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Behavioural Response to a Sudden Health Risk: Dengue and Educational Outcomes in Colombia

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Behavioural Response to a Sudden Health Risk: Dengue and Educational Outcomes in Colombia*

Supplementary material

Supplementary Material A: SABER 11

The main result of our study shows that fewer students participated in the SABER 11 examination during their last year of secondary education due to the 2010 peak in severe dengue incidence. However, this clearly doesn't imply that these students never completed the exam at all. Many of these students may have simply participated in the exam 6 or 12 months later[1]. Therefore, while permanent non-completion of the examination is likely to have a large negative impact on life outcomes[2], it is important to also consider the likely implications of a temporary delay in the completion of the examination.

Unfortunately, to the best of our knowledge, there exists no study that directly considers this question for the Colombian context, however, Fortin and Ragued (2016) show that in the Canadian context, similar temporary interruptions in post-secondary education are relevant for wages, conditional on the activity undertaken during the interruption. Furthermore, in order to provide some suggestive evidence for the Colombian context, in Figure 1 we plot the relationship between a students' age at time of completing the examination and their rank in the examination (for 2009, 2010, 2011). As one might expect, there is a strong negative correlation. Taken together, this evidence suggests that there may have been negative implications for human capital formation and other lifetime outcomes for those who temporary delayed participation in the examination, as well as for the those who dropped out permanently. At minimum, it implied a 6 month period of non-employment for many students. This short-run cost is non-negligible and should not be disregarded.

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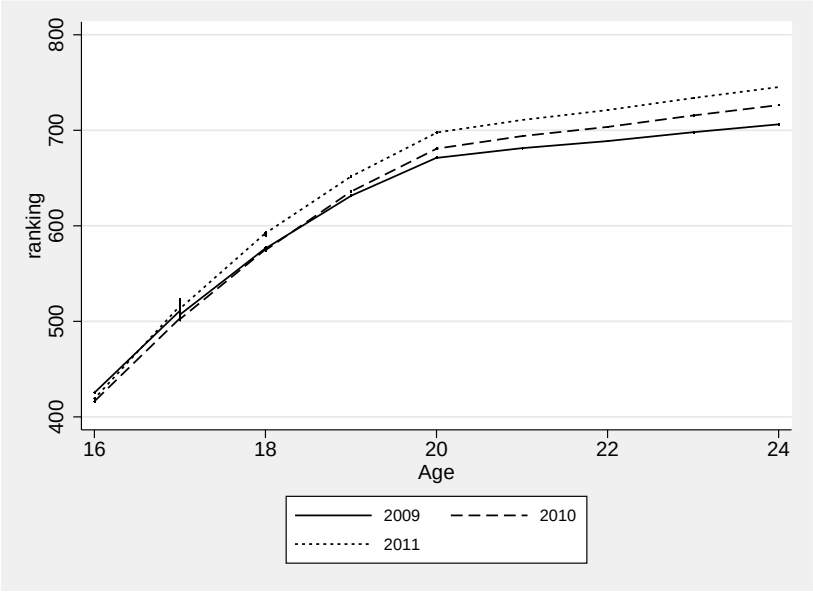
[1]Unfortunately, our data does not permit us to estimate the fraction of students who missed SABER 11 in 2010 that then participated the following year.

[2]This is because non-completion of the examination implies that these students will never have completed secondary school, and will not be eligible for tertiary education. Furtherfore, it is viewed as a negative signal to potential employers.

Figure 1: Age and rank at Saber 11



Source: Own calculations using SABER 11

Supplementary Material B: Robustness checks

Placebo Test

One may be concerned that there is a common factor that is driving both the variation in the incidence of *severe Dengue* across municipalities, as well as the variation in the number of test takers. However, as discussed above, our empirical specification includes both municipality level and year fixed effects and therefore, this should rule out the influence of any common factor that is not varying across both time and space and driving both *severe Dengue* incidence and test attendance. However, in order to provider stronger evidence of our results, we conduct a placebo test using variation in the incidence between 2009 and 2011.

This placebo test involves estimating the same specification as in Table 4 from the main text, but here using the Dengue incidence (*classic* and *severe*) as predictors of test attendance two years before. For example, testing whether the severity of the outbreak of 2010 in a municipality is related to the number of students who attended the test in 2008. Notice that, while the timing should invalidate the relationship, there are still chances of detecting an effect as Dengue incidence is geographically persistent. However, if the impact we observe on test taking is connected to the media storm generated by the epidemic in 2010, then we should not observe a large correlation with test taking in 2008.

The results from this placebo exercise are summarized in Table 1 and they indicate clearly that future severe Dengue incidence was not predictive of exam attendance. The results of this table therefore provide further support for the validity of our main results regarding the impact of *severe Dengue* on exam attendance in 2010.

Table 1: Placebo: Number of test takers per school two years ago and Dengue Incidence

LOG(Number of students who presented the test two years ago)
Includes variation of incidence rates from 2009 to 2012, and on SABER 11 participation from 2007 to 2010

	(1)	(2)	(3)	(4)
S. Dengue 10000h (4M)	0.005		0.005	
	(0.006)		(0.006)	
L.S. Dengue 10000h (4M)			-0.003	
			(0.003)	
L2.S. Dengue 10000h (4M)			0.004	
			(0.003)	
C. Dengue 1000h (4M)		-0.004		-0.009
		(0.004)		(0.006)
L.C. Dengue 1000h (4M)				-0.012
				(0.009)
L2.C. Dengue 1000h (4M)				-0.005
				(0.011)
Observations	26956	26956	26956	26956
Schools	8064	8064	8064	8064
Avg. periods per school	3.34	3.34	3.34	3.34
Municipalities	836	836	836	836
$\bar{Y}$	3.55	3.55	3.55	3.55
Adj. R squared	0.0194	0.0193	0.0198	0.0197

Linear fixed effects panel regression at school level (see Equation 1). Main independent variable: Reported incidence of Dengue in the last 4 months (4M) at municipality level. On top of the fixed effects by school and by year, these estimates include as controls: Inpatient beds and AE positions per 10.000h, Subsidized Health Care registry as a percentage of Population, municipality dependence on central government transfers, municipality income per capita, avg. temperature and rainfall for the last 8 months, log-population, std. of the number of people, houses and roads affected by natural disasters, and the incidence rate of influenza-like cases per 1.000h in the municipality during the calendar year. See Table 2 for further details.
Clustered at school level SD in parenthesis. Significance: * 10%, ** 5%, *** 1%.

