fact that many recruits moved. In future work, we will better control for this by including variables on years of exposure to lead.

of the following symptoms: dizziness; ear problems; deafness; memory loss; kidney tenderness and pain; and kidney disease. Accordingly, we estimate variants on the following logit model:

$$X_i = \beta_0 + \beta_1 L1_i + \beta_2 L2_i + \mathbf{Z}_i \boldsymbol{\beta}_3 + \varepsilon_i \qquad (2)$$

where X_i is an indicator variable equal to 1 if by 1910 the recruit reported a specific ailment related to lead poisoning (e.g., hearing or kidney problems), and 0 otherwise; $L1_i$ is an indicator variable equal to 1 if the recruit resided in a city that used lead water mains in conjunction with other types of mains (e.g., iron) as of 1900, and 0 otherwise (henceforth, we refer to this variable as the some-lead dummy); $L2_i$ is an indicator variable equal to 1 if the recruit resided in a city that used lead water mains exclusively as of 1900, and 0 otherwise (henceforth, we refer to this variable as the all-lead dummy); $\mathbf{Z}_i$ is a vector of other control variables related to the individual (e.g., occupation and health), war-time regiment, and the size of the city in which they resided in 1900 or the size of the city in which they enlisted; and ε_i is an error term. The control variables included in $\mathbf{Z}_i$ are summarized in Table 5, and for the most part, are identical to those employed in Costa (2000).

Table 6 reports the predicted effects of lead service mains under three conceivable hypotheses. The first hypothesis is that lead service mains had, at most, sub-clinical effects that did not manifest themselves in any ailments related to lead exposure and resulted in blood concentration levels less than 10 μg Pb/dl. Under this hypothesis, recruits living in cities with lead pipes as of 1900 would have experienced no more lead-related ailments than recruits living cities without lead pipes and the coefficients on lead water mains would be close to zero and statistically insignificant. One might expect results consistent with this hypothesis if people routinely flushed their pipes, used only cold tap water for cooking and drinking, and had their water tested. Results consistent with hypothesis 1 might also be obtained if the effects of lead service mains were overwhelmed by other sources of lead exposure we have not been able to fully control for, such as work-related exposure, the use of lead-based solder and pipes in plumbing, or the use of lead-based paints.

The second hypothesis is that lead water mains had small but identifiable effects on human health, resulting in blood concentration levels between 10 and 40 μg Pb/dl and symptoms such as dizziness and reduced hearing acuity. Under this hypothesis, recruits living in cities with lead pipes as of 1900 would have experienced more ailments associated with low levels of lead exposure than recruits living in cities without lead pipes. The coefficients on lead water mains would be positive and statistically significant for dizziness and ear problems, but close to zero and statistically insignificant for more serious lead-related ailments such as kidney disease and memory loss. In addition, for dizziness and ear problems, we expect the coefficient on the some-lead dummy to be smaller than the coefficient on the all-lead dummy, because individuals living in cities that used lead mains in conjunction with iron mains would have been exposed to less lead on average than individuals living in cities that used lead mains exclusively. Results consistent with the second hypothesis would suggest that only small amounts lead dissolved into water as a result of lead service pipes.

The third hypothesis is that lead water mains had large adverse effects on human health, resulting in blood concentration levels greater than 40 μg Pb/dl and symptoms such as kidney failure and memory loss. Under this hypothesis, recruits living in cities with lead pipes as of 1900 would have experienced more ailments associated with high levels of lead exposure than recruits living in cities without lead pipes. The coefficients on lead water mains would be positive and statistically significant for all of the lead-related ailments we consider–dizziness, ear problems, deafness, kidney disease, and memory loss. Again, we expect the coefficient on the some-lead dummy to be smaller than the coefficient on the all-lead dummy, because individuals living in cities that used lead mains in conjunction with iron mains would have been exposed to less lead on average than individuals living in cities that used lead mains exclusively. Results consistent with the third hypothesis would suggest that significant amounts lead dissolved into water as a result of lead service pipes. Of the three hypotheses, this one strikes us as the least plausible. If the use of lead services caused such serious and life-threatening conditions, city residents would have grown increasingly cognizant of the dangers of lead and lead mains and demanded that local and state governments take steps to eradicate lead service pipes. Historically, we do not observe political outcomes consistent with this. On the contrary, as noted above, all but a handful the nation's largest cities (those with populations greater than 300,000) used, and continued to install, lead services well into the twentieth century, and as late as 1916, engineering journals were claiming that lead was the most attractive metal for service mains.

Table 7 reports some of the more important regression results for the variables of interest, $L1_i$ and $L2_i$. There are three notable findings. First, the explanatory power of these models is not high, and all of the psuedo-R^2's are less 20 percent. This is consistent with other studies exploring the health of Union Army veterans. Second, overall, the results are most consistent with the second hypothesis: lead water mains appear to have had a small but identifiable effect on the health of Union Army veterans. Only two mild ailments, specifically dizziness and ear problems, show a significant positive correlation with the use of lead mains are dizziness and ear problems. More serious symptoms and ailments such as kidney disease show no significant correlation with the use of lead services. Third, whenever we obtain statistically significant results, the estimated coefficient on the all-lead dummy is greater than the estimated coefficient on the some-lead dummy. Because recruits living in cities that used lead mains exclusively would have been exposed to more lead on average than recruits living in cities that used both lead and iron mains, we expect this pattern and view it as weak confirmation that we are estimating reasonable specifications.

In all of the regressions, some observations are dropped because they are predicted perfectly by specific individual variables. This is particularly true when we include regiment fixed effects. To address this issue, we also estimate the equations using linear probability models. The same results are obtained. In addition, we report results without the regiment fixed effects (regressions 2, 5, 8, and 11), as well as, the raw, uncontrolled correlations (regressions 1, 4, 7, and 10). Again, the same results are obtained.

An appendix reports descriptive statistics and results for all variables for the "complete" regressions (i.e., equations 3, 6, 9, and 12). Also not reported in table 7 are our findings for deafness and kidney trouble. We find no statistically significant relationship between lead water mains and deafness, and between lead water mains and kidney tenderness and pain.

It is possible that veterans already in poor health were the most vulnerable to environmental insults, and therefore experienced more severe reactions to lead water mains. To explore this possibility, we restrict our sample to only those recruits who were privates throughout the Civil War on the assumption that they had poorer health than higher ranking soldiers. Restricting the sample this way does not significantly alter our findings except that lead now appears to have had a much larger impact on the probability that the recruit reports dizziness. See table 8, which reports the important regression results. Again, complete results are presented in the appendix.

VII. Conclusions

The central conclusions of this paper are as follows. First, in 1900, lead water mains were pervasive, especially among large cities. In the sixteen largest cities in the United States, all but one used lead mains exclusively or in combination with some other type of main. According to the engineering literature, lead was attractive because it was pliable and easy to work with, and because it did not corrode as quickly as iron and steel. Second, the use of lead service mains does not appear to have had serious effects on the health of Union Army veterans. Veterans living in cities with lead mains reported higher rates of dizziness and ear problems than veterans living cities without lead, but they did not report higher levels of more serious lead-related ailments such as kidney failure. An important caveat is in order, however. Because lead's effects can be especially serious for the young, it would be desirable to extend this analysis to explore how lead water mains affected the growth and development of children.

References

Aufderheide, A.C., F.D. Neiman, L.E. Wittmers, et al. 1981. "Lead in Bone II: Skeletal-Lead Content as an Indicator of Lifetime Lead Ingestion and the Social Correlates in an Archeological Population." *American Journal of Physical Anthropology*, 45:723-35.

Baker, M.N. 1897. *The Manual of American Water-Works*. New York: The Engineering News Publishing Company.

Centers for Disease Control and Prevention. 1997. *Morbidity and Mortality Weekly Report*.

Charney, E., J.W. Sayre, and M. Coulter. 1980. "Increased Lead Absorbtion in Inner City Children: Where Does the Lead Come From?" *Pediatrics*, 65:226-31.

Cohen, N., D. Modai,. A. Golik, J. Weissgarten, S. Peller, A. Katz, Z. Averbukh, and U. Shaked. 1989. "Increased Concanavalin A-induced Suppressor Cell Activity in Humans With Occupational Lead Exposure." *Environmental Research*, 48:1-6.

Costa, D.L. 2000. "Understanding the Twentieth-Century Decline in Chronic Conditions Among Older Men." *Demography*, 37:53-72.

Deppisch, L.M., J.A. Centeno, D.J. Gemmel, J. David, and N.L. Torres. 1999. "Andrew Jackson's Exposure to Mercury and Lead: Poisoned President?" *Journal of the American Medical Association*, 282:569-71.

Fischbein, A., P. Tsang, J.J. Luo, J.P. Roboz, J.P. Jiang, and J.G. Bekesi. 1993. "The Immune System as Target for Subclinical Lead Related Toxicity." *British Journal of Industrial Medicine*, 50:185-86.

Fogel, R.W. 1986. "Nutrition and the Decline in Mortality Since 1700: Some Preliminary Findings." In *Long-Term Factors in American Economic Growth*, edited by S. Engerman and R.E. Gallman. Chicago: University of Chicago Press.

Fogel, R.W. 2000. *Public Use Tape on the Aging of Veterans of the Union Army: Military, Pension, and Medical Records, 1860-1940, Version M-5*. Center for Population Economics, University of Chicago Graduate School of Business, and Department of Economics, Brigham Young University.

Fogel, R. W. and D.L. Costa. 1997. "A Theory of Technophysio Evolution, with Some Implications for Forecasting Population, Health Care Costs, and Pension Costs." *Demography*, 34: 49-66.

Lanphear, B. and K.J. Rogham. 1997. "Pathways of Lead Exposure in Urban Children." *Environmental Research*, 74:67-73.

Markowitz, G. and D. Rosner. 2000. "'Cater to the Children': The Role of the Lead Industry in a Public Health Tragedy, 1900-1955." *American Journal of Public Health*, 90:36-46.

Melosi, Martin V. 2000. *The Sanitary City: Urban Infrastructure from Colonial Times to the Present*. Baltimore: The Johns Hopkins University Press.

Needleman, H.L. and D. Belinger. 1991. "The Health Effects of Law Level Exposure to Lead." *Annual Review of Public Health*, 40:111-40.

Perazella, M.A. 1996. "Lead and the Kidney: Nephropathy, Hypertension, and Gout." *Connecticut Medicine*, 60:521-26.

