DOI 10.15826/izv2.2021.23.4.078
УДК 94(72)“1918” + 314.42.3(726.1) +
+ 351.755.5 + 616.921.5(09)

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MORTALITY AND DEATH CAUSES IN REVOLUTIONARY VERACRUZ, MEXICO (Based on Analysis of the Civil Registry Death Records)

This article is devoted to a detailed analysis of death causes in Mexico during the Revolution and Civil War period. Our study is based on the death registration records in six government-controlled municipalities in Veracruz State which promoted registration accuracy. A total of 2 876 records from 1918 were analyzed, most of which contained information about the causes of death. The main objectives of the study were to determine the main causes of death, to identify territorial, age and gender differences, to establish the time and extent of the spread of the Spanish flu epidemic and the overall mortality rate in 1918. The 10th revision of the International Classification of Diseases (ICD-10), developed by the World Health Organization, was used as a basis for coding the causes of death. Thus, the causes of diseases that led to the death of the inhabitants of Veracruz were divided into eight main classes: infectious; respiratory; related to pregnancy or childbirth; those caused by difficulties in the perinatal period of fetal development; external violent reasons; unclassifiable, those associated with infancy and childhood; the unclassifiable; and finally, the missing. The analysis revealed registration problems, especially in the agrarian regions, caused by the poor development of medical infrastructure and aggravated by wartime conditions. Based on the analysis of individual level data on the causes of death, the authors identified the 161 diagnostic options found in the sources, identified the main ten death causes for each of the six cities of Veracruz, determined the level and accuracy of registration and the age characteristics of the spread of certain classes of fatal diseases. The most common cause of death was infectious diseases, particularly children from one to five years old suffered from these. The rate of respiratory diseases was also high, the proportion of deaths from these rose sharply in the last quarter of 1918, which was caused by the spread of the Spanish flu. The analysis of the nominative data made it possible to refute the official statement of the Mexican government about the cessation of influenza at the end of 1918. The high mortality rate from various respiratory diseases in December 1918 among young men suggests that the flu pandemic was hidden behind various other concepts.

K e y w o r d s: causes of death; Veracruz; Mexico; Mexican revolution; civil registration of death; 1918; nominative data; history of medicine; Spanish flu

F o r c i t a t i o n: Méndez Maín, S. M., & Rivas Méndez, A. V. (2021). Mortality and Death Causes in Revolutionary Veracruz, Mexico (Based on Analyses of the Civil Registry Death Records). *Izvestiya Uralskogo federalnogo universiteta. Seriya 2: Gumanitarnye nauki, 23*(4), 268–282. https://doi.org/10.15826/izv2.2021.23.4.078

Submitted: 27.04.2021
Accepted: 09.11.2021

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СМЕРТНОСТЬ В РЕВОЛЮЦИОННОЙ МЕКСИКЕ, ШТАТ ВЕРАКРУС (по материалам записей о регистрации смерти в 1918 г.)

Исследование посвящено анализу причин смертности в Мексике в ходе гражданской войны за независимость. В качестве источника использованы записи о регистрации смертей в шести муниципалитетах штата Веракрус, находившихся под контролем правительства, что обеспечило аккуратность ведения регистрации. Всего было проанализировано 2 876 записей, датированных 1918 г., большая часть которых содержала информацию о причинах смерти. Основными задачами исследования было определение основных причин смерти, выявление территориальных и половозрастных различий, установление времени и степени распространения эпидемии «испанского гриппа» и общего уровня смертности в 1918 г. Для кодирования причин смерти в качестве основы была использована международная классификация, разработанная Всемирной организацией здравоохранения, — IDC-10. В соответствии с поставленными задачами все варианты записей, в которых были указаны или не указаны причины заболеваний, приведших к смерти, для удобства анализа были распределены по восьми основным классам: инфекционные; респираторные; связанные с беременностью или родами; вызванные осложнениями в перинатальный период развития плода; внешние насильственные причины; не поддающиеся классификации, связанные с младенческим и детским возрастом; не поддающиеся классификации; без указания причин. Проведенный анализ выявил проблемы регистрации, особенно в аграрных областях, вызванные слабым развитием медицинской инфраструктуры, усугубленные условиями гражданской войны. На основе анализа индивидуальных данных о причинах смерти, авторы выявили 161 вариант диагнозов, встречающихся в источниках; определили основные десять причин по каждому из шести городов Веракруса, выявив территориальные особенности; определили уровень и аккуратность регистрации, а также возрастные особенности распространения отдельных классов смертельных заболеваний. Наиболее частой причиной смерти жителей Веракруса являлись инфекционные заболевания, в особенности от них страдали дети в возрасте от года до пяти лет. Высок был также уровень респираторных заболеваний, доля смертей от которых резко возросла в последней четверти 1918 г., что было вызвано распространением испанского гриппа. Проведенный анализ номинативных данных позволил опровергнуть официальное утверждение правительства Мексики об остановке гриппа в конце 1918 г. Высокий уровень смертности от различных респираторных заболеваний в декабре 1918 г. именно в среде молодых мужчин позволяет предположить, что за различными наименованиями скрывался именно грипп.

