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 20th century. Using a variety of official statistical sources and qualitative evidence, this paper documents uniquely high infant mortality among ethnic Russians. In contrast, among other ethnic groups of the Empire infant mortality rates did not exceed those of the European countries by much. The evidence suggests that the explanation for the Russian infant mortality pattern was ethnic-specific infant care practices, such as the early introduction of solid food, which increased the incidence of lethal gastrointestinal diseases. Our findings highlight the importance of traditional infant feeding practices for mortality 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.[1] In contrast, the infant mortality rate was 154 in England and 160 in France (Mitchell, 2007). 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 practice, as documented by contemporaneous medical studies, was the timing of solid food introduction, although other unobserved ethnic-specific 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 503 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. Employing data at the different levels of spatial aggregation allows us to partially mitigate the ecological inference problem.[2] 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. The studies report that up to 90% of Russian infants and up to 40% of Ukrainian infants were introduced to solid supplements 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 (see Table 2). 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 503 districts of European Russia. The regressions show that the best predictor of infant mortality is the share of ethnic Russians. The regression coefficient is stable across specifications and significant both

[1] Gundobin (1906), the founder of Russian pediatrics, wrote: "Every year 1,196,000 infants under the age of one year die in the European part of the Empire. No infectious disease results in comparable mortality rates. In 1887-1892, only 385,000 died from cholera. Infant mortality is a fatal epidemic that annually takes hundreds of thousands of lives."

[2] Data aggregation might result in the loss of variation making it harder to reject the null hypothesis. Brown and Guinnane (2007) conduct a computational experiment using historical demographic data and show that aggregation tends to inflate standard errors.

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%. Supporting micro-level and township-level evidence, the share of Russians is insignificant for the mortality of children aged 1-2 and 2-5 years. As our results appear consistent across different levels of aggregation, ecological fallacy becomes less of a concern. 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-19$^{\text{th}}$ century was strongly correlated with the 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 19$^{\text{th}}$-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.

In contrast to regional aggregates, individual-level data help to uncover the mechanisms driving the health benefits of breastfeeding. Relying on individual-level longitudinal data from Derby in 1917–1922, Reid (2002) finds that earlier weaning increased mortality risk – especially from diarrheal diseases. Davenport (2019) demonstrates that the replacement of wet-nursing with maternal breastfeeding among wealthier families increased infant survival in London in 1750s-1810s. Arthi and Schneider (2021) study health outcomes among nearly 1,000 orphaned children in turn-of-the-twentieth century London and find that breastfeeding reduced mortality risk and raised weight-for-age in infancy with the strongest effects for exclusively breastfed children. They also show that early post-weaning advantages did not persist into mid-childhood, suggesting a catch-up growth for initially disadvantaged children. The historical evidence is consistent with contemporary epidemiological studies, which prove the protective effects of breastfeeding against diarrhea-induced mortality (Lamberti et al., 2011).

The literature on mortality in the Russian Empire is scarce and largely descriptive. 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, mortality among older children was mostly induced by infectious diseases – smallpox, scarlet fever, and 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 contrast mortality patterns among infants with those of 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 19$^{\text{th}}$-early 20$^{\text{th}}$ 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 combination of diverse evidence allows us to develop the first systematic account of infant mortality in the late Russian Empire.

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 them – 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 (1993), the Orthodox population baptized their infants in the first days of life believing that those who died without baptism could not enter heaven.[3] There is no evidence that registration practices differed across ethnic groups within the Orthodox denomination.[4]

Throughout the paper, we compute our main outcome variable, the infant mortality rate, as the number of deaths of children under the age of one year per 1,000 live births in the same year. We measure 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

[3]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 18th and early 19th centuries (Minello et al., 2017).

[4]Private e-mail exchange with Boris Mironov, the leading social historian of Imperial Russia. See also Mironov (2012), Chapter 3.

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.

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

Notes: Green 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.

Micro-level medical studies. Contemporaneous medical studies are the only source of statistical information on infant care practices at the household level. We collected seven studies from Moscow and St. Petersburg historical libraries conducted by rural doctors in different provinces of European Russia in the late 19th-early 20th centuries – four 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 2). 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

Table 1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Panel A: *Townships of Voronezh province*					
Child diarrhea, mortality	3	2.5	0	14	218
Adult diarrhea, mortality	0.4	1.1	0	7	218
Scarlet fever, mortality	1.1	1.4	0	8.9	218
Diphtheria, mortality	2.9	2.8	0	14.2	218
Smallpox, mortality	1.3	2.3	0	15.1	218
Whooping cough, mortality	1.2	1.6	0	14.9	218
Ukrainians, %	41.2	45.8	0	100	218
Rural clinic, dummy	0.3	0.5	0	1	218
Population density, per sq. km	41.5	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	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	376	247
Ukrainians, %	6.3	20.8	0	99.9	247
Rural health clinic, dummy	0.1	0.3	0	1	247
Population density, per sq. km	29.4	18.1	5.5	138	247
Literacy, %	6.0	2.6	0.4	16.3	247
Animals, per household	9.1	3	1.9	19.7	247
Panel C: *Districts of European Russia*					
Infant mortality, average 1900–1903	260.4	75.1	110.1	522.5	503
Child mortality (1-2 year olds), 1900–1903	92.8	26.7	20.8	199.3	503
Child mortality (2-5 year olds), 1900–1903	101.4	24.8	31.1	198.9	503
Russians, %	56.5	41.8	0.2	100	503
Ukrainians, %	17.4	32	0	98.1	503
Belarusians, %	6.6	21.3	0	90	503
Urbanization, %	10.2	12.7	0	96	503
Literacy, %	23.4	14.3	7.1	82.7	503
Doctors, per 1,000	4.4	2.9	0.4	35.9	503

Notes: District data set covers 503 districts (*uezd*) in 50 European provinces. Data set on Voronezh province covers 218 townships (*volost'*), and data set on Saratov province covers 247 townships (*volost'*).

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.

District-level data. Our district-level sample covers 503 districts in 50 provinces of European Russia. We digitize data on births and child deaths from 1900 to 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 F1 in the Online Appendix.[5]

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 Belarusian 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 (2021). Panel C in Table 1 presents summary statistics of the main variables from the cross-section of districts. Table 6 in the Appendix reports summary statistics for the full set of variables.

3 Descriptive analysis

The Russian Empire had the highest infant mortality rate among European countries – approximately 250 deaths per 1,000 live 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. Figure 2 shows the spatial distribution of infant mortality across 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.[6]

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.[7] Jews had the lowest rate.[8] High rates of Orthodox infant mortality were driven mostly by ethnic Russians who had the highest rate across all ethnic and religious groups.

[5] All replication materials are available in Natkhov and Vasilenok (2022).

[6] The spatial distribution of infant mortality persisted over 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 C1 in the Online Appendix).

[7] 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).

[8] 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.

Figure 4 shows the shares of deaths caused by different 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.