Ravin, J.G. and T.B. Ravin. 1999. "What Ailed Goya?" *Journal of Ophthalmology*, 44:163-70.

Sata, F., S. Araki, T. Tanigawa, Y. Morita, S. Sukurai, A. Nakata, and N. Katsuno. 1998. "Changes in T Cell Subpopulations in Lead Workers." *Environmental Research*, 76:61-64.

Solliway, B.M., A. Schaffer, H. Pratt, S. Yannai. 1994. "A Multidisciplinary Study of Lead-Exposed Subjects." *Environmental Research*, 67:168-82.

Tarr, J.A. 1996. *The Search for the Ultimate Sink*. Akron: The University of Akron Press.

Trepka, M.J., J. Heinrich, C. Krause, C. Schulz, U. Lippold, E. Meyer, and H.E. Wichman. 1997. "The Internal Burden of Lead Among Children in a Smelter Town–A Small Area Analysis." *Environmental Research*, 72:118-30.

Troesken, W. 1997. "The Sources of Public Ownership: Historical Evidence from the Gas Industry." *Journal of Law, Economics, and Organization*, 13:1-27.

United States. Environmental Protection Agency. Office of Water. 2000. *Lead in Your Drinking Water*. (http://www.epa.gov/safewater/Pubs/lead1.html).

Waldron, H.A. and D. Stöfen. 1974. *Sub-clinical Lead Poisoning*. London: Academic Press.

Wisconsin. Department of Natural Resources. 1993. *Lead in Drinking Water*. (http://www.dnr. state.wi.us/org/water/dwg/lead.html).

Xintaras, C. 1992. *Analysis Paper: Impact of Lead-Contaminated Soil on Public Health*. U.S. Department of Health and Human Services. Agency for Toxic Substances and Disease Registry. Atlanta, GA. (http://www.atsdr.cdc.gov/exlead.html).

Table 1. The Costs and Benefits of Some Common Types of Service Mains

Main characteristics	Cost of material	Malleability	External corrosion	Internal corrosion	Toxicity
Material and lining:					
plain iron or steel[a]	1	3	3	5	2
galvanized iron or steel[a]	2	4	2	4	1
lead[a]	4	1	1	1	3
iron: cement lined[b]	3	3	2	3	2
iron: lead lined[c]	3	2	2	2	3
Size of pipe:					
small (3/4" diameter)	1	–	–	3	–
medium (1" diameter)	2	–	–	2	–
large (1 1/4" diameter)	3	–	–	1	–

Notes:

[a] - unlined

[b] - exterior of pipe, galvanized iron; interior of pipe, cement.

[c] - exterior of pipe, galvanized iron; interior of pipe, lead.

Source: *Engineering News*, September 28, 1916, pp. 594-97.

Table 2. City Size and Lead Usage in 1900

City size as of 1900	Total cities	Cities using		
		only lead[a]	lead & other[b]	no lead[c]
Pop > 300,000	16	8 (50%)	7 (44%)	1 (6%)
30,000 < Pop < 300,000	107	55 (51%)	22 (21%)	30 (28%)
8,000 < Pop < 30,000	156	46 (29%)	36 (23%)	74 (47%)
Pop < 8,000	518	100 (19%)	72 (14%)	346 (67%)
All towns and cities	797	209 (26%)	137 (17%)	451 (57%)

Notes:

[a] - cities using lead or lead-lined service mains exclusively.

[b] - cities using lead or lead-lined service mains alongside services made of other materials such as galvanized iron or cement-lined.

[c] - cities using non-lead service mains exclusively.

Source: Data on services are from Baker (1897); sample derived from the Union-Army data compiled under the auspices of the Center for Population Economics at the University of Chicago. See Fogel (2000).

Table 3. The Correlates of Lead Usage in Large Cities (Pop > 30,000 in 1902)

Variable	: (F^2)	Predicted sign	ordered-probit (1)	(2)	(3)
Water services:					
2 if lead exclusively	1.23	. . .		dependent	
1 if lead and other	(.89)			variable	
0 if no lead					
1 if public water co.;	.766	+	.667*	.728*	.662*
0 if private	. . .		(.29)	(.29)	(.29)
Year waterworks were	1867	–	-.001	. . .	.001
built	(19)		(.01)		(.07)
1 if built before 1880;	.187	+	. . .	.374	. . .
0 if after	. . .			(.33)	
Total population in	110	+	.001	.001	. . .
1900 (000s)	(157)		(.001)	(.001)	
1 if pop < 80,000;	.636	–	. . .	. . .	-.712*
0 if not	. . .				(.28)
pct of roads paved	.399	+	.048	.303	-.271
	(.24)		(.09)	(.56)	(.58)
Miles of sewer mains	1.01	+	-.170	-.167	-.171
per 1,000 persons	(.45)		(.26)	(.27)	(.26)
1 if city in Northeast;	.491	. . .	omit	omit	omit
0 otherwise	. . .				
1 if city in Midwest;	.290	+/–	.851*	.814*	.724*
0 otherwise	. . .		(.31)	(.29)	(.31)
1 if city in South;	.159	+/–	.264	.159	.208
0 otherwise	. . .		(.34)	(.35)	(.34)
1 if city in West	.056	+/–	.491	.456	.173
0 otherwise	. . .		(.55)	(.55)	(.56)
No. of observations	107	. . .	107	107	107
Log likelihood	. . .	. . .	-99.0	-100.3	-95.8
Pseudo R^2	. . .	. . .	.071	.075	.101

Table 3 continued. . .

Notes:
* - significant at the 5 percent level or higher.

Standard errors are in parentheses.

Sources: see text.

Table 4. How Lead Affects Children and Adults

Lead levels in blood	Effects	
	Children	Adults
0-9 : g Pb/dl	uncertain	uncertain
10-19 : g Pb/dl	ú IQ, hearing, and growth ú vitamin D metabolism; erythocyte protoporphyrin[a]	hypertension; erythocyte proto-porphyrin[a] (women)
20-29 : g Pb/dl	ú nerve conduction velocity	erythocyte protoporphyrin[a] (men)
30-39 : g Pb/dl		ü systolic blood pressure (men); ú hearing acuity
40-49 : g Pb/dl	ú hemoglobin synthesis	peripheral neuropathies[b]; infertility (men); nephropathy[c]
50-100 : g Pb/dl	colic; frank anemia; nephro-pathy[c]; encyphalopathy[d]	ú hemoglobin synthesis; ú longev-ity; frank anemia; encephalopathy[d]
> 100 : g Pb/dl	death	death

Notes:
ú - decreased function.
ü - increased function.
[a] - changes in the shape and size of red blood cells.
[b] - nerve disorders in the extremities. Historically, such disorders might have manifested themselves as complaints about "rheumatism" in the hands and feet, gout, and wrist and foot drop.
[c] - chronic or acute kidney failure.
[d] - any brain-related disorder. Historically, such disorders might have manifested themselves in violent mood swings, memory loss, and dementia.

Source: Perazella 1996; Ravin and Ravin 1999; and Xintaras (1992).

Table 5. List of Control Variables

Individual Characteristics	**Individual Characteristics** (continued)
At time of enlistment	*In 1900*
Occupation:	Occupation (in 1900):
=1 if farmer	=1 if farmer
=1 if professional	=1 if professional
=1 if artisan	=1 if artisan
=1 if laborer	=1 laborer
=1 if skilled laborer	=1 skilled laborer
=1 if occupation unknown	=1 occupation unknown
Physical condition:	Marital status and age:
Height	Age
Weight	=1 if married
During wartime	**Regiment Fixed Effects**
Wounds, rank, etc:	**City-Level Characteristics**
=1 if gunshot wound	*At time of enlistment*
=1 if prisoner of war	City size:
=1 if dishonorable discharge	=1 if < 4,000
=1 if private	=1 if > 4,000 & < 30,000
=1 if injured	=1 if > 30,000
Illnesses:	In 1900:
=1 if measles	=1 if < 8,000
=1 if diarrhea	=1 if > 8,000 & < 30,000
=1 if respiratory	=1 if > 30,000
=1 if tuberculosis	
=1 if typhoid	
=1 if malaria	
=1 if syphilis	
=1 if rheumatism	

Table 6. Predicted Effects

Variable	Dependent variable: =1 if recruit reported dizziness	ear problems	deafness	kidney disease	memory loss
	Hypothesis 1: lead water mains had no effect (blood concentration < 10)				
some lead ($\$_1$)	0	0	0	0	0
all lead ($\$_2$)	0	0	0	0	0
relative effect	. . .	. . .	. . .	. . .	. . .
	Hypothesis 2: lead water mains had small effect (blood concentration > 10 & < 40)				
some lead ($\$_1$)	+	+	0	0	0
all lead ($\$_2$)	+	+	0	0	0
relative effect	$\$_1 < \$_2$	$\$_1 < \$_2$	. . .	. . .	. . .
	Hypothesis 3: lead water mains had large effect (blood concentration > 40)				
some lead ($\$_1$)	+	+	+	+	+
all lead ($\$_2$)	+	+	+	+	+
relative effect	$\$_1 < \$_2$	$\$_1 < \$_2$	$\$_1 < \$_2$	$\$_1 < \$_2$	$\$_1 < \$_2$

Table 6. Regression Results: Full Sample

	Dependent variable =1 if recruit reported:											
	dizziness			ear problems			kidney disease			memory loss		
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
some lead	.302	.295	.362	.084	.070	.059	-.015	-.136	.051	-.092	-.145	-.052
	(.32)	(.33)	(.37)	(.11)	(.11)	(.13)	(.50)	(.50)	(.57)	(.25)	(.25)	(.28)
all lead	.508*	.540*	.674*	.215*	.196*	.261*	.040	-.081	.654	-.009	-.051	.127
	(.28)	(.29)	(.35)	(.10)	(.10)	(.12)	(.45)	(.46)	(.56)	(.22)	(.23)	(.27)
Table 5 Controls:												
Individual characteristics	no	yes	yes	no	yes	yes	no	yes	yes	no	yes	yes
Regiment fixed effects	no	no	yes	no	no	yes	no	no	yes	no	no	yes
City-level characteristics	no	no	yes	no	no	yes	no	no	yes	no	no	yes
Pseudo R^2	.005	.098	.120	.001	.012	.039	.000	.084	.197	.000	.036	.068

Notes:
All equations are estimated with a logit.
Standard errors are in parentheses.
* - significant at the 10 percent level or higher.

