Supplementary Materials

In Utero Exposure to Chikungunya and Child Morbimortality: A Population-Based Longitudinal Study

Authors:
Mio Kushibuchi, MD, MSc[1]; Orlagh Carroll, PhD[2]; Thiago Cerqueira-Silva, MD, PhD[2,4]; Viviane S. Boaventura, MD, PhD[3, 4]; Maria Glória Teixeira, M.D, PhD[5]; Mauricio L Barreto, MD, PhD[1]; and Enny S Paixão, PhD[2]

1 Centre for Data and Knowledge Integration for Health (CIDACS), Fundação Oswaldo Cruz, Salvador, Brazil;
2 Faculty of Epidemiology and Population Health, London School of Hygiene and Tropical Medicine, London, UK;
3 Faculty of Medicine of Bahia, Universidade Federal da Bahia, Salvador, Brazil.
4 The Gonçalo Moniz Institute (IGM), Fundação Oswaldo Cruz, Salvador, Brazil.
5 Institute of Collective Health (ISC), Federal University of Bahia, Brazil

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Supplementary material 1: The details of each dataset and variables obtained from the dataset, as well as the information on the linkage

Material 1.1: Databases used in the analysis, obtained from the cohort profile

Information cited from the cohort profile described in detail in Paixão 2024(1)

Database	Description	Variable used	Sensitivity
SINASC (Sistema de Informação sobre Nascidos Vivos/ Information System of Live Birth)	SINASC is the birth registry of Brazil, completed by a health professional who was present at the delivery	Information about the mother (age, educational attainment, marital status, and race/ethnicity), the pregnancy (the length of gestation, the number of previous gestations, whether the pregnancy was a singleton, and the number of antenatal care visits), and the newborn (birth date, sex, the municipality of residence, birth weight, gestational age at birth, and the APGAR score at 1 minute and 5 minutes).	Records information of 97% of Brazilian live births
CadUnico (Cadastro único para Programas Sociais/ Unified System for Social Programs	CadUnico is an integrated system in which all households and individuals receiving any social programs, including the conditional cash transfer program Bolsa Familia, are registered. It contains socioeconomic information about these families.	Whether the mother of the newborn is registered in the CadUnico, and the urbanicity of the residence.	More than 50% of the Brazilian population
SINAN (Sistema de Informação sobre Agravos de Notificação/ Information System for Notifiable Diseases)	SINAN contains all the registered cases of specific infectious diseases including Chikungunya, Dengue and Zika. The health professional who diagnosed these infections in the local health center registers all cases in this system. The system is disease specific.	Date of symptom onset, date of registry, and the diagnosis (either clinical or lab-confirmed) of the CHIKV, DENV and ZIKV infection	Depends on the disease
SIM (Sistema de Informação sobre Mortalidade/ Information System of Mortality)	SIM uses the death certificate, a legal document that records all deaths.	Date of death	Varies by place, range 70–95% of Brazilian deaths

SIH (Sistema de Informações Hospitalares/ Hospitalization Information System)	SIH is the register for all hospital admissions in the public hospital, under the national health system (Sistema Único de Saude). Admissions in private hospitals are not included, but it is probable that the poorer population registered in CadUnico uses the public hospitals.	Date of hospitalization and the cause (ICD-10) of hospitalization	Around 70% of all hospitalizations in Brazil

Material 1.2: Details on the exclusion criteria

Criteria	Numbers	Reason
Births with mismatched birth dates between SINASC and SIH	21064	Remove data with inconsistencies in the chronology of events, which has a high probability of linkage error
Does not have an RGI	235	The RGI was used for matching; thus, the information was needed for selecting the cohort.
Non-singleton births	123922	Having multiple fetuses is a high risk of birth complications and neonatal morbidity, thus the outcome may be caused by this rather than the infection.
Births with inconsistent dates (date for hospitalization or death before the date of birth)	119	Remove data with inconsistencies in the chronology of events, which has a high probability of linkage error
Births with missing gestational age at birth	130969	Gestational age information is needed to define the timing of exposure.
Births from mothers younger than 14.9 years or older than 49.9 Years	56657	The reproductive age defined by the WHO is 15 to 49 years. There is high possibility that the extreme values were errors in the data record, and if the value is true, the young (or old) maternal age is associated with birth complications.
Births with weights of below 500g or above 6000g	7040	There is high possibility of error in data record, and even if the value is true, that the newborn was hospitalized or died due to the underlying condition that caused a low birth weight.
Births with gestational ages below 20 weeks or above 45 weeks	479	There is high possibility of error in data record, and even if the value is true, that the newborn was hospitalized or died due to prematurity rather than the infection