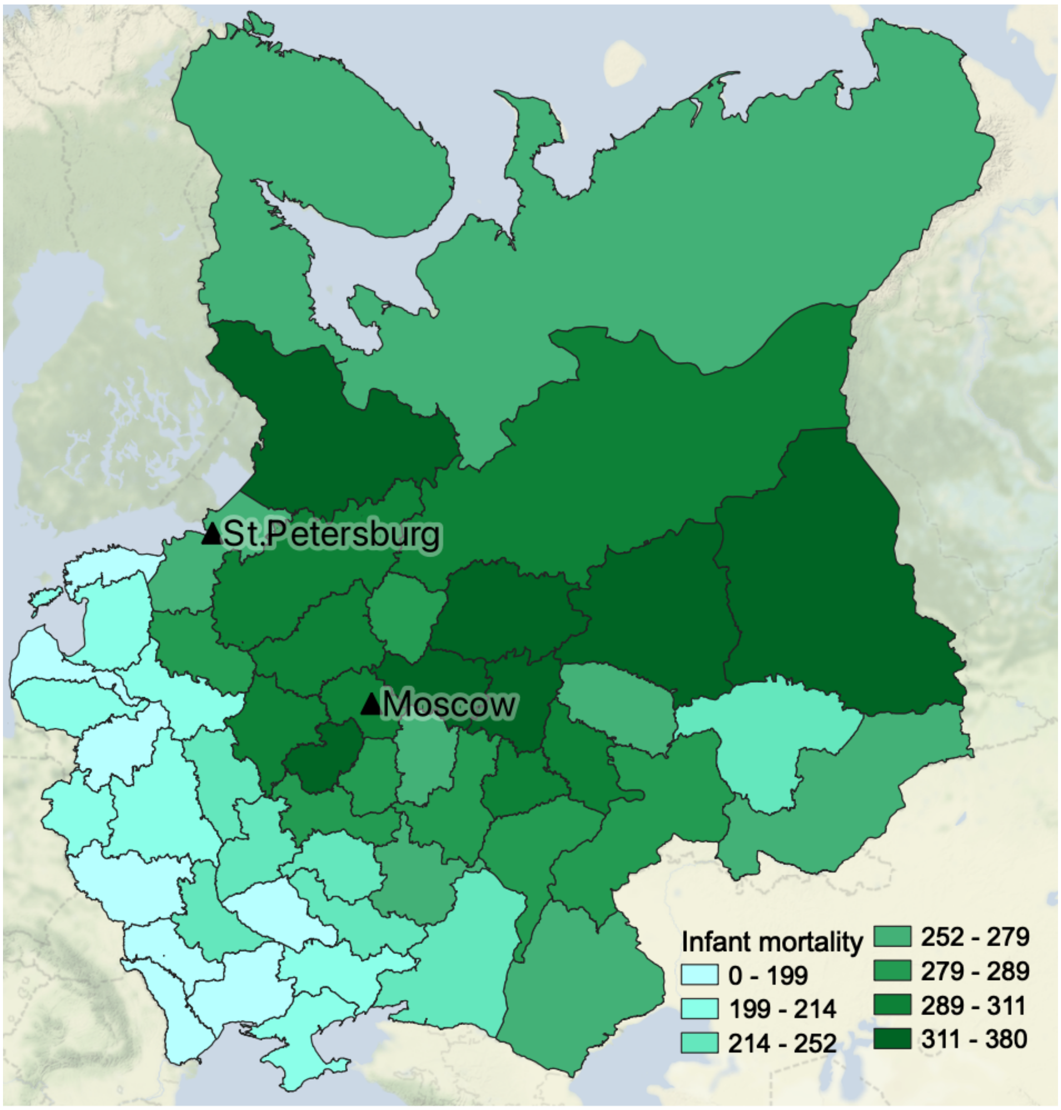

Figure 2: Infant mortality across provinces, 1900–1903

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

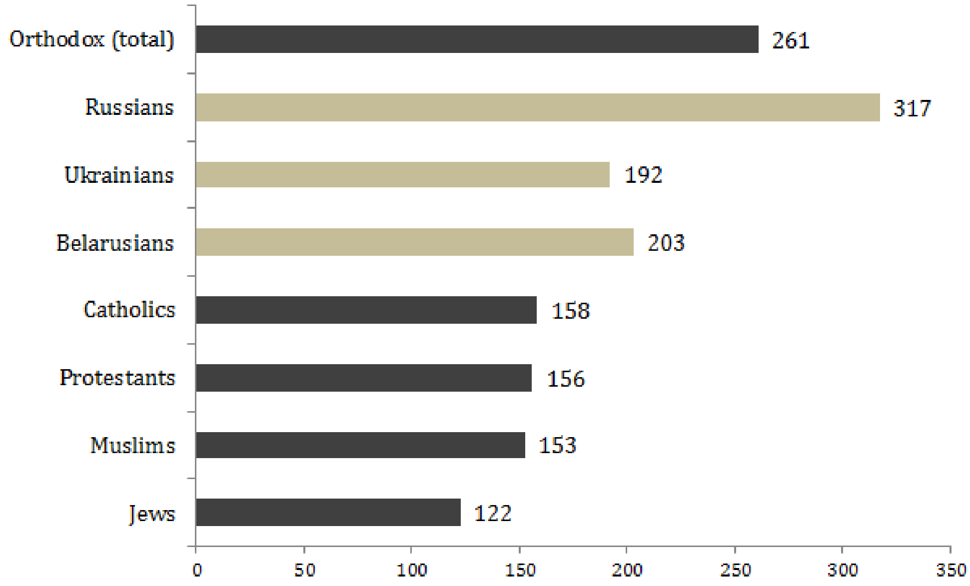

Figure 3: Infant mortality across religious and ethnic groups, 1900–1903

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).

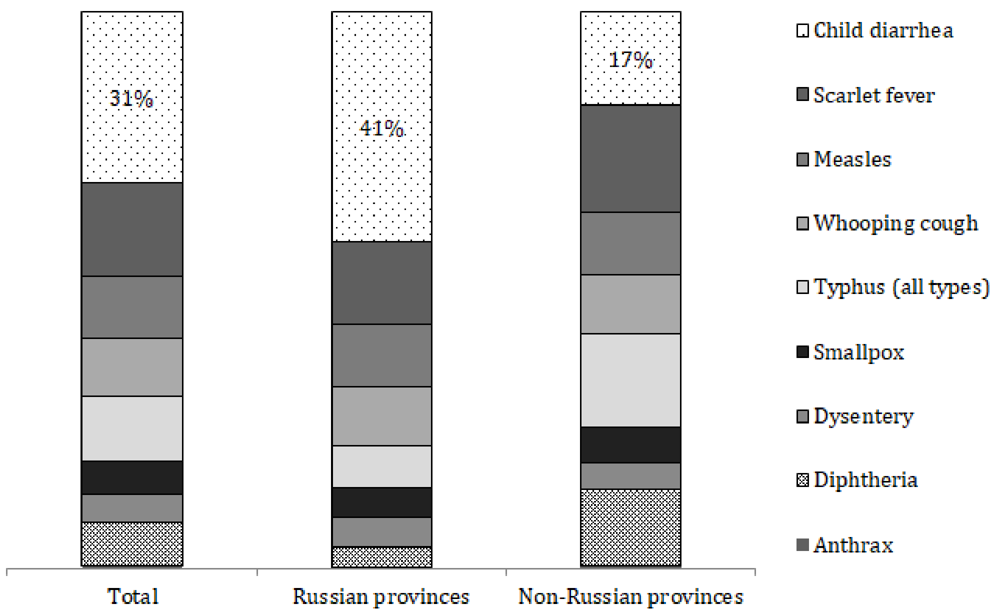

Figure 4: Death causes from infectious diseases, average over 1903, 1906, and 1907

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.

4 Medical evidence

This section summarizes the evidence reported in seven individual-level medical studies conducted by rural doctors in different provinces of European Russia in the late 19th-early 20th centuries. Their authors were mostly local public health officials at the provincial self-government institutions. Four studies focused on ethnic Russians, and three on ethnic Ukrainians, reporting data on feeding practices, death causes, and mortality rates. The number of observed households ranged from less than a hundred to several thousand; the length of observation from several months to ten years. The studies were local initiatives uncoordinated by the central government, thus not following a standardized research program. In Table 2, we report the main findings of these studies in a standardized way.