К л ю ч е в ы е с л о в а: причины смерти; Веракрус; Мексика; революция; регистрация смерти; 1918; номинативные данные; история медицины; испанский грипп

Цитирование: *Méndez Maín S. M., Rivas Méndez A. V.* Mortality and Death Causes in Revolutionary Veracruz, Mexico (Based on Analyses of the Civil Registry Death Records) // Известия Уральского федерального университета. Сер. 2: Гуманитарные науки. 2021. Т. 23, № 4. С. 268–282. https://doi.org/10.15826/izv2.2021.23.4.078

Поступила в редакцию: 27.04.2021
Принята к печати: 09.11.2021

Introduction

The Mexican Revolution, followed by the Civil War and social and political instability, marked the decade from 1910 to 1920. In addition, the 1918 influenza epidemic had devastating effects in the country [McCaa], including in the state of Veracruz, which forms a significant part of the coastline on the Gulf of Mexico. Some municipal authorities even had to change their location due to the regular raids of bandits and systematic destruction of telegraph and telephone lines [Blázquez Domínguez]. The number of war and influenza victims are still unknown in Mexico, except in selected municipalities, because of the lack of health care and vital events registration during those turbulent years. Therefore, the causes of death in Veracruz state are mostly unknown, both in urban and rural areas.

Some studies help us to estimate the extent of the 1918 influenza in Mexico and its influence on demography [Chowell, Viboud, Simonsen, Miller, & Acuna Soto]. Several researchers have focused on how Mexico's urban population experienced the influenza [Cuenya Mateos; Valdez Aguilar; González Arriata; Méndez Maín]. González Navarro [1974] wrote that the influenza caused 82.2 % of the deaths in 1918 at the national level. Since not all deaths and births were registered by the civil offices, Bustamante asserted that the overall mortality in 1922 was 25.1 deaths per thousand inhabitants, and that infant mortality before 1922 was underestimated in Mexico [Bustamante, p. 49]. The infant mortality rate estimated for 1922 was 223.1 deaths per 1000 live births [Cordero, p. 47]. Martínez pointed out that mortality was higher in rural areas due to limited economic and educational resources, as well as the lack of social and health services [Martínez, p. 43].

Veracruz State covers the middle part of the coastline along 800 km of the Gulf of Mexico, with mixed ethnic and indigenous populations. By the early 20th century, railways and roads already connected the major cities. Agriculture still dominated the economy, but oil drilling, electricity, textile and tobacco industry were developing, creating spots of relative local affluence. Nevertheless, these enclaves of modernity coexisted with a reality of backwardness, isolation and rural poverty that characterized the rest of the territory of Veracruz. The contradictions generated gave rise to outbursts of discontent which were fiercely repressed [González Sierra].

This article is based on nominative sources — the death records of the Civil Registry of six municipalities — Xalapa, Coatepec, Cosautlán, Las Vigas, Tampico Alto and Gutiérrez Zamora located in the northern and central Veracruz state (see Fig. 1).

We consider the death record series of 1918 for these six cities to be complete, while records for other municipalities dominated by political factions outside the government's control [Blázquez Domínguez] were incomplete.

Xalapa, the capital city, with a population of 28 333 in 1910, was the third biggest city in Veracruz. Coatepec had 17 475 inhabitants and was considered an urban municipality in the 1910 census, even if its dispersed population's main occupation was agriculture. Cosautlán and Las Vigas, with 6 536 and 4 011 inhabitants respectively, were both located in the rural area of the state. These municipalities are located in mountainous regions: the first three are 1 000–1 500 meters above sea level and Las Vigas is even at 2 400. We find the other two rural municipalities — Tampico Alto and Gutiérrez Zamora with 5 262 and 4 451 inhabitants respectively, at less than 44 meters above sea level, thus outside the mountainous area. Las Vigas, a municipality that belonged to the Canton of Xalapa, is located on the slopes of the Cofre de Perote, less than 50 km away from the capital. Cosautlán and Coatepec are between 30 and 15 km from the capital; the municipalities of Gutiérrez Zamora are 200 km away, and Tampico Alto is 400 km from Xalapa. In the rainy season, it took several hours to reach the capital with its health infrastructure. Differences in causes of death could be influenced by the climate, urban/rural character of the area, development level, access to health services and proximity to Xalapa.