Table 8. Regression Results: Privates Only

	Dependent variable: =1 if recruit reported					
Variable	dizziness	memory loss	ear problems	deafness	kidney disease	kidney trouble
=1 if recruit lived in city using	1.30*	.005	-.007	.112	-.784	-.579
both lead & iron services	(.578)	(.439)	(.185)	(.438)	(1.41)	(.482)
=1 if recruit lived in city using	1.61*	.166	.300*	-.167	1.27	-.678
exclusively lead services	(.540)	(.418)	(.175)	(.416)	(1.13)	(.480)
Table 5 controls	included	included	included	included	included	included
Log likelihood	-128.7	-167.8	-689.9	-170.7	-33.6	-137.9
Pseudo R^2	.148	.098	.051	.115	.387	.175
Number of observations	825	875	1065	896	434	744

Notes:

All equations are estimated with a logit. In all of the regressions, some observations are dropped because they are predicted perfectly. To address this issue, we also estimate the equations using linear probability models. The same results are obtained.

Standard errors are in parentheses.

* - significant at the 10 percent level or higher.

Source: see text.

Appendix

Key to variable names in tables

Variable definition	Variable name in output
Occupation at time of enlistment:	
=1 if farmer	
=1 if professional	efarmer
=1 if artisan	eprof
=1 if laborer	eartisan
=1 if skilled laborer	elaborer
=1 if occupation unknown	eskllab
Size of city of enlistment:	eoccna
=1 if < 4,000	
=1 if > 4,000 & < 30,000	sml1870
=1 if > 30,000	med1870
Physical condition at time of	big1870
enlistment:	
Height	
Weight	height
Wartime experiences:	weight
=1 if gunshot wound	
=1 if prisoner of war	wgsw
=1 if private	pow
=1 if injured	private
Regiment fixed effects:	winjury
Wartime illnesses:	Iregi_1...Ireg_29
=1 if measles	
=1 if diarrhea	wmeasl
=1 if respiratory	wdiar
=1 if tuberculosis	wresp
=1 if typhoid	wtb
=1 if malaria	wtyphoid
=1 if syphilis	wmalaria
=1 if rheumatism	wsyphilis
Occupation in 1900:	wrheum
=1 if farmer	
=1 if professional	farmer
=1 if artisan	prof
=1 laborer	artisan
=1 skilled laborer	laborer
=1 occupation unknown	skllab
Size of city of residence in	occna
1900:	
=1 if < 8,000	
=1 if > 8,000 & < 30,000	sml1900
=1 if > 30,000	med1900
Other 1900 information:	big1900
Age	
=1 if married	married
	age

Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
dizzy1	2215	.0334086	.1797416	0	1
memory	2215	.0505643	.2191558	0	1
rheu	2215	.7589165	.4278375	0	1
efarmer	2215	.4907449	.5000272	0	1
eprof	2215	.0984199	.2979488	0	1
eprof	2215	.0984199	.2979488	0	1
eartisan	2215	.2343115	.4236634	0	1
elaborer	2215	.1128668	.3165014	0	1
eskllab	2215	.0505643	.2191558	0	1
eoccna	2215	.0117381	.1077293	0	1
height	2196	67.35384	2.597964	56.5	81
pow	2215	.0893905	.285371	0	1
private	2215	.4848758	.4998841	0	1
age	2215	59.69526	6.622322	5	86
married	2215	.7056433	.4558559	0	1
farmer	2215	.1327314	.3393608	0	1
prof	2215	.1616253	.3681898	0	1
artisan	2215	.1367946	.343708	0	1
laborer	2215	.0844244	.278086	0	1
skllab	2215	.0776524	.2676842	0	1
occna	2215	.0478555	.2135087	0	1
kidneyd	2215	.0121896	.1097564	0	1
kidneyt	2215	.0397291	.1953662	0	1
lead1	2215	.2659142	.4419186	0	1
lead2	2215	.3598194	.4800557	0	1
big1900	2215	.4252822	.4944974	0	1
med1900	2215	.1923251	.394216	0	1
big1870	2215	.1349887	.3417887	0	1
med1870	2215	.3553047	.4787136	0	1
wdiar	2215	.2668172	.4423959	0	1
wresp	2215	.0419865	.2006035	0	1
wtb	2215	.0171558	.1298809	0	1
wmeasl	2215	.0383747	.1921426	0	1
wtyphoid	2215	.048307	.2144626	0	1
wmalaria	2215	.0230248	.1500162	0	1
wsyphil	2215	.0158014	.1247345	0	1
wrheum	2215	.1079007	.310325	0	1
winjury	2215	.1155756	.3197875	0	1
wgsw	2215	.1751693	.3801977	0	1

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FULL SAMPLE REGRESSION: DIZZY DEPENDENT VARIABLE

Number of obs = 1998
LR chi2(55) = 74.89
Prob > chi2 = 0.0385 Log likelihood = -275.79209 Pseudo R2=0.1195

dizzy1	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lead1	.3618071	.3733428	0.969	0.332	-.3699313	1.093546
lead2	.6740107	.349562	1.928	0.054	-.0111183	1.35914
efarmer	13.942	3.844745	3.626	0.000	6.406443	21.47757
eprof	13.67622	3.860368	3.543	0.000	6.110038	21.2424
eartisan	13.82824	3.846503	3.595	0.000	6.289233	21.36725
elaborer	14.43134	3.837231	3.761	0.000	6.910503	21.95217
eskllab	14.0496	3.872441	3.628	0.000	6.45976	21.63945
eoccna	15.18721	3.917585	3.877	0.000	7.508888	22.86554
weight	.0001833	.004972	0.037	0.971	-.0095617	.0099282
height	.0073933	.052924	0.140	0.889	-.0963359	.1111225
pow	.2957393	.4149364	0.713	0.476	-.5175211	1.109
private	.021524	.265011	0.081	0.935	-.4978879	.540936
age	-.0396996	.0214491	-1.851	0.064	-.0817391	.0023398
married	.583426	.3442622	1.695	0.090	-.0913154	1.258167
farmer	.1853978	.4753374	0.390	0.697	-.7462464	1.117042
prof	.2314218	.4697823	0.493	0.622	-.6893347	1.152178
artisan	.808543	.4469507	1.809	0.070	-.0674643	1.68455
laborer	-1.278671	.8214115	-1.557	0.120	-2.888608	.3312658
skllab	.413302	.5313752	0.778	0.437	-.6281744	1.454778
occna	.6959518	.5563779	1.251	0.211	-.3945288	1.786432
big1900	-.2104294	.3317404	-0.634	0.526	-.8606286	.4397699
med1900	-.3858917	.3852104	-1.002	0.316	-1.14089	.3691068
big1870	.6209966	.4606949	1.348	0.178	-.2819487	1.523942
med1870	-.4907256	.3041889	-1.613	0.107	-1.086925	.1054736
wdiar	.05613	.2845946	0.197	0.844	-.5016652	.6139251
wresp	-1.30773	1.035315	-1.263	0.207	-3.336909	.7214495
wtb	-.1863323	1.06564	-0.175	0.861	-2.274948	1.902283
wmeasl	-.3398632	.6427306	-0.529	0.597	-1.599592	.9198657
wtyphoid	.9686065	.4571741	2.119	0.034	.0725616	1.864651
wmalaria	-.228707	.7871308	-0.291	0.771	-1.771455	1.314041
wsyphil	1.018011	.8105646	1.256	0.209	-.5706664	2.606688
wrheum	.4602238	.3655438	1.259	0.208	-.2562288	1.176676
winjury	.5318856	.3531952	1.506	0.132	-.1603643	1.224135
wgsw	-.2925745	.3795134	-0.771	0.441	-1.036407	.451258
Iregi_2	1.449476	1.307459	1.109	0.268	-1.113097	4.012049
Iregi_4	1.78341	1.19341	1.494	0.135	-.555631	4.122451
Iregi_5	1.188114	1.303099	0.912	0.362	-1.365914	3.742143
Iregi_7	-.1926895	1.488817	-0.129	0.897	-3.110717	2.725338
Iregi_8	-.3998096	1.23006	-0.325	0.745	-2.810683	2.011064
Iregi_9	.2661801	1.167011	0.228	0.820	-2.021119	2.553479
Iregi_10	-.7162974	1.485028	-0.482	0.630	-3.626898	2.194303
Iregi_11	-.1133103	1.494231	-0.076	0.940	-3.04195	2.81533
Iregi_13	.811934	1.162709	0.698	0.485	-1.466934	3.090802
Iregi_14	.8073187	1.226379	0.658	0.510	-1.596341	3.210978
Iregi_15	1.63565	1.1334	1.443	0.149	-.5857731	3.857073
Iregi_16	1.791495	1.190572	1.505	0.132	-.5419825	4.124972
Iregi_17	-.3250819	1.298325	-0.250	0.802	-2.869751	2.219587
Iregi_18	1.418898	1.101044	1.289	0.198	-.7391083	3.576903
Iregi_19	.1519883	1.17614	0.129	0.897	-2.153204	2.457181
Iregi_20	1.64976	1.125572	1.466	0.143	-.5563199	3.85584
Iregi_21	.6877184	1.257612	0.547	0.584	-1.777155	3.152592

Iregi_24	1.191629	1.528258	0.780	0.436	-1.803702	4.18696
Iregi_26	.1944334	1.494952	0.130	0.897	-2.735619	3.124485
Iregi_28	2.635698	1.684896	1.564	0.118	-.6666383	5.938035
Iregi_29	1.768699	1.347187	1.313	0.189	-.8717391	4.409137
_cons	-17.23474	.	.	.	.	.