The studies provide unique quantitative evidence on infant feeding practices. They document that up to 90% of Russian infants got introduced to supplementary food before they reached six months of age in contrast to 43% among Ukrainians (Chebotarev, 1901; Smorodintsev, 1895; Avdeev, 1925).[9] The reported infant mortality rates among Russians were considerably higher than among Ukrainians, which is consistent with Figure 3. The two ethnic groups also differed in the prevalent infant death cause – diarrhea and other gastrointestinal diseases induced up to 75% of infant deaths among Russians and only 13% among Ukrainians (Shverin, 1898; Chebotarev, 1901; Shingarev, 1907).

It appears that infant mortality was associated with feeding practices. The evidence on Russian peasants shows that infant mortality rates varied with the type of supplements. Solid supplements, such as rye bread, resulted in the highest infant mortality rate – 460 deaths per 1,000 births – whereas it was 274 among infants fed with cow milk (Shingarev, 1907).[10] The evidence on Ukrainian peasants shows that in the district with the lowest infant mortality rate – 108 deaths per 1,000 births – only 25% of infants under six months were introduced to supplementary food, whereas in the district with the highest infant mortality rate – 272 deaths per 1000 births – this share was as high as 59% (Avdeev, 1925).[11]

Our review suggests that contemporaries were well aware of high infant mortality among ethnic Russians. They attributed it to unhygienic infant care practices, such as the early introduction of solid food to infants, more widespread among Russians than other Orthodox ethnic groups (Gundobin, 1906).[12] Ethnographic evidence suggests these practices were supported by the belief that an infant could not survive on breast milk alone widespread among Russian peasant women (Popov, 1903). The implication was that the infant's diet needed to be supplemented with bread, porridge, and cow milk as early as possible. The medical evidence reviewed in this section suggests a link between ethnic-specific infant care practices, gastrointestinal diseases, and infant mortality.

[9] When asked to explain this practice, Russian mothers surveyed in Samara province referred to "customs", "traditions" and the "wisdom of the elderly", and all of them "were surprised that such a question could even be raised" (Chebotarev, 1901). See extract from the study on Photo D1 in the Online Appendix.

[10] See extract from the study on Photo D2 in the Online Appendix.

[11] See extract from the study on Photo D3 in the Online Appendix.

[12] Doctor Gundobin founded a charitable organization to address the problem of child mortality in Russia that advocated for the spread of hygienic knowledge among peasant women. 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: Summaries of medical studies

Study	Sample and region	Ethnic group	Practices	Mortality rate	Infant death causes
Smorodintsev (1895)	1,809 peasant households in Perm, Ufa and Orenburg provinces	Russians	92% of mothers introduced supplementary food to infants before five months of age; 20% of mothers did not breastfeed at all	435 among children aged 0-5	52% of deaths induced by diarrhea and other gastrointestinal diseases
Zolotavin (1898)	3,508 peasants in the Nozhovka village in Perm province	Russians	No data	408 among infants; 504 among children aged 0-5	The most frequent death cause is diarrhea (no numbers reported)
Chebotarev (1901)	59 peasant Orthodox households in four villages in Samara province	Predominantly Russians	90% of infants were introduced to solid food before they reached six months of age	402 among children aged 0-5	75% of deaths induced by gastrointestinal diseases
Shingarev (1907)	162 peasant households in two villages in Voronezh province	Russians	91 out of 93 mothers introduced supplementary food to infants in the first days of their lives	No data	Around 70% of deaths induced by gastrointestinal diseases
Shverin (1898)	The universe of parish and hospital records in one district of Kherson province	Ukrainians	No data	176 among infants	13% of deaths induced by diarrhea
Avdeev (1925)	38,934 peasants in Chernigov province	Ukrainians	43% of infants under six month of age were introduced to supplementary food; in the districts with the lowest infant mortality rates, this number was as low as 26%	161 among infants	No data
Grigoriev (1925)	10,671 peasant households in Ekaterinoslav province (sample representative at the district level)	Ukrainians	28% of infants under six month of age were introduced to supplementary food	140 among infants	No data

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 environments. 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. Data on infectious diseases mortality is available only for one year preventing us from averaging out the possible occurrence of epidemics.[13] For Saratov province, y_i denotes infant mortality averaged over 1899–1901 which we contrast to child mortality for age groups 1-2 and 2-5. The comparisons can be interpreted as placebo tests, as we expect ethnic-specific practices to affect predominantly infants through gastrointestinal mortality.[14]

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

Table 3 reports the results for Voronezh province. The share of Ukrainians is significantly and negatively associated with mortality from child diarrhea, but the coefficient is insignificant for adult diarrhea. This result documents cross-ethnic differentials in the incidence of diarrhea-induced mortality among children but not adults.[15] The share of Ukrainians is not associated with mortality from other infectious diseases except for smallpox and diphtheria, for which the coefficients have the opposite signs. Notably, development indicators are uncorrelated with mortality from child diarrhea.

Table 4 reports the results for Saratov province. The share of Ukrainians is significantly and negatively associated with infant mortality and is not associated with the mortality

[13] The data spanning a longer time period are available only at the province level. We collected data on mortality from smallpox, scarlet fever, diphtheria, and whooping cough in Voronezh province from 1893 to 1901 and found that 1898 did not exceed the eight-year average with an exception of whooping cough. See Table B1 in the Online Appendix.

[14] The results of the placebo tests should be treated with caution. Higher infant mortality might lead to higher average health among survivors due to selective culling (Schneider, 2020). In this case, we would expect lower child mortality for ages 1-5 years among Russians. The fact that there is no difference in mortality among older children might suggest other ethnic-specific factors at play on top of infant feeding. For the detailed discussion, see Section A in the Online Appendix.

[15] Child and adult diarrheas are age-specific diseases, with adult diarrhea affecting mostly older people. To account for potential differences in age structure between Russians and Ukrainians, we explicitly control for the shares of the population under 6 years and above 60 years in Table B2 in the Online Appendix. The results do not change.

Table 3: 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, %	-0.319**	-0.167	0.093	0.285**	-0.236**	-0.136
	(0.127)	(0.147)	(0.099)	(0.117)	(0.111)	(0.091)
Rural clinic, dummy	-0.013	-0.005	0.061	-0.030	-0.111**	-0.039
	(0.053)	(0.066)	(0.089)	(0.071)	(0.049)	(0.038)
Population density, log	-0.041	-0.043	-0.006	-0.000	0.025	-0.188**
	(0.066)	(0.071)	(0.055)	(0.077)	(0.059)	(0.079)
Literacy, %	0.120*	0.026	-0.067	-0.222***	0.180*	0.147**
	(0.065)	(0.071)	(0.079)	(0.078)	(0.092)	(0.067)
Animals, per household	0.144	0.036	0.078	-0.002	0.300***	-0.065
	(0.116)	(0.050)	(0.068)	(0.066)	(0.103)	(0.048)
Controls	✓	✓	✓	✓	✓	✓
Mean of dependent variable	3.0	0.4	1.1	2.9	1.3	1.2
SD of dependent variable	2.5	1.1	1.4	2.8	2.3	1.6
R^2	0.256	0.104	0.158	0.145	0.227	0.059
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 4: 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, %	-0.131***	-0.002	0.051
	(0.049)	(0.045)	(0.047)
Rural clinic, dummy	0.014	0.040	0.038
	(0.034)	(0.035)	(0.036)
Population density, log	-0.192**	0.040	-0.068
	(0.076)	(0.074)	(0.075)
Literacy, %	0.009	-0.078	0.044
	(0.064)	(0.078)	(0.060)
Animals, per household	0.063	0.040	0.095
	(0.070)	(0.069)	(0.058)
Controls	✓	✓	✓
Mean of dependent variable	287.5	109.3	112.4
SD of dependent variable	57.6	40.6	58.1
R^2	0.173	0.174	0.298
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. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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 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.[16] Taken together, this evidence suggests that unhealthy 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 503 districts in 50 provinces of European Russia. We estimate the following model:

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

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 St. Petersburg, 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 5 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 conclusion.[17] The coefficient on Russians remains positive and highly significant both statistically and economically.[18] 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

[16] We explicitly control for a rural health clinic as a measure of health care supply. However, the demand for healthcare and other health-related investments, which we cannot measure, might have also differed across ethnic groups on top of infant feeding practices.