Births exposed to in-utero DENV or ZIKV	41136	The outcome of event (hospitalization or death) may have been associated with the exposure to other Arboviruses, especially given that ZIKV is known to cause congenital Zika syndrome
Births with inconsistent CHIKV infection status (more than 2 infection registries which were more than 30 days apart)	11	It was uncertain whether both registries were of the same episode, and there was high possibility that at least one of the registries was a misclassification. Furthermore, we were not sure which of the multiple registries was the actual date the symptom started.
Births with CHIKV symptom onset before January 1st 2015	19	Although there were some CHIKV cases reported in specific regions during 2014, the disease diagnosis protocol had not been well established before the outbreak in 2015, thus there was a high possibility of misclassification.

Material 1.3: Details on the linkage accuracy

A detailed information is available in Ali 2019(2) and Paixao 2024(1). In summary, record linkage was performed using CIDACS-RL, a validated tool developed for large-scale Brazilian administrative data. This approach combines deterministic and probabilistic matching techniques, utilizing key identifiers including name, mother's name, date of birth, sex, and municipality of residence. Prior to linkage, datasets underwent rigorous preprocessing, including standardization of names and dates, imputation of missing values, and removal of duplicates.

The CIDACS-RL algorithm uses Apache Lucene for indexing and blocking to reduce computational demands, followed by a hybrid matching approach. Categorical variables were matched deterministically, while names and dates were compared probabilistically using similarity functions like the Dice coefficient. The linkage process was conducted within the secure data infrastructure of CIDACS, adhering to strict data security protocols and ethical governance. CIDACS-RL has been previously validated with >90% sensitivity and specificity.

Supplementary material 2: The distribution of missing variables among observations with at least one variable missing, and those with complete variables.

	Observations with missing covariates			Observations without missing covariates		
	N	Overall N = 751,085	Exposed N = 793	N	Overall N = 4,662,527	Exposed N = 3,154
Gestation weeks at birth	751,085	39 (38, 40)	39 (38, 40)	4,662,527	39 (38, 40)	39 (38, 40)
Gestation week category	751,085			4,662,527		
19wks and below		0 (0%)	0 (0%)		0 (0%)	0 (0%)
20-27wks		4,237 (0.6%)	3 (0.4%)		18,507 (0.4%)	14 (0.4%)
28-31wks		8,201 (1.1%)	11 (1.4%)		41,833 (0.9%)	26 (0.8%)
32-36wks		69,154 (9.2%)	72 (9.1%)		415,906 (8.9%)	254 (8.1%)
37-46wks		669,493 (89%)	707 (89%)		4,186,281 (90%)	2,860 (91%)
47wks or more		0 (0%)	0 (0%)		0 (0%)	0 (0%)
Maternal education level	675,334			4,662,527		
none		8,342 (1.2%)	9 (1.3%)		22,494 (0.5%)	17 (0.5%)
1-3 years		30,505 (4.5%)	19 (2.7%)		131,061 (2.8%)	118 (3.7%)
4-7 years		152,755 (23%)	148 (21%)		999,980 (21%)	693 (22%)
8-11 years		420,391 (62%)	472 (67%)		3,146,550 (67%)	2,103 (67%)
12 or more years		63,341 (9.4%)	55 (7.8%)		362,442 (7.8%)	223 (7.1%)
Unknown		75,751	90		0	0
Maternal race	515,332			4,662,527		
Asian		1,446 (0.3%)	0 (0%)		13,386 (0.3%)	8 (0.3%)
Black		31,177 (6.0%)	8 (1.7%)		298,369 (6.4%)	112 (3.6%)
Indigenous		7,623 (1.5%)	1 (0.2%)		47,999 (1.0%)	9 (0.3%)
Pardo		368,633 (72%)	412 (87%)		2,988,021 (64%)	2,693 (85%)
White		106,453 (21%)	50 (11%)		1,314,752 (28%)	332 (11%)
Unknown		235,753	322		0	0
Maternal age	751,078	25 (20, 29)	25 (21, 30)	4,662,524	24 (20, 30)	25 (21, 31)
Unknown		7	0		0	0
Maternal age category	751,078			4,662,523		
15 to 19		150,004 (20%)	145 (18%)		964,666 (21%)	587 (19%)
20 to 34		526,473 (70%)	549 (69%)		3,225,663 (69%)	2,227 (71%)
35 to 49		74,601 (9.9%)	99 (12%)		472,194 (10%)	340 (11%)
Unknown		7	0		0	0