FULL SAMPLE REGRESSION: MEMOREY DEPENDENT VARIABLE

Logit estimates; Number of obs = 1965; LR chi2(55) = 57.96

Prob > chi2= 0.3667; log likelihood = -394.98618 ; Pseudo R2=0.0684

memory	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lead1	-.0529411	.2817207	-0.188	0.851	-.6051035	.4992213
lead2	.1267313	.264741	0.479	0.632	-.3921516	.6456141
efarmer	14.59645	2.932261	4.978	0.000	8.849323	20.34357
eprof	15.23987	2.929252	5.203	0.000	9.498638	20.9811
eartisan	14.34789	2.932253	4.893	0.000	8.600781	20.095
elaborer	13.08046	2.97092	4.403	0.000	7.25756	18.90335
eskllab	14.94598	2.937854	5.087	0.000	9.187895	20.70407
eoccna	15.65906	2.961377	5.288	0.000	9.854867	21.46325
weight	-.0005708	.0040073	-0.142	0.887	-.008425	.0072834
height	.0527155	.0419753	1.256	0.209	-.0295545	.1349855
pow	.1545636	.353533	0.437	0.662	-.5383483	.8474755
private	-.1488722	.2162653	-0.688	0.491	-.5727443	.2749999
age	-.0078759	.0170706	-0.461	0.645	-.0413336	.0255818
married	.1572017	.256567	0.613	0.540	-.3456604	.6600639
farmer	-.6288286	.3962039	-1.587	0.112	-1.405374	.1477169
prof	-.2270954	.3461391	-0.656	0.512	-.9055156	.4513248
artisan	-.1457617	.3766481	-0.387	0.699	-.8839784	.5924549
laborer	-.1974786	.4233504	-0.466	0.641	-1.02723	.6322729
skllab	-.2453878	.4463617	-0.550	0.582	-1.120241	.629465
occna	.0084847	.4687593	0.018	0.986	-.9102666	.9272361
big1900	-.268488	.2731989	-0.983	0.326	-.803948	.266972
med1900	.1327314	.2755725	0.482	0.630	-.4073807	.6728435
big1870	-.5725792	.4202435	-1.362	0.173	-1.396241	.2510829
med1870	.1858064	.2352678	0.790	0.430	-.27531	.6469228
wdiar	-.2807422	.2420982	-1.160	0.246	-.755246	.1937615
wresp	.3437166	.4559641	0.754	0.451	-.5499565	1.23739
wtb	.4816163	.6496152	0.741	0.458	-.7916062	1.754839
wmeasl	.8554742	.4139768	2.066	0.039	.0440945	1.666854
wtyphoid	.1682589	.4559202	0.369	0.712	-.7253283	1.061846
wmalaria	.7050691	.5054801	1.395	0.163	-.2856537	1.695792
wrheum	-.0672488	.3404907	-0.198	0.843	-.7345984	.6001007
winjury	.4871729	.2838969	1.716	0.086	-.0692548	1.043601
wgsw	.2550009	.2681778	0.951	0.342	-.2706178	.7806197
Iregi_2	-.0747275	1.201312	-0.062	0.950	-2.429255	2.2798
Iregi_3	.9614925	.8899627	1.080	0.280	-.7828024	2.705787
Iregi_4	.8846916	.8781943	1.007	0.314	-.8365376	2.605921
Iregi_7	-.0314154	.968776	-0.032	0.974	-1.930181	1.867351
Iregi_8	1.210052	.713208	1.697	0.090	-.1878104	2.607914
Iregi_9	.3387086	.7449079	0.455	0.649	-1.121284	1.798701
Iregi_10	.7003191	.9752604	0.718	0.473	-1.211156	2.611794
Iregi_11	1.967863	.8496522	2.316	0.021	.3025754	3.633151
Iregi_12	1.658248	1.262096	1.314	0.189	-.8154145	4.13191
Iregi_13	.6022782	.7510961	0.802	0.423	-.8698431	2.0744
Iregi_14	1.170498	.7557439	1.549	0.121	-.3107325	2.651729
Iregi_15	.6155873	.8172105	0.753	0.451	-.9861159	2.217291
Iregi_16	.7825827	.8868695	0.882	0.378	-.9556496	2.520815
Iregi_17	.7770568	.7720135	1.007	0.314	-.7360619	2.290175
Iregi_18	1.159185	.6813908	1.701	0.089	-.1763164	2.494687
Iregi_19	.2245688	.7536621	0.298	0.766	-1.252582	1.701719
Iregi_20	1.138954	.7236142	1.574	0.115	-.2793033	2.557212
Iregi_21	.5425224	.771385	0.703	0.482	-.9693645	2.054409
Iregi_22	1.390245	.9159427	1.518	0.129	-.4049697	3.18546

Iregi_24	.3062856	1.229756	0.249	0.803	-2.103991	2.716563
Iregi_25	1.773623	1.303953	1.360	0.174	-.7820782	4.329323
Iregi_29	.2052196	1.222868	0.168	0.867	-2.191558	2.601997
_cons	-21.1892	.	.	.	.	.

FULL SAMPLE REGRESSION: EAR PROBLEMS

Number of obs = 2195
LR chi2(65) = 115.22
Prob > chi2 = 0.0001 Log likelihood = -1435.3406 Pseudo R2= 0.0386

earprob	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lead1	.0590704	.1262051	0.468	0.640	-.1882871	.3064278
lead2	.261108	.1216722	2.146	0.032	.0226348	.4995812
efarmer	-1.257694	1.289434	-0.975	0.329	-3.784938	1.269551
eprof	-1.305081	1.295441	-1.007	0.314	-3.844099	1.233937
eartisan	-1.228642	1.28897	-0.953	0.340	-3.754978	1.297693
elaborer	-1.315555	1.295	-1.016	0.310	-3.853709	1.222598
eskllab	-.8550887	1.301543	-0.657	0.511	-3.406067	1.695889
eoccna	-1.750584	1.366631	-1.281	0.200	-4.429132	.9279637
weight	.0038437	.0018313	2.099	0.036	.0002545	.0074329
height	-.0102717	.0189537	-0.542	0.588	-.0474203	.0268768
dishonor	1.072593	.734513	1.460	0.144	-.3670257	2.512212
pow	.1284608	.1594134	0.806	0.420	-.1839837	.4409053
private	.0595451	.0944426	0.630	0.528	-.1255589	.2446491
age	.0103809	.007291	1.424	0.155	-.0039091	.024671
nonwhite	-.4023775	1.186898	-0.339	0.735	-2.728655	1.9239
married	-.2103875	.1100869	-1.911	0.056	-.4261539	.005379
farmer	.1032807	.1707826	0.605	0.545	-.231447	.4380084
prof	.2140553	.1589463	1.347	0.178	-.0974737	.5255843
artisan	.5782624	.1650712	3.503	0.000	.2547287	.901796
laborer	.2443172	.1891435	1.292	0.196	-.1263972	.6150317
skllab	.3113438	.1922473	1.619	0.105	-.0654541	.6881417
occna	.1399859	.2301725	0.608	0.543	-.3111439	.5911156
big1900	-.002396	.1216077	-0.020	0.984	-.2407427	.2359507
med1900	.3044183	.1302479	2.337	0.019	.049137	.5596995
big1870	-.1349526	.1583568	-0.852	0.394	-.4453262	.175421
med1870	-.0024591	.1074282	-0.023	0.982	-.2130145	.2080962
wdiar	.0623224	.1041694	0.598	0.550	-.1418458	.2664907
wresp	.4284713	.2219552	1.930	0.054	-.0065529	.8634954
wtb	.0018242	.3489201	0.005	0.996	-.6820465	.685695
wmeasl	.3014778	.2325638	1.296	0.195	-.154339	.7572946
wtyphoid	.5324291	.2131942	2.497	0.013	.1145762	.9502821
wmalaria	.5474237	.2982275	1.836	0.066	-.0370914	1.131939
wsyphil	-.2898388	.3736368	-0.776	0.438	-1.022153	.4424758
wrheum	.0946861	.1453399	0.651	0.515	-.1901747	.379547
winjury	-.0583068	.1445768	-0.403	0.687	-.3416722	.2250585
wgsw	-.0858391	.1259208	-0.682	0.495	-.3326392	.1609611
Iregi_2	.3952642	.4506543	0.877	0.380	-.488002	1.27853
Iregi_3	-.0277976	.4326919	-0.064	0.949	-.8758582	.8202631
Iregi_4	.2417783	.4113018	0.588	0.557	-.5643584	1.047915
Iregi_5	-.3846704	.4893535	-0.786	0.432	-1.343786	.5744448
Iregi_6	.7226568	.4653469	1.553	0.120	-.1894063	1.63472
Iregi_7	.0412065	.3891318	0.106	0.916	-.7214779	.8038909
Iregi_8	.4480115	.3182191	1.408	0.159	-.1756864	1.071709
Iregi_9	.613753	.310175	1.979	0.048	.0058212	1.221685
Iregi_10	.693371	.3807116	1.821	0.069	-.0528101	1.439552
Iregi_11	.8156451	.421639	1.934	0.053	-.0107521	1.642042
Iregi_12	1.14388	.6988114	1.637	0.102	-.2257651	2.513525
Iregi_13	.714712	.3245828	2.202	0.028	.0785414	1.350883
Iregi_14	1.178741	.3560057	3.311	0.001	.480983	1.8765
Iregi_15	.8197801	.3490471	2.349	0.019	.1356603	1.5039
Iregi_16	.7077137	.4074123	1.737	0.082	-.0907996	1.506227

Iregi_17	.6991417	.3349323	2.087	0.037	.0426865	1.355597
Iregi_18	.7435378	.3082462	2.412	0.016	.1393863	1.347689
Iregi_19	.7623839	.3110078	2.451	0.014	.1528197	1.371948
Iregi_20	.5185634	.3303052	1.570	0.116	-.128823	1.16595

continued next page

Iregi_21	1.210052	.3443053	3.514	0.000	.5352256	1.884878
Iregi_22	1.211712	.5048354	2.400	0.016	.2222524	2.201171
Iregi_23	.5098877	.5280421	0.966	0.334	-.5250558	1.544831
Iregi_24	1.704998	.5057439	3.371	0.001	.7137581	2.696238
Iregi_25	1.297155	.7425214	1.747	0.081	-.1581601	2.75247
Iregi_26	.7028773	.3968316	1.771	0.077	-.0748982	1.480653
Iregi_27	1.696339	.5288995	3.207	0.001	.6597155	2.732963
Iregi_28	.1032684	1.20772	0.086	0.932	-2.26382	2.470356
Iregi_29	.6962184	.5023282	1.386	0.166	-.2883268	1.680763
Iregi_31	1.226254	.6415438	1.911	0.056	-.0311486	2.483657
_cons	-.5424628	1.810524	-0.300	0.764	-4.091025	3.006099