[17] 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.

[18] To make sure that the share of Russians is not picking up the relative absence of one of the non-Orthodox religious groups, we control for the shares of Catholics, Protestants, Muslims, and Jews in Table B3 in the Online Appendix. The coefficient on Russians is robust to this exercise.

Table 5: Correlates of infant and child mortality across districts of European Russia

	Infant mortality, average 1900–1903				Child mortality, 1-2	Child mortality, 2-5
	(1)	(2)	(3)	(4)	(5)	(6)
Russians, %	0.820***	0.706***	0.451***	0.465***	0.071	-0.075
	(0.088)	(0.081)	(0.123)	(0.088)	(0.097)	(0.158)
Ukrainians, %	0.005	-0.103	0.033	0.143*	0.027	0.064
	(0.062)	(0.064)	(0.075)	(0.078)	(0.079)	(0.109)
Belarusians, %	0.054	-0.016	-0.012	0.097**	0.034	0.054
	(0.047)	(0.047)	(0.057)	(0.042)	(0.059)	(0.077)
Urbanization, %		-0.006	0.069*	0.106***	0.025	-0.052
		(0.026)	(0.036)	(0.029)	(0.045)	(0.053)
Literacy, %		-0.143***	-0.101*	-0.100	-0.038	-0.139
		(0.046)	(0.055)	(0.070)	(0.124)	(0.117)
Doctors, per 1,000		0.013	0.010	-0.082***	0.006	-0.000
		(0.031)	(0.033)	(0.026)	(0.058)	(0.048)
Controls			✓	✓	✓	✓
Province fixed effects				✓	✓	✓
Mean of dependent variable	260.4	260.4	260.4	260.4	92.8	101.4
SD of dependent variable	75.1	75.1	75.1	75.1	26.7	24.8
R^2	0.635	0.648	0.746	0.868	0.751	0.596
Observations	503	503	503	503	503	503

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 St. Petersburg, 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. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

with a 10 percentage points larger Russian population was likely to have eight additional infant deaths per 1,000 births. We estimate the same regressions separately for boys and girls and do not find any substantial difference in the magnitude of the coefficients.

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.[19] 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.[20]

[19] In Table B4 in the Online Appendix, we show that the coefficient on Russians is robust to the inclusion of crude birth rate and the share of infants in the population in the regression of infant mortality. For the mortality of older children, the coefficient on Russians remains insignificant even when we control for crude birth rate and the share of respective cohorts in the population.

[20] In Table B5 in the Online Appendix, we control for the share of women employed in agriculture. The coefficient on Russians in the regression of infant mortality remains positive and highly significant, while the coefficient on female agricultural employment is insignificant and close to zero.

7 On the origins of Russian infant care practices

Breastfeeding decisions are paramount examples of "parent-offspring conflict" (Trivers, 1974). While infants benefit unilaterally from maximal breastfeeding, it may be optimal for mothers to allocate more energy to household activities and future reproduction at the expense of an infant's needs. The anthropological studies conducted in traditional societies document high variation in the timing of supplementary food introduction.[21] The variation follows seasonal patterns of work activity and food availability, reflecting a trade-off between an infant's energetic needs and maternal labor time. From this perspective, infant care practices can be interpreted as an adaptation to various environmental constraints faced by a particular ethnic group.

For ethnic Russians, one of the main environmental constraints was the length of an agricultural season. In central Russia, it lasts about four months, in contrast to about six months in Ukraine. In four months, Russian peasants had to plow the land, sow the seeds, reap the harvest, and prepare the land for the winter crops. This required extensive labor inputs in a relatively short period of time, and additional labor was provided by women. Qualitative evidence suggests that Russian peasant women spent nearly as many hours on agricultural labor, on top of household work, as did the men (Bolshakov, 1925).[22]

Figure 5 shows the monthly distribution of infant deaths – deaths in a month divided by total deaths in a year – in the two provinces with the maximum shares of Ukrainians and Russians respectively. White bars denote Poltava province with 93% Ukrainians, gray bars denote Vladimir province with 98% ethnic Russians, and the dashed black line denotes the benchmark of uniform distribution (1/12 for each month). Among Russians, a summer peak of infant deaths is much more pronounced than among Ukrainians. Around 45% of infant deaths in the Russian province occurred in summer and only 20% in winter. In the Ukrainian province, infant deaths spread more evenly within a year – about 28% in summer and 25% in winter. Figure 6 shows the deaths distribution of children aged 2-5 in the same two provinces. In contrast to infants, there is almost no difference between the Ukrainian and the Russian provinces, and the distribution is closer to the uniform benchmark.

Taken together, the evidence suggests that a shorter agricultural season in central Russia accentuated the trade-off between maternal care and women's labor inputs, compelling Russian peasant women to participate in the summer fieldwork at the expense of infant care. Hence, Russian infant feeding practices appear as an environmental adaptation that persisted well into the early 20th century in the absence of alternative sources of information due to the cultural homogeneity of central Russia.[23]

[21] For example, Sellen (2001) studies several ethnic groups in East Africa and finds that supplementation before the age of six months was observed in more than 70% of populations, with standard deviations of age at liquid and solid food introduction as high or higher than the mean (4.5 ± 6.0 and 5.0 ± 4.0 months, respectively).

[22] See Photos E4 in the Online Appendix documenting Russian women working along with men in the fields.

[23] By the end of the 19th century, Russians, Belarusians, and Ukrainians had been living in the same country for a little more than a century. Prior to 1795, the territories populated by Belarussians and Ukrainians were controlled by the Polish-Lithuanian Commonwealth. Limited migration between the former Polish territories and central Russia precluded communication and the exchange of traditional know-how between Russians on the one hand, and Belarusians and Ukrainians on the other. According to the 1897 census, Russians constituted less than 5% of the population in the former Polish provinces, whereas less than 10% of Ukrainians and Belarusians lived in the provinces of central Russia. This is especially true for peasants who were substantially less mobile than the urban dwellers.