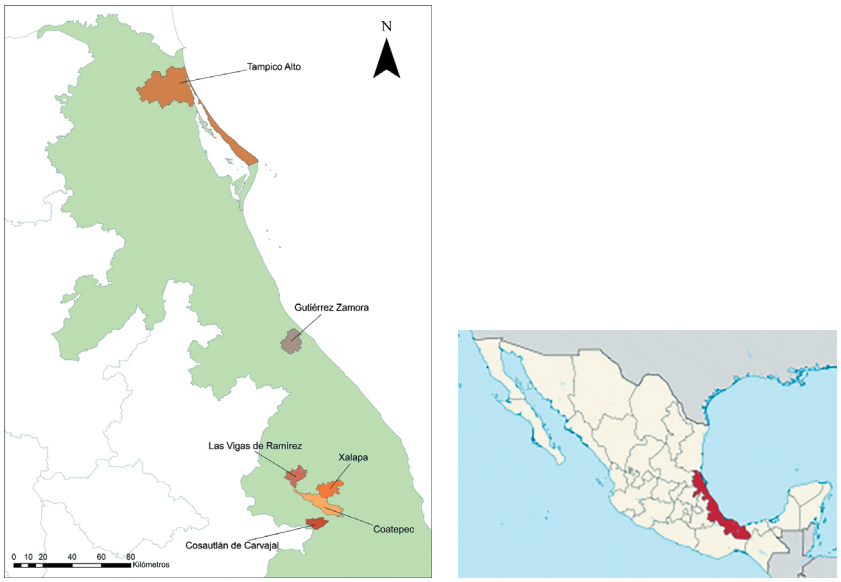

Fig. 1. The state of Veracruz, location and selected municipalities

The main objective of our study is to identify the main causes of death throughout 1918 using the International classification of diseases (ICD-10), elaborated by the World Health Organization, and to determine the impact of respiratory diseases in order to understand the possible effect of the Spanish flu.

Data source and methods

The source basis for the research is the death records from the Registro Civil — the Civil Registry for six selected municipalities in Veracruz state, Mexico — Xalapa, Coatepec, Cosautlán, Las Vigas, Tampico Alto and Gutiérrez Zamora. They are microfilmed with open access at FamilySearch [Registro Civil]. Altogether, we used 2 876 death certificates (see Table 1).

Table 1

Death certificates used for the research by municipality

Municipality	Abs N	%
Xalapa	1 349	46.9
Coatepec	711	24.7
Cosautlán	252	8.8
Las Vigas	191	6.6
Tampico Alto	106	3.7
Gutiérrez Zamora	267	9.3
Total	2 876	100.0

The records for 1918 are in relatively good condition, rather legible and complete. However, we assume there was under-registration of deaths, which cannot be ruled out. Unfortunately, parish records for some municipalities and years, including 1917 to 1919, perished during the Revolution or after, and thus cannot be used to verify the Civil Registry.

All records have the date of death and almost in all cases provide information on the age and marital status of the diseased person. In addition, some of them specify the occupation of some deceased men as military, “villista”, or “vagrant”. While race / ethnic classification had generally disappeared from the records as early as the end of the Independence War in 1824, some municipalities kept rudiments: the Gutiérrez Zamora records reported the deceased persons as “Latina/o white/o” or “Latina/o indigenous”; in Tampico Alto they marked people belonging to the “white race”; and in Cosautlán they marked people as “indigenous” or “non-indigenous”.

Up to 97.8 % of the records stated the causes of death: in Xalapa and Coatepec certified by a doctor, while in rural Las Vigas, Cosautlán, Tampico Alto and Gutiérrez Zamora we have no evidence that the death causes were certified by a professional. In 1910 the state of Veracruz had only 219 doctors for a population of 1 132 859 people; thus the doctor-patient ratio was 1 : 5173 [Dirección de Estadística]. The doctors naturally stayed in the administrative centers far away from their rural patients, who were dispersed over an area of 72 000 sq km. This hardly available professional medical care under normal circumstances, in the turbulent times of civil war became completely inaccessible for most. The physicians, while managing to help in some communities, left others without any medical help (see Table 2).

Table 2

Population density and patient per doctor ratio in six Veracruz municipalities, 1918*

Municipality	Population density	Doctors, N	Patient per doctor ratio
Xalapa	29.9	22	4 193
Coatepec	54.4	10	5 014
Cosautlán	54.4	10	5 014
Las Vigas	29.9	22	4 193
Tampico Alto	5.4	4	10 233
Gutiérrez Zamora	18.1	2	30 811

* Source: [Dirección de Estadística, p. 6].

As expected, there was high infant and child mortality in Veracruz, and the number of girls' deaths was higher than the boys' in the age group under 5 years old. Stillbirths were recorded in urban Xalapa but not in other municipalities. Also, there was a general under-registration of infants' death, especially in rural areas, which affected our results for this age group. The group 11 to 15 years old had fewer deaths, which may indicate that these children had immunity against certain contagious diseases such as measles, whooping cough, smallpox etc. We might ordinarily assume death under-registration among the females in the age group 16–40 years old, where the female mortality rate should have been higher than men's due to high maternal mortality. However, the violence in times of war could have caused an increase of male deaths in this age group (see Fig. 2).

Classifying causes of death

There were 480 different causes of death statements recorded in the Civil Registry in 1918, which we standardized to 161 unique death causes, using the 10th version of the International Statistical Classification of Diseases and Related Health Problems [ICD]. We then distributed these 161 death causes between the appropriate ICD classes[1]. We chose this extensive system to perform an explorative classification exercise and to compare a broad group of causes. Also, the ICD system allowed the identification of influenza-related respiratory diseases.

While encoding, we grouped death causes stated in the Civil Registry into standardized ones. For example, verbatim causes of the digestive system disorder, such as "enterocolitis", "enteritis-colitis", "chronic enteritis", "entire acute colitis", "chronic whole-colitis" etc. were encoded as "enteritis and enterocolitis". Likewise, the 51 verbatim causes of the respiratory system were homogenized into 12 groups:

[1] While this system has been widely used by historical demographers worldwide, the most recent attempt has been done to construct international historical classifications of diseases [Sommerseth, Walhout, 2019; 2020]. The Radboud Group is developing a historical version of ICD-10 for Historical Demography and Family History within the SHiP project — *editors' comment*.

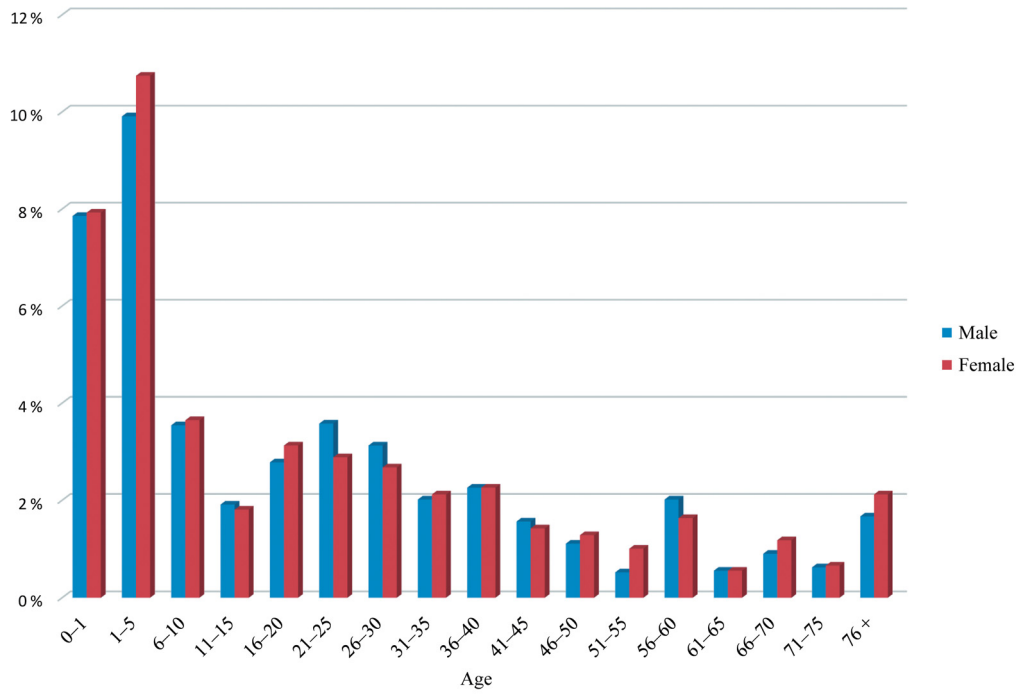

Fig. 2. Number of deaths in Veracruz in 1918
according to the Civil Registry by age group and sex (n = 2876)*

* Source: Own calculations based on death records from the Civil Registry
(Xalapa, Coatepec, Cosautlán, Las Vigas, Tampico Alto and Gutiérrez Zamora)

e.g. the causes registered as “capillary bronchitis”, “acute capillary bronchitis”, “acute bronchitis”, “catarrhal bronchitis”, “flu bronchitis”, “pulmonary bronchitis” were standardized as “bronchitis”. Conditions such as “double pneumonia”, “catarrhal pneumonia”, “severe acute pneumonia” were merged into the category of just “pneumonia”. Likewise, “bronchial influenza” and “influenza pneumonia” were standardized as “influenza”. A few death causes related to neonatal conditions were mostly registered as *alferecia*, likely referring to neonatal tetanus. On the other hand, causes of death defined as “senile exhaustion”, “vital exhaustion”, “senile cachexia”, “decrepitude”, “senile gangrene”, and “senile dementia” were grouped as “adult death causes” (see Table 3).

After standardization, we have 113 distinct causes of death registered by the civil registry in Xalapa, 73 in Coatepec, 31 Cosautlán, 24 in Las Vigas, 36 in Gutiérrez Zamora and 22 in Tampico Alto. It is noteworthy that in distinction to other municipalities, the unclear causes of deaths such as “pain”, “bile spill”, “colic pain”, “congestion”, etc., were not recorded in Xalapa. That indicates that there were differences between the capital and the countryside with respect to how the nosologies were implemented.

Table 3

Classification of causes of deaths by ICD-10 classes

I	X	XV	XVI	XX
Certain infectious and parasitic diseases (n = 22)	Diseases of the respiratory system (n = 12)	Pregnancy, childbirth and the puerperium (n = 10)	Certain conditions originating in the perinatal period (n = 9)	External causes of morbidity and mortality (n = 8)
Intestinal colic	Influenza	In labor	Lack of development	Wounds on skull, heart, foot, belly, brain, contusions
Colitis	Pneumonia	Endometritis	Congenital weakness	Wounds caused by firearm, stab wound, projectile
Diphtheria	Bronchitis	Miscarriage	Death at birth	Hung
Dissent	Broncho-pneumonia	Puerperal fever	Suffocation	Beheaded
Enteritis	Far/laryngitis	Others	Others	Executed
Enterocolitis	Tonsils	Puerperal septicemia	Umbilical hemorrhage	Strangulation
Erysipelas	Pulmonary congestion	Bleeding	Miscarriage	Killed in action of war
Fever	Pulmonary emphysema	Postpartum hemorrhage	Blue syncope	“Passed by guns”
Typhoid fever	Asthma	Acute sepsis	Stillbirth	
Gastroenteritis	Flu	Eclampsia		
Leprosy	Grippe			
Intestinal worms	Pulmonary enteritis			
Malaria				
Measles				
Septicemia				
Syphilis				
Tetanus				
Typhus				
Typhoid				
Whooping cough				
Tuberculosis				
Smallpox				

Gastrointestinal diseases occupy the first place in urban and some rural municipalities, while respiratory diseases were the most common in other rural municipalities. The climate factor, with average temperatures of 22 °C to 28 °C in Cosautlán, Gutiérrez Zamora and Tampico Alto could have affected the high frequency of malaria or typhoid which were simply called "fever". Influenza in rural municipalities was registered as the "grippe" or just "fever" because it was an unknown disease easily mixed with other ones. We may assume that respiratory diseases listed rather frequently such as pneumonia, bronchopneumonia and bronchitis, were likely influenza (the Spanish flu) especially considering the months when they were registered (see Table 4).

Table 4

Main causes of death in the six Veracruz municipalities, 1918*

Cosautlán	Gutiérrez Zamora	Las Vigas	Tampico Alto	Coatepec	Xalapa
Gastro-enteritis	Influenza	Flu	Flu	Enteritis	Gastro-enteritis
Fever	Fever	Pneumonia	Fever	Gastro-enteritis	Enterocolitis
Influenza	Malaria	Measles	Malaria	Flu	Tuberculosis
Eclampsia	Alferecía** / Tetanus Neonatal***	Epilepsy (Alferecía)****	Tuberculosis	Malaria	Wounds
Seizures	Pneumonia	Wounds	Pneumonia	Tuberculosis	Enteritis
Belly Inflammation	Pertussis	Gastroenteritis	Childbirth	Wounds	Stillborn
Seizures / Neonatal Tetanus	Gastro-enteritis	Senility	Wounds	Bronchitis	Influenza
Senility	Tuberculosis	Pertussis	Gastro-enteritis	Pneumonia	Broncho-pneumonia
Malaria	Wounds	Alferecía / Neonatal Tetanus	Other	Dysentery	Pneumonia
Death at Birth	Tuberculosis	Cancer	Senility	Meningitis	Bronchitis

* Source: Own calculations based on death records from the Civil Registry (Xalapa, Coatepec, Cosautlán, Las Vigas, Tampico Alto and Gutiérrez Zamora).

** *Alferecia* refers to convulsions.

*** Mostly infants aged under 28 days.

**** Mostly infants aged over 28 days.

When implementing the nosology, we grouped the possible death causes into eight classes. Five classes we borrowed from the ICD: I — Certain infectious and parasitic diseases; X — Diseases of the respiratory system; XV — Pregnancy, childbirth and the puerperium; XVI — Certain conditions originating in the perinatal period; XX — External causes of morbidity and mortality. The remaining three classes, we introduced for the unclassified infantile causes; causes impossible to classify and for the cases missing cause of death.

Certain infectious diseases claimed 42.2 % of all deaths in Veracruz during 1918; respiratory diseases caused 23.1 %; and conditions related to pregnancy, childbirth and originated in the perinatal period made up 9.4 %. The deaths caused by external causes composed up to 5.9 % of all deaths, and were mainly related to violence during the war period: e.g. wounds caused by weapons, shooting etc. Often, these records lack the deceased person's identity and/or age.

According to the Civil Registry, there was a significant increase in deaths in Veracruz caused by respiratory diseases in November and December 1918 (see Fig. 3).

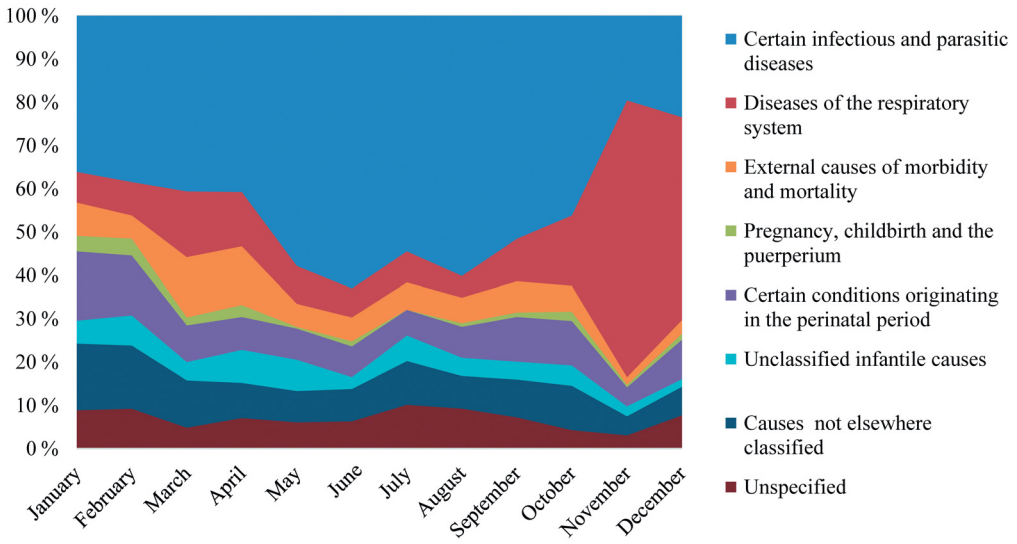

Fig. 3. Death causes' monthly distribution (n = 2876)*

* Source: Own calculations based on death records from the Civil Registry (Xalapa, Coatepec, Cosautlán, Las Vigas, Tampico Alto and Gutiérrez Zamora)

In 1918 two main factors affected mortality in Veracruz severely: the Spanish flu epidemic and the war. Mortality in all age groups seem to have been impacted directly or indirectly by scarcity, famine, military actions and the pandemic. Information provided by the Mexican government asserts that the Spanish flu had invaded the state of Veracruz since September and until December 1918 [Blázquez], however in some

municipalities extensive registration of respiratory diseases ended only in January or February 1919 [Méndez, Abejez]. Thus, the increase in deaths started in September, followed by a decrease in December in the urban and rural municipalities, particularly in Las Vigas, Gutiérrez Zamora and Tampico Alto. Another aspect to consider is the increase in deaths during the hot summer months, even if the rising pandemic curve in the autumn makes them look less significant (see Fig. 4).

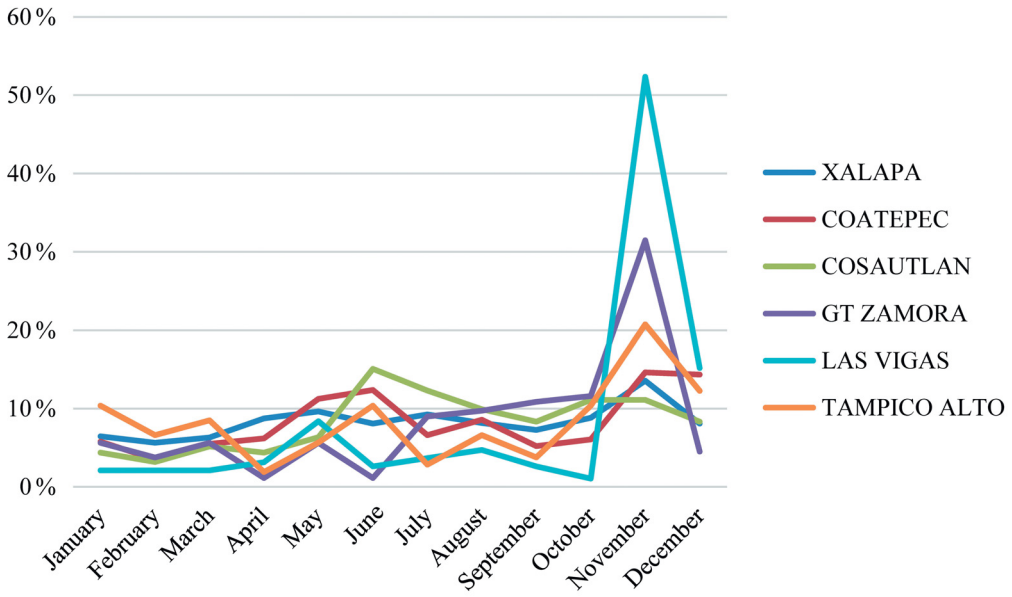

Fig. 4. Monthly distribution of deaths by municipalities, 1918

Source: Own calculations based on death records from the Civil Registry (Xalapa, Coatepec, Cosautlán, Las Vigas, Tampico Alto and Gutiérrez Zamora)

The mortality by age groups seems to be similar in most municipalities; however, Tampico Alto likely had significant under-registration of deaths among children aged under five years old. Probably, there was a surplus of deaths in the 25–44 age group due to maternal mortality and violence caused by the war (see Fig. 5).

Infectious and parasitic diseases were the most common death causes, but the number of deaths caused by these infections decreased during the Spanish flu pandemic. The number of deaths caused by respiratory diseases increased in September and peaked in November. The increase in total deaths during the last 1918 quarter was due to the Spanish flu, which despite the official statement at the time remained lethal also in December. Las Vigas and Gutiérrez Zamora had the highest mortality caused by respiratory diseases (see Fig. 6). Mortality from infections and respiratory diseases had the same pattern throughout the year. Under-registration of deaths occurred in connection with pregnancy and childbirth. Also, deaths caused

by conditions originating in the perinatal period (classes XV and XVI) influenced the mortality statistics, especially in rural areas [Méndez Maín, Abejez]. External causes of death (class XX) mainly occurred due to the Civil War and peaked in April and May. The entries in the Civil Registry often provide details such as "decapitated", "killed in combat", "two shots", "hung", "wounded in the campaign", etc. Some records provide no information on the name or age of the person but just attribute him to one of the combating sides, e.g. "dead Zapatista" or "killed by Chiltoyac forces".

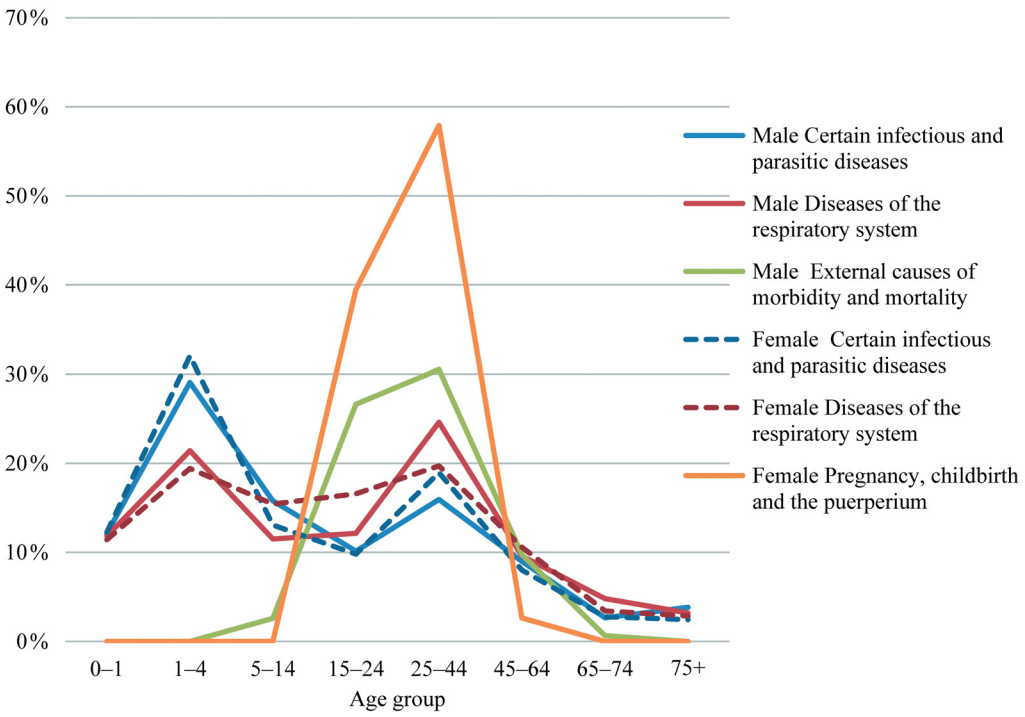

Fig. 5. Mortality by age, sex, and main causes

Source: Own calculations based on death records from the Civil Registry (Xalapa, Coatepec, Cosautlán, Las Vigas, Tampico Alto and Gutiérrez Zamora)

Finally, using the 1900 and 1910 census data, we projected the population size for 1918[2]. Together with the death certificates for the six selected municipalities of Veracruz, this allowed us to estimate the 1918 mortality rate at 42.5 ‰, which is higher than the rate for the whole of Mexico for 1918–1919 at 35 ‰ calculated earlier [Valdez Aguilar].

[2] The 1918 population size of each municipality was estimated with the 1900 and 1910 censuses by computing the growth rate of each age group during the century's first decade and then project the same growth rates until June 30, 1918.

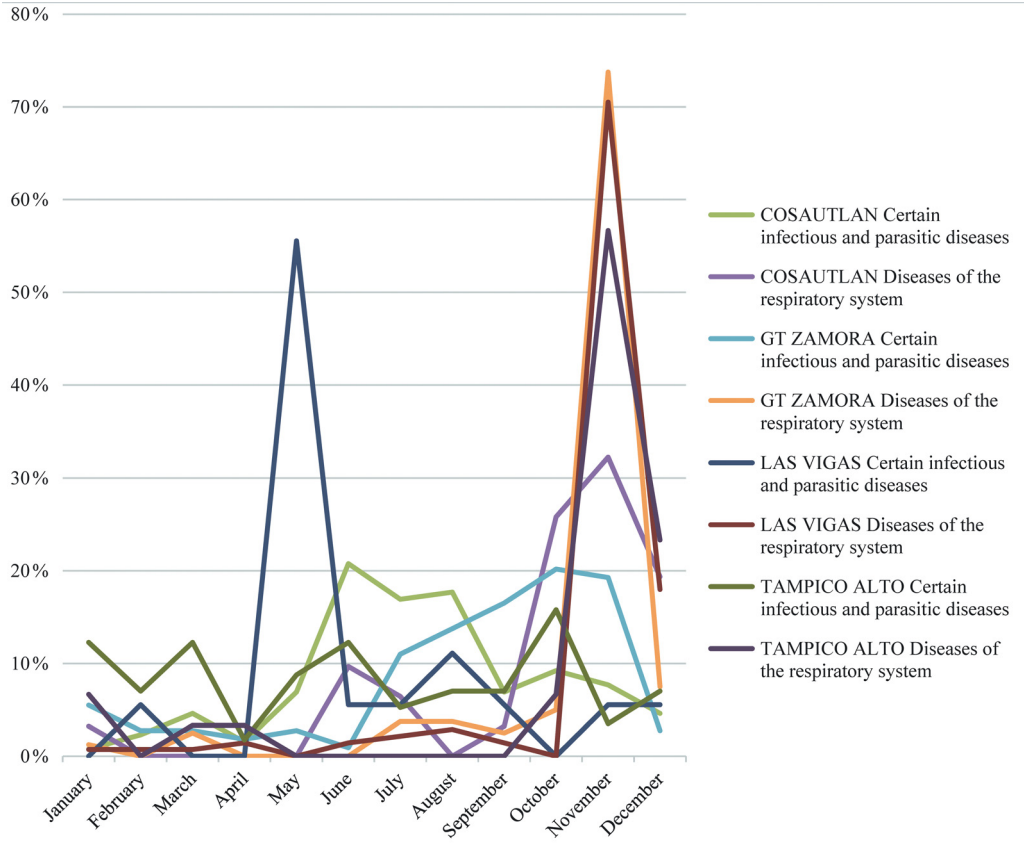

Fig. 6. Mortality from infectious and respiratory diseases, by month
Source: Own calculations based on death records from the Civil Registry (Xalapa, Cosautlán, Las Vigas, Tampico Alto and Gutiérrez Zamora)

Conclusion

Our analyses of the selected Veracruz Civil Registries for 1918 showed that the registration of death causes was more accurate and precise in urban areas, and that the lists of death causes mentioned in the death certificates had significantly more variations in Xalapa. In addition, the "diagnosis" was often rather descriptive, based on symptoms, indicating that the death records were likely not certified by doctors, especially in rural municipalities.

Our results show high mortality from influenza in Veracruz in 1918. However, the government tended to minimize its mortal influence due to political issues and a lack of knowledge about its lethality. Furthermore, infectious and parasitic diseases, mainly gastrointestinal, were the leading causes of death before the Spanish flu arrived. These diseases caused high mortality, especially among youngsters, and hence a low life expectancy. In addition, the revolutionary period of 1918, followed

by the Civil War, caused the rise of mortality from violence, particularly causing high male mortality in the age group 15–44.

It is likely that malnutrition also increased the death toll; thus, exploring the maternal and neonatal mortality of infants who died during or shortly after delivery and whose death cause was stated as "lack of development" is a pending issue for further research. The turbulence of war and the shortages made the population weaker and generally more vulnerable to diseases. This situation undoubtedly prevailed in the population living in the rural area of Veracruz state, but also among those living in the small urban centers, some of them like Coatepec lacking medical infrastructure. Our findings show how high mortality dominated during 1918 and proved that the influenza wave continued into 1919 in contrast to the official government statement that there was no new Spanish flu wave in 1919. The bottom line is that both civil war and the influenza epidemic particularly hit the young men.

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