FULL SAMPLE REGRESSION: DEAFNESS

Number of obs = 2091

LR chi2(61) = 48.66
Prob > chi2 = 0.8731
Log likelihood = -395.02222 Pseudo R2 = 0.0580

deaf	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lead1	-.0550463	.299835	-0.184	0.854	-.642712	.5326194
lead2	.3666335	.269922	1.358	0.174	-.162404	.895671
efarmer	14.82169	3.048747	4.862	0.000	8.846261	20.79713
eprof	14.88965	3.047364	4.886	0.000	8.916928	20.86238
eartisan	14.51393	3.051674	4.756	0.000	8.532756	20.4951
elaborer	14.88536	3.048526	4.883	0.000	8.910357	20.86036
eskllab	15.51656	3.055281	5.079	0.000	9.528316	21.5048
eoccna	14.86926	3.195951	4.653	0.000	8.60531	21.13321
weight	-.0049232	.0042539	-1.157	0.247	-.0132608	.0034144
height	-.0208002	.0437365	-0.476	0.634	-.1065222	.0649217
pow	.0744807	.357909	0.208	0.835	-.6270081	.7759695
private	-.0266343	.2175348	-0.122	0.903	-.4529946	.399726
age	.0081634	.0168571	0.484	0.628	-.0248758	.0412026
nonwhite	1.639758	1.435907	1.142	0.253	-1.174567	4.454084
married	.0390051	.2535224	0.154	0.878	-.4578896	.5358998
farmer	.20392	.3821935	0.534	0.594	-.5451654	.9530055
prof	.0377489	.39143	0.096	0.923	-.7294399	.8049376
artisan	.9251224	.3568252	2.593	0.010	.2257579	1.624487
laborer	.2874533	.4544796	0.632	0.527	-.6033103	1.178217
skllab	.3071017	.4548679	0.675	0.500	-.5844231	1.198626
occna	.0379004	.5475809	0.069	0.945	-1.035338	1.111139
big1900	-.4831864	.2744283	-1.761	0.078	-1.021056	.0546831
med1900	-.2388358	.2928988	-0.815	0.415	-.8129069	.3352354
big1870	-.7900537	.4546189	-1.738	0.082	-1.68109	.1009829
med1870	-.1364843	.240446	-0.568	0.570	-.6077498	.3347812
wdiar	.301755	.2262441	1.334	0.182	-.1416752	.7451852
wresp	-.4879584	.6088336	-0.801	0.423	-1.68125	.7053335
wtb	.9339614	.5982364	1.561	0.118	-.2385604	2.106483
wmeasl	.2816147	.4572353	0.616	0.538	-.61455	1.177779
wtyphoid	.3754025	.42889	0.875	0.381	-.4652064	1.216011
wmalaria	-.4173986	.7528246	-0.554	0.579	-1.892908	1.05811
wsyphil	-.8319818	1.055065	-0.789	0.430	-2.899872	1.235909
wrheum	.1068554	.3177831	0.336	0.737	-.5159881	.7296989
winjury	.2250638	.30589	0.736	0.462	-.3744696	.8245972
wgsw	.3195932	.2676754	1.194	0.232	-.2050409	.8442273
Iregi_2	.2479747	.9780037	0.254	0.800	-1.668877	2.164827
Iregi_4	-.0336285	.9704365	-0.035	0.972	-1.935649	1.868392
Iregi_6	.3178136	1.222969	0.260	0.795	-2.079162	2.714789
Iregi_7	.2748891	.8860601	0.310	0.756	-1.461757	2.011535
Iregi_8	.1992367	.7497377	0.266	0.790	-1.270222	1.668695
Iregi_9	-.1274046	.7485866	-0.170	0.865	-1.594607	1.339798
Iregi_10	-.9312476	1.203263	-0.774	0.439	-3.289601	1.427105
Iregi_11	.4443559	.9826451	0.452	0.651	-1.481593	2.370305
Iregi_12	1.283352	1.250694	1.026	0.305	-1.167962	3.734666
Iregi_13	.378742	.7458225	0.508	0.612	-1.083043	1.840527
Iregi_14	.5507941	.802013	0.687	0.492	-1.021122	2.122711
Iregi_15	.6485324	.7705002	0.842	0.400	-.8616203	2.158685
Iregi_16	.3188647	.8931028	0.357	0.721	-1.431585	2.069314
Iregi_17	.5235678	.7546131	0.694	0.488	-.9554468	2.002582

Iregi_18	.4951796	.7004804	0.707	0.480	-.8777368	1.868096
Iregi_19	.2671233	.7338943	0.364	0.716	-1.171283	1.70553
Iregi_20	.2938469	.7665645	0.383	0.701	-1.208592	1.796286
Iregi_21	.9723537	.7636377	1.273	0.203	-.5243486	2.469056

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deafness continued from last page

Iregi_22	.3252031	1.245086	0.261	0.794	-2.11512	2.765526
Iregi_23	.5162149	1.225977	0.421	0.674	-1.886656	2.919085
Iregi_24	.4832657	1.24338	0.389	0.698	-1.953715	2.920246
Iregi_26	.075126	.9878225	0.076	0.939	-1.86097	2.011222
Iregi_27	1.625997	1.026634	1.584	0.113	-.3861695	3.638163
Iregi_28	3.166158	1.416561	2.235	0.025	.3897496	5.942567
Iregi_29	.2328978	1.232616	0.189	0.850	-2.182986	2.648781
Iregi_31	1.290093	1.298375	0.994	0.320	-1.254676	3.834862
_cons	-16.74388	.	.	.	.	.

FULL SAMPLE REGRESSION: KIDNEY DISEASE

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Number of obs   =       1481
                                                  LR chi2(48)     =      53.24
                                                  Prob > chi2     =     0.2797
Log likelihood =  -108.2595                       Pseudo R2       =     0.1973
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kidneyd	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lead1	.050764	.5695637	0.089	0.929	-1.06556	1.167088
lead2	.6535724	.5647033	1.157	0.247	-.4532258	1.760371
efarmer	11.7673	5.550977	2.120	0.034	.8875815	22.64701
eprof	11.99372	5.495323	2.183	0.029	1.22308	22.76435
eartisan	11.16771	5.56358	2.007	0.045	.2632898	22.07212
elaborer	11.77433	5.55452	2.120	0.034	.8876731	22.66099
eskllab	10.91137	5.592495	1.951	0.051	-.0497242	21.87245
weight	-.0041278	.0083057	-0.497	0.619	-.0204067	.0121511
height	-.2036582	.0828101	-2.459	0.014	-.365963	-.0413533
pow	.8269955	.6393939	1.293	0.196	-.4261936	2.080185
private	-.1814693	.4459425	-0.407	0.684	-1.055501	.6925621
age	.0130561	.033914	0.385	0.700	-.0534142	.0795264
married	.1575498	.4939508	0.319	0.750	-.810576	1.125676
prof	-.3096238	.7801508	-0.397	0.691	-1.838691	1.219444
artisan	-1.480752	1.136658	-1.303	0.193	-3.708561	.7470569
laborer	.1118964	.7809787	0.143	0.886	-1.418794	1.642586
skllab	.0790846	.7748584	0.102	0.919	-1.43961	1.597779
occna	.8398234	.7998538	1.050	0.294	-.7278612	2.407508
big1900	-1.404775	.6264549	-2.242	0.025	-2.632604	-.1769462
med1900	.1050529	.5257011	0.200	0.842	-.9253023	1.135408
big1870	1.70649	.7141021	2.390	0.017	.306876	3.106105
med1870	-.2683275	.5756185	-0.466	0.641	-1.396519	.859864
wdiar	.1038202	.4990146	0.208	0.835	-.8742305	1.081871
wresp	1.209847	.6637536	1.823	0.068	-.0910862	2.51078
wmalaria	.911795	1.146828	0.795	0.427	-1.335947	3.159537
wsyphil	1.410923	1.23416	1.143	0.253	-1.007986	3.829833
wrheum	.4980966	.5736279	0.868	0.385	-.6261934	1.622387
winjury	.0225065	.6730837	0.033	0.973	-1.296713	1.341726
wgsw	-1.37779	.7901466	-1.744	0.081	-2.926449	.1708692
Iregi_4	.4778837	1.182429	0.404	0.686	-1.839635	2.795403
Iregi_5	.5100259	1.418871	0.359	0.719	-2.27091	3.290962
Iregi_6	.7148217	1.455115	0.491	0.623	-2.137151	3.566794
Iregi_7	-1.162491	1.432818	-0.811	0.417	-3.970764	1.645781
Iregi_8	-1.589902	1.207141	-1.317	0.188	-3.955855	.7760506
Iregi_9	-2.282221	1.394786	-1.636	0.102	-5.015952	.4515104
Iregi_13	-1.525985	1.382211	-1.104	0.270	-4.235069	1.1831
Iregi_14	-.7267685	1.422222	-0.511	0.609	-3.514273	2.060736
Iregi_15	-.9229662	1.402461	-0.658	0.510	-3.67174	1.825807
Iregi_16	-.5709844	1.424446	-0.401	0.689	-3.362848	2.220879
Iregi_17	-1.868125	1.438218	-1.299	0.194	-4.686981	.9507309
Iregi_18	-.3709208	1.111111	-0.334	0.739	-2.548659	1.806817
Iregi_19	-2.07604	1.360076	-1.526	0.127	-4.741739	.5896591
Iregi_20	-1.294746	1.383695	-0.936	0.349	-4.006739	1.417246
Iregi_21	-1.44674	1.442062	-1.003	0.316	-4.27313	1.379651
Iregi_22	-.7875423	1.515768	-0.520	0.603	-3.758393	2.183308
Iregi_24	.1709115	1.325746	0.129	0.897	-2.427503	2.769326
Iregi_26	-.7074676	1.448274	-0.488	0.625	-3.546032	2.131097
Iregi_27	-.2327662	1.516363	-0.154	0.878	-3.204784	2.739251

_cons	-1.415954	.	.	.	.	.