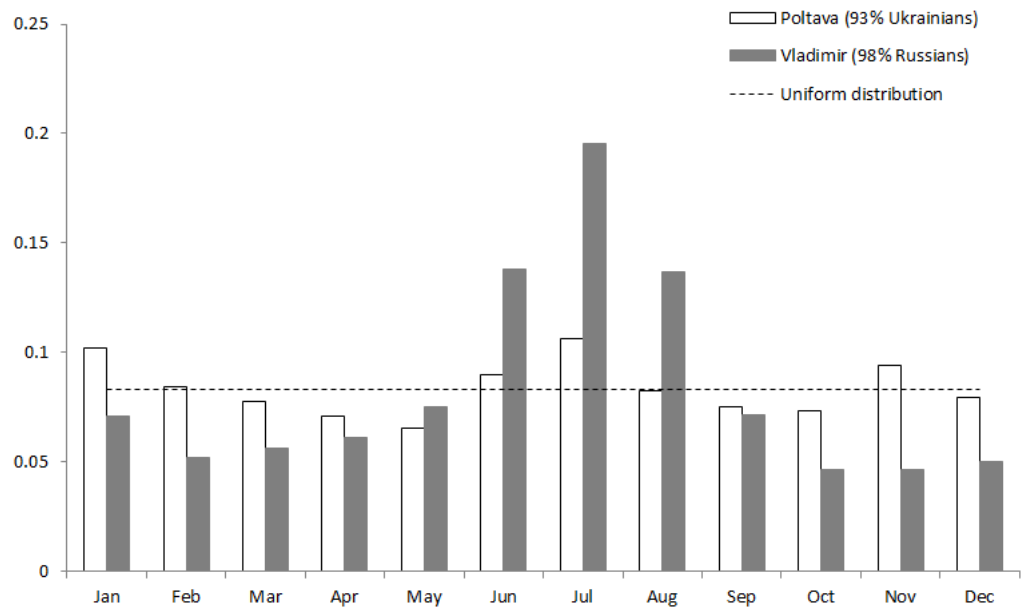

Figure 5: Monthly distribution of infant deaths, 1900–1903

Notes: Infant deaths in a month divided by total infant deaths in a year, averaged over 1900–1903. White bars denote Poltava province with 93% Ukrainians, gray bars denote Vladimir province with 98% ethnic Russians, the dashed black line denotes the benchmark of uniform distribution (1/12 for each month).

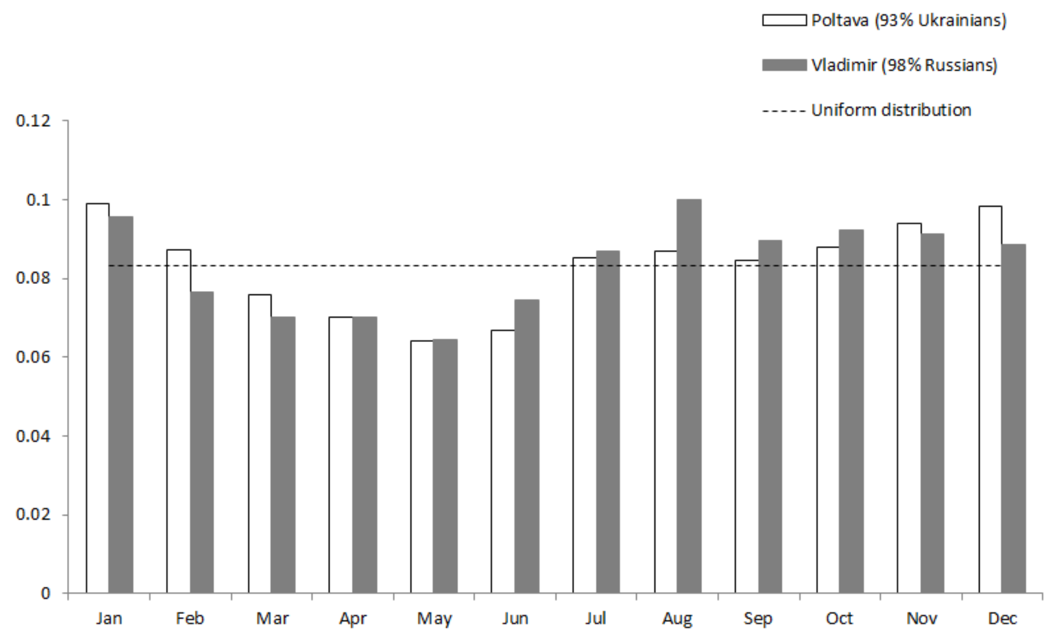

Figure 6: Monthly distribution of deaths among children aged 2-5, 1900–1903

Notes: 2-5 years old child deaths in a month divided by total child deaths in the same age cohort in a year, averaged over 1900-3. White bars denote Poltava province with 93% Ukrainians, gray bars denote Vladimir province with 98% ethnic Russians, the dashed black line denotes the benchmark of uniform distribution (1/12 for each month).

8 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, including other Orthodox ethnic groups – Ukrainians and Belarusians. Our evidence suggests that ethnic differentials in infant mortality largely resulted from ethnic-specific infant care practices, namely, the introduction of solid food. Russian mothers started to introduce supplements, such as rye bread, from the first weeks of infants' lives, which increased the risk of lethal gastrointestinal diseases.

The Russian Empire was not unique in the relationship between traditional infant care practices and infant mortality. Studies in European demographic history suggest that changing infant feeding practices contributed to the decline in infant mortality rate prior to the 20th century.[24] (Brandstrom, 1993). Russia followed the same path but lagged behind Europe for several decades. The decline started at the beginning of the 20th century and accelerated with growing urbanization. While there are no studies on changing feeding practices in the Soviet period, we can speculate that urbanization played a major role in changing traditional child care practices into modern ones.[25]

Recently, the growing body of literature has emphasized the importance of cultural practices in shaping infant mortality. For example, Derosas (2003) documents the differences in infant mortality rates between Catholics and Jews that cannot be explained by income or education using data from 19th century Venice. In the contemporary context, 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) explain this puzzle with healthier sanitation practices among Muslims. Supplementing the existing literature, our paper demonstrates the importance of the ethnic dimension of infant mortality revealing variation within the same religious group.

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 ethnic groups? Why do some communities maintain unhealthy health care practices? Can best practices spread from high to low performing groups? What determines the success of the diffusion? These questions are still to be explored.

[24] For example, in 1800, the infant mortality rate in Sweden was around 220 deaths per 1,000 live births, which literature attributed to irregular breastfeeding and artificial feeding among other factors (Brandstrom, 1993; Edvinsson et al., 2008). A steady decline began in 1810, and by 1900, the infant mortality rate reached 99 (Mitchell, 2007). The decline was partially enabled by the systematic training of physicians, midwives, and clergymen in infant care by the Swedish government

[25] The Soviet government also created a nationwide network of maternity hospitals, women's health clinics, and research centers and launched a massive educational campaign to promote modern medical knowledge on child care among the general population (Avdeev, 2010).

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Appendix

Table 6: Summary statistics

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**	**N**
	Panel A: *Townships of Voronezh province*				
Child diarrhea, mortality	3	2.5	0	14	218
Adult diarrhea, mortality	0.4	1.1	0	7	218
Scarlet fever, mortality	1.1	1.4	0	8.9	218
Diphtheria, mortality	2.9	2.8	0	14.2	218
Smallpox, mortality	1.3	2.3	0	15.1	218
Whooping cough, mortality	1.2	1.6	0	14.9	218
Ukrainians, %	41.2	45.8	0	100	218
Rural clinic, dummy	0.3	0.5	0	1	218
Population density, per sq. km	41.5	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
River dummy	0.3	0.5	0	1	218
Railroad dummy	0.1	0.3	0	1	218
Wheat suitability	78.7	12.4	34.0	100	218
Terrain ruggedness index	46.2	15.8	12.5	77.3	218
Latitude, degrees	50.9	0.7	49.7	52.8	218
Longitude, degrees	39.6	1.1	37.6	42.7	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	99.9	247
Rural health clinic, dummy	0.1	0.3	0	1	247
Population density, per sq. km	29.4	18.1	5.5	138.0	247
Literacy, %	6.0	2.6	0.4	16.3	247
Animals, per household	9.1	3	1.9	19.7	247
Crude birth rate, 1899–1901	60.5	15.9	10.0	113.9	247
River dummy	0.2	0.4	0	1	247
Railroad dummy	0.3	0.5	0	1	247
Wheat suitability	71.5	18.8	22.1	100	247
Terrain ruggedness index	42.2	15.9	16.1	97.2	247
Latitude, degrees	52	0.8	48.7	53.3	247
Longitude, degrees	45.1	1.4	42.7	48	247
Muslims, %	3.2	10.7	0.0	77.4	247
Old Believers, %	4.8	9.3	0	83.4	247
Germans, %	0.2	0.5	0	4.9	247
	Panel C: *Districts of European Russia*				
Infant mortality, average 1900–3	260.4	75.1	110.1	522.5	503
Child mortality (1-2 year olds), 1900–3	92.8	26.7	20.8	199.3	503
Child mortality (2-5 year olds), 1900–3	101.4	24.8	31.1	198.9	503
Russians, %	56.5	41.8	0.2	100	503
Ukrainians, %	17.4	32.0	0	98.1	503
Belarusians, %	6.6	21.3	0	90	503
Urbanization, %	10.2	12.7	0	96	503