Number of antenatal care visits	595,900			4,662,527		
adequate		521,486 (80%)	641 (87%)		3,653,685 (78%)	2,611 (83%)
one less		53,319 (8.1%)	45 (6.1%)		392,693 (8.4%)	251 (8.0%)
2+ less		81,076 (12%)	50 (6.8%)		616,149 (13%)	292 (9.3%)
Unknown		155,185	84		0	0
Number of gestations	468,126			4,662,527		
No parity		140,980 (30%)	143 (29%)		1,629,840 (35%)	1,088 (34%)
1-2 parity		240,283 (51%)	268 (54%)		2,240,895 (48%)	1,496 (47%)
3 or more parities		86,863 (19%)	84 (17%)		791,792 (17%)	570 (18%)
Unknown		282,959	298		0	0
Urbanicity of residence	592,379			4,662,527		
Rural		172,614 (29%)	135 (20%)		1,042,541 (22%)	651 (21%)
Urban		419,765 (71%)	531 (80%)		3,619,986 (78%)	2,503 (79%)
Unknown		158,706	127		0	0
All-cause hospitalization	751,085	148,760 (20%)	221 (28%)	4,662,527	901,171 (19%)	686 (22%)
All-cause death	751,085	9,760 (1.3%)	13 (1.6%)	4,662,527	48,352 (1.0%)	38 (1.2%)

Supplemental material 4: STROBE statement checklist

	Item No	Recommendation
Title and abstract	1	(*a*)The study design, longitudinal study, is stated in the title
		(*b*) The methods section of the abstract summarizes what we did, and the results section summarizes what was found.
Introduction		
Background/rationale	2	The scientific background and rationale for the investigation is explained in the second and third paragraph of the introduction
Objectives	3	The objectives of ths study is stated in the last paragraph of the introduction
Methods		
Study design	4	The key elements of the study design (a matched cohort study following children from birth until hospitalization, death, age 3, or Dec 31, 2018) are described at the beginning of the Methods, under Study design

Setting	5	The study setting, population, and time frame are described under Study design and Study population. Children were born between Jan 1, 2015 and Dec 31, 2018 in Brazil. Data were obtained from linked administrative databases (CIDACS Birth Cohort, CADU, SINASC, SINAN, SIH, SIM). Follow-up extended to Dec 31, 2018, with periods of exposure and outcomes clearly defined.
Participants	6	(*a*) Eligibility criteria, sources, and selection are described under Study population. Exclusions included non-singletons, implausible dates, missing gestational age, implausible birthweight, and exposure to ZIKV or DENV. Participants were followed until hospitalization, death, age 3, or end of 2018.
		(*b*) Matching criteria are given under Statistical analysis: each exposed newborn was matched to 10 unexposed by month of conception and Immediate Geographic Region (RGI). Final numbers were 3,154 exposed and 31,540 unexposed.
Variables	7	Definitions of exposures, outcomes, predictors, confounders, and effect modifiers are described in Exposures, Outcome, and Covariates. Exposures: maternal CHIKF infection during pregnancy, stratified by trimester and intrapartum. Outcomes: first hospitalization and all-cause death by age 3. Covariates included maternal education, race/skin colour, age, adequacy of antenatal care, previous gestations, and urbanicity.
Data sources/ measurement	8	Sources of data and methods of assessment are detailed under Data source. Maternal and child data came from SINASC, social information from CADU, exposures from SINAN, hospitalizations from SIH, and deaths from SIM. Assessment methods were consistent across exposed and unexposed groups because they rely on the same national surveillance systems.
Bias	9	Efforts to reduce bias are described in Statistical analysis and Limitations. Matching by conception month and RGI reduced temporal and geographic confounding. Excluding records with implausible or inconsistent data minimized misclassification. Sensitivity analyses (lab-confirmed cases, alternative exposure definitions, restriction to term/normal weight births) addressed possible misclassification and residual confounding
Study size	10	Study size was determined by including all eligible live births in the CIDACS Birth Cohort between 2015 and 2018 after applying exclusion criteria. No formal sample size calculation was performed.
Quantitative variables	11	Quantitative variables were categorized where appropriate (e.g., maternal age into 3 groups, gestational age into term/preterm, education into categories). Some categories were collapsed (e.g., maternal education none/1–3 years, race white/non-white) to ensure sufficient statistical power
Statistical methods	12	(*a*) Statistical methods are described under Statistical analysis: stratified Cox proportional hazards models adjusted for confounders estimated HRs, with marginal standardized risk differences. Kaplan–Meier curves described survival. Bootstrapping was used for confidence intervals.

		(*b*) Subgroup analyses included trimester-specific and intrapartum exposures; interactions were assessed by categorizing exposure timing.
		(*c*) Missing data were minimal (<6%); a complete case analysis was performed.
		(*d*) All hospitalizations and deaths are registered in the national registry, thus there were no loss to follow-up
		(*e*) Four sensitivity analyses were conducted: restriction to term/normal weight births, restriction to lab-confirmed cases, extended exposure window to two days post-birth, and alternative matching criteria (4:1 matching).
Results		
Participants	13*	(a) Numbers of individuals at each stage are reported in Results, Study population and baseline characteristics and shown in Figure 1. From 5,795,265 live births, exclusions were applied, leaving 3,154 exposed and 31,540 matched unexposed.
		(b) Reasons for non-participation (exclusions: non-singletons, implausible dates, implausible birthweight, missing gestational age, other arbovirus exposures, inconsistent CHIKF records) are described in Study population (Methods).
		(c) A flow diagram of inclusion/exclusion is provided in Figure 1.
Descriptive data	14*	(a) Characteristics of study participants (demographics, maternal and pregnancy variables, covariates) are shown in Table 1 and Supplementary Table 4.
		(b) Numbers of missing data for each variable are given in Supplementary Table 2.
		(c) Follow-up time is summarized in Results: median follow-up for hospitalization was 19.1 months [IQR: 27.9], and for death was 25.8 months [IQR: 23.2].
Outcome data	15*	Numbers of outcome events are reported in Results. Hospitalizations: 687 (21%) in exposed and 5,705 (18%) in unexposed. Deaths: 38 (1.2%) in exposed and 342 (1.1%) in unexposed. Further details by cause are shown in Supplementary Tables 5–11 and Figures 2–4.
Main results	16	(*a*) The crude hazards are described as Kaplan Meier curves. Confounder-adjusted hazard ratios and risk differences with 95% CIs are reported in Results, All-cause first hospitalization and All-cause death, adjusted for maternal education, race/skin colour, age, antenatal care, previous gestations, and urbanicity.
		(*b*) Category boundaries are defined in Covariates (e.g., maternal age 15–19, 20–34, 35–49; education collapsed into categories; race white vs non-white).
		(*c*) Absolute risks and standardized risk differences per 1000 children are presented in Results, All-cause hospitalization (e.g., 39.4 additional hospitalizations per 1000 exposed).
Other analyses	17	Analyses of subgroups (by trimester, intrapartum, neonatal outcomes) and sensitivity analyses (term/normal weight births, lab-confirmed cases, extended exposure window, alternative matching) are described in Results, Sensitivity analyses and Methods, Statistical analysis.
Discussion		

Key results	18	Key results are summarized in the first paragraph of Discussion: a 22% higher hazard of hospitalization and possible increased risk of death, especially with intrapartum and early-trimester exposures.
Limitations	19	Limitations are discussed in Discussion, including live birth bias, passive surveillance and misclassification, missing data, lack of confounders (income, living conditions), under-ascertainment, and reduced power in sensitivity analyses.
Interpretation	20	Interpretation is provided throughout Discussion, linking findings to previous literature, hypothesized biological mechanisms, and public health implications, while acknowledging uncertainty and imprecision of mortality estimates.
Generalisability	21	Generalisability is discussed in Discussion: findings are relevant to Brazil and globally, given the expansion of endemic areas to Europe with climate change and globalization.
Other information		
Funding	22	Funding sources (Wellcome Trust, Royal Society) are reported in the Abstract and under Funding at the end of the manuscript.

Supplementary material 4: The characteristics of the matched and the non-matched controls.

	N	Overall N = 34,694	Matched		Not matched
			Non-exposed N = 31,540	Exposed N = 3,154	Non-exposed N = 4,627,833
Sex	34,688				
Female		16,864 (49%)	15,342 (49%)	1,522 (48%)	2,256,217 (49%)
Male		17,824 (51%)	16,193 (51%)	1,631 (52%)	2,370,911 (51%)
Unknown		6	5	1	705
Birth weight	34,692	3,265 (2,950, 3,580)	3,265 (2,950, 3,580)	3,270 (2,955, 3,590)	3,235 (2,930, 3,545)
Unknown		2	2	0	1,300
Birth weight category	34,692				
500g and below		0 (0%)	0 (0%)	0 (0%)	0 (0%)
501-1000g		138 (0.4%)	127 (0.4%)	11 (0.3%)	17,461 (0.4%)
1001-1500g		196 (0.6%)	179 (0.6%)	17 (0.5%)	27,613 (0.6%)
1501-2500g		2,047 (5.9%)	1,849 (5.9%)	198 (6.3%)	296,358 (6.4%)
2501-4000g		30,177 (87%)	27,463 (87%)	2,714 (86%)	4,040,790 (87%)
4001-6000g		2,134 (6.2%)	1,920 (6.1%)	214 (6.8%)	244,311 (5.3%)
6001g and above		0 (0%)	0 (0%)	0 (0%)	0 (0%)
Unknown		2	2	0	1,300
Gestation weeks at birth	34,694	39 (38, 40)	39 (38, 40)	39 (38, 40)	39 (38, 40)
Gestation week category	34,694				
19wks and below		0 (0%)	0 (0%)	0 (0%)	0 (0%)
20-27wks		161 (0.5%)	147 (0.5%)	14 (0.4%)	18,346 (0.4%)
28-31wks		318 (0.9%)	292 (0.9%)	26 (0.8%)	41,515 (0.9%)
32-36wks		3,141 (9.1%)	2,887 (9.2%)	254 (8.1%)	412,765 (8.9%)
37-46wks		31,074 (90%)	28,214 (89%)	2,860 (91%)	4,155,207 (90%)
47wks or more		0 (0%)	0 (0%)	0 (0%)	0 (0%)
Maternal marital status	34,466				
divorced		226 (0.7%)	201 (0.6%)	25 (0.8%)	48,371 (1.1%)
married		7,508 (22%)	6,883 (22%)	625 (20%)	1,004,107 (22%)
single		16,180 (47%)	14,684 (47%)	1,496 (48%)	2,318,767 (50%)
union		10,484 (30%)	9,507 (30%)	977 (31%)	1,224,609 (27%)

widowed		68 (0.2%)	59 (0.2%)	9 (0.3%)	7,302 (0.2%)
Unknown		228	206	22	24,677
apgar1	33,834				
3 or below		410 (1.2%)	380 (1.2%)	30 (1.0%)	55,887 (1.2%)
4 to 6		1,469 (4.3%)	1,320 (4.3%)	149 (4.9%)	205,994 (4.6%)
7 or more		31,955 (94%)	29,064 (94%)	2,891 (94%)	4,257,282 (94%)
Unknown		860	776	84	108,670
Maternal education level	34,694				
1-3 years		1,351 (3.9%)	1,233 (3.9%)	118 (3.7%)	129,710 (2.8%)
12 or more years		2,575 (7.4%)	2,352 (7.5%)	223 (7.1%)	359,867 (7.8%)
4-7 years		8,227 (24%)	7,534 (24%)	693 (22%)	991,753 (21%)
8-11 years		22,310 (64%)	20,207 (64%)	2,103 (67%)	3,124,240 (68%)
none		231 (0.7%)	214 (0.7%)	17 (0.5%)	22,263 (0.5%)
Maternal race	34,694				
Asian		86 (0.2%)	78 (0.2%)	8 (0.3%)	13,300 (0.3%)
Black		1,538 (4.4%)	1,426 (4.5%)	112 (3.6%)	296,831 (6.4%)
Indigenous		196 (0.6%)	187 (0.6%)	9 (0.3%)	47,803 (1.0%)
Pardo		28,825 (83%)	26,132 (83%)	2,693 (85%)	2,959,196 (64%)
White		4,049 (12%)	3,717 (12%)	332 (11%)	1,310,703 (28%)
Maternal age	34,694	25 (20, 30)	24 (20, 30)	25 (21, 31)	24 (20, 30)
Maternal age category	34,694				
15 to 19		7,073 (20%)	6,486 (21%)	587 (19%)	957,597 (21%)
20 to 34		24,091 (69%)	21,864 (69%)	2,227 (71%)	3,201,572 (69%)
35 to 49		3,530 (10%)	3,190 (10%)	340 (11%)	468,664 (10%)
Number of antenatal care visits	34,694				
0-3 times		2,505 (7.2%)	2,349 (7.4%)	156 (4.9%)	366,114 (7.9%)
4-5 times		5,341 (15%)	4,930 (16%)	411 (13%)	665,993 (14%)
6 or more times		26,848 (77%)	24,261 (77%)	2,587 (82%)	3,595,726 (78%)
Number of previous gestations	34,694				
No parity		12,126 (35%)	11,038 (35%)	1,088 (34%)	1,617,714 (35%)
1-2 parity		16,942 (49%)	15,446 (49%)	1,496 (47%)	2,223,953 (48%)
3 or more parity		5,626 (16%)	5,056 (16%)	570 (18%)	786,166 (17%)

Urbanicity of residence	34,694				
Rural		9,808 (28%)	9,157 (29%)	651 (21%)	1,032,733 (22%)
Urban		24,886 (72%)	22,383 (71%)	2,503 (79%)	3,595,100 (78%)
All-cause hospitalization	34,694	6,392 (18%)	5,705 (18%)	687 (22%)	894,866 (19%)
All-cause death	34,694	380 (1.1%)	342 (1.1%)	38 (1.2%)	47,973 (1.0%)

Supplementary material 5: The number of events overall and in each stratum.

	Total number	Admissions		Death	
		Number	Percentage	Number	Percentage
Overall	34694	6305	18.17%	379	1.09%
Unexposed	31540	5619	17.82%	342	1.08%
Exposed	3154	686	21.75%	38	1.2%
First	888	281	31.64%	9	1.01%
Second	1239	214	17.27%	18	1.45%
Third	1027	215	20.93%	11	1.07%
Antepartum	3040	649	21.35%	33	1.09%
Intrapartum	114	37	32.46%	5	4.39%

Supplementary material 6: The number of neonatal events in each stratum.

	Total number	Admissions		Death	
		Number	Percentage	Number	Percentage
Overall	34694	3455	9.96%	233	0.67%
Unexposed	31540	3099	9.83%	207	0.66%
Exposed	3154	356	11.29%	26	0.82%
First	888	102	11.49%	4	0.45%
Second	1239	148	11.95%	14	1.13%
Third	1027	106	10.32%	8	0.78%
Antepartum	3040	333	10.95%	22	0.72%
Intrapartum	114	23	20.18%	4	3.51%

Supplementary material 7: HR of the Cox regressions and their 95% CI obtained by bootstrapping.

		HR	Bootstrapped 95% CI
Admission	Overall	1.212	[1.109-1.324]
	First trimester	1.281	[1.089-1.499]
	Second trimester	1.277	[1.142-1.469]
	Third trimester	1.085	[0.942-1.259]
	Antepartum	1.188	[1.093-1.29]
	Intrapartum	1.882	[1.217-2.828]
Death	Overall	1.076	[0.699-1.506]
	First trimester	0.851	[0.352-1.668]
	Second trimester	1.343	[0.77-2.413]
	Third trimester	0.971	[0.432-1.819]
	Antepartum	0.969	[0.629-1.408]
	Intrapartum	3.914	[1.031-12.398]

Abbreviations: 95% CI, 95 percent confidence interval

Supplementary material 8: Standardized marginal risk and absolute risk difference per 1000 population for each exposure group, and their 95% confidence interval (CI) obtained by bootstrapping.

		Risk difference per 1000 people	95% CI			Risk difference per 1000 people	95% CI
Admission	12 months	25.77	[4.27-74.7]	Death	12 months	0.71	[-7.58-25.72]
	24 months	30.79	[5.05-87.6]		24 months	0.78	[-7.72-25.92]
	36 months	32.88	[5.42-92.74]		36 months	0.79	[-8.55-27.92]

Abbreviations: 95% CI, 95 percent confidence interval

Supplementary material 9: Proportional hazards assumption test by Schoenfeld residuals.

Cox model	Exposure variable	p value	PH Assumption Violated
Main analysis for admissions			
Overall	chik	0.481	No
Analyses by trimester	trimester	0.65	No
Analyses by intrapartum period	intrapartum	0.459	No
Main analysis for deaths			
Overall	chik	0.898	No
Analyses by trimester	trimester	0.915	No
Analyses by intrapartum period	intrapartum	0.889	No
Sub-analyses of neonatal outcomes			
Admissions	chik	0.091	No
Deaths	chik	0.122	No
Sensitivity analyses for normal-weight and -term births			
Admissions	chik	0.301	No
Deaths	chik	0.336	No
Sensitivity analyses for lab-confirmed cases			
Admissions	chik	0.033	Yes
Deaths	chik	0.53	No
Sensitivity analyses including exposures until 2 days after birth			
Admissions, overall	chik	0.517	No
Admissions, intrapartum period	intrapartum	0.143	No
Death, overall	chik	0.822	No
Death, intrapartum period	intrapartum	0.22	No
Sensitivity analyses for mont-year and municipality matching			
Admissions	chik	0.515	No
Deaths	chik	0.08	No
Sensitivity analyses for propensity score matching			
Admissions	chik	0.69	No
Deaths	chik	0.226	No

Exposure variables chik was a binary variable of exposed and non-exposed; trimester was a four-level categorical variable of non-exposed, first trimester, second trimester and third trimester; intrapartum was a three-level categorical variable of non-exposed, antepartum and intrapartum.

Supplementary material 10: HR of the Cox regressions of neonatal outcomes and their 95% CI obtained by bootstrapping.

	HR	Bootstrapped 95% CI
Neonatal Admission	1.125	[1.001-1.269]
Neonatal Death	1.21	[0.75-1.856]

Abbreviations: 95% CI, 95 percent confidence interval

Supplementary material 11: The ICD-10 codes and classes for the causes of the first-time hospitalizations.

Letter(s)	ICD Chapter Title	Non exposed		Exposed	
		N	%	N	%
A–B	Certain infectious and parasitic diseases	901	16.2%	120	17.8%
C–D (C00–D48)	Neoplasms	4	0.1%	0	0%
D (D50–D89)	Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	36	0.6%	4	0.6%
E	Endocrine, nutritional and metabolic diseases	53	1%	6	0.9%
F	Mental and behavioural disorders	0	0%	0	0%
G	Diseases of the nervous system	67	1.2%	6	0.9%
H00–H59	Diseases of the eye and adnexa	3	0.1%	0	0%
H60–H95	Diseases of the ear and mastoid process	21	0.4%	3	0.4%
I	Diseases of the circulatory system	16	0.3%	3	0.4%
J	Diseases of the respiratory system	1265	22.7%	146	21.6%
K	Diseases of the digestive system	131	2.4%	20	3%
L	Diseases of the skin and subcutaneous tissue	118	2.1%	16	2.4%
M	Diseases of the musculoskeletal system and connective tissue	9	0.2%	2	0.3%
N	Diseases of the genitourinary system	143	2.6%	21	3.1%
O	Pregnancy, childbirth and the puerperium	2	0%	0	0%
P	Certain conditions originating in the perinatal period	2506	45.1%	294	43.5%
Q	Congenital malformations, deformations and chromosomal abnormalities	144	2.6%	20	3%
R	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	54	1%	5	0.7%

S–T	Injury, poisoning and certain other consequences of external causes	88	1.6%	10	1.5%
V–Y	External causes of morbidity and mortality	0	0%	0	0%
Z	Factors influencing health status and contact with health services	58	1%	10	1.5%

Supplementary material 12: The number of observations and events in each sensitivity analyses.

	Total number	Admissions		Death	
		Number	Percentage	Number	Percentage
For normal-weight, normal-term births					
Non-exposed	23858	3714	15.57%	131	0.55%
Exposed	2756	519	18.83%	13	0.47%
For laboratory-confirmed exposed cases					
Non-exposed	9430	1707	18.1%	89	0.94%
Exposed	943	183	19.41%	11	1.17%
Exposed cases for up to two days after delivery added					
Non-exposed	31730	5748	18.12%	354	1.12%
Exposed	3173	694	21.87%	39	1.23%

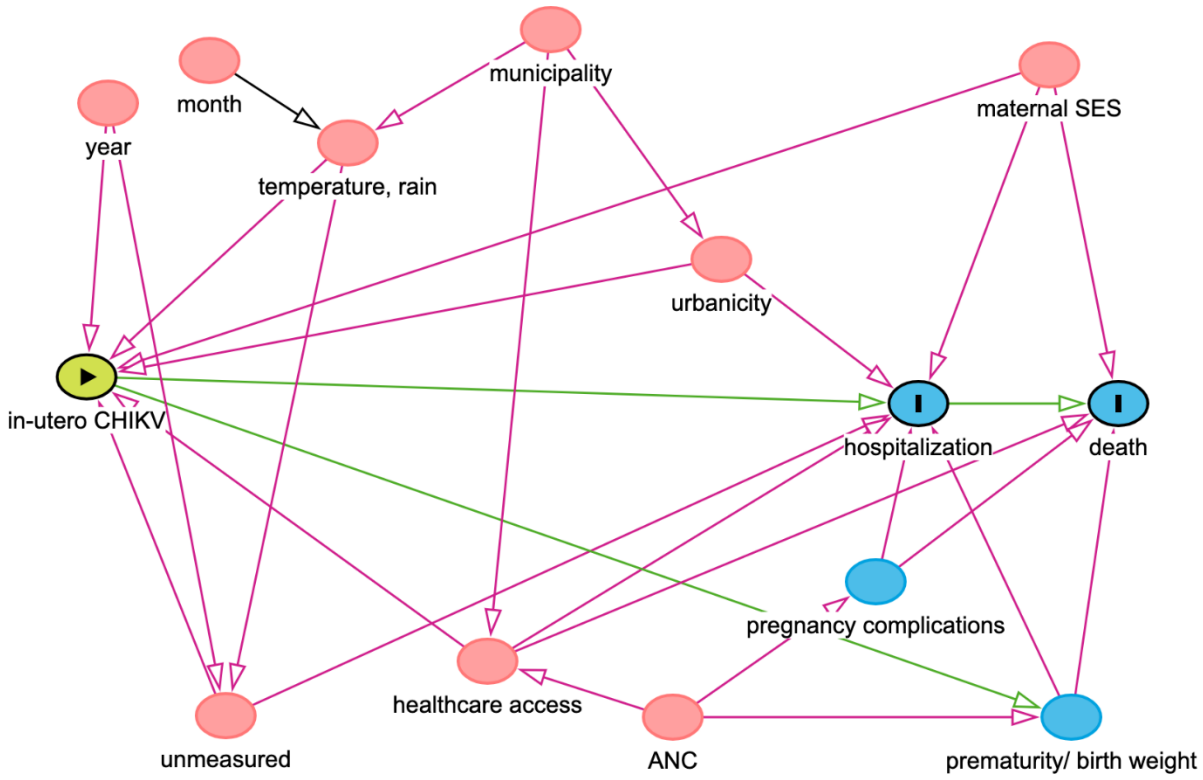
Supplementary material 13: The HR for the Cox regression of the sensitivity analyses.

	HR	Bootstrapped 95% CI
For normal-weight, normal-term births		
Admission	1.22	[1.110-1.341]
Death	0.818	[0.373-1.331]
For laboratory-confirmed exposed cases		
Admission	1.139	[0.976-1.341]
Death	1.356	[0.574-2.385]
Exposed cases for up to two days after delivery added		
Admission		
Overall	1.217	[1.117-1.318]
Intrapartum	2.073	[1.505-2.723]
Death		

Overall	1.124	[0.789-1.514]
Intrapartum	3.896	[1.262-7.517]
Alternative matching method used		
Admission	1.191	[1.092-1.3]
Death	1.052	[0.73-1.518]

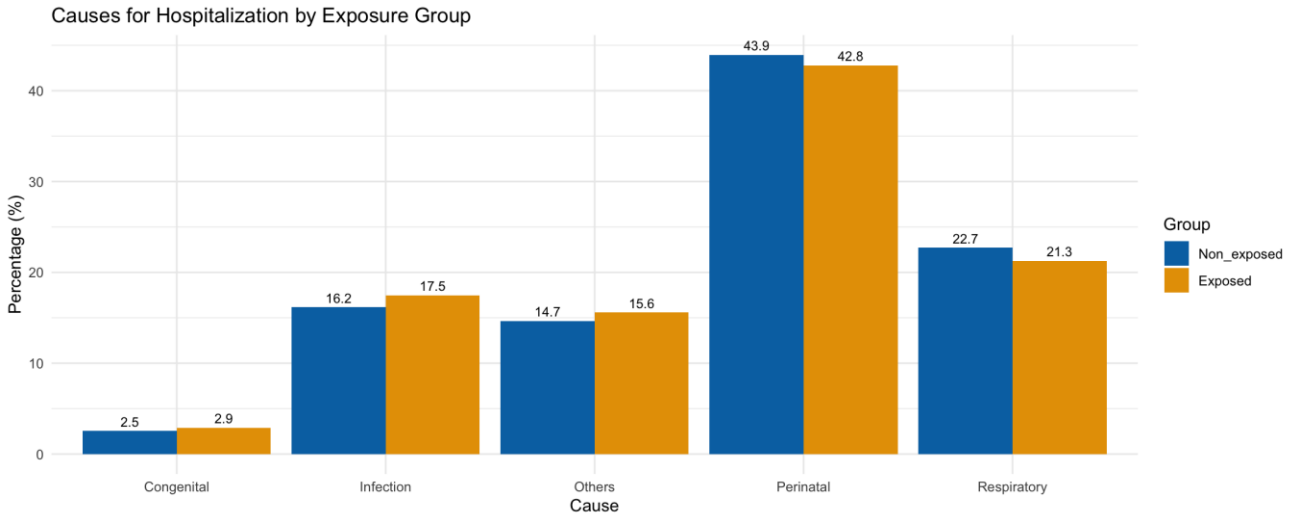
Abbreviations: 95% CI, 95 percent confidence interval

Supplementary Figure 1: DAG model of covariates.



Abbreviations: ANC, antenatal care visits; CHIKV, chikungunya virus; SES, socioeconomic status

Supplementary Figure 2: The distribution of causes of the first-time hospitalization by CHIKF exposure status.



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