FULL SAMPLE: KIDNEY TROUBLE

Logit estimates

Number of obs	=	1687
LR chi2(52)	=	74.29
Prob > chi2	=	0.0229
Pseudo R2	=	0.1084

Log likelihood = -305.50996

kidneyt	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lead1	-.4472463	.3282424	-1.363	0.173	-1.090589	.1960969
lead2	-.4626372	.3261728	-1.418	0.156	-1.101924	.1766497
efarmer	15.56898	3.589254	4.338	0.000	8.534173	22.60379
eprof	15.21681	3.583249	4.247	0.000	8.193773	22.23985
eartisan	14.56808	3.590686	4.057	0.000	7.530467	21.6057
elaborer	14.54171	3.594801	4.045	0.000	7.496026	21.58739
eskllab	15.12893	3.608279	4.193	0.000	8.056833	22.20103
weight	-.0062215	.0049961	-1.245	0.213	-.0160136	.0035706
height	.0666345	.0498315	1.337	0.181	-.0310334	.1643025
pow	-.3560974	.497579	-0.716	0.474	-1.331334	.6191396
private	-.0520363	.2419474	-0.215	0.830	-.5262446	.422172
age	.0326056	.0184794	1.764	0.078	-.0036134	.0688246
married	-.1155734	.2858482	-0.404	0.686	-.6758256	.4446788
farmer	-.022978	.3923086	-0.059	0.953	-.7918888	.7459327
prof	.3955449	.3922937	1.008	0.313	-.3733366	1.164426
artisan	.0160047	.4816974	0.033	0.973	-.9281048	.9601142
laborer	-.2256339	.5465683	-0.413	0.680	-1.296888	.8456203
skllab	-.0873876	.5438423	-0.161	0.872	-1.153299	.9785238
occna	.41995	.5151776	0.815	0.415	-.5897796	1.42968
big1900	-.3977514	.3312185	-1.201	0.230	-1.046928	.2514248
med1900	-.0988556	.3204535	-0.308	0.758	-.726933	.5292218
big1870	.7421154	.476779	1.557	0.120	-.1923542	1.676585
med1870	.0825532	.2662086	0.310	0.756	-.4392061	.6043126
wdiar	.5821503	.2453631	2.373	0.018	.1012475	1.063053
wresp	-.3047807	.6279264	-0.485	0.627	-1.535494	.9259325
wmeasl	-.6624083	.6347576	-1.044	0.297	-1.90651	.5816937
wtyphoid	.6900532	.448289	1.539	0.124	-.188577	1.568683
wmalaria	.3349784	.5802025	0.577	0.564	-.8021976	1.472154
wsyphil	-.000339	1.079904	0.000	1.000	-2.116912	2.116234
wrheum	-.0455317	.3709836	-0.123	0.902	-.7726462	.6815827
winjury	.264809	.3437596	0.770	0.441	-.4089476	.9385655
wgsw	-.7436111	.401547	-1.852	0.064	-1.530629	.0434065
Iregi_2	1.428151	1.285508	1.111	0.267	-1.091398	3.947701
Iregi_4	1.491835	1.212941	1.230	0.219	-.8854845	3.869155
Iregi_8	.320544	1.210765	0.265	0.791	-2.052512	2.6936
Iregi_10	1.439719	1.222675	1.178	0.239	-.9566792	3.836118
Iregi_11	.8886921	1.478774	0.601	0.548	-2.009651	3.787036
Iregi_12	2.320377	1.523735	1.523	0.128	-.666088	5.306842
Iregi_13	1.61211	1.106438	1.457	0.145	-.5564688	3.780689
Iregi_14	1.633974	1.132502	1.443	0.149	-.5856883	3.853636
Iregi_15	2.037918	1.10497	1.844	0.065	-.1277842	4.20362
Iregi_16	2.45305	1.137944	2.156	0.031	.2227205	4.683379

Iregi_17	.7278007	1.214791	0.599	0.549	-1.653146	3.108747
Iregi_18	1.357572	1.09367	1.241	0.214	-.785983	3.501126
Iregi_19	.7879986	1.138083	0.692	0.489	-1.442604	3.018601
Iregi_20	1.246269	1.128656	1.104	0.270	-.9658573	3.458395
Iregi_21	1.906728	1.124653	1.695	0.090	-.297552	4.111007
Iregi_22	.8239706	1.505174	0.547	0.584	-2.126115	3.774057
Iregi_23	1.049785	1.487303	0.706	0.480	-1.865276	3.964846
Iregi_26	.4789048	1.4794	0.324	0.746	-2.420665	3.378475
Iregi_27	1.691141	1.519566	1.113	0.266	-1.287155	4.669436
Iregi_29	1.171089	1.506086	0.778	0.437	-1.780785	4.122962
_cons	-24.87106	.	.	.	.	.

DROP IF PRIVATE == 0

Logit dizzy1 lead1 lead2 efarmer-eoccna weight height-private age-occna big1
> 900-Iregi_31

```
Logit estimates                                   Number of obs   =        825
                                                  LR chi2(47)     =      44.71
                                                  Prob > chi2     =     0.5677
Log likelihood = -128.66598                       Pseudo R2       =     0.1480
```

dizzy1	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lead1	1.298346	.5782436	2.245	0.025	.1650091	2.431683
lead2	1.608334	.5397789	2.980	0.003	.5503872	2.666282
efarmer	14.24739	5.375095	2.651	0.008	3.712399	24.78238
eprof	13.96377	5.373186	2.599	0.009	3.432523	24.49502
eartisan	14.21994	5.417664	2.625	0.009	3.601518	24.83837
elaborer	14.70794	5.362669	2.743	0.006	4.197298	25.21857
eskllab	14.88257	5.398548	2.757	0.006	4.301612	25.46353
weight	-.008089	.0075888	-1.066	0.286	-.0229627	.0067848
height	.0853543	.0769216	1.110	0.267	-.0654093	.2361179
pow	.1726709	.7163043	0.241	0.810	-1.23126	1.576602
age	-.0779924	.0304332	-2.563	0.010	-.1376403	-.0183445
married	.7602741	.5151697	1.476	0.140	-.2494399	1.769988
farmer	-.4712777	.6961987	-0.677	0.498	-1.835802	.8932467
prof	-.2666093	.7106415	-0.375	0.708	-1.659441	1.126223
artisan	.6125377	.631364	0.970	0.332	-.6249131	1.849988
laborer	-1.055343	.9250253	-1.141	0.254	-2.86836	.757673
skllab	.4605025	.7285916	0.632	0.527	-.9675108	1.888516
occna	.6643835	.7338623	0.905	0.365	-.7739603	2.102727
big1900	-.8830639	.4587407	-1.925	0.054	-1.782179	.0160513
med1900	-.6308891	.5397148	-1.169	0.242	-1.688711	.4269326
big1870	.6485155	.7798793	0.832	0.406	-.8800199	2.177051
med1870	-.1375618	.4169106	-0.330	0.741	-.9546915	.679568
wdiar	.006634	.4257754	0.016	0.988	-.8278705	.8411386
wresp	-1.011633	1.106237	-0.914	0.360	-3.179819	1.156552
wtb	1.733347	1.195061	1.450	0.147	-.6089299	4.075624
wmeasl	-.4880651	.8306139	-0.588	0.557	-2.116038	1.139908
wtyphoid	.8712362	.7774192	1.121	0.262	-.6524774	2.39495
wmalaria	-.4292003	1.190199	-0.361	0.718	-2.761948	1.903548
wsyphil	.6988848	1.19674	0.584	0.559	-1.646682	3.044452
wrheum	.3857353	.557605	0.692	0.489	-.7071504	1.478621
winjury	.0648333	.6033182	0.107	0.914	-1.117649	1.247315

wgsw	-.346168	.6039517	-0.573	0.567	-1.529892	.8375555
Iregi_2	1.964124	1.434224	1.369	0.171	-.8469038	4.775151
Iregi_4	1.065333	1.57502	0.676	0.499	-2.02165	4.152317
Iregi_8	-.0461901	1.39057	-0.033	0.974	-2.771657	2.679277
Iregi_9	-.0872988	1.415876	-0.062	0.951	-2.862365	2.687767
Iregi_11	.0642485	1.627157	0.039	0.969	-3.124921	3.253418
Iregi_13	.3630095	1.406196	0.258	0.796	-2.393083	3.119102
Iregi_14	.9115624	1.367075	0.667	0.505	-1.767855	3.59098
Iregi_15	.6108791	1.39823	0.437	0.662	-2.129601	3.35136
Iregi_16	1.140085	1.456064	0.783	0.434	-1.713748	3.993919
Iregi_17	-.6461417	1.6159	-0.400	0.689	-3.813248	2.520965
Iregi_18	.9516859	1.250435	0.761	0.447	-1.499122	3.402494
Iregi_19	-.4942101	1.382397	-0.358	0.721	-3.203658	2.215238
Iregi_20	1.833564	1.258678	1.457	0.145	-.6333988	4.300527
Iregi_26	.4221743	1.584941	0.266	0.790	-2.684254	3.528602
Iregi_29	.9364247	1.537561	0.609	0.543	-2.07714	3.94999
_cons	-19.34451	.	.	.	.	.

PRIVATE ONLY: MEMORY

logit memory lead1 lead2 efarmer-eoccna weight height-private age-occna big1

Logit estimates	Number of obs	=	875
	LR chi2(49)	=	36.44
	Prob > chi2	=	0.9080
Log likelihood = -167.78543	Pseudo R2	=	0.0979

memory	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lead1	.0059758	.4390263	0.014	0.989	-.8544999	.8664515
lead2	.1658829	.4183666	0.397	0.692	-.6541005	.9858664
efarmer	15.30311	4.750624	3.221	0.001	5.992056	24.61416
eprof	15.80257	4.731334	3.340	0.001	6.529325	25.07581
eartisan	14.80267	4.76167	3.109	0.002	5.469965	24.13537
elaborer	13.25025	4.837802	2.739	0.006	3.768333	22.73217
eskllab	15.07907	4.741979	3.180	0.001	5.784959	24.37317
eoccna	16.50203	4.764736	3.463	0.001	7.163318	25.84074
weight	-.0004927	.0061808	-0.080	0.936	-.0126068	.0116214
height	.0802498	.0675204	1.189	0.235	-.0520877	.2125873
pow	.3202061	.598118	0.535	0.592	-.8520836	1.492496
age	.0125471	.024872	0.504	0.614	-.036201	.0612952
married	-.3969503	.363654	-1.092	0.275	-1.109699	.3157985
farmer	-1.090051	.6565447	-1.660	0.097	-2.376855	.1967532
prof	-.0409056	.540246	-0.076	0.940	-1.099768	1.017957
artisan	.3054774	.5445292	0.561	0.575	-.7617803	1.372735
laborer	-.1319897	.6420548	-0.206	0.837	-1.390394	1.126414
skllab	-.5235634	.8288621	-0.632	0.528	-2.148103	1.100977
occna	.0216369	.6912272	0.031	0.975	-1.333144	1.376417
big1900	-.6581487	.4305754	-1.529	0.126	-1.502061	.1857636
med1900	.0394255	.4190884	0.094	0.925	-.7819727	.8608237
big1870	.233654	.734279	0.318	0.750	-1.205506	1.672814
med1870	.5496105	.3547873	1.549	0.121	-.1457598	1.244981
wdiar	.0114414	.3673739	0.031	0.975	-.7085982	.7314811
wresp	-.7742485	1.068582	-0.725	0.469	-2.868631	1.320134