Literacy, %	23.4	14.3	7.1	82.7	503
Doctors, per 1,000	4.4	2.9	0.4	35.9	503
Crude birth rate, average 1900-1903	51.9	9.6	16.9	74	503
Population density, per sq. km	42.9	45.8	0.1	759.9	503
Distance to St. Petersburg, km	936.3	394.5	22	2020.1	503
Private serfs in 1858, %	37.8	25.3	0	85.2	503
Latitude, degrees	54.1	3.9	44.6	67.9	503
Longitude, degrees	37.1	8.5	21.2	63.3	503

Notes: This table is an extended version of Table 1. District data set covers 503 districts (*uezd*) in 50 European provinces. Data set on Voronezh province covers 218 townships (*volost'*), and data set on Saratov province covers 247 townships (*volost'*).

Online Appendix

A Survival Bias

The results of the placebo comparison between infant and child mortality should be treated with caution as it can be affected by a survival bias (Schneider, 2020). Assuming that ethnic groups have the same latent health distribution at birth and breastfeeding more strongly benefits the lower tail of this distribution, we can expect that average latent health among Russian children surviving past infancy was higher than among ethnic groups with lower infant mortality. This implies that we should observe lower mortality for older cohorts of Russian children.

In Tables 4 and 5, we do find a negative coefficient on the share of Russians and a positive coefficient on the share of Ukrainians in the regressions of child mortality in the 2-5 age group, though both coefficients are insignificant. The fact that we find no statistical difference in mortality among older children across ethnic groups might signal the bias in our placebo test and evidence for other ethnic-specific factors contributing to infant mortality on top of feeding practices.

The exercise below explicitly exacerbates the survival bias, controlling for infant mortality as an outcome of feeding practices – our unobserved treatment – in the regressions of child mortality. If infant mortality depends on feeding practices and child mortality is not associated with it, controlling for infant mortality should introduce a negative selection bias. This is precisely what we observe below.

Table A1 reports the results for Saratov province. After controlling for infant mortality the coefficient on the share of Ukrainians for the mortality of children aged 2-5, retains its sign, increases in magnitude and becomes statistically significant (Column 4). Table A2 reproduces the exercise for the districts of the Russian Empire. Similarly, for children aged 2-5, the coefficient on the share of Russians increases in magnitude and becomes statistically significant (Column 4). Lower mortality rates among Russian children suggest that an average Russian survivor past infancy is healthier than a Ukrainian one, as we could have expected, providing support to our mechanism.

Table A1: Survival bias in Saratov province

	(1)	(2)	(3)	(4)
	Child mortality,			
	1-2 years		2-5 years	
Ukrainians, %	-0.002	0.062	0.051	0.104**
	(0.045)	(0.043)	(0.047)	(0.048)
Infant mortality, average 1899-1901		0.487***		0.404***
		(0.087)		(0.084)
Controls	✓	✓	✓	✓
Mean of dependent variable	109.7	109.7	113.5	113.5
SD of dependent variable	39.9	39.9	58.6	58.6
R^2	0.174	0.370	0.298	0.433
Observations	247	247	247	247

Notes: The unit of analysis is township (*volost'*) of Saratov province. The dependent variables are child mortality rates per 1,000 survived in 1899-1901. 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 A2: Survival bias in the Russian Empire

	(1)	(2)	(3)	(4)
	Child mortality,			
	1-2 years		2-5 years	
Russians, %	0.071	-0.275***	-0.075	-0.283*
	(0.097)	(0.105)	(0.158)	(0.164)
Infant mortality, average 1900-1903		0.744***		0.448***
		(0.133)		(0.109)
Controls	✓	✓	✓	✓
Mean of dependent variable	92.8	92.8	101.4	101.4
SD of dependent variable	26.7	26.7	24.8	24.8
R^2	0.751	0.825	0.596	0.622
Observations	503	503	503	503

Notes: The unit of analysis is district (*uezd*) of European Russia. The dependent variables are child mortality rates per 1,000 survived in 1900-1903. Standardized beta coefficients are reported. Standard errors, adjusted to spatial correlation within 300 km, are in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

B Tables

Table B1: Infectious diseases mortality in Voronezh over time

Year	Smallpox	Scarlet fever	Diphtheria	Whooping cough
1893	1.96	4.24	2.74	3.29
1894	0.88	2.21	4.72	1.66
1895	0.81	4.61	2.71	1.78
1896	1.56	2.23	1.42	0.63
1897	1.04	1.75	1.27	1.33
1898	1.16	1.86	1.36	1.62
1899	1.14	4.64	1.55	1.37
1900	1.64	4.55	1.68	1.18
1901	1.52	5.40	1.35	0.46
Average	1.30	3.50	2.09	1.48

Notes: Table reports the number of deaths from smallpox, scarlet fever, diphtheria, and whooping cough per 1,000 population in Voronezh province. Source: Department of the Chief Medical Inspector of the Ministry of Internal Affairs (1903).

Table B2: Age structure in Voronezh province

	(1)	(2)	(3)	(4)	(5)	(6)
	Child diarrhea			Adult diarrhea		
Ukrainians, %	-0.319**	-0.277**	-0.293**	-0.167	-0.094	-0.106
	(0.127)	(0.129)	(0.129)	(0.147)	(0.153)	(0.173)
Population under 6 years			0.060			
			(0.070)			
Population over 60 years						0.036
						(0.114)
Controls	✓	✓	✓	✓	✓	✓
Mean of dependent variable	3.0	3.0	3.0	0.4	0.5	0.5
SD of dependent variable	2.5	2.4	2.4	1.1	1.1	1.1
R^2	0.256	0.297	0.300	0.104	0.119	0.119
Observations	218	203	203	218	203	203

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. The data on age structure is not available for one of the districts, which leaves us with 203 out of 218 observations. 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 B3: Religious composition and infant mortality

	Infant mortality, average 1900-1903				
	(1)	(2)	(3)	(4)	(5)
Russians, %	0.465***	0.468***	0.445***	0.420***	0.464***
	(0.088)	(0.089)	(0.092)	(0.075)	(0.089)
Ukrainians, %	0.143*	0.147*	0.132*	0.097	0.140*
	(0.078)	(0.081)	(0.077)	(0.078)	(0.078)
Belarusians, %	0.097**	0.101**	0.093**	0.079*	0.095**
	(0.042)	(0.043)	(0.044)	(0.041)	(0.044)
Catholics, %		0.011			
		(0.022)			
Protestants, %			-0.132		
			(0.084)		
Muslims, %				-0.071	
				(0.044)	
Jews, %					-0.011
					(0.047)
Controls	✓	✓	✓	✓	✓
Province fixed effects	✓	✓	✓	✓	✓
Mean of dependent variable	260.4	260.4	260.4	260.4	260.4
SD of dependent variable	75.1	75.1	75.1	75.1	75.1
R^2	0.868	0.868	0.868	0.869	0.868
Observations	503	503	503	503	503

Notes: The unit of analysis is district (*uezd*) of European Russia. The dependent variables are average infant mortality rates over 1900-1903. Infant mortality is the number of infant deaths per 1,000 live births. Controls include urbanization, literacy, the number of doctors per 1,000 population, crude birth rate, logarithm of population density, distance to St. Petersburg, 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.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B4: Age structure and child mortality

	Infant mortality, average 1900-03		Child mortality, 1-2 years		2-5 years	
	(1)	(2)	(3)	(4)	(5)	(6)
Russians, %	0.465***	0.509***	0.071	0.079	-0.075	-0.030
	(0.088)	(0.096)	(0.097)	(0.095)	(0.158)	(0.165)
Ukrainians, %	0.143*	0.156**	0.027	0.033	0.064	0.031
	(0.078)	(0.079)	(0.079)	(0.078)	(0.109)	(0.103)
Belarusians, %	0.097**	0.110**	0.034	0.041	0.054	0.040
	(0.042)	(0.045)	(0.059)	(0.059)	(0.077)	(0.078)
Crude birth rate	0.200***		0.294***	0.302***	0.127*	0.081
	(0.063)		(0.102)	(0.105)	(0.067)	(0.064)
Infants, share		0.112*				
		(0.064)				
Children 1-2, share				-0.028		
				(0.040)		
Children 2-5, share						0.198**
						(0.077)
Controls	✓	✓	✓	✓	✓	✓
Province fixed effects	✓	✓	✓	✓	✓	✓
Mean of dependent variable	260.4	260.4	92.8	92.8	101.4	101.4
SD of dependent variable	75.1	75.1	26.7	26.7	24.8	24.8
R^2	0.868	0.863	0.751	0.752	0.596	0.602
Observations	503	503	503	503	503	503

Notes: The unit of analysis is district (*uezd*) of European Russia. The dependent variables are average infant 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. Controls include urbanization, literacy, the number of doctors per 1,000 population, logarithm of population density, distance to St. Petersburg, 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.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B5: Female employment and child mortality

	Infant and child mortality, average 1900-1903			
	Infants		1-2 years	2-5 years
	(1)	(2)	(3)	(4)
Russians, %	0.465***	0.466***	0.074	-0.070
	(0.088)	(0.087)	(0.097)	(0.157)
Female agricultural employment, %		-0.022	-0.136*	-0.257***
		(0.060)	(0.075)	(0.079)
Controls	✓	✓	✓	✓
Province fixed effects	✓	✓	✓	✓
Mean of dependent variable	260.4	260.4	92.8	101.4
SD of dependent variable	75.1	75.1	26.7	24.8
R^2	0.868	0.868	0.755	0.608
Observations	503	503	503	503

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. 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. Controls include urbanization, literacy, the number of doctors per 1,000 population, crude birth rate, logarithm of population density, distance to St. Petersburg, 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.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

C Figures

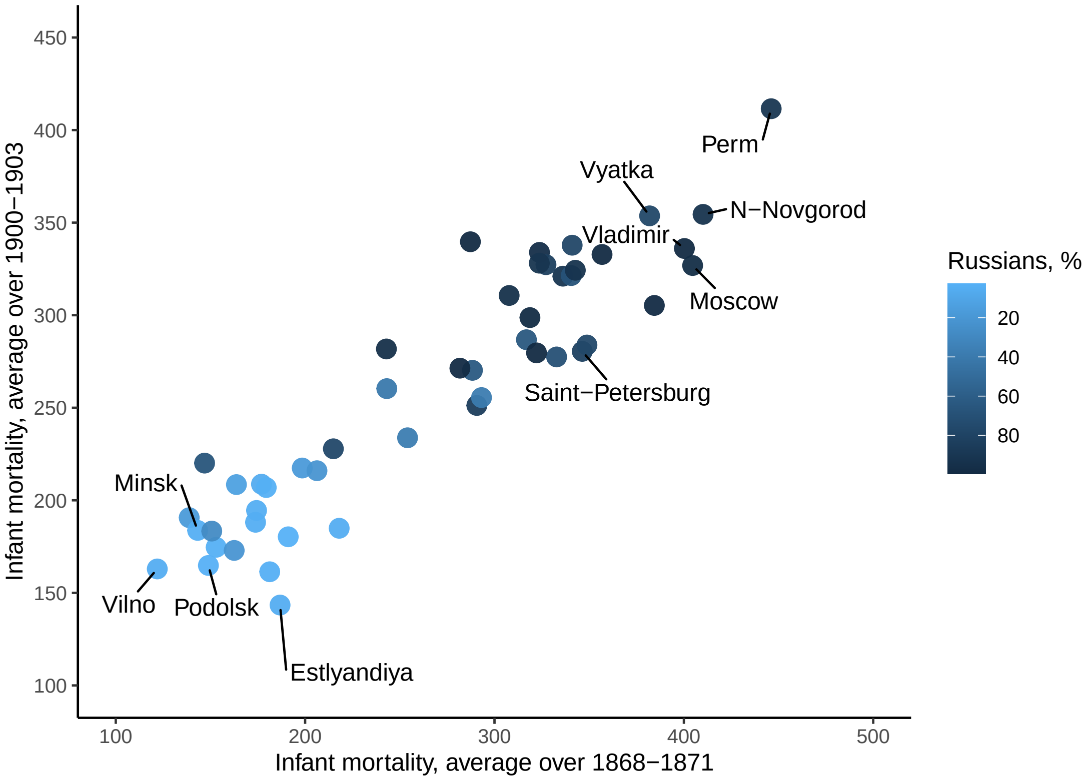
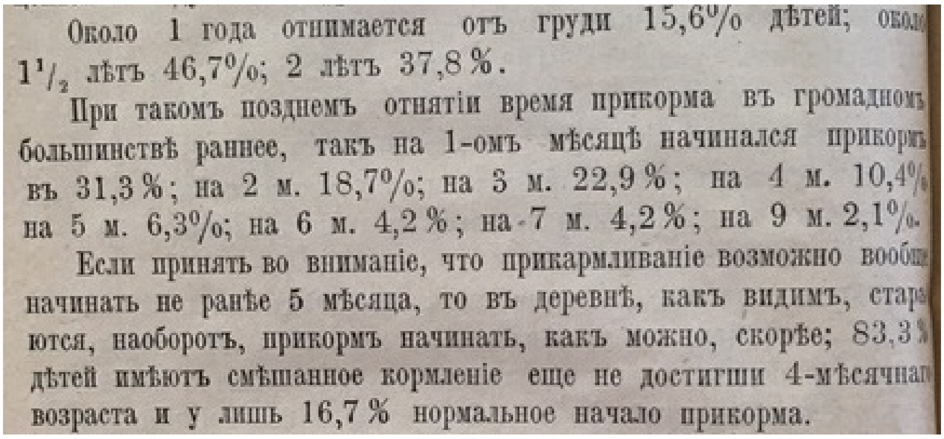


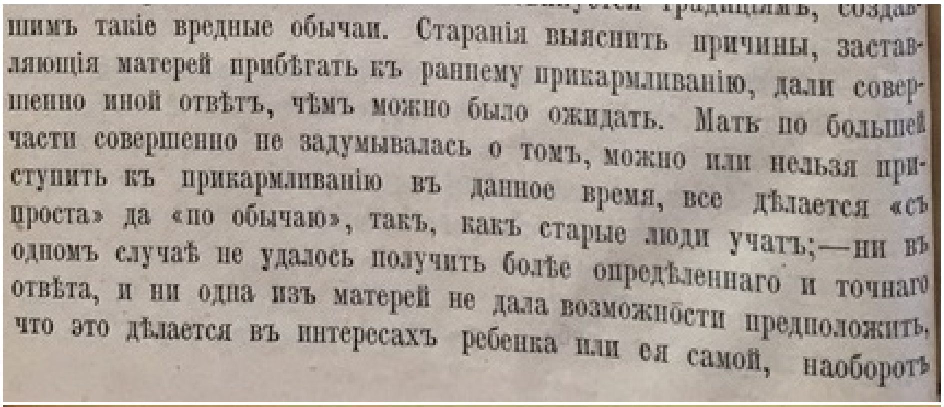
Figure C1: Spatial persistence of infant mortality, 1868-1903