Impacts using alternative incidence windows

For our main exercises we have presented data using incidence during the 4 months preceding the main SABER 11 test date (May, June, July and August). It is important to know what the implications of this choice are, and further to know the influence of Dengue incidence earlier in the year. Columns 1 - 3 of Table 2 present the estimates for different incidence windows: one year, 8 months, and 4 months. These estimates suggest that while much of the impact of *severe Dengue* is driven by the variance in the incidence in the 4 months preceding the exam, the earlier months may also have influence.[3] We split up the cumulative incidence for the last year into three four-month windows, with column 4 displaying the results when we include the incidence for each of the following windows: 0 to 4, 5 to 8, and 8 to 12 months. While all three coefficients have a negative sign, the most recent trimester has the strongest impact. The 2nd trimester has almost

[3]Note, in order to make these estimates comparable to one another, the estimates are for the average monthly incidence over the period. This is why the estimate in column 3 is four times as large as the estimate in the main Table which corresponds to a three months incidence.

zero impact, highlighting that the shocks are exerting a short-term influence. The last trimester also has a negative impact, which is plausible as it would be reflecting impacts on enrolment for the school calendar year which typically starts in January.

Table 2: Number of test takers per school and Severe Dengue: different incidence periods

	LOG(Number of students who presented the test)			
	All municipalities			
	(1)	(2)	(3)	(4)
Severe Dengue per 10.000h, 4M August				-0.008***
				(0.003)
Severe Dengue per 10.000h, 5-8 months from August				-0.001
				(0.003)
Severe Dengue per 10.000h, 9-12 months from August				-0.005
				(0.003)
Avg. Monthly Incidence S. Dengue, 4M August			-0.040***	
			(0.010)	
Avg. Monthly Incidence S. Dengue, 8M August		-0.039***		
		(0.009)		
Avg. Monthly Incidence S. Dengue, 12M August	-0.048***			
	(0.011)			
N Obs	37299	37299	37299	37299
N schools	8839	8839	8839	8839
Avg. periods	4.22	4.22	4.22	4.22
Adj. R2	0.02	0.02	0.02	0.02
p-val for Wald test on H0: I04 - I58=0				0.14
p-val for Wald test on H0: I04 - I912=0				0.41

Linear fixed effects panel regression at school level (see Equation 1). Main independent variable: Reported incidence of Dengue in the last 4 months (4M), 8 months (8M) and year (12M), or the stated period, at municipality level. On top of the fixed effects by school and by year, these estimates include as controls: Inpatient beds and AE positions per 10.000h, Subsidized Health Care registry as a percentage of Population, municipality dependence on central government transfers, municipality income per capita, avg. temperature and rainfall for the last 8 months, log-population, std. of the number of people, houses and roads affected by natural disasters, and the incidence rate of influenza-like cases per 1.000h in the municipality during the calendar year. See Table 2 for further details. Wald tests of hyphotesis were performed in order to asses if the coefficients for incidence of the last 4 months and 5-8 months were the same (H0: I04 - I058 =0). A similar procedure was done for the incidence between 9 to 12 months (H: I04 - I912 =0). Results are presented in the last two rows of the table.
Clustered at school level SD in parenthesis. Significance: * 10%, ** 5%, *** 1%.

Estimates for subsample with non-zero *severe Dengue* incidence

Table 3 presents the estimates for the impact of *severe Dengue* on attendance, when we restrict our sample to the subsample of schools in municipalities with at least one case of *severe Dengue* per 10 000 inhabitants. Here, we observe that the effect persists and the magnitude of the effect is only slightly dampened when we consider this subsample.

Table 3: Number of test takers per school and Dengue Incidence

	LOG(Number of students who presented the test) Only for municipalities with at least 1 case of Dengue			
	(1)	(2)	(3)	(4)
S. Dengue 10000h (4M)	-0.008		-0.011**	
	(0.005)		(0.005)	
L.S. Dengue 10000h (4M)			-0.010*	
			(0.006)	
L2.S. Dengue 10000h (4M)			-0.001	
			(0.004)	
C. Dengue 1000h (4M)		0.003		0.002
		(0.006)		(0.006)
L.C. Dengue 1000h (4M)				-0.002
				(0.006)
L2.C. Dengue 1000h (4M)				0.005
				(0.009)
Observations	15502	25730	12682	21652
Schools	5287	8109	5095	8017
Avg. periods per school	2.93	3.17	2.49	2.70
Municipalities	392	671	363	661
$\bar{Y}$	0.0248	0.0245	0.0299	0.0256

Linear fixed effects panel regression at school level (see Equation 1). Main independent variable: Reported incidence of Dengue in the last 4 months (4M) at municipality level. On top of the fixed effects by school and by year, these estimates include as controls: Inpatient beds and AE positions per 10.000h, Subsidized Health Care registry as a percentage of Population, municipality dependence on central government transfers, municipality income per capita, avg. temperature and rainfall for the last 8 months, log-population, std. of the number of people, homes and roads affected by natural disasters. See Table 2 for further details.
Clustered at school level SD in parenthesis. Significance: * 10%, ** 5%, *** 1%.

Synthetic Control Strategy

In this exercise, we match municipalities on an array of pre-outbreak observable characteristics. The basic idea is to try to approximate an experiment in which the sole difference between two areas is that one of them is suddenly afflicted by some additional cases of *severe Dengue*, while the other is not. We do this by using the group of municipalities with zero incidence of Dengue to construct a synthetic control group for municipalities with positive incidence of *severe Dengue*. Furthermore, we divide the municipalities with positive *severe Dengue* incidence into three groups according to the intensity of the disease in the municipality.

The synthetic control group for each of these three groups is constructed by re-weighting the control group observations (those without cases of severe Dengue in 2010) using a kernel propensity score matching (Heckman et al., 1997).[4] In essence, we want to compare municipalities that were as likely to have cases of severe Dengue, given their pre-outbreak observable characteristics,

[4]Implemented using psmatch2 in STATA (Leuven and Sianesi, 2014)The matching was done between each set of municipalities and the control group separately. Then, the weights were combined to construct a single measure to be used in all the regressions below.

as those who reported them, but did not.[5]

Table 4 shows the result of this matching procedure. Column C displays the average values for each of the variables of interest at municipality level for the control group, before re-weighting. Columns T show the average values for each of the three treated groups. Notice the variation in the incidence of *severe Dengue* across these three groups (see the row, third from the bottom). The stars appended to the figures in columns T come from a t-test of difference of means between each of the treatment groups and the control group, before reweighting. Columns MC show the average values of the control group after reweighting, using the weights that are calculated for the relevant treatment group. Again, stars reflect a t-test comparison between the treatment group and the re-weighted control group. In order to ensure, common support municipalities for which there is no valid counterpart (too low or high propensity scores) are omitted. This will reduce the sample size of our estimates as we will see in the following tables.