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
wtb	1.756276	1.234888	1.422	0.155	-.6640598	4.176612
wmeasl	.282706	.6917462	0.409	0.683	-1.073092	1.638504
wtyphoid	.8227823	.6897926	1.193	0.233	-.5291863	2.174751
wmalaria	1.132517	.6943555	1.631	0.103	-.2283945	2.493429
wrheum	.1054723	.5214493	0.202	0.840	-.9165496	1.127494
winjury	-.3790138	.5916098	-0.641	0.522	-1.538548	.7805201
wgsw	.3767336	.4907281	0.768	0.443	-.5850758	1.338543
Iregi_4	.568105	1.343294	0.423	0.672	-2.064704	3.200914
Iregi_7	.7399846	1.10846	0.668	0.504	-1.432557	2.912527
Iregi_8	.5174812	1.058823	0.489	0.625	-1.557773	2.592735
Iregi_9	-.8727386	1.325452	-0.658	0.510	-3.470578	1.7251
Iregi_10	.2512463	1.358526	0.185	0.853	-2.411416	2.913908
Iregi_12	2.035431	1.479287	1.376	0.169	-.8639184	4.934781
Iregi_13	.575412	.9977829	0.577	0.564	-1.380207	2.531031
Iregi_14	.8540231	1.039727	0.821	0.411	-1.183804	2.891851
Iregi_15	.1210506	1.342079	0.090	0.928	-2.509376	2.751478
Iregi_16	.4232052	1.375719	0.308	0.758	-2.273154	3.119564
Iregi_17	.3476751	1.14631	0.303	0.762	-1.899051	2.594401
Iregi_18	.3470315	.9291865	0.373	0.709	-1.474141	2.168204
Iregi_19	.2036047	.9713531	0.210	0.834	-1.700212	2.107422
Iregi_20	1.400258	.9429456	1.485	0.138	-.447882	3.248397
Iregi_21	.7219842	1.025124	0.704	0.481	-1.287222	2.73119
Iregi_24	1.395397	1.450541	0.962	0.336	-1.447612	4.238406
Iregi_29	.0485416	1.424658	0.034	0.973	-2.743736	2.840819
_cons	-24.50792	.	.	.	.	.

PRIVATE ONLY: EAR PROBLEMS

```
logit earprob lead1 lead2 efarmer-eoccna weight height-private age-occna  big
> 1900-Iregi_31

Logit estimates                                   Number of obs   =       1065
                                                  LR chi2(61)     =      73.45
                                                  Prob > chi2     =     0.1318
Log likelihood = -689.86102                       Pseudo R2       =     0.0505
```

earprob	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lead1	-.0070224	.184947	-0.038	0.970	-.3695118	.355467
lead2	.2999023	.1754202	1.710	0.087	-.043915	.6437195
efarmer	-15.68072	1.931736	-8.117	0.000	-19.46685	-11.89459
eprof	-16.17912	1.939957	-8.340	0.000	-19.98136	-12.37687
eartisan	-15.7544	1.93628	-8.136	0.000	-19.54944	-11.95936
elaborer	-15.41296	1.930685	-7.983	0.000	-19.19703	-11.62888
eskllab	-15.33954	1.932807	-7.936	0.000	-19.12778	-11.55131
eoccna	-15.85593	2.032944	-7.799	0.000	-19.84043	-11.87143
weight	.0040582	.0026424	1.536	0.125	-.0011209	.0092373
height	-.0039471	.0280697	-0.141	0.888	-.0589627	.0510685
dishonor	-.1492275	1.447395	-0.103	0.918	-2.98607	2.687615
pow	.1304038	.2451478	0.532	0.595	-.3500772	.6108847
age	.0070085	.0099067	0.707	0.479	-.0124083	.0264253
married	-.2399098	.1609045	-1.491	0.136	-.5552769	.0754572
farmer	.0554786	.2412524	0.230	0.818	-.4173674	.5283245
prof	.3698354	.2437664	1.517	0.129	-.107938	.8476089
artisan	.4486838	.2404928	1.866	0.062	-.0226734	.920041
laborer	.0494841	.2661055	0.186	0.852	-.472073	.5710412

skllab	.5565173	.2899525	1.919	0.055	-.0117792	1.124814
occna	.0135643	.321465	0.042	0.966	-.6164955	.6436241
big1900	-.0301003	.1753862	-0.172	0.864	-.3738509	.3136504
med1900	.3273478	.1905417	1.718	0.086	-.0461071	.7008027
big1870	-.1412237	.2627004	-0.538	0.591	-.6561071	.3736596
med1870	-.0922059	.1529426	-0.603	0.547	-.3919679	.2075561
wdiar	-.2243973	.1538722	-1.458	0.145	-.5259814	.0771867
wresp	.3580247	.3353891	1.067	0.286	-.2993258	1.015375
wtb	-.6108249	.6328308	-0.965	0.334	-1.851151	.6295007
wmeasl	.3100703	.308276	1.006	0.315	-.2941395	.9142801
wtyphoid	.3872834	.331531	1.168	0.243	-.2625053	1.037072
wmalaria	1.111629	.4123563	2.696	0.007	.3034252	1.919832
wsyphil	.1154728	.5081131	0.227	0.820	-.8804106	1.111356
wrheum	.05676	.213261	0.266	0.790	-.3612239	.4747439
winjury	-.1260137	.2203331	-0.572	0.567	-.5578586	.3058312
wgsw	.1763228	.200076	0.881	0.378	-.2158189	.5684645
Iregi_2	.0333479	.5781061	0.058	0.954	-1.099719	1.166415
Iregi_3	-.0049168	.6110826	-0.008	0.994	-1.202617	1.192783
Iregi_4	.0840304	.5922795	0.142	0.887	-1.076816	1.244877
Iregi_5	-.5517348	.6102212	-0.904	0.366	-1.747746	.6442769
Iregi_6	.7689411	.6546749	1.175	0.240	-.5141982	2.05208
Iregi_7	-.0290771	.5598873	-0.052	0.959	-1.126436	1.068282
Iregi_8	-.0176589	.473897	-0.037	0.970	-.9464799	.9111622
Iregi_9	.5665914	.4522739	1.253	0.210	-.3198491	1.453032
Iregi_10	.3711782	.5419404	0.685	0.493	-.6910054	1.433362
Iregi_11	-.0673092	.6145283	-0.110	0.913	-1.271762	1.137144
Iregi_12	.457887	.8783473	0.521	0.602	-1.263642	2.179416
Iregi_13	.5426415	.4634935	1.171	0.242	-.365789	1.451072
Iregi_14	.8154752	.48975	1.665	0.096	-.1444171	1.775368
Iregi_15	.2309781	.5230021	0.442	0.659	-.7940872	1.256043
Iregi_16	.406625	.5759551	0.706	0.480	-.7222262	1.535476
Iregi_17	.2008495	.4972308	0.404	0.686	-.773705	1.175404

Table continued next page

Private only ear problems continued

Iregi_18	.6070134	.4275227	1.420	0.156	-.2309157	1.444943
Iregi_19	.6991013	.4315025	1.620	0.105	-.146628	1.544831
Iregi_20	.2961755	.451143	0.657	0.512	-.5880485	1.180399
Iregi_21	1.090019	.4944877	2.204	0.028	.1208405	2.059197
Iregi_22	.5636984	1.310933	0.430	0.667	-2.005682	3.133079
Iregi_23	.9141096	.6577951	1.390	0.165	-.3751452	2.203364
Iregi_24	2.171055	.9407917	2.308	0.021	.3271372	4.014973
Iregi_26	.7998658	.5849808	1.367	0.172	-.3466755	1.946407
Iregi_27	1.881008	.8120453	2.316	0.021	.2894286	3.472588
Iregi_29	.7386136	.621022	1.189	0.234	-.4785672	1.955794
Iregi_31	.4327513	1.048997	0.413	0.680	-1.623245	2.488748
_cons	14.02136	.	.	.	.	.

PRIVATE ONLY: DEAF

```
. logit deaf lead1 lead2 efarmer-eoccna weight height-private age-occna  big190

Logit estimates                                   Number of obs   =        896
                                                  LR chi2(49)     =      44.26
                                                  Prob > chi2     =     0.6655
Log likelihood =  -170.7449                       Pseudo R2       =     0.1147

------------------------------------------------------------------------------
    deaf |      Coef.   Std. Err.       z     P>|z|       [95% Conf. Interval]
---------+--------------------------------------------------------------------
   lead1 |   .1121231   .4376114      0.256   0.798      -.7455796    .9698258
   lead2 |  -.1673763    .415573     -0.403   0.687      -.9818845    .6471319
 efarmer |   16.48134   4.512677      3.652   0.000       7.636657    25.32603
   eprof |   16.31592   4.516182      3.613   0.000       7.464363    25.16747
eartisan |     16.391   4.510111      3.634   0.000       7.551342    25.23065
elaborer |   16.72724   4.508523      3.710   0.000       7.890694    25.56378
 eskllab |   17.30328   4.529824      3.820   0.000       8.424989    26.18157
  weight |  -.0011553   .0062292     -0.185   0.853      -.0133643    .0110536
  height |   -.026969   .0632901     -0.426   0.670      -.1510153    .0970773
     pow |  -1.921882   1.042344     -1.844   0.065      -3.964839    .1210758
     age |  -.0231698   .0209449     -1.106   0.269       -.064221    .0178813
 married |   .5096593   .4152059      1.227   0.220      -.3041293    1.323448
  farmer |   .6738226   .5803025      1.161   0.246      -.4635493    1.811194
    prof |   .0666775   .6606657      0.101   0.920      -1.228204    1.361558
 artisan |   1.357366   .5425152      2.502   0.012       .2940554    2.420676
 laborer |   .6658931   .6588341      1.011   0.312      -.6253981    1.957184
  skllab |    .312322   .7502824      0.416   0.677      -1.158204    1.782848
   occna |  -.6874704   1.107177     -0.621   0.535      -2.857497    1.482557
 big1900 |   .0665215   .4092168      0.163   0.871      -.7355287    .8685717
 med1900 |   .0563539   .4366797      0.129   0.897      -.7995227    .9122304
 big1870 |  -1.512431   1.105198     -1.368   0.171      -3.678578    .6537173
 med1870 |   .0633357   .3466565      0.183   0.855      -.6160985    .7427699
   wdiar |   .5221316   .3325095      1.570   0.116       -.129575    1.173838
   wresp |  -.0626863   .8107866     -0.077   0.938      -1.651799    1.526426
     wtb |   1.156501   1.157974      0.999   0.318      -1.113087    3.426089
  wmeasl |   .1014207   .6486931      0.156   0.876      -1.169994    1.372836
wtyphoid |   .0192125   .8067436      0.024   0.981      -1.561976    1.600401
wmalaria |   .0151905    .788107      0.019   0.985      -1.529471    1.559852
  wrheum |  -.1800248   .5275813     -0.341   0.733      -1.214065    .8540154
 winjury |   .3813721   .4494712      0.848   0.396      -.4995753    1.262319
    wgsw |   .5180646   .4196345      1.235   0.217      -.3044039    1.340533
 Iregi_2 |   .4116011   1.142058      0.360   0.719      -1.826791    2.649993
 Iregi_4 |   .2019802   1.360674      0.148   0.882      -2.464892    2.868852
 Iregi_7 |   .1553935   1.324159      0.117   0.907      -2.439911    2.750698
 Iregi_8 |   .2405284   1.045773      0.230   0.818      -1.809149    2.290206
 Iregi_9 |  -.1725585   1.048533     -0.165   0.869      -2.227646    1.882529
Iregi_11 |   .1587449   1.367377      0.116   0.908      -2.521265    2.838755
Iregi_13 |   .4106801   1.040672      0.395   0.693      -1.628999    2.450359
Iregi_14 |   .6578466   1.067337      0.616   0.538      -1.434095    2.749788
Iregi_15 |    .951364   1.009712      0.942   0.346      -1.027634    2.930362
Iregi_17 |   .6971365   1.072263      0.650   0.516      -1.404461    2.798734
Iregi_18 |   .9421995   .8920899      1.056   0.291      -.8062646    2.690663
Iregi_19 |    .279405   .9591265      0.291   0.771      -1.600448    2.159258
Iregi_20 |   -.469007   1.110704     -0.422   0.673      -2.645946    1.707932
Iregi_21 |   .8381611   1.084273      0.773   0.440      -1.286975    2.963297
Iregi_23 |    1.06755   1.407858      0.758   0.448        -1.6918    3.826901
```

Iregi_26	.6456663	1.376924	0.469	0.639	-2.053055	3.344388
Iregi_27	1.906352	1.4905	1.279	0.201	-1.014975	4.827679
Iregi_29	.6511693	1.397634	0.466	0.641	-2.088142	3.390481
_cons	-17.49595	.	.	.	.	.

PRIVATE ONLY: KIDNEY DISEASE

```
Logit kidneyd lead1 lead2 efarmer-eoccna weight height-private age-occna  big
> 1900-Iregi_31
```

```
Logit estimates                                   Number of obs   =        434
                                                  LR chi2(34)     =      42.49
                                                  Prob > chi2     =     0.1505
Log likelihood = -33.644324                       Pseudo R2       =     0.3871
```

kidneyd	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lead1	-.7837767	1.406122	-0.557	0.577	-3.539725	1.972171
lead2	1.267866	1.13322	1.119	0.263	-.9532046	3.488936
efarmer	9.469134	1.736996	5.451	0.000	6.064684	12.87358
eprof	10.88686	1.829492	5.951	0.000	7.301117	14.47259
eartisan	10.42026	1.762599	5.912	0.000	6.965632	13.87489
elaborer	8.402053	.	.	.	.	.
weight	-.0089151	.0189366	-0.471	0.638	-.0460301	.0281998
height	.0271163	.1507911	0.180	0.857	-.2684288	.3226614
pow	-.1925607	1.319218	-0.146	0.884	-2.77818	2.393059
age	-.0137345	.0688624	-0.199	0.842	-.1487024	.1212333
married	2.702748	1.279111	2.113	0.035	.1957359	5.20976
prof	-.9540097	1.463557	-0.652	0.515	-3.822528	1.914508
artisan	-1.233434	1.578394	-0.781	0.435	-4.327029	1.86016
laborer	1.695127	1.243298	1.363	0.173	-.7416932	4.131947
occna	1.787145	1.355418	1.319	0.187	-.8694245	4.443715
big1900	-2.198116	1.325979	-1.658	0.097	-4.796987	.4007546
med1900	.2046342	1.039852	0.197	0.844	-1.833438	2.242706
big1870	2.629361	1.585969	1.658	0.097	-.4790806	5.737803
med1870	-4.309231	1.949362	-2.211	0.027	-8.12991	-.488552
wdiar	1.244517	.9433194	1.319	0.187	-.6043547	3.093389
wresp	4.230811	1.492294	2.835	0.005	1.305969	7.155653
wrheum	1.651036	.927773	1.780	0.075	-.1673654	3.469438
winjury	1.053703	1.278875	0.824	0.410	-1.452846	3.560252
wgsw	-.1693872	1.130783	-0.150	0.881	-2.385681	2.046906
Iregi_5	-.5359892	2.118165	-0.253	0.800	-4.687516	3.615538
Iregi_8	-6.584618	2.695515	-2.443	0.015	-11.86773	-1.301505
Iregi_13	-6.104573	2.660064	-2.295	0.022	-11.3182	-.8909437
Iregi_14	-4.308145	2.691382	-1.601	0.109	-9.583157	.9668661
Iregi_17	-4.980698	2.75158	-1.810	0.070	-10.3737	.4122996
Iregi_18	-6.725504	3.046396	-2.208	0.027	-12.69633	-.7546772
Iregi_19	-5.223841	2.39621	-2.180	0.029	-9.920326	-.5273559
Iregi_20	-5.899837	2.625723	-2.247	0.025	-11.04616	-.7535136
Iregi_21	-5.207154	2.600079	-2.003	0.045	-10.30322	-.1110926
Iregi_26	-2.359941	2.324153	-1.015	0.310	-6.915197	2.195316
_cons	-11.20351	9.626103	-1.164	0.244	-30.07032	7.66331

PRIVATE ONLY: KIDNEY TROUBLE

```
. logit kidneyt lead1 lead2 efarmer-eoccna weight height-private age-occna  big

Logit estimates                                   Number of obs   =        744
                                                  LR chi2(46)     =      58.44
                                                  Prob > chi2     =     0.1031
Log likelihood = -137.87564                       Pseudo R2       =     0.1749
```

kidneyt	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lead1	-.5785576	.4817251	-1.201	0.230	-1.522722	.3656063
lead2	-.6784425	.4801737	-1.413	0.158	-1.619566	.2626807
efarmer	13.97877	3582.359	0.004	0.997	-7007.316	7035.273
eprof	14.9133	3582.359	0.004	0.997	-7006.381	7036.208
eartisan	13.27686	3582.359	0.004	0.997	-7008.018	7034.571
elaborer	13.57478	3582.359	0.004	0.997	-7007.72	7034.869
eskllab	12.96819	3582.359	0.004	0.997	-7008.327	7034.263
weight	-.0030749	.0076336	-0.403	0.687	-.0180364	.0118867
height	.1029099	.0766072	1.343	0.179	-.0472374	.2530573
age	.0131602	.025383	0.518	0.604	-.0365896	.06291
married	-.3130589	.4202418	-0.745	0.456	-1.136718	.5106
farmer	-.2735705	.5862454	-0.467	0.641	-1.42259	.8754494
prof	.122796	.6472575	0.190	0.850	-1.145805	1.391397
artisan	-.4236648	.7830529	-0.541	0.588	-1.95842	1.111091
laborer	.0914916	.6944631	0.132	0.895	-1.269631	1.452614
skllab	-1.257908	1.134941	-1.108	0.268	-3.482352	.9665367
occna	1.068104	.6657868	1.604	0.109	-.2368142	2.373022
big1900	-.7090602	.4800136	-1.477	0.140	-1.64987	.2317492
med1900	-.1787916	.4951352	-0.361	0.718	-1.149239	.7916557
big1870	.9484699	.7976035	1.189	0.234	-.6148041	2.511744
med1870	.4268834	.375093	1.138	0.255	-.3082854	1.162052
wdiar	1.238374	.3704076	3.343	0.001	.512388	1.964359
wresp	.2284773	.8653761	0.264	0.792	-1.467629	1.924583
wmeasl	-.74714	.8575963	-0.871	0.384	-2.427998	.9337179
wtyphoid	.5397972	.8910642	0.606	0.545	-1.206657	2.286251
wmalaria	1.03244	.7472688	1.382	0.167	-.4321803	2.49706
wsyphil	1.729406	1.28313	1.348	0.178	-.7854827	4.244295
wrheum	.2351284	.5146638	0.457	0.648	-.7735941	1.243851
winjury	.2800908	.5559477	0.504	0.614	-.8095467	1.369728
wgsw	-1.276723	.7877352	-1.621	0.105	-2.820656	.2672094
Iregi_2	17.65375	3470.78	0.005	0.996	-6784.949	6820.257
Iregi_8	15.85389	3470.78	0.005	0.996	-6786.749	6818.457
Iregi_10	16.31505	3470.78	0.005	0.996	-6786.288	6818.918

Iregi_11	17.53231	3470.78	0.005	0.996	-6785.071	6820.136
Iregi_13	17.23376	3470.78	0.005	0.996	-6785.369	6819.837
Iregi_14	17.44089	3470.78	0.005	0.996	-6785.162	6820.044
Iregi_15	16.63114	3470.78	0.005	0.996	-6785.972	6819.234
Iregi_16	18.1081	3470.78	0.005	0.996	-6784.495	6820.711
Iregi_17	16.27294	3470.78	0.005	0.996	-6786.33	6818.876
Iregi_18	16.97676	3470.78	0.005	0.996	-6785.626	6819.58
Iregi_19	16.45131	3470.78	0.005	0.996	-6786.152	6819.054
Iregi_20	16.50668	3470.78	0.005	0.996	-6786.096	6819.11
Iregi_21	17.9957	3470.78	0.005	0.996	-6784.607	6820.599
Iregi_23	17.01758	3470.78	0.005	0.996	-6785.586	6819.621
Iregi_26	17.39793	3470.78	0.005	0.996	-6785.205	6820.001
Iregi_29	17.12883	3470.78	0.005	0.996	-6785.474	6819.732
_cons	-40.84261	4987.948	-0.008	0.993	-9817.04	9735.355