D Extracts from medical studies

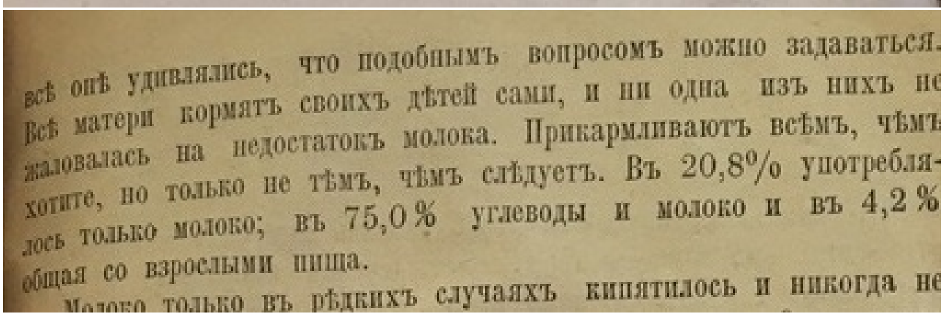


Около 1 года отнимается отъ груди 15,6% дѣтей; около
1½ лѣтъ 46,7%; 2 лѣтъ 37,8%.
При такомъ позднемъ отнятіи время прикорма въ громадномъ
большинствѣ раннее, такъ на 1-омъ мѣсяцѣ начинался прикормъ
въ 31,3%; на 2 м. 18,7%; на 3 м. 22,9%; на 4 м. 10,4%
на 5 м. 6,3%; на 6 м. 4,2%; на 7 м. 4,2%; на 9 м. 2,1%.
Если принять во вниманіе, что прикармливаніе возможно вообще
начинать не ранѣе 5 мѣсяца, то въ деревнѣ, какъ видимъ, стар
ются, 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.

At around one year of age 15.6% of children are weaned, at one year and a half 46.7%, and at two years 37.8%. Despite late weaning, supplementary feeding starts early; during the first month of an infant's life among 31.3% of infants, the second month 18.7%, the third 22.9%, the fourth 10.4%, the fifth 6.3%, the sixth 4.2%, the seventh 4.2%, the ninth 2.1%. Despite the fact that supplementary feeding can be harmful before an infant reaches five months, we observe that peasants tend to introduce supplements as early as possible; 83.3% of children are introduced to supplements before four months, and only for 16.7% supplementary feeding begins at the right time.



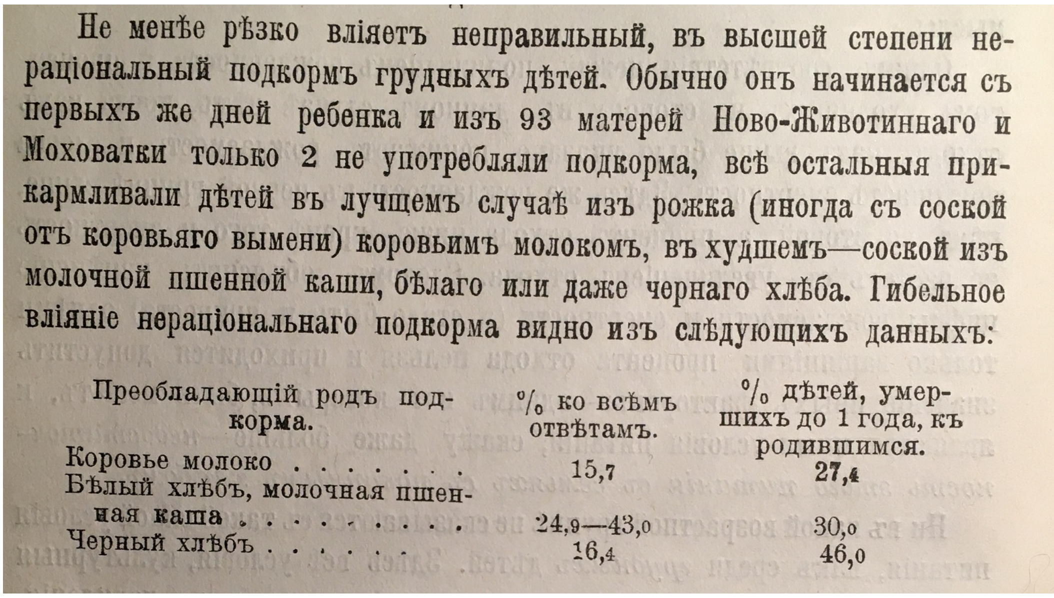
традиціямъ, создав-
шимъ такіе вредные обычаи. Старанія выяснить причины, застав-
ляющія матерей прибѣгать къ раннему прикармливанію, дали совер-
шенно иной отвѣтъ, чѣмъ можно было ожидать. Мать по большей
части совершенно не задумывалась о томъ, можно или нельзя при-
ступить къ прикармливанію въ данное 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% употребля-
лось 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

Trying to figure out why mothers stick to early supplementary feeding, we encountered a completely unexpected answer. In most cases, mothers do not even consider what the right time is to introduce supplements. Everything is being done according to a custom and by the wisdom of the elderly; there was no way to elicit a clearer explanation, and no mother even accounted for her own or infant's interests. In contrast, they fancied how such a question could even be asked. All mothers breastfeed their children themselves. As for supplements, anything can be used, and nothing that is indeed healthy.

Photo D1: 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 лучщемъ 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

(infant's health) is also affected by wrong and extremely irrational supplementary feeding of infants. It tends to start from the very first days of an infant's life, and out of 93 mothers from Novo-Zhivotinnoye and Mokhovatka only 2 did not rely on supplements; all the others supplemented their infants' diet with cow milk, a cloth pacifier with millet porridge, wheat or even rye bread. The data below illustrate the lethal effect of irrational supplementary feeding.

The columns are *prevalent supplement*, response share, and *infant mortality rate per 100 births.* The rows are *cow milk*, *wheat bread or millet porridge*, and *rye bread.*

Photo D2: Extract from the medical study of Shingarev (1907)

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

The columns are *infant deaths*, *infant deaths induced by child diarrhea*, *infant deaths induced by other diseases* per 100 living infants. The rows are the districts of Chernigov province.

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.

The columns are the shares of infants under six month of age that are *breastfed exclusively* and *fed with supplements*. The rows are the districts of Chernigov province.

Photo D3: Extract from the medical study of Avdeev (1925)

E Photos

Haying, near rest time, 1909

At harvest time, 1909

Photo E4: Photos by Sergei Prokudin-Gorskii

Notes: Images have been digitized and made publicly available by the Library of Congress

F Data sources

Table F1: Data sources

Data	Description	Level	Source
District-level analysis			
Dependent variables			
Infant mortality	Deaths of infants under 1 year of age per 1,000 live births, averaged over 1900-1903	District	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)
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	
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)		
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 (2021)
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	Township	Voronezh Provincial Zemstvo (1900)
Rural clinic, dummy	Dummy variable indicating whether a township had at least one rural health clinic in 1898	Township	Shingarev (1906)
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)
Rural health clinic, dummy	Dummy variable indicating whether a township had at least one rural health clinic in 1898	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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