[5]While this methodology follows the logic of the synthetic control strategy (Abadie and Gardeazabal, 2003) (See Rodríguez-Lesmes et al. (2014) for other applications of this strategy using SABER11 data.), one concern would be that we might be inducing a bias in the estimates: there might be unobserved characteristics of the health system that could be related to under-reporting of *severe Dengue* which are exacerbated by the matching procedure. However, provided these characteristics are uncorrelated to the intensity of the behavioral response to new cases of Dengue, this strategy will ensure that we are comparing municipalities which are generally similar.

Table 4: Matching: Balance Table

	Municipality average						
		Group 1		Group 2		Group 3	
Variable	C	T	MC	T	MC	T	MC
C. Dengue 1000h (4M)	0.66	1.43***	1.28	1.76***	1.37	3.03***	3.16
Population in 100.000	0.17	1.21***	0.43	0.53*	0.24	0.48***	0.26
Current Road Density	0.15	0.44***	0.21	0.38**	0.23	0.32***	0.25
Distance to Department's capital	143.14	114.81**	133.40	117.31***	111.84	92.60***	94.05
Altitude (meters above sea level)	845.64	553.58***	476.31	748.57	711.87	841.71	861.56
Avg. precipitation in mm/1000	2.18	1.91**	1.87	2.04	2.04	1.82***	1.84
Subsidized Health Care / Population: 2009	0.78	0.68***	0.73	0.75	0.77	0.75*	0.79
Total Municipality Income per capita: 2009	0.74	0.56***	0.50	0.72	0.70	0.91**	0.84
Municipality dependence on central Gov. transfers: 2009	0.61	0.62	0.64	0.56**	0.57	0.55***	0.56
% of female test-takes: 2007	0.49	0.48	0.49	0.48	0.48	0.51	0.51
% of female test-takes: 2008	0.49	0.48	0.48	0.49	0.48	0.52**	0.52
% of female test-takes: 2009	0.49	0.48	0.49	0.48	0.49	0.51	0.51
% of SISBEN 12 test-takers: 2009	0.84	0.74***	0.81	0.78*	0.80	0.81	0.84
% of SISBEN 12 test-takers: 2008	0.83	0.70***	0.78	0.77*	0.79	0.81	0.83
Avg. Family Income Index: 2009	0.96	1.17***	1.11	1.12***	1.08	1.13***	1.12
Avg. Family Income Index: 2008	0.97	1.23***	1.18	1.16***	1.10	1.16***	1.17
Avg. Maths Score: 2009	0.03	0.03	0.02	0.03	0.02	0.11***	0.09
Avg. Maths Score: 2007	0.03	0.03	0.03	0.04	0.02	0.09***	0.08
Avg. Maths Score: 2008	0.03	0.04	0.04	0.05	0.03	0.11***	0.10
Avg. Language Score: 2009	0.02	0.04**	0.03	0.02	0.01	0.07***	0.04
Avg. Language Score: 2007	0.03	0.04	0.02	0.04	0.03	0.07***	0.07
Avg. Language Score: 2008	0.03	0.04	0.02	0.05	0.04	0.07***	0.06
Avg. N test takers: 2009	128.10	1027.62***	331.51	252.61**	192.65	403.88***	173.85
Avg. N test takers: 2007	122.51	1075.80***	331.79	261.84**	191.92	441.89***	178.12
Avg. N test takers: 2008	120.81	1008.09***	315.13	243.92**	180.85	380.56***	159.91
S. Dengue Incidence		0.02 to 0.70		0.71 to 1.78		1.80 to 44.31	
No. Municipalities	523	108		107		108	
No. Municipalities Common S	444	88		93		92	

Municipalities were matched using Kernel Propensity Score matching (bandwidth for the kernel: 0.06). T: municipalities with positive Severe Dengue incidence in 2010. C: municipalities with zero Severe Dengue incidence in 2010. MC: re-weighted average of group C. The stars show the significance of a t-test of difference of means: In column T the test is between groups T and C, and in column MC, between groups T and C but after matching.
Significance: * 10%, ** 5%, *** 1%.

Overall, the matching procedure works very well, with the only remaining significant differences between the treatment and synthetic control being the number of test takers for group 3 (high *severe Dengue* intensity), which is only significant at the 10 percent level. Interestingly, looking at the pre-weighted groups, we see that there are correlations between many of the observable variables and pre-outbreak Dengue incidence, as one would expect. For example, it is unsurprising that the population density is lowest for municipalities with no *severe Dengue* and for the municipalities with the highest incidence of *severe Dengue*. It is perhaps more surprising that the proportion of poor students (SISBEN 1 and 2) varies so little across the three treatments and control group, with the proportion only changing by 12 percentage points between the lowest and highest of the groups.

With our matching weights in hand, Table 5 below presents the estimates for the impact of *severe Dengue*, with each school weighted using the appropriate municipality weight. The results are very similar to our main results, with *severe Dengue* causing a sizeable reduction in test attendance, and no significant impact of *classic Dengue*. This serves as a further validation of the estimated impact of the 2010 epidemic on test taking behaviour.

Table 5: Matching: Number of test takers per school and Dengue Incidence

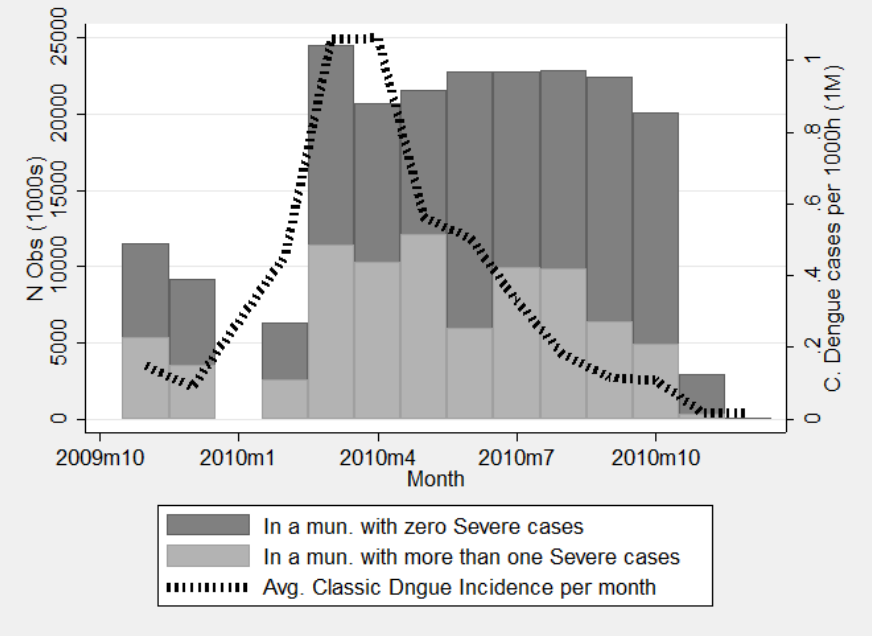
	LOG(Number of students who presented the test)			
	(1)	(2)	(3)	(4)
S. Dengue 10000h (4M)	-0.007**		-0.008**	
	(0.003)		(0.003)	
L.S. Dengue 10000h (4M)			-0.001	
			(0.003)	
L2.S. Dengue 10000h (4M)			-0.002	
			(0.003)	
C. Dengue 1000h (4M)		-0.005		-0.002
		(0.005)		(0.007)
L.C. Dengue 1000h (4M)				0.008
				(0.006)
L2.C. Dengue 1000h (4M)				0.005
				(0.007)
Observations	15777	15777	13108	13108
R^2	0.027	0.026	0.019	0.019
Adjusted R^2	0.026	0.025	0.018	0.018
N_g	3746	3746	3721	3721

Clustered at school level SD in parenthesis. Significance: * 10%, ** 5%, *** 1%.
Schools are weighted so municipalities are matched on fix and pre-outbreak characteristics

Supplementary Material C: Impact of Dengue on household activity

In this appendix we explore the influence that the Dengue fever outbreak had on households' daily activities. In particular, we want to determine if the outbreak produced serious disruptions economic activity or to health-related activities and outcomes at the population level. In order to do this, we use information from the DHS 2010. This is a cross-section dataset and for that reason our main identification strategy presented in section 3.2 of the main text cannot be used. In contrast, we instrument the incidence of both versions of the disease.

Figure 2: DHS date of interview and Dengue outbreak



The Demographic and Health Survey 2010 (DHS) os collected by Profamilia (2011) under the international DHS program guidelines[6]. This survey is representative at the state level (*Departamento*) and was collected between October 2009 and October 2010. One very attractive feature of this dataset is that this collection period effectively covers the entire start, peak and decline of the epidemic, both in municipios with and without Severe Dengue (see Figure). With this data we can explore how students and their family were affected by the disease. The main outcomes and controls used for our analysis are presented in Table 6.

[6]Recoded datasets COPR61FL, COHR61FL. Colombia 2010 is a standard DHS-VI version.

Table 6: Descriptive Statistics DHS 2010

Variable	Mean (SD)	Obs
Self Reported Health (1: Very Good, 5: Very Bad)	3(.91)	186974
Sr Health: Regular Or Bad	.02(.14)	186974
Any Health Problem (Outpatient)	.11(.31)	186974
Stop Activities Due To A Health Problem (Outpatient)	.058(.23)	186974
Occupation Last Week: Working, 12+ Years (P16)	.48(.5)	142060
Occupation Last Week: Studying, 12+ Years (P16)	.17(.38)	142060
Hospitalized	.062(.24)	186974
Male Household Member	.48(.5)	186974
Age In Years	29(21)	186929
Member Is A Native Colombian	.11(.32)	186974
Member Is An Afro-Descen	.11(.31)	186974
Member Attended School During Previous School Year	.29(.45)	186974
Number Of Household Members	5.1(2.4)	186974
Number Of Children 5 And Under	.67(.89)	186974
Female Household Head	.31(.46)	186974
Access To Piped Water	.79(.41)	186974
Access To Sewer	.64(.48)	186974
Age Of Head Of Household	47(15)	186974
Head Of Household Is Male	.69(.46)	186974
Wealth Index Factor Score (5 Decimals)	-10816(105736)	186974

Source: Own calculations based on the DHS 2010 for Colombia.

While the DHS is a rich dataset, its design does not allow for the fixed effects regression used for the SABER 11 analysis.[7] In contrast, we exploit the discussed environmental diversity of the country to instrument the incidence of classic Dengue during the outbreak. Equation 1 presents the first stage, and Equation 2 the second stage of this instrumental variables approach.

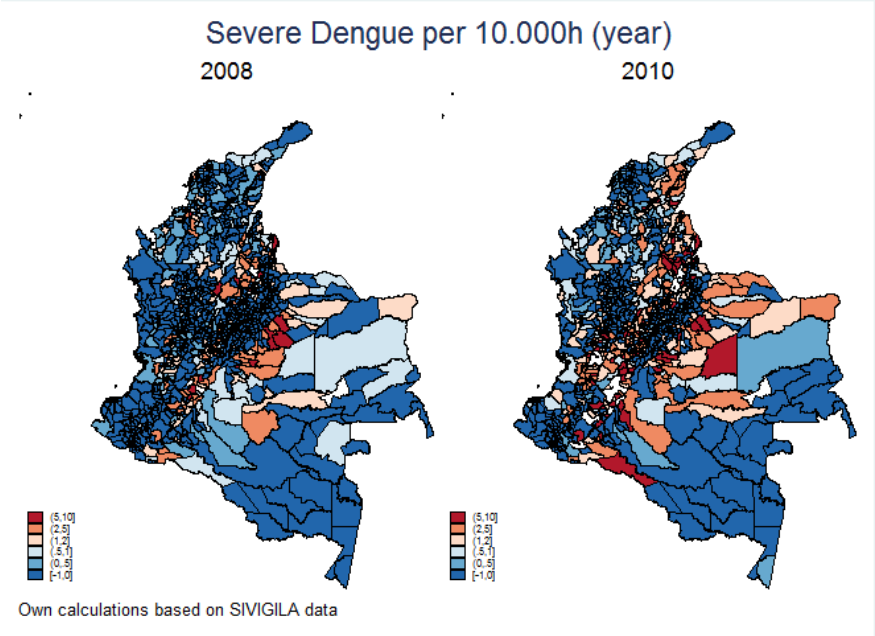
$$CD_{jt} = \iota_1 \mathbb{1}\{Alt_j < 1800\} \cdot Ep_t + \iota_2 \mathbb{1}\{Alt_j < 1800\} + \iota_3 Ep_t + \iota X_{jt} + u_{jt} \quad (1)$$

$$Y_{ijt} = \eta_1 CD_{jt} + \eta_2 \mathbb{1}\{Alt_j < 1800\} + \eta_3 Ep_t + \eta X_{ijt} + v_{ijt} \quad (2)$$

where i is the individual living in municipality j and surveyed in month t. CD_{jt} is the classic Dengue incidence per month at municipality level per 10.000 inhabitants. Alt_j is the altitude over the sea level of the municipality, and the focus is on 1800 meters as above this altitude the mosquito cannot develop (see Section 2 of the main text). Ep_t is a dummy variable that indicates that the survey was carried on during the main epidemic time (February 2010 to August 2011). Finally, X_{ijt} includes controls at individual, household and municipality level; including altitude in meters, temperature and precipitation.

[7] Its previous wave is from 2005 and given that is not representative at municipality level, many of these administrative divisions are not covered in both surveys.

Figure 3: DHS date of interview and Dengue outbreak



For severe Dengue, in order to disentangle it from classic Dengue, we consider as an instrument the incidence of the disease in the non-epidemic period (total number of cases between 2007 and 2008 per 10.000 inhabitants, ySD_j). The idea behind this is that Severe Dengue tends to be persistent in certain areas of the country, thus, during the outbreak it was more likely that those areas where Severe Dengue is endemic, again suffered from this strand of the disease. The maps in Figure illustrate this argument. Equations 3 and 4 shows that once again, the instrument is the interaction between space and time.

$$SD_{jt} = \zeta_1 ySD_j \cdot Ep_t + \zeta_2 ySD_j + \zeta_3 \mathbb{1}\{Alt_j < 1800\} + \zeta_4 Ep_t + \zeta_5 CD_{jt} + \zeta X_{jt} + u_{jt} \quad (3)$$

$$Y_{ijt} = \omega_1 SD_{jt} + \omega_2 ySD_j + \omega_3 \mathbb{1}\{Alt_j < 1800\} + \omega_4 Ep_t + \omega_5 CD_{jt} + \omega X_{ijt} + v_{ijt} \quad (4)$$

Tables 7, 8 and 9 present the estimates for the coefficients of the equations explained above for several outcomes of interest. Students who are finishing their secondary school are in general 14 to 18 years old, covered in Table 7. Children under the age of 5, typically the most affected by the disease, are covered in Table 8, and all the others are grouped in Table 9. In particular, our interest relies on coefficients η_1 and ω_1, which are interpreted as the causal effect of increased incidence of Dengue on the outcomes of interest. Each of the tables also presents the first stage results, showing the power of the particular instrument.

In these tables we see that Classic Dengue is related to a slight increase in the probability of hospitalization for children under the age of 5 (4 pp., with respect to a 22% mean) and for those aged 19 and older, but has no significant impact on health status perception of the overall population. In the case of Severe Dengue, there is no additional effect on top of the Classic Dengue

incidence. For the 14 to 18 year olds, the age at which students typically participate in the SABER 11 test, there is a negative coefficient on the probability of reporting that one studied last week, but it important to note that it is not significant, so we cannot draw conclusions from this.

Table 7: Dengue Incidence and Households' activity: 14 to 18 years old

	Dependent variable						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	cstud	**work**	**hprob**	**hosp**	**stopact**	**badHe**	**Dengue**
Panel A: Classic Dengue							
C. Dengue 1000h (1M)	-0.00206	0.0124	0.00523	0.0123	0.00705	0.000292	
	[-0.11]	[0.68]	[0.18]	[1.02]	[0.36]	[0.08]	
Below 1800 masl	-0.000212	-0.0298	-0.00678	-0.0360**	-0.00693	0.00274	0.547*
	[-0.01]	[-1.12]	[-0.14]	[-2.29]	[-0.23]	[0.49]	[1.74]
Outbreak period	0.0128	-0.0283***	0.000900	-0.0133*	-0.00371	0.00244	-0.0171
	[1.20]	[-2.94]	[0.05]	[-1.91]	[-0.29]	[1.15]	[-0.19]
Below 1800 masl × Outbreak period							0.696***
							[3.65]
Observations	20282	20470	20482	20482	20482	20482	20282
N of clusters (municipios)	250	250	250	250	250	250	250
F-stat First Stage	13.32	13.32	13.30	13.30	13.30	13.30	
Average of the dependent variable	0.741	0.134	0.0765	0.0466	0.0442	0.00644	
R Squared	0.477	0.221	0.0143	0.0187	0.00646	0.00537	0.373
Panel B: Severe Dengue							
S. Dengue 10.000h (1M)	-0.0522	-0.0356	0.00894	-0.00484	0.00985	0.000418	
	[-1.30]	[-0.72]	[0.33]	[-0.20]	[0.48]	[0.05]	
C. Dengue 1000h (1M)	0.0259	0.0149	-0.00275	0.000627	-0.00381	-0.000414	0.470*
	[1.21]	[0.59]	[-0.18]	[0.05]	[-0.32]	[-0.10]	[1.75]
S. Dengue incide 2007-08 per 10.000h	-0.0000649	0.00179**	-0.00180***	-0.000208	-0.000845**	-0.0000856	-0.0169
	[-0.08]	[2.08]	[-3.96]	[-0.51]	[-2.52]	[-0.69]	[-1.00]
Below 1800 masl	-0.0337	-0.0291	-0.00316	-0.0244	0.00276	0.00326	-0.557
	[-1.14]	[-0.83]	[-0.14]	[-1.36]	[0.17]	[0.55]	[-1.52]
Outbreak period	0.0125*	-0.0221***	0.00516	-0.00531	0.000556	0.00282**	-0.0636
	[1.90]	[-2.78]	[0.83]	[-1.51]	[0.13]	[2.33]	[-1.07]
S. Dengue incide 2007-08 per 10.000h × Outbreak period							0.0331**
							[2.22]
Observations	20282	20470	20482	20482	20482	20482	20282
N of clusters (municipios)	250	250	250	250	250	250	250
F-stat First Stage	4.93	4.89	4.88	4.88	4.88	4.88	
Average of the dependent variable	0.741	0.134	0.0765	0.0466	0.0442	0.00644	
R Squared	0.473	0.217	0.0149	0.0209	0.00603	0.00543	0.396

Notes: Own calculations based mainly on DHS-2010, SIVIGILA, population projections by DANE, emergency cases from *Sistema Nacional de Informacion y Gestion del Riesgo* (SNIGRD). This table presents coefficients of a instrumental variables regression in columns 1 to 6, estimated via two-stage least squares. Column 7 presents the first stage for the sample used in column 1. t-statistic from clustered standard errors presented in brackets. * p¡0.10, ** p¡0.05, *** p¡0.01.
Municipio Controls: 2nd order polynomial of Municipio's altitude in meters above the sea level; average month temperature, precipitation and their interaction; Standarized total individuals, dwellings, roads and agriculture hectares affected by natural events in the year. Inpatient Beds per 10.000h, A&E positions per 10.000h, Subsidized Health Care per capita, Municipality dependence on central Gov. transfers. Influenza-like per 1000h, Cal Y, Log-population, log income per-capita, categories of a poverty index based on quality of life (NBI). *Household Controls:* number of household members, number of children under the age of 5, access to piped water and sewer, household head age and gender; 2nd order polynomial wealth index. *Individual Controls:* 2nd order polynomial of age in years; gender, black or native american ethnicity dummies; and a dummy that indicates if the individual was studiying the previous academic year.

Table 8: Dengue Incidence and Households' activity: 0 to 5 years old

	Dependent variable						
	(1) **fever**	(2) **mediAtt**	(3) **hprob**	(4) **hosp**	(5) **stopact**	(6) **badHe**	(7) **Dengue**
Panel A: Classic Dengue							
C. Dengue 1000h (1M)	-0.00760	0.0122	-0.0342	0.00739	-0.0247	0.00754*	
	[-0.16]	[0.28]	[-0.91]	[0.59]	[-0.95]	[1.87]	
Below 1800 masl	0.0272	-0.0342	0.0190	0.00252	0.0209	-0.00735	0.475
	[0.34]	[-0.58]	[0.29]	[0.16]	[0.49]	[-1.15]	[1.58]
Outbreak period	0.0211	0.0205	0.00685	-0.00163	0.00777	-0.00374**	-0.0965
	[0.68]	[0.97]	[0.30]	[-0.25]	[0.50]	[-2.02]	[-1.27]
Below 1800 masl × Outbreak period							0.758***
							[4.11]
Observations	16107	8812	22714	22714	22714	22714	16107
N of clusters (municipios)	250	250	250	250	250	250	250
F-stat First Stage	16.85	15.55	16.24	16.24	16.24	16.24	
Average of the dependent variable	0.271	0.434	0.139	0.0676	0.0726	0.00616	
R Squared	0.0231	0.0333	0.0192	0.0213	0.00620	0.00146	0.350
Panel B: Severe Dengue							
S. Dengue 10.000h (1M)	0.0719	0.181*	0.0847	-0.00942	0.0240	-0.000921	
	[0.89]	[1.80]	[1.57]	[-0.46]	[0.59]	[-0.12]	
C. Dengue 1000h (1M)	-0.0242	-0.0582	-0.0471	0.00492	-0.0115	-0.000103	0.447*
	[-0.61]	[-1.25]	[-1.54]	[0.51]	[-0.56]	[-0.03]	[1.84]
S. Dengue incide 2007-08 per 10.000h	-0.00133	-0.000968	-0.00317***	0.0000197	-0.00153**	0.0000606	-0.0144
	[-0.88]	[-0.44]	[-2.73]	[0.05]	[-2.12]	[0.50]	[-0.97]
Below 1800 masl	0.0395	0.0363	0.0232	0.00499	0.00237	0.000776	-0.446
	[0.71]	[0.54]	[0.55]	[0.32]	[0.09]	[0.15]	[-1.36]
Outbreak period	0.0124	0.0156	-0.00507	0.00210	-0.00378	0.000434	-0.0544
	[0.91]	[0.90]	[-0.42]	[0.44]	[-0.53]	[0.29]	[-1.03]
S. Dengue incide 2007-08 per 10.000h × Outbreak period							0.0305**
							[2.37]
Observations	16107	8812	22714	22714	22714	22714	16107
N of clusters (municipios)	250	250	250	250	250	250	250
F-stat First Stage	5.61	5.76	5.82	5.82	5.82	5.82	
Average of the dependent variable	0.271	0.434	0.139	0.0676	0.0726	0.00616	
R Squared	0.0133	0.00893	0.00379	0.0217	0.00718	0.00628	0.388

Notes: Own calculations based mainly on DHS-2010, SIVIGILA, population projections by DANE, emergency cases from *Sistema Nacional de Informacion y Gestion del Riesgo* (SNIGRD). This table presents coefficients of a instrumental variables regression in columns 1 to 6, estimated via two-stage least squares. Column 7 presents the first stage for the sample used in column 1. t-statistic from clustered standard errors presented in brackets. * p¡0.10, ** p¡0.05, *** p¡0.01.
Municipio Controls: 2nd order polynomial of Municipio's altitude in meters above the sea level; average month temperature, precipitation and their interaction; Standarized total individuals, dwellings, roads and agriculture hectares affected by natural events in the year. Inpatient Beds per 10.000h, A&E positions per 10.000h, Subsidized Health Care per capita, Municipality dependence on central Gov. transfers. Influenza-like per 1000h, Cal Y, Log-population, log income per-capita, categories of a poverty index based on quality of life (NBI). *Household Controls:* number of household members, number of children under the age of 5, access to piped water and sewer, household head age and gender; 2nd order polynomial wealth index. *Individual Controls:* 2nd order polynomial of age in months; gender dummy, and WHO height-for-age z-score.

Table 9: Dengue Incidence and Households' activity: older than 19

	Dependent variable						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	stud	**work**	**hprob**	**hosp**	**stopact**	**badHe**	**Dengue**
Panel A: Classic Dengue							
C. Dengue 1000h (1M)	0.00361	0.0129	-0.00197	0.0150*	-0.00349	-0.00849	
	[0.71]	[0.75]	[-0.11]	[1.88]	[-0.46]	[-1.06]	
Below 1800 masl	-0.00288	-0.0373	0.0269	-0.0189*	0.0206*	0.0186*	0.555*
	[-0.35]	[-1.35]	[1.00]	[-1.82]	[1.85]	[1.74]	[1.87]
Outbreak period	-0.00305	-0.00623	0.00524	-0.00602*	0.00272	0.00542	-0.0494
	[-1.03]	[-0.67]	[0.49]	[-1.68]	[0.61]	[1.11]	[-0.57]
Below 1800 masl × Outbreak period							0.732***
							[3.91]
Observations	122564	122564	122628	122628	122628	122628	122564
N of clusters (municipios)	250	250	250	250	250	250	250
F-stat First Stage	15.28	15.28	15.28	15.28	15.28	15.28	
Average of the dependent variable	0.0351	0.572	0.115	0.0731	0.0604	0.0300	
R Squared	0.321	0.262	0.0194	0.0149	0.00754	0.0378	0.395
Panel B: Severe Dengue							
S. Dengue 10.000h (1M)	0.0117	0.00592	0.0477*	0.00236	0.0171	0.00208	
	[1.62]	[0.16]	[1.66]	[0.18]	[1.14]	[0.16]	
C. Dengue 1000h (1M)	-0.00366	-0.00600	-0.0190	-0.00131	-0.00393	-0.0000649	0.404*
	[-1.13]	[-0.37]	[-1.35]	[-0.23]	[-0.54]	[-0.01]	[1.71]
S. Dengue incide 2007-08 per 10.000h	-0.000260	0.00131*	-0.00239***	-0.000440	-0.000946***	0.0000709	-0.0166
	[-1.55]	[1.89]	[-3.39]	[-1.64]	[-3.10]	[0.32]	[-0.95]
Below 1800 masl	0.00481	-0.0123	0.0403**	-0.00232	0.0190**	0.00974	-0.473
	[0.89]	[-0.54]	[2.07]	[-0.29]	[2.06]	[1.07]	[-1.44]
Outbreak period	-0.00178	0.000232	0.00578	0.00248	0.000129	0.000449	-0.0562
	[-0.92]	[0.04]	[0.94]	[0.85]	[0.04]	[0.22]	[-1.03]
S. Dengue incide 2007-08 per 10.000h × Outbreak period							0.0347**
							[2.22]
Observations	122564	122564	122628	122628	122628	122628	122564
N of clusters (municipios)	250	250	250	250	250	250	250
F-stat First Stage	4.94	4.94	4.94	4.94	4.94	4.94	
Average of the dependent variable	0.0351	0.572	0.115	0.0731	0.0604	0.0300	
R Squared	0.321	0.263	0.0133	0.0167	0.00636	0.0393	0.373

Notes: Own calculations based mainly on DHS-2010, SIVIGILA, population projections by DANE, emergency cases from *Sistema Nacional de Informacion y Gestion del Riesgo* (SNIGRD). This table presents coefficients of a instrumental variables regression in columns 1 to 6, estimated via two-stage least squares. Column 7 presents the first stage for the sample used in column 1. t-statistic from clustered standard errors presented in brackets. * p¡0.10, ** p¡0.05, *** p¡0.01.
Municipio Controls: 2nd order polynomial of Municipio's altitude in meters above the sea level; average month temperature, precipitation and their interaction; Standarized total individuals, dwellings, roads and agriculture hectares affected by natural events in the year. Inpatient Beds per 10.000h, A&E positions per 10.000h, Subsidized Health Care per capita, Municipality dependence on central Gov. transfers. Influenza-like per 1000h, Cal Y, Log-population, log income per-capita, categories of a poverty index based on quality of life (NBI). *Household Controls:* number of household members, number of children under the age of 5, access to piped water and sewer, household head age and gender; 2nd order polynomial wealth index. *Individual Controls:* 2nd order polynomial of age in years; gender, black or native american ethnicity dummies; and a dummy that indicates if the individual was studiying the previous academic year.

In general, the results highlighted above show that despite the high incidence of Dengue, this is not a disease that generates a massive real health consequences and causes a disruption to all aspects of life. Rather, it is a transitory health event, and it is likely that the channel of influ-

ence is related to the fear of potential health consequences, rather than its real observed overall deterioration.

Supplementary Material D: Additional results and full estimates

Main results

Table11 presents the estimates of the main results without omitting coefficients.

Municipality level analysis

The variation of our analysis occurs at municipality level. This aggregation level is not only relevant because is the most readily available data , but also because authorities at this level are those which react to outbreaks. In fact, in a typical municipality there might be only one or two schools with upper-middle education. The true difference will come when considering cities, which is where the effect is concentrated.

As shown in the table 10, main results are almost the same if we consider the municipality as observation unit. This was not an obvious result as each school is not a random sample of the student population of a city. For instance, private schools are smaller and with a wealthier population. Hence, the weight given to each student not taking the test might differ substantially if considered in the municipality or school level, especially in the presence of heterogeneous effects.

Table 10: Number of test takers and average test scores per municipality and Dengue Incidence

	LOG(Number of students who presented the test)		MATH	LANG
	(1)	(2)	(3)	(4)
C. Dengue 1000h (4M)	0.004			
	(0.004)			
S. Dengue 10000h (4M)		-0.009***	0.005	-0.002
		(0.003)	(0.003)	(0.002)
Observations	3935	3935	3935	3935
Municipalities	837	837	837	837
Municipalities	837	837	837	837
Adj. R squared	0.12029	0.12182	0.01374	0.05930

Linear fixed effects panel regression at school level (see Equation 1). S. Dengue is the reported incidence of Severe Dengue in the last 4 months (4M) at municipality level and C. Dengue is the incidence of Classic Dengue at the same level. L.S. Dengue and L.C. Dengue are the lag of Severe and Classic Dengue, respectively. On top of the fixed effects by school and by year, these controls for Inpatient beds and AE positions per 10.000h, Subsidized Health Care registry as a percentage of Population, municipality dependence on central government transfers, municipality per capita income, the incidence rate of influenza-like cases per 1.000h in the municipality during the calendar year, avg. temperature and rainfall for the last 8 months, log-population and the standardized number of people, houses and roads affected by natural disasters. See Table 2 for further details.
Clustered at municipality level SD in parenthesis. Significance: * 10%, ** 5%, *** 1%.

Table 11: Main results full-table

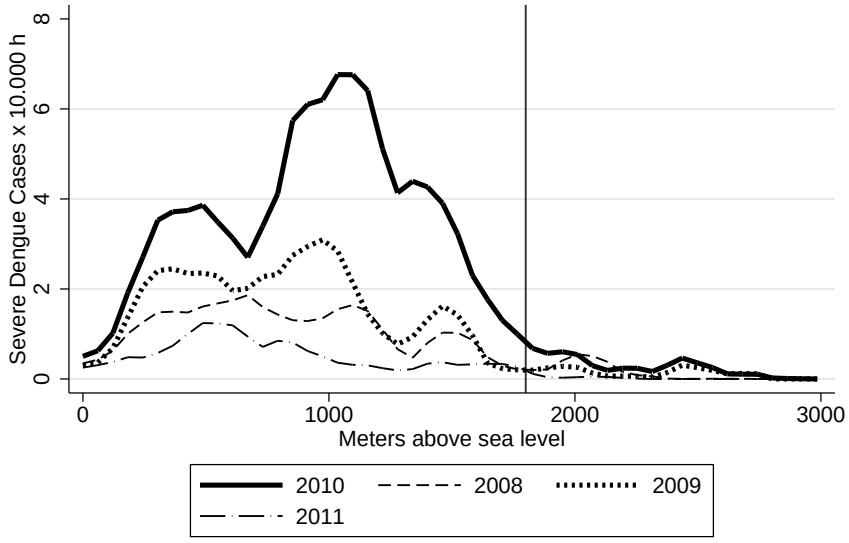
	LogEST	LogEST	Maths	Maths	Lang	Lang
	(1)	(2)	(3)	(4)	(5)	(6)
S. Dengue 10000h (4M)	-0.010**	-0.011**	0.000		-0.005*	
	(0.005)	(0.005)	(0.002)		(0.002)	
L.S. Dengue 10000h (4M)		-0.005	0.002		-0.005**	
		(0.004)	(0.002)		(0.003)	
L2.S. Dengue 10000h (4M)		-0.000	-0.000		-0.002	
		(0.003)	(0.002)		(0.002)	
C. Dengue 1000h (4M)				0.006**		0.002
				(0.002)		(0.004)
L.C. Dengue 1000h (4M)				0.002		0.010**
				(0.003)		(0.004)
L2.C. Dengue 1000h (4M)				-0.005		0.007
				(0.004)		(0.006)
Std. people affected by emergencies produced by natural events	-0.001**	0.000	0.001***	0.001***	-0.001***	-0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Std. dwellings affected by emergencies produced by natural events	0.000	0.001*	0.001***	0.001***	0.001	0.001*
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)
Std. roads affected by emergencies produced by natural events	0.002	0.002*	-0.000	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)
Std. hects of farm land affected by emergencies produced by natural events	-0.005	0.001	0.003	0.003	0.000	0.001
	(0.004)	(0.006)	(0.004)	(0.003)	(0.002)	(0.002)
Inpatient Beds per 10.000h	0.000	0.000	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
A&E positions per 10.000h	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Subsidized Health Care / Population	0.000	-0.002	-0.001	-0.001	-0.002	-0.002
	(0.003)	(0.004)	(0.002)	(0.002)	(0.006)	(0.006)
logingresospc	-0.000	-0.010	0.042***	0.037**	-0.034	-0.038
	(0.030)	(0.024)	(0.015)	(0.015)	(0.029)	(0.029)
Municipality dependence on central Gov. transfers	0.019	-0.017	0.133***	0.128***	0.006	-0.001
	(0.054)	(0.055)	(0.035)	(0.036)	(0.053)	(0.054)
Influeza-like per 1000h, Cal Y	-0.010*	-0.007	0.000	-0.000	-0.022	-0.022
	(0.005)	(0.005)	(0.003)	(0.003)	(0.013)	(0.014)
Log-population	0.453**	0.793***	-0.075	-0.085	0.631**	0.673**
	(0.228)	(0.272)	(0.163)	(0.166)	(0.272)	(0.263)
Avg. 2m temperature (C), last 8 months (Aug)	-0.042	0.014	0.130***	0.127***	0.131***	0.110***
	(0.028)	(0.027)	(0.019)	(0.019)	(0.031)	(0.033)
Avg. Precipitation (mm)*100, last 8 months (Aug)	-0.034	0.055	-0.102***	-0.097***	0.011	0.019
	(0.055)	(0.044)	(0.037)	(0.037)	(0.042)	(0.039)
year=2009	0.039					
	(0.030)					
year=2010	0.055	-0.030*	-0.051***	-0.058***	-0.050**	-0.042*
	(0.041)	(0.018)	(0.013)	(0.012)	(0.022)	(0.022)
year=2011	0.083***	0.025**	0.046***	0.042***	-0.004	-0.016
	(0.030)	(0.011)	(0.008)	(0.009)	(0.012)	(0.014)
year=2012	0.125***	0.074***	0.018**	0.023***	-0.011	-0.013
	(0.038)	(0.016)	(0.008)	(0.009)	(0.017)	(0.021)
Observations	37299	30862	30862	30862	30864	30864
Schools	8839	8746	8746	8746	8746	8746
Avg. periods per school	4.22	3.53	3.53	3.53	3.53	3.53
Municipalities	837	836	836	836	836	836
$\bar{Y}$	0.02	0.02	0.01	0.01	0.01	0.01

Linear fixed effects panel regression at school level (see Equation 1). S. Dengue is the reported incidence of Severe Dengue in the last 4 months (4M) at municipality level and C. Dengue is the incidence of Classic Dengue at the same level. L.S. Dengue and L.C. Dengue are the lag of Severe and Classic Dengue, respectively. On top of the fixed effects by school and by year, these controls for Inpatient beds and AE positions per 10.000h, Subsidized Health Care registry as a percentage of Population, municipality dependence on central government transfers, municipality per capita income, the incidence rate of influenza-like cases per 1.000h in the municipality during the calendar year, avg. temperature and rainfall for the last 8 months, log-population and the standardized number of people, houses and roads affected by natural disasters. See Table 2 for further details.
Clustered at municipality level SD in parenthesis. Significance: * