Ethnic-Specific Infant Care Practices and Infant Mortality in Late Imperial Russia *

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Abstract

The Russian Empire had the highest infant mortality rate in Europe at the beginning of the 20^{th} century. This paper documents uniquely high infant mortality among ethnic Russians. In contrast, infant mortality rates among other ethnic groups of the Empire did not exceed those of the European countries by much. Using a variety of official statistical sources and qualitative evidence, we suggest that the explanation for the Russian infant mortality pattern was ethnic-specific infant care practices, such as early weaning and the introduction of solid food. Our findings call for caution in using infant mortality rates as a proxy for standards of living in pre-industrial societies.

Keywords: infant mortality, infant care, Russian Empire

JEL codes: N33, N53, I15, O15

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1 Introduction

The Russian Empire was notorious for its infant mortality rate. At the beginning of the 20th century, Russia had the highest infant mortality in Europe – 250 out of 1,000 newborns died before they reached one year of age. In contrast, the infant mortality rate was 154 in England and 160 in France. Why was infant mortality in Russia so high?

This paper suggests that high infant mortality in the Russian Empire was largely an ethnic-Russian phenomenon. Russians had the highest rate across all ethnic and religious groups of the Empire – 317 deaths per 1,000 births. In contrast, two other Orthodox ethnic groups, Ukrainians and Belarusians, had infant mortality rates not too far above the leading European economies – 192 and 203 respectively. The ethnic differences in infant mortality appear to result from ethnic-specific infant care practices rather than economic or geographic factors. The most salient practices, as documented by contemporaneous medical studies, were the timing of weaning and the introduction of solid food, although other unobserved practices might have contributed as well. Remarkably, the mortality of children above the age of one year, which is less dependent on feeding practices, did not differ much across ethnic groups.

Our findings rest on a combination of quantitative and qualitative evidence. We assemble three cross-sectional data sets on infant mortality, child mortality, and death causes from imperial statistical volumes. One data set covers 502 districts (*uezd*) in 50 provinces (*gubernia*) of European Russia in 1900-1903. The other two zoom in on within-province variation at the township (*volost'*) level in two predominantly Russian provinces with notable Ukrainian minorities – Voronezh and Saratov. We supplement quantitative data with a review of contemporaneous individual-level medical studies conducted by rural doctors in Russian and Ukrainian villages in the late 19th – early 20th centuries. The doctors observed peasant households and collected data on feeding practices, disease incidence, and mortality in different age groups.

The medical studies suggest that the Russian infant mortality pattern largely resulted from ethnic-specific infant feeding practices. They report that up to 90% of Russian infants and only about 40% of Ukrainian infants were fed supplementary solid food before they reached six months of age. As a result, child diarrhea induced about 75% of infant deaths among Russians and only 13% among Ukrainians. Our township-level regressions support these observations. In Voronezh province, the share of Ukrainians is negatively and significantly associated with diarrhea-induced child but not adult mortality. In Saratov province, the share of Ukrainians is negatively and significantly associated with infant but not child mortality.

We obtain similar results in a cross-section of districts of the European part of the Empire. The regressions show that the best predictor of infant mortality is the share of ethnic Russians. The regression coefficient is remarkably stable across specifications and significant both statistically and economically; a standard deviation increase in the share of ethnic Russians is associated with a 0.46 standard deviations increase in infant mortality. The ethnic composition explains about 63% of the variation in infant mortality. In contrast, all development and geographic controls explain less than 12%. Consistent with micro-level and township-level evidence, the share of Russians is insignificant for child mortality of ages 1-2 and 2-5.

Our results are in line with similar studies on infant mortality in European demographic history. The link between traditional infant care practices and infant survival was not

uniquely Russian. For example, Knodel and Van de Walle (1967) show that infant mortality across southern Germany in the mid-19th century was strongly correlated with a proportion of mothers who regularly breastfed their infants and the timing of weaning. Brown and Guinnane (2018) suggest that changes in attitudes towards infant care mattered for the decline in infant mortality in late 19th-century Bavaria. Botticini et al. (2019) show that superior childcare practices of Jewish families, including extended breastfeeding, contributed to lower infant mortality and higher growth rates of the Jewish population in Eastern Europe from 1500 to 1930. The historical evidence is consistent with contemporary epidemiological studies, which prove the protective effects of breastfeeding against diarrhea-induced mortality (Lamberti et al., 2011).

Our paper contributes to the literature on mortality in the Russian Empire. Patterson (1995) conducts a general overview of mortality patterns exploring seasonal, regional, and religious variation. He documents a large difference in infant mortality between Orthodox and non-Orthodox populations. Bonneuil and Fursa (2016) reach the same conclusion using data on Don province. Ransel (1990) attributes religious differentials in infant mortality to infant care practices, drawing from numerous historical and ethnographic sources. Hoch (1998) studies mortality trends in one Russian village in Tambov province and finds that mortality from gastrointestinal diseases was prevalent among infants. In contrast, child mortality was mostly induced by infectious diseases – smallpox, scarlet fever, diphtheria.

Our study improves upon the existing literature along several lines. First, we focus on cross-ethnic variation within the Orthodox population, while previous studies examine differences across religious groups. Second, we compare determinants of mortality between infants and older cohorts of children. Third, we collect and survey contemporaneous medical research on infant mortality from the historical libraries in Moscow and St. Petersburg. The studies were based on individual-level data and published in the late 19th – early 20th centuries. Fourth, we compile a comprehensive district-level data set on infant and child mortality for the European part of the Empire from previously undigitized sources. Using these data, we conduct a regression analysis to explore economic, geographic, and cultural determinants of mortality. Finally, we supplement district-level analysis with township-level data to minimize variation in the geographic and institutional environment.

The research in health economics has firmly established a negative correlation between infant mortality and socioeconomic status both across and within countries (Cutler et al., 2006). Recently, the growing body of literature has documented the importance of traditional practices in shaping infant mortality on top of socioeconomic status both in historical and contemporary contexts.[1] Therefore, one should be very cautious in using infant mortality as a proxy for economic development, especially for pre-industrial societies. This implication is particularly relevant for the late Russian Empire, which remained largely an agrarian economy at the beginning of the 20th century.

[1] Derosas (2003) documents differences in infant mortality between Catholics and Jews in 19th century Venice, which cannot be explained by income or education levels. Bhalotra et al. (2010) show that Indian Muslims exhibit a substantial advantage in child survival despite being, on average, poorer and less educated than high-caste Hindus. In a follow-up study, Geruso and Spears (2018) show that the main explanation for this puzzling fact is sanitation practices.

2 Data

In Imperial Russia, vital events – births, marriages, and deaths – were recorded in parish registers. Parish registration of vital statistics was introduced in 1722 when Peter the Great ordered the Orthodox clergy to keep the registers for the Orthodox population. Over the next century, the government expanded parish registration to other religions: Lutherans in 1764, Catholics in 1826, Muslims in 1832, and Jews in 1835. In 1865, the government started to collect parish data from religious officials, who filled in standardized statistical forms. The new rules of data reporting allowed for the annual publication of statistical volumes *Dvizhenie naseleniya v Evropeiskoi Rossii* (Population movement in European Russia) starting from 1867. We use these volumes as our main source.

Parish registration of births and deaths could introduce a downward bias into the official data. Clergymen recorded not vital events per se, but religious ceremonies associated with vital events – for example, infant baptism and not births. Thus, infants who died before being baptized often remained unregistered (Novoselskiy, 1916). To the extent that registration practices varied across religious groups, infant mortality rates might suffer from differential bias. To avoid comparison across religious groups, we focus on the Orthodox population, comprised mostly of Russians, Ukrainians, and Belarusians. According to Semyonova Tian-Shanskaia (1993), the Orthodox population baptized their infants in the first days of life believing that those who died without baptism could not enter heaven.[2] There is no evidence that registration practices differed across ethnic groups within the Orthodox denomination.[3]

Throughout the paper, we calculate our main outcome variable, the infant mortality rate, as the number of deaths of children under one year of age per 1,000 live births in the same year. We estimate child mortality as the number of deaths in an age group per 1,000 children who have survived to that age.

An ideal data set for the study of infant mortality would comprise individual data on ethnicity, feeding practices, disease incidence, age of death, and a set of household-level controls. Since such data do not exist, we compile three cross-sectional data sets: i) districts (*uezd*) of European Russia; ii) townships (*volost'*) of Voronezh province and iii) townships of Saratov province. District-level data include infant mortality rates, child mortality rates, ethnic structure, and measures of economic development. Township-level data on Voronezh include mortality from infectious diseases, ethnic structure, and measures of economic development. Township-level data on Saratov include infant mortality rates, child mortality rates, ethnic structure, and measures of economic development. At the township level, mortality and disease incidence are measured among the Orthodox population exclusively. We supplement statistical data with a review of contemporaneous individual-level medical studies conducted by rural doctors in Russian and Ukrainian villages in the late 19^{th} – early 20^{th} centuries.

Micro-level medical studies. Contemporaneous medical studies are the only source of statistical information on infant care practices at the household level. We collected eight studies from Moscow and St. Petersburg historical libraries conducted by rural doctors in different provinces of European Russia in the late 19^{th} – early 20^{th} centuries

[2]Using individual-level data from a parish in Moscow province in 1815-1918, Avdeev et al. (2008) document that 96% of Orthodox infants were baptized within three days after birth. Early baptism was a widespread practice across Europe in the 18^{th} and early 19^{th} centuries (Minello et al., 2017).

[3]Private e-mail exchange with Boris Mironov, the leading social historian of Imperial Russia. See also Mironov (1999), Chapter 3.

Figure 1: Geography of micro-level and township-level evidence

Notes: Dots depict the locations of micro-level medical studies conducted by rural doctors in the late 19th – early 20th centuries. Blue dots are the Russian villages; yellow dots are the Ukrainian villages. The colored polygons show provinces covered in the township-level analysis. The orange polygon is Voronezh province; the green polygon is Saratov province.

– five studies of the Russian peasants and three studies of the Ukrainian peasants. The studies document feeding practices, disease incidence, and mortality in different age groups. The number of observed households varies from less than a hundred to several thousand; the length of observation – from several months to ten years (see Table C1 in the Online Appendix). The geography ranges from Perm province in the north-east to Kherson province in the south-west. Figure 1 shows the location of each study.

Township-level data. We collect data on two predominantly Russian provinces with notable Ukrainian minorities – Voronezh and Saratov. For both provinces, we digitize data on mortality, ethnic composition, development, and geography. For Voronezh province, our outcome variables measure mortality from infectious diseases – such as child and adult diarrhea – per 1,000 population in 1898, digitized from Tezyakov (1900). The sample comprises 218 townships. For Saratov province, our outcomes are infant and child mortality rates among the Orthodox population in 1899-1901, digitized from Tezyakov (1904). The sample includes 247 townships. For both provinces, we digitize township-level maps and calculate latitude and longitude of a township centroid, terrain ruggedness, and wheat suitability using GIS software. Figure 1 shows the location of the provinces. Panels A and B in Table 1 present summary statistics of the township-level data for Voronezh and Saratov respectively.

Table 1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Panel A: *Townships of Voronezh province*					
Child diarrhea, mortality	3.0	2.5	0.0	14.0	218
Adult diarrhea, mortality	0.4	1.1	0.0	7.0	218
Scarlet fever, mortality	1.1	1.4	0.0	8.9	218
Diphtheria, mortality	2.9	2.8	0.0	14.2	218
Smallpox, mortality	1.3	2.3	0.0	15.1	218
Whooping cough, mortality	1.2	1.6	0.0	14.9	218
Ukrainians, %	39.8	45.6	0.0	100.0	218
Population density, per sq. km	41.6	18.1	6.1	172.6	218
Literacy, %	7.2	3.1	1.1	19.1	218
Animals, per household	5.2	2.7	1.2	20.9	218
Panel B: *Townships of Saratov province*					
Infant mortality, average 1899-1901	287.5	57.5	69.3	473.0	247
Child mortality (1-2 year olds), 1899-1901	109.3	40.6	34.5	276.1	247
Child mortality (2-5 year olds), 1899-1901	112.4	58.1	32.0	376.0	247
Ukrainians, %	6.3	20.8	0.0	99.9	247
Population density, per sq. km	34.4	21.7	5.6	164.2	247
Literacy, %	6.0	2.6	0.4	16.3	247
Animals, per household	8.8	2.7	2.3	20.9	247
Panel C: *Districts of European Russia*					
Infant mortality, average 1900-1903	260.6	75.1	110.1	522.5	502
Child mortality (1-2 year olds), 1900-1903	92.9	26.7	20.8	199.3	502
Child mortality (2-5 year olds), 1900-1903	101.4	24.9	31.1	198.9	502
Russians, %	56.6	41.8	0.2	100	502
Ukrainians, %	17.3	31.9	0	98.1	502
Belarusians, %	6.6	21.3	0	90	502
Urbanization, %	10.2	12.7	0	96	502
Literacy, %	23.4	14.3	7.1	82.7	502
Doctors, per 1,000	4.4	2.9	0.4	35.9	502
Crude birth rate, average 1900-1903	51.9	9.6	16.9	74.0	502
Population density, per sq. km	37.7	40.3	0.6	667.9	502
Distance to Moscow, km	641	323.7	13.4	1609.4	502
Private serfs in 1858, %	37.8	25.2	0	85.2	502

Notes: Summary statistics for three data sets. District data set covers 502 districts (*uezd*) in 50 European provinces. Data sets on Voronezh province covers 218 townships (*volost'*), and data set on Saratov province covers 247 townships (*volost'*).

District-level data. Our district-level sample covers 502 districts in 50 provinces of European Russia. We digitize data on births and child deaths over 1900-1903. We focus on this period to exclude the potential effect of epidemic diseases, local famines, or peasant revolts during the 1905 Revolution. We calculate the outcomes separately for each year and then average over four years. For data sources, see Table D1 in the Online Appendix.

We supplement mortality data with ethnic composition and various controls. We focus on differences within the largest denomination in the Russian Empire, the Orthodox. Thus, we employ data on the percentages of the Russian, Ukrainian, and Belaru-

sian population defined by the native language from the first Imperial Census of 1897 (Troinitskiy, 1904). To control for development, we collect data on urbanization, literacy, and the number of rural doctors per 1,000 population from the same source. To control for the legacy of serfdom, we use the data on the share of private serfs before the emancipation from Buggle and Nafziger (2019). Panel C in Table 1 presents summary statistics of the main variables from the cross-section of districts.

3 Descriptive analysis

The Russian Empire had the highest infant mortality rate among European countries – approximately 250 deaths per 1,000 births in 1900. For comparison, the infant mortality rate was 230 in Germany, 174 in Italy, 160 in France, and 154 in England and Wales in 1900 (Mitchell, 2007). However, the aggregate infant mortality rate in Russia hides substantial variation. Map 2 shows the spatial distribution of infant mortality in the provinces of European Russia averaged over 1900-1903. Northern and eastern provinces experienced much higher rates than western and southern provinces. For example, the infant mortality rate was 379 in Perm province in north-eastern Russia and only 184 in the Ukrainian province of Kherson.[4]

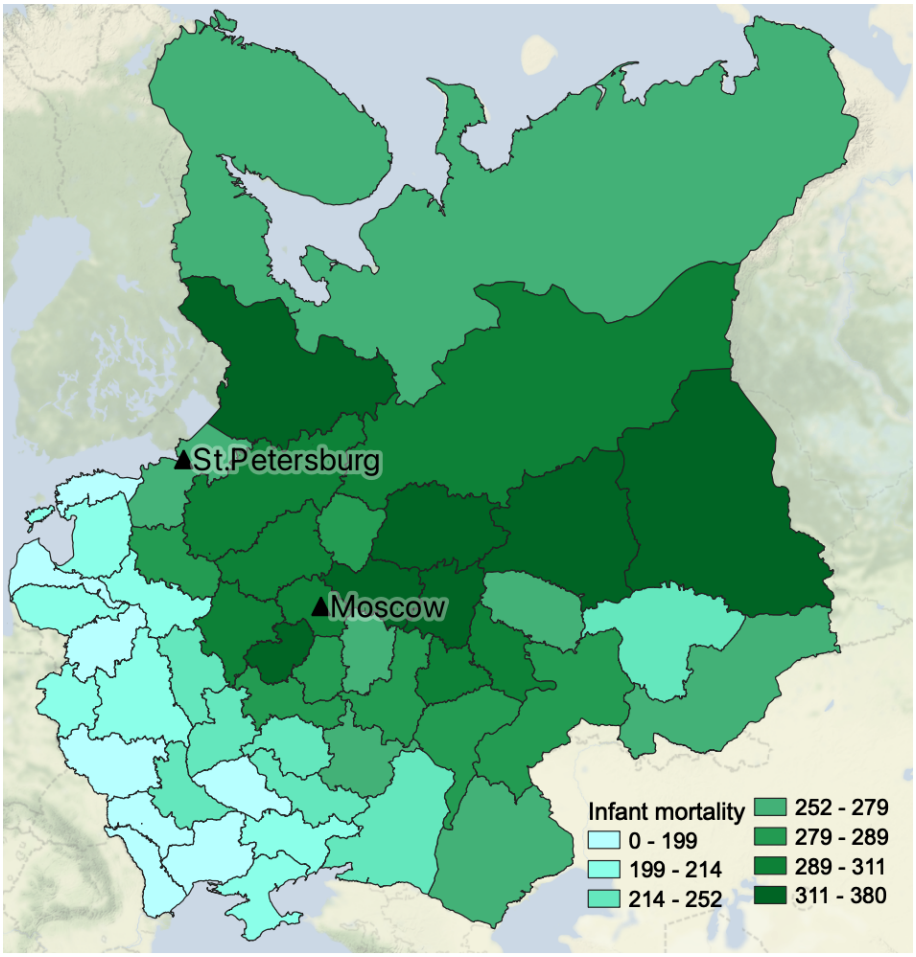

Figure 2: Infant mortality across provinces, 1900-1903

Notes: Infant deaths per 1,000 live births. The map is colored using the quantile scale.

[4]The spatial distribution of infant mortality persisted in time. The correlation coefficient between infant mortality averaged over 1868-1871 and infant mortality averaged over 1900-1903 across 50 provinces of European Russia is 0.93 (Figure A1 in the Online Appendix).

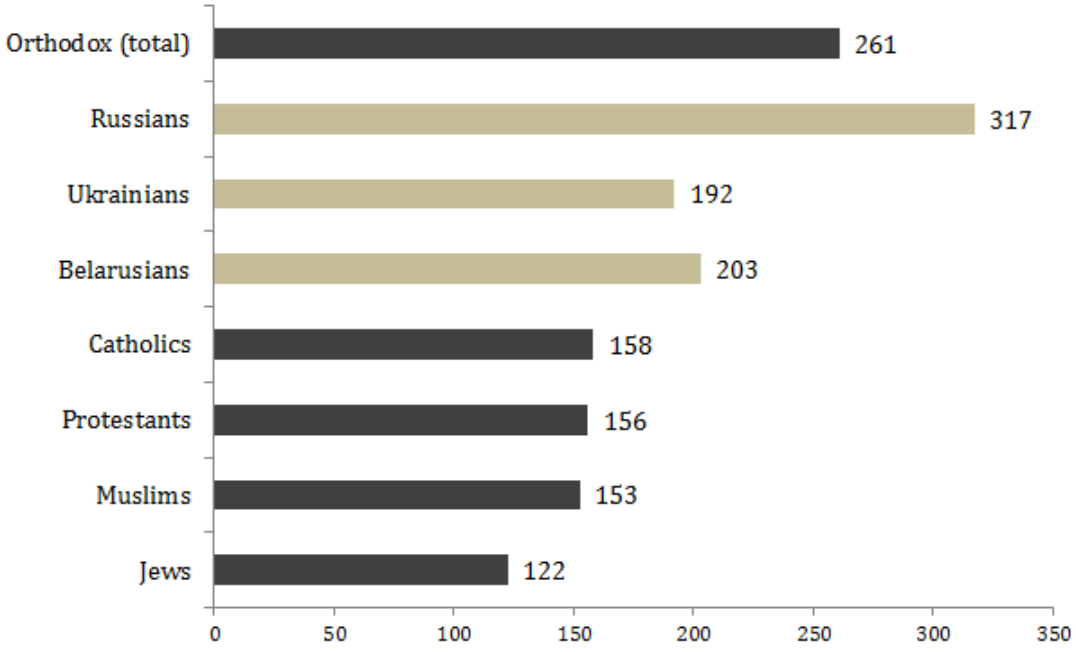

Figure 3: Infant mortality across religious and ethnic groups, 1900-1903

Notes: Infant deaths per 1,000 live births. Religious-specific rates (dark bars) are the number of infant deaths per 1,000 live births within each group. Ethnic-specific rates (light bars) are the average infant mortality rates in predominantly Russian (n=232), Ukrainian (n=59) and Belarusian (n=23) districts (more than 80% of the respective ethnic group).

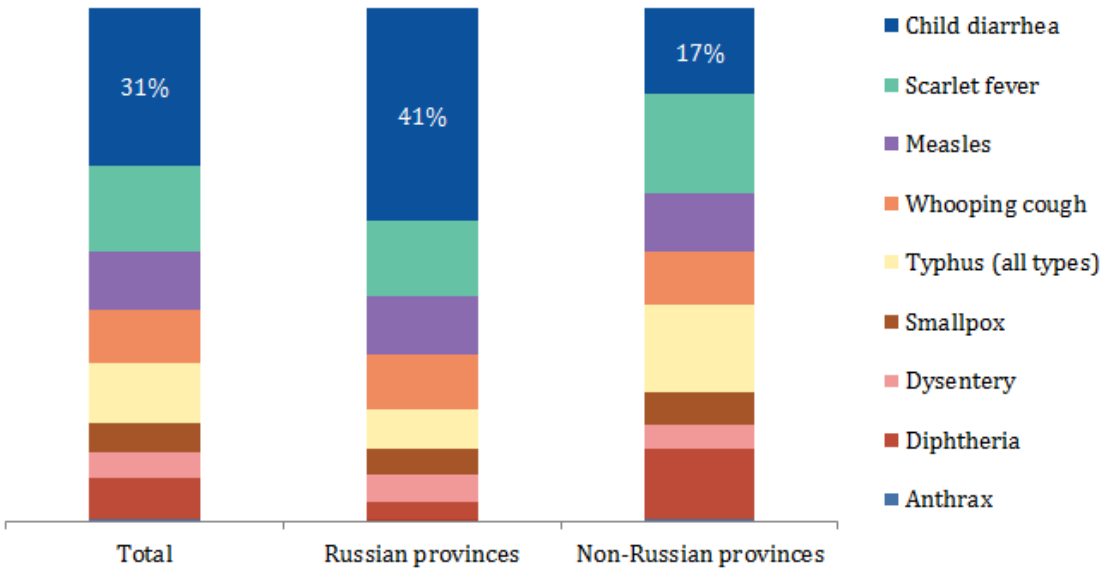

Figure 4: Death causes from infectious diseases, average over 1903, 1906, and 1907

Notes: Deaths per 1,000 population. Data on 50 provinces of European Russia. Russian provinces are 25 provinces with the share of Russians above the median of 67%. Non-Russian provinces are 25 provinces with the share of Russians below the median.

Another salient dimension of infant mortality variation was religion (Novoselskiy, 1916). Figure 3 depicts infant mortality rates for five major religious groups and three ethnic groups within the Orthodox denomination in 1900-1903. Across the religious groups, the highest rate was among Orthodox Christians, followed by Catholics, Protestants, and Muslims with approximately the same infant mortality rate.[5] Jews had the lowest rate.[6] High rates of Orthodox infant mortality were driven mostly by ethnic Russians who had the highest rate across all ethnic and religious groups.

Figure 4 shows the distribution of death causes from infectious diseases in 50 provinces of European Russia averaged over 1903, 1906, and 1907. The most frequent cause of death was child diarrhea comprising 31% of recorded pathogen-induced deaths. However, the high frequency of child diarrhea was driven mainly by provinces with predominantly Russian population, where it amounted to 41% of deaths. In contrast, in non-Russian provinces, child diarrhea accounted only for 17%, becoming the second most frequent cause of death after scarlet fever.

The descriptive evidence suggests that high infant mortality in the Russian Empire was largely an ethnic-Russian phenomenon. It appears there must have been something unique about Russian households that affected infants and caused higher death rates from child diarrhea.

4 Micro-level evidence

This section reviews individual-level medical studies conducted by rural doctors in the late 19th – early 20th centuries. The studies suggest a link between ethnic-specific infant care practices, gastrointestinal diseases, and infant mortality.[7]

Smorodintsev (1895) collected detailed data on 1,809 ethnic Russian peasant families in Perm, Ufa, and Orenburg provinces over several years. During the observation period, 43.5% of newly-born children died before age five. The most frequent cause of death for infants were diarrhea and other gastrointestinal diseases (52%). He also observes that 20% of mothers did not breastfeed their infants at all, 49% started to introduce solid food in the very first month of the infant's life, and 92% before five months of age.[8] The author concludes that early weaning and solid food supplements were the main cause of gastrointestinal diseases and diarrhea-induced deaths because an infant's digestive system is not fully developed until at least six months of age. This finding is consistent with contemporary medical studies showing that breastfeeding is crucial for the healthy development of the infant's digestive system (Abrahamse et al., 2012).

Chebotarev (1901) observed 59 peasant Russian families in Samara province for several years after their weddings. Among 261 newly born children, 42% died before age five. The main cause of death for infants was gastrointestinal diseases (74.6%). Only 18.7%

[5]Contemporaneous evidence suggests that Muslim advantage in infant survival was unlikely induced by misreporting. Doctor Ershov (1888) compared parish-level records from several villages in Kazan province with regional censuses and household lists over 27 years. He concluded that the mortality levels of Muslim children "are not a result of shortcomings or omissions in the records" (p. 32).

[6]The lowest infant mortality rate among Jews is consistent with the study by Botticini et al. (2019). They show that low infant and child mortality among the Jewish population in Eastern Europe resulted from superior child care practices, including extended breastfeeding.

[7]Table C1 in the Online Appendix summarizes the findings presented in this section along with additional studies omitted from the section for the sake of brevity.

[8]See extract from the study on Photo B1 in the Online Appendix.

of infants were breastfed without any supplements, whereas 77.9% were fed with solid supplements – 31.3% of them in the first month of life, and 83.3% before four months of age. When asked by the doctor for the reasons behind this practice, most mothers referred to "customs", "traditions" and the "wisdom of the elderly", and all of them "were surprised that such a question could even be raised."[9]

Shingarev (1907) studied 162 households in two Russian villages in Voronezh province. The main cause of death for infants was gastrointestinal diseases (70%), while for children of age 1-2 and 2-4 it was other infectious diseases (55% and 90% respectively). Out of 93 mothers, 91 introduced supplementary food to infants in the first days of their lives. The supplements consisted of bread and porridge (43% of mothers), rye bread (16%), and cow milk (16%). The infant death rate was the highest among those who were fed with rye bread (46%) and lowest among those who were fed with cow milk (27%).[10]

A novel study by Kudryavtsev (1900) conducted in Simbirsk province examines the effect of policy intervention on infant mortality. In the summer of 1899, the local *zemstvo*, an institution of local self-government, introduced day nurseries in 46 villages. Nurses took care of children of various ages including infants when mothers were working in the fields. In nurseries, infants were fed with pasteurised cow milk, which is almost as good as breast milk for the infant's digestive system. Before the intervention, there was almost no difference between the two groups of villages. The comparison of treated villages with neighbouring villages without nurseries revealed a staggering difference in child mortality rates. The infant mortality rate was only 114 in villages with nurseries and 429 in villages without nurseries.[11] The author suggests that unhealthy feeding practices of Russian mothers, especially during summer field works, contributed to high infant mortality.

The studies of the Ukrainian peasants reveal contrasting patterns of feeding practices and infant mortality. Shverin (1898) shows that infant deaths from gastrointestinal diseases and diarrhea were considerably less prevalent in Ukrainian villages than in Russian villages described above. Out of 8,747 newborns in Kherson province, only 1,542 died in the first year of life, which implies an infant mortality rate at 176 per thousand, much lower than in a typical Russian village (300-350 infant deaths per thousand). Out of 1,542 infant deaths, only 195 (12.5%) were related to diarrhea.

Similarly, Grigoriev (1925) compiled a sample of 10,671 ethnic Ukrainian peasant households in Ekaterinoslav province (representative at the district level) and showed that out of 1,213 infants 72% were fed exclusively with breast milk, and only for 28% some supplements were introduced before they reached six months of age. In Chernigov province, Avdeev (1925) compiled a sample of 38,934 Ukrainian peasants and found that infant mortality was only 161 per thousand newborns. More than half of infants (56.5%) were fed exclusively with breast milk before they reached six months of age. In districts with the lowest infant mortality, this number was as high as 73-75%. The same districts stood out in the lowest level of diarrhea-induced deaths.[12]

Our review suggests that contemporaneous demographers and doctors were well aware of high infant mortality among the Russian population. They saw the reasons in unhygienic infant care practices, such as early weaning and early introduction of solid food

[9] See extract from the study on Photo B2 in the Online Appendix.
[10] See extract from the study on Photo B3 in the Online Appendix.
[11] See extract from the study on Photo B4 in the Online Appendix.
[12] See extract from the study on Photo B5 in the Online Appendix.

to infants (Gundobin, 1906).[13] Ethnographic evidence suggests that these practices originated from the belief widespread among peasant women that an infant could not survive on breast milk alone and his diet should be supplemented with bread, porridge, and cow milk as early as possible (Popov, 1903). Feeding practices leading to severe gastrointestinal diseases underlie the observed cross-ethnic differentials in infant mortality.

5 Township-level evidence

In this section, we explore variation in causes of death and child mortality within two Russian provinces with notable Ukrainian minorities – Voronezh and Saratov. Ukrainians constituted 36.2% of the total population in Voronezh province and 6.2% in Saratov province according to the 1897 Census. The comparison of Russian and Ukrainian peasant communities residing in the same administrative areas minimizes the variation in the geographic and institutional environment. The focus on the Orthodox population of the same province helps to mitigate the concerns about differential bias in infant mortality registration across provinces and religious groups.

For both provinces, we estimate the following equation:

$$y_i = \alpha_0 + \alpha_1 Ukr_i + \alpha_2 \boldsymbol{D} + \alpha_3 \boldsymbol{G} + \epsilon_i \tag{1}$$

For Voronezh province, y_i denotes mortality from infectious diseases calculated as the number of deaths per 1,000 population in 1898. We focus on mortality from child diarrhea and juxtapose it to mortality from adult diarrhea and childhood infectious diseases – scarlet fever, diphtheria, smallpox, and whooping cough. For Saratov province, y_i denotes infant mortality and child mortality for age groups 1-2 and 2-5 averaged over 1899-1901.

Ukr_i is the share of Ukrainians in a township. The vector of development controls $\boldsymbol{D}$ includes logarithm of population density, literacy, livestock per household, and railroad dummy. The vector of geographic controls $\boldsymbol{G}$ includes latitude, longitude, river dummy, wheat suitability, and terrain ruggedness. Standard errors are adjusted to spatial correlation within 50 km following Conley (1999).

Table 2 reports the results for Voronezh province. The share of Ukrainians is significantly and negatively associated with mortality from child diarrhea but is insignificant for adult diarrhea. This result documents cross-ethnic differentials in the incidence of diarrhea-induced mortality among children but not adults. The share of Ukrainians is not associated with mortality from other infectious diseases except for smallpox. Notably, development indicators are uncorrelated with mortality from child diarrhea. Table 3 reports the results for Saratov province. The share of Ukrainians is significantly and negatively associated with infant mortality and insignificant for the mortality of older cohorts of children. Lower infant but not child mortality among Ukrainians suggests the importance of ethnic-specific infant care practices.

We find that Russians and Ukrainians did not differ in child mortality and mortality from adult diarrhea. However, Russians had significantly higher infant mortality and

[13] Doctor Gundobin founded a charitable organization to address the problem of high child mortality in Russia. He advocated for the organization of child medical care centers and sanitary education among peasant women. Interestingly, Gundobin's study was published in the same year as Newman's famous book that launched a massive European educational campaign for the benefits of breastfeeding (Newman, 1906).

Table 2: Mortality from infectious diseases in Voronezh province

	Child diarrhea (1)	Adult diarrhea (2)	Scarlet fever (3)	Diph-theria (4)	Small-pox (5)	Whooping cough (6)
Ukrainians, %	-0.238**	-0.131	0.119	0.114	-0.212**	-0.057
	(0.100)	(0.136)	(0.088)	(0.114)	(0.096)	(0.084)
Population density, log	-0.033	-0.040	0.001	-0.011	0.014	-0.171**
	(0.057)	(0.072)	(0.054)	(0.068)	(0.060)	(0.071)
Literacy, %	0.080	0.008	-0.069	-0.150*	0.153*	0.107*
	(0.055)	(0.065)	(0.070)	(0.090)	(0.083)	(0.056)
Animals, per household	0.123	0.035	0.072	0.001	0.306***	-0.057
	(0.100)	(0.052)	(0.067)	(0.059)	(0.103)	(0.043)
Controls	✓	✓	✓	✓	✓	✓
Mean of dependent variable	3.2	1.2	2.2	6.5	2.8	2.7
SD of dependent variable	2.9	2.8	3.5	6.3	5.3	3.7
R^2	0.248	0.100	0.158	0.124	0.217	0.053
Observations	218	218	218	218	218	218

Notes: The unit of analysis is township (*volost'*) of Voronezh province. The dependent variables are mortality rates from infectious diseases per 1,000 population in 1898. Controls include railroad dummy, river dummy, terrain ruggedness, wheat suitability, and latitude and longitude of a township centroid. Standardized beta coefficients are reported. Standard errors, adjusted to spatial correlation within 50 km, are in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: Infant and child mortality in Saratov province

	Infant mortality, average 1899-1901 (1)	Child mortality, 1-2 years (2)	Child mortality, 2-5 years (3)
Ukrainians, %	-0.132***	0.003	0.054
	(0.047)	(0.043)	(0.043)
Population density, log	-0.198***	0.046	-0.057
	(0.074)	(0.071)	(0.071)
Literacy, %	0.006	-0.070	0.051
	(0.064)	(0.075)	(0.058)
Animals, per household	0.064	0.031	0.083
	(0.069)	(0.070)	(0.059)
Controls	✓	✓	✓
Mean of dependent variable	287.5	109.7	113.5
SD of dependent variable	57.6	39.9	58.6
R^2	0.169	0.168	0.290
Observations	247	247	247

Notes: The unit of analysis is township (*volost'*) of Saratov province. The dependent variables are average infant and child mortality rates in 1899-1901. Controls include railroad dummy, river dummy, terrain ruggedness, wheat suitability, latitude and longitude of a township centroid, and population composition controls – the shares of Muslims, Old Believers, Jews, and Germans. Standardized beta coefficients are reported. Standard errors, adjusted to spatial correlation within 50 km, are in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

mortality from child diarrhea than Ukrainians. This pattern might be explained by ethnic differences in infant care practices, which is consistent with contemporaneous medical studies reviewed in Section 4. Unhealthier infant care practices among the Russian population increased the incidence of gastrointestinal diseases among infants, which contributed to higher infant mortality rates.

6 District-level evidence

In this section, we explore the relative importance of economic, geographic, and cultural correlates of infant and child mortality in a cross-section of 502 districts in 50 provinces of European Russia. We estimate the following model:

$$y_i = \beta_0 + \beta_1 Rus_i + \beta_2 Ukr_i + \beta_3 Bel_i + \beta_4 \mathbf{X} + \mu_j + \varepsilon_i \quad (2)$$

where y_i is infant mortality and child mortality for ages 1-2 and 2-5 in a district, averaged over four years from 1900 to 1903. Rus_i, Ukr_i, Bel_i are the shares of Russians, Ukrainians, and Belarusians respectively. $\mathbf{X}$ is the vector of control variables that includes urbanization, literacy, the number of doctors per 1,000 population, crude birth rate, latitude and longitude of a district centroid, a logarithm of population density, distance to Moscow, and the share of private serfs in 1858 on the eve of the abolition of serfdom; μ_j represents province fixed effects. Standard errors are adjusted to spatial correlation within 300 km, following Conley (1999).

Table 4 reports the results. In Column (1), we regress infant mortality on the shares of Russians, Ukrainians, and Belarusians. All coefficients are positive because the Orthodox had the highest infant mortality rates across all religious groups (see Figure 3). The Orthodox population explains about 63% of the variation in infant mortality. However, the coefficient is statistically significant only on the share of Russians. In Column (2), we control for urbanization, literacy, and the number of doctors per 1,000 population. Altogether, these development covariates only add about 2% to the explained variation in infant mortality. The inclusion of the remaining controls in Column (3) and province fixed effects in Column (4) does not affect our main result. The coefficient on Russians remains positive and highly significant both statistically and economically.[14] A one standard deviation increase in the share of Russians is associated with a 0.46 standard deviations increase in infant mortality. In terms of real measures, a province with a 10 percentage points larger Russian population was likely to have eight additional infant deaths per 1,000 births.[15]

If high infant mortality among Russians was a result of lower income or adverse geographic conditions, we should have observed higher mortality throughout childhood. In Columns (5) and (6), we estimate the baseline regression with two alternative dependent variables – mortality of 1-2 and 2-5 year-old children. We find that the share of Russians is insignificant for the mortality of both age groups. This result shows that ethnic Russians were unique in infant mortality, but not in child mortality. As the health of a child over one year of age is less susceptible to feeding practices, the effect of Russians points towards the importance of ethnic-specific infant care.

[14]The coefficients on Ukrainians and Belarusians also become significant. However, the magnitude of the coefficients is about three times smaller than the coefficient on Russians. Once we control for province fixed effects, Jews become the baseline group for Ukrainians and Belarusians, because they were the third largest ethnic group in the Ukrainian and Belarusian provinces. Thus, the coefficients reflect relative infant mortality levels of the Orthodox groups in comparison to Jews.

[15]We estimate the same regressions separately for boys and girls and do not find any substantial difference in the magnitude of the coefficients.

Table 4: Correlates of infant and child mortality across districts of European Russia

	Infant mortality, average 1900-1903				Child mortality,	
					1-2	2-5
	(1)	(2)	(3)	(4)	(5)	(6)
Russians, %	0.820***	0.706***	0.525***	0.461***	0.050	-0.108
	(0.088)	(0.081)	(0.114)	(0.090)	(0.099)	(0.155)
Ukrainians, %	0.007	-0.101	0.046	0.146*	0.018	0.053
	(0.061)	(0.064)	(0.073)	(0.081)	(0.083)	(0.114)
Belarusians, %	0.054	-0.015	0.003	0.095**	0.025	0.035
	(0.047)	(0.047)	(0.049)	(0.043)	(0.059)	(0.077)
Urbanization, %		-0.007	0.052	0.110***	0.032	-0.029
		(0.026)	(0.036)	(0.029)	(0.044)	(0.053)
Literacy, %		-0.143***	-0.089*	-0.101	-0.037	-0.148
		(0.046)	(0.048)	(0.072)	(0.122)	(0.117)
Doctors, per 1,000		0.015	0.004	-0.083***	0.007	0.000
		(0.031)	(0.033)	(0.027)	(0.060)	(0.049)
Controls			✓	✓	✓	✓
Province fixed effects				✓	✓	✓
Mean of dependent variable	260.6	260.6	260.6	260.6	92.8	101.4
SD of dependent variable	75.1	75.1	75.1	75.1	26.7	24.8
R^2	0.634	0.647	0.749	0.867	0.752	0.594
N	502	502	502	502	502	502

Notes: The unit of analysis is district (*uezd*) of European Russia. The dependent variables are average mortality rates over 1900-1903. Infant mortality is the number of infant deaths per 1,000 live births. Child mortality is the number of deaths in an age group per 1,000 children who have survived to that age. Ethnic structure, urbanization, literacy, and the number of doctors come from the 1897 Census. Controls include crude birth rate, logarithm of population density, distance to Moscow, the share of serfs in 1859, latitude and longitude of a district centroid. Standardized beta coefficients are reported. Standard errors, adjusted to spatial correlation within 300 km, are in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

7 Conclusion

This paper studies the patterns of infant mortality in late imperial Russia. We find that ethnic Russians had the highest infant mortality rates across all ethnic and religious groups of the Empire. Infant mortality rates among other Orthodox ethnic groups – Ukrainians and Belarusians – were much lower than among Russians. The evidence suggests that ethnic differentials in infant mortality largely resulted from ethnic-specific infant care practices, such as the timing of weaning and the introduction of solid food.

Our results demonstrate that Russians exhibited a higher rate of infant, but not child mortality across districts of European Russia even after we account for development and environmental factors. To resolve this puzzle, we zoom in on two Russian provinces with notable Ukrainian minorities – Voronezh and Saratov. We confirm that Ukrainians had lower infant but not child mortality. In addition, we discover that Ukrainians had lower mortality from infant but not adult diarrhea. The review of contemporaneous individual-level medical studies reveals that gastrointestinal diseases prevailed among infant causes of death in the Russian but not Ukrainian villages. This differ-

ence resulted from ethnic-specific feeding practices documented by rural doctors. For example, Russian mothers weaned their infants earlier than Ukrainian mothers and started to introduce solid food from the first weeks of infants' lives. Those practices disproportionately affected Russian infants, but not older cohorts of children.

Unpacking the "black box" of traditional health care practices is the next step in studying the causes of infant mortality in Russia and worldwide. What explains the variation in infant care practices across groups? Do best practices spread from high to low performing groups? What are the determinants of this diffusion? These questions could be addressed in the future.

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Online Appendix

A Figures

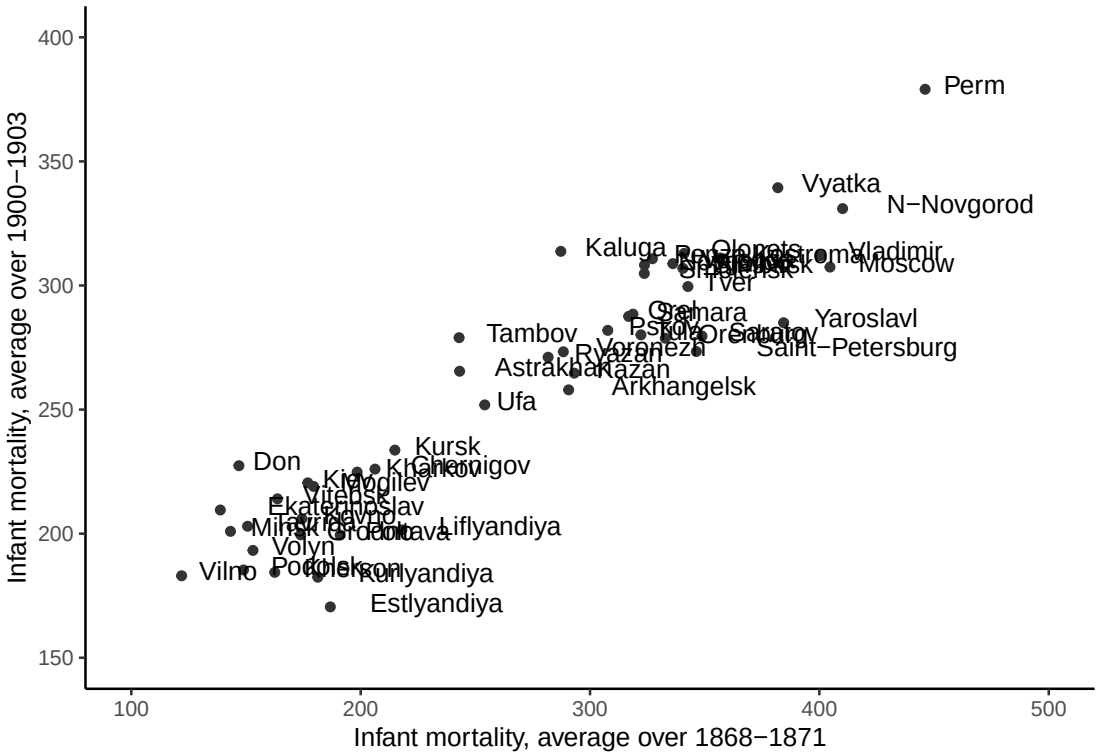
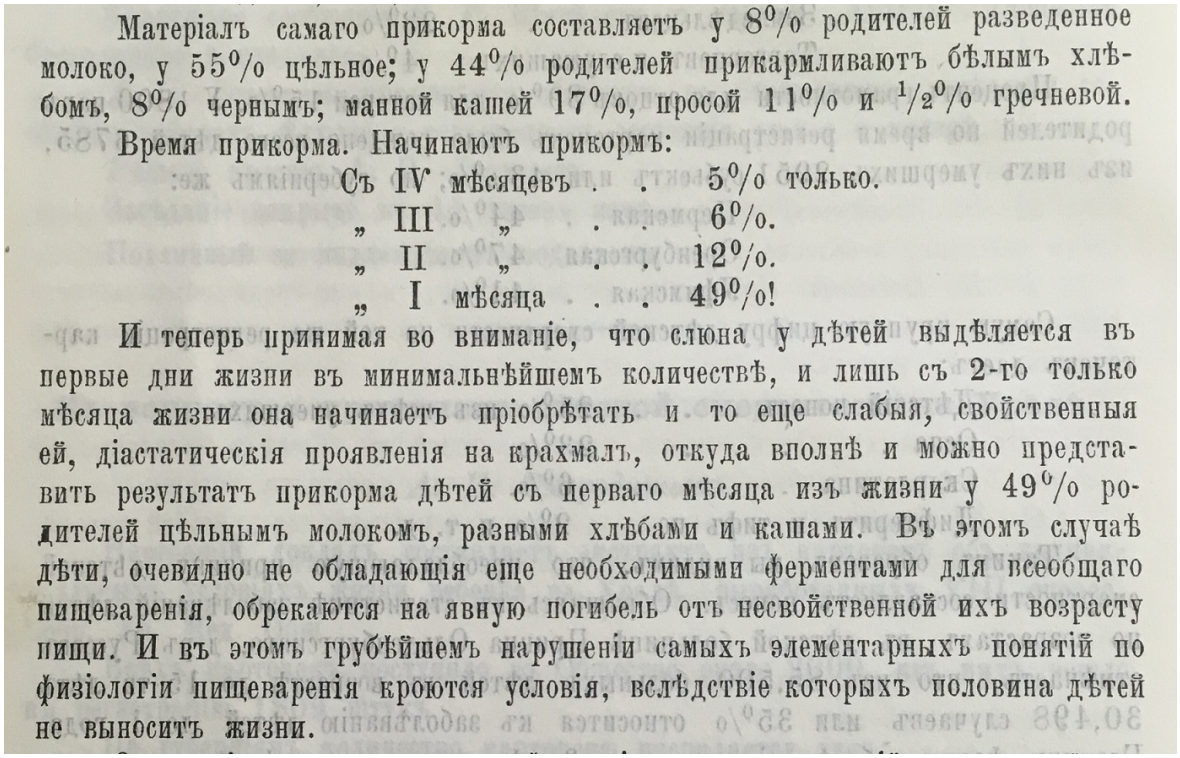


Figure A1: Spatial persistence of infant mortality, 1868-1903

B Extracts from medical studies



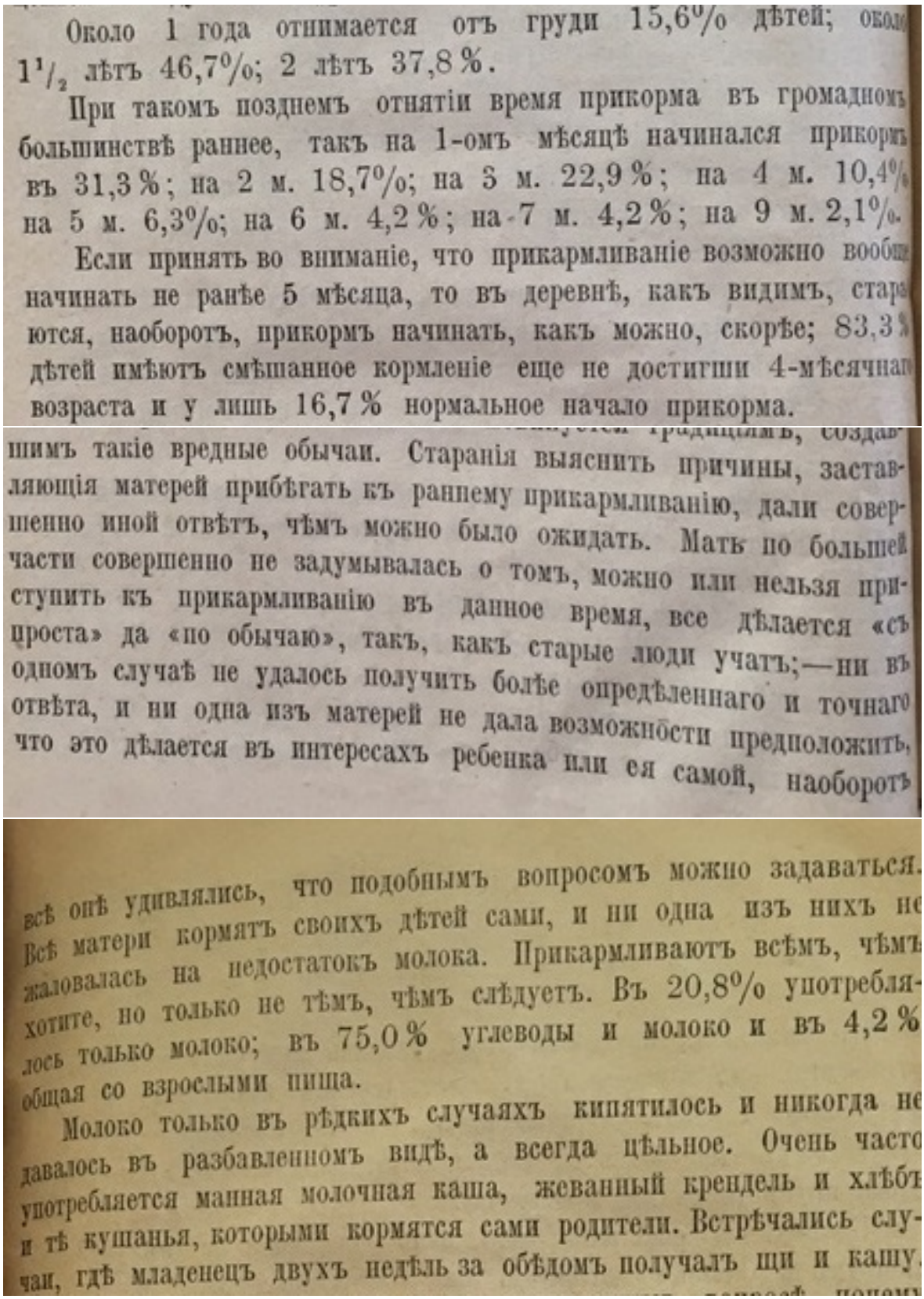
Матеріалъ самаго прикорма составляетъ у 8% родителей разведенное молоко, у 55% цѣльное; у 44% родителей прикармливаютъ бѣлымъ хлѣбомъ, 8% чернымъ; манной кашей 17%, просой 11% и ½% гречневой.

Время прикорма. Начинаютъ прикормъ:

Съ IV мѣсяцевъ . . 5% только.
„ III „ . . 6%.
„ II „ . . 12%.
„ I мѣсяца . . 49%!

И теперь принимая во вниманіе, что слюна у дѣтей выдѣляется въ первые дни жизни въ минимальнѣйшемъ количествѣ, и лишь съ 2-го только мѣсяца жизни она начинаетъ пріобрѣтать и то еще слабыя, свойственныя ей, діастатическія проявленія на крахмалъ, откуда вполнѣ и можно представить результатъ прикорма дѣтей съ перваго мѣсяца изъ жизни у 49% родителей цѣльнымъ молокомъ, разными хлѣбами и кашами. Въ этомъ случаѣ дѣти, очевидно не обладающія еще необходимыми ферментами для всеобщаго пищеваренія, обрекаются на явную погибель отъ несвойственной ихъ возрасту пищи. И въ этомъ грубѣйшемъ нарушеніи самыхъ элементарныхъ понятій по физіологіи пищеваренія кроются условія, вслѣдствіе которыхъ половина дѣтей не выноситъ жизни.

Photo B1: Extract from the medical study of Smorodintsev (1895)



Около 1 года отнимается отъ груди 15,6% дѣтей; около $1^1/_2$ лѣтъ 46,7%; 2 лѣтъ 37,8%.

При такомъ позднемъ отнятіи время прикорма въ громадномъ большинствѣ раннее, такъ на 1-омъ мѣсяцѣ начинался прикормъ въ 31,3%; на 2 м. 18,7%; на 3 м. 22,9%; на 4 м. 10,4%; на 5 м. 6,3%; на 6 м. 4,2%; на 7 м. 4,2%; на 9 м. 2,1%.

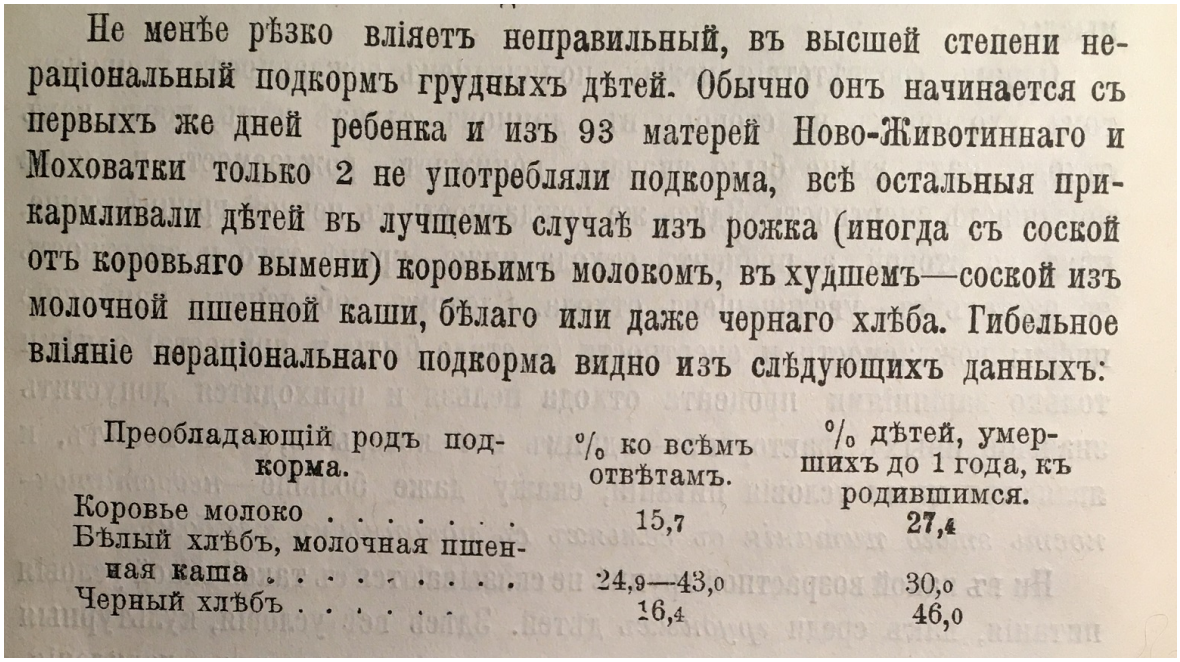
Если принять во вниманіе, что прикармливаніе возможно вообще начинать не ранѣе 5 мѣсяца, то въ деревнѣ, какъ видимъ, стараются, наоборотъ, прикормъ начинать, какъ можно, скорѣе; 83,3% дѣтей имѣютъ смѣшанное кормленіе еще не достигши 4-мѣсячнаго возраста и у лишь 16,7% нормальное начало прикорма.

шимъ такіе вредные обычаи. Старанія выяснить причины, заставляющія матерей прибѣгать къ раннему прикармливанію, дали совершенно иной отвѣтъ, чѣмъ можно было ожидать. Мать по большей части совершенно не задумывалась о томъ, можно или нельзя приступить къ прикармливанію въ данное время, все дѣлается «съ проста» да «по обычаю», такъ, какъ старые люди учатъ;—ни въ одномъ случаѣ не удалось получить болѣе опредѣленнаго и точнаго отвѣта, и ни одна изъ матерей не дала возможности предположить, что это дѣлается въ интересахъ ребенка или ея самой, наоборотъ

всѣ онѣ удивлялись, что подобнымъ вопросомъ можно задаваться. Всѣ матери кормятъ своихъ дѣтей сами, и ни одна изъ нихъ не жаловалась на недостатокъ молока. Прикармливаютъ всѣмъ, чѣмъ хотите, но только не тѣмъ, чѣмъ слѣдуетъ. Въ 20,8% употреблялось только молоко; въ 75,0% углеводы и молоко и въ 4,2% общая со взрослыми пища.

Молоко только въ рѣдкихъ случаяхъ кипятилось и никогда не давалось въ разбавленномъ видѣ, а всегда цѣльное. Очень часто употребляется манная молочная каша, жеванный крендель и хлѣбъ и тѣ кушанья, которыми кормятся сами родители. Встрѣчались случаи, гдѣ младенецъ двухъ недѣль за обѣдомъ получалъ щи и кашу.

Photo B2: Extract from the medical study of Chebotarev (1901)



Не менѣе рѣзко вліяетъ неправильный, въ высшей степени нераціональный подкормъ грудныхъ дѣтей. Обычно онъ начинается съ первыхъ же дней ребенка и изъ 93 матерей Ново-Животиннаго и Моховатки только 2 не употребляли подкорма, всѣ остальныя прикармливали дѣтей въ лучшемъ случаѣ изъ рожка (иногда съ соской отъ коровьяго вымени) коровьимъ молокомъ, въ худшемъ—соской изъ молочной пшенной каши, бѣлаго или даже чернаго хлѣба. Гибельное вліяніе нераціональнаго подкорма видно изъ слѣдующихъ данныхъ:

Преобладающій родъ подкорма.	% ко всѣмъ отвѣтамъ.	% дѣтей, умершихъ до 1 года, къ родившимся.
Коровье молоко	15,7	27,4
Бѣлый хлѣбъ, молочная пшенная каша	24,9—43,0	30,0
Черный хлѣбъ	16,4	46,0

Photo B3: Extract from the medical study of Shingarev (1907)

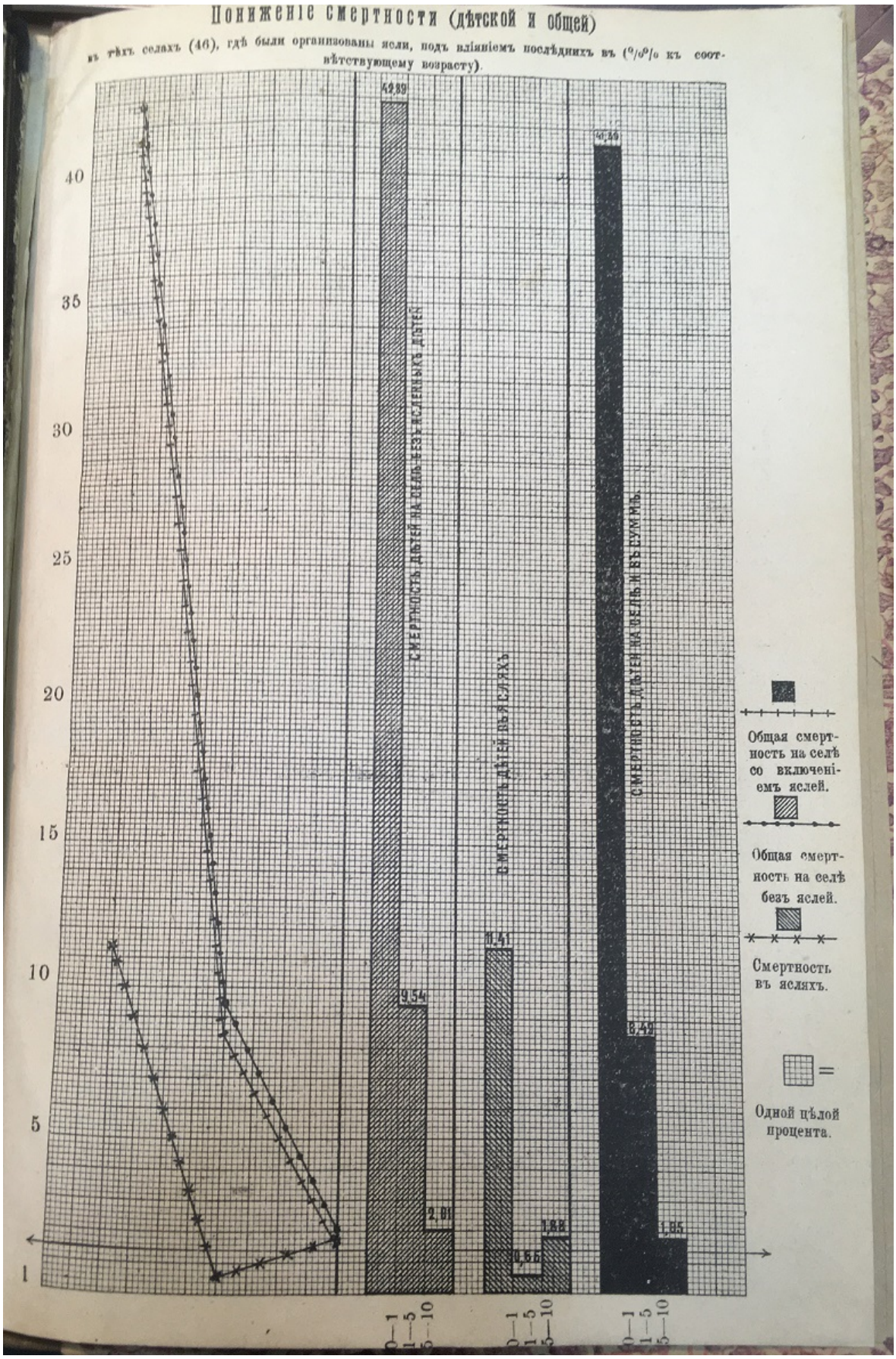


Photo B4: Extract from the medical study of Kudryavtsev (1900)

Из приведенной таблицы видно, что на 100 детей в возрасте до 6-ти месяцев приходилось искусственно и естественно вскормленных:

Таблица № 13.

ОКРУГА.	Вскармл. исключит. грудью.	Искусств. вскармливаемых.
Конотопский . . .	40,8	59,2
Нежинский	34,3	65,7
Н.-Северский . . .	73,5	26,5
Сновский	74,5	25,5
Черниговский . . .	60,7	39,3

В среднем по губернии из 100 детей в возрасте до 6-ти месяцев 54,8% находится на искусственном кормлении. Диаграмма № 6.

Довольно показательные данные выяснены обследованием в отношении детской смертности до 1-го года от поноса по отношению к обследованным живым детям в том же возрасте (сверстников умерших).

Таблица № 14.

На 100 душ обследованных детей до 1-го года приходится умерших в том же возрасте.

ОКРУГА.	Всего приходится умерших.	В том числе от поноса.	От прочих болезней.
Конотопский	20,5	16,8	3,7
Нежинский	15,7	7,5	8,2
Н.-Северский	9,1	3,1	6,0
Сновский	10,3	5,3	5,0
Черниговский	21,1	14,9	6,2

Таблица № 15.

На 100 душ обследованных до 1-го года детей приходилось:

ОКРУГА.	Болевших поносом.	Неболевших поносом.
Конотопский	42,7	57,3
Нежинский	43,5	56,5
Н.-Северский	31,4	68,6
Сновский	27,9	72.1
Черниговский	62,8	37,2

Диаграмма № 6-б.

Photo B5: Extract from the medical study of Avdeev (1925)

C Summaries of medical studies

Table C1: Summaries of micro-level medical studies

Study	Region and sample	Ethnic group	Mortality rate	Diseases	Practices
Smorodintsev (1895)	1,809 peasant families in Perm, Ufa and Orenburg provinces	Russians	Child mortality (0-5) 435	Diarrhea and other gastrointestinal diseases induced 52% of infant deaths	92% of families introduced supplementary food to infants before they reached five months of age, including 20% of mothers who did not breastfeed at all
Chebotarev (1901)	59 peasant Orthodox families in four villages in Samara province	Predominantly Russians	Child mortality (0-5) 402	Gastrointestinal diseases induced 74.6% of infant deaths	18.7% of infants were breastfed without any supplements; 77.9% of infants were fed with supplements, 83.3% of them were introduced to solid food before they reached four months of age
Zolotavin (1898)	3,508 residents of the Nozhovka village in Perm province for ten years, 1881-1890	Russians	Child mortality (0-5) 504; infant mortality 408	Diarrhea for infants and smallpox for children of 1-5 years old as the most frequent death causes (no numbers reported); the fluctuations in infant mortality follow the fluctuations in deaths from diarrhea	No data
Shingarev (1907)	162 households in two villages in Voronezh province	Russians	No data	Gastrointestinal diseases were the main death cause for infants (76% and 63% in two villages respectively); infectious diseases for children of age 1-2 and 2-4 (50% and 59%, and 86% and 94% respectively)	91 out of 93 mothers introduced supplementary food to their infants in the first days of their lives. The infant death rate was the highest among those who were fed with rye bread (46%) and lowest among those who were fed with cow milk (27%)

Kudryavtsev (1900)	46 villages treated with summer nurseries in Simbirsk province	Russians	Infant mortality 429 in villages without nurseries; 114 in villages with nurseries	No data	In nurseries, children were fed with pasteurized cow milk
Shverin (1898)	Kherson province	Ukrainians	Infant mortality 176	Diarrhea induced 12.5% of infant deaths; gastrointestinal diseases accounted for 34% of 8,258 observed infant disease incidents	No data
Grigoriev (1925)	10,671 peasant households in Ekaterinoslav province (sample representative at the district level)	Ukrainians	No data	No data	72% of infants were fed exclusively with mother's breast, for 28% some supplements were introduced before they reached six months of age
Avdeev (1925)	38,934 peasants in Chernigov province	Ukrainians	Infant mortality 161	No data	56.5% of infants were fed exclusively with mother's breast before they reached six months of age; in districts with lowest infant mortality this number was as high as 73-75%

D Data sources

Table D1: Data sources

Data	Description	Level	Source
District-level analysis			
Dependent variables			Central Statistical committee of the Ministry of Internal Affairs (1906a), Central Statistical committee of the Ministry of Internal Affairs (1906b), Central Statistical committee of the Ministry of Internal Affairs (1907), Central Statistical committee of the Ministry of Internal Affairs (1909)
Infant mortality	Deaths of infants under 1 year of age per 1,000 live births, averaged over 1900-1903	District	
Child mortality, 1-2 years	Deaths of children between 1 and 2 years of age per 1,000 children survived to 1 year, averaged over 1900-1903	District	
Child mortality, 2-5 years	Deaths of children between 2 and 5 years of age per 1,000 children survived to 2 years, averaged over 1900-1903	District	
Development covariates			
Urbanization, %	The share of population residing in towns in 1897	District	Data from the 1897 Imperial Census published in Troinitskiy (1904)
Literacy, %	The share of literate population in 1897	District	
Doctors, per 1,000	The number of medical personnel in rural areas, per 1,000 population in 1897	District	
Population density	Population in 1897 per sq. km	District	
Serfs in 1858, %	The number of private serfs in 1858 divided by total population in 1863	District	Buggle and Nafziger (2019)
Population structure			
Russians, %	Russian population in 1897 (defined by a native language)	District	Data from the 1897 Imperial Census published in Troinitskiy (1904)

Ukrainians, %	Ukrainian population in 1897 (defined by a native language)		
Belarusians, %	Belarusian population in 1897 (defined by a native language)		
Within-province analyses			
Voronezh province			
Mortality from infectious diseases	Deaths caused by infectious diseases (child diarrhea, adult diarrhea, scarlet fever, diphtheria, smallpox, whooping cough) per 1,000 population in 1898	Township	Tezyakov (1900)
Ukrainians, %	Estimated Ukrainian population in 1900; the share of township population residing in villages identified as Ukrainian plus 0.5 times the share of population residing in mixed Ukrainian-Russian villages	Township	Voronezh Provincial Zemstvo (1900)
Population density	Population in 1900 per sq. km	Township	Population data come from Voronezh Provincial Zemstvo (1900); area calculated using the map digitized from Central Statistical Committee (1892)
Literacy, %	The share of literate population in 1892	Township	Voronezh Provincial Zemstvo (1892)
Animals, per household %	The number of livestock per household in 1892		
Saratov province			
Infant mortality	Deaths of infants under 1 year of age per 1,000 live births, averaged over 1899-1901	Township	Tezyakov (1904)

Child mortality, 1-2 years	Deaths of children between 1 and 2 years per 1,000 children survived to 1 year, averaged over 1899-1901	Township	
Child mortality, 2-5 years	Deaths of children between 1 and 2 years per 1,000 children survived to 2 years, averaged over 1899-1901	Township	
Ukrainians, %	Estimated Ukrainian population in 1913; the share of township population residing in villages identified as Ukrainian plus 0.5 times the share of population residing in mixed Ukrainian-Russian villages	Township	Saratov Provincial Zemstvo (1914)
Population density	Population in 1897 per sq. km	Township	Data from the 1897 Imperial Census accessed at the Russian State Historical Archive (RGIA F. 1290. Op. 11. D. 2041-2075); area calculated using the map digitized from Tezyakov (1904)
Literacy, %	The share of population who completed any type of education in any language in 1888	Township	Saratov Provincial Zemstvo (1888)
Animals, per household	The number of livestock per household in 1888	Township	
Muslims, %	Muslim population in 1897	Township	The 1897 Imperial Census (RGIA F. 1290. Op. 11. D. 2041-2075)
Jews, %	Jewish population in 1897	Township	
Old Believers, %	Old Believers in 1897	Township	
Germans, %	German population in 1897; measured as a sum of Protestants and Catholics	Township	
Geogata			
Terrain ruggedness	Average terrain ruggedness	Township	Shaver et al. (2019)
Wheat suitability	Average wheat suitability	Township	FAO GAEZ

Other data			
Deaths caused by infectious diseases (child diarrhea, scarlet fever, measles, etc.)	Mortality rates from infectious diseases per 1000 population, average for 1903, 1906, and 1907	Province	Department of the Chief Medical Inspector of the Ministry of Internal Affairs (1905), Department of the Chief Medical Inspector of the Ministry of Internal Affairs (1908), Department of the Chief Medical Inspector of the Ministry of Internal Affairs (1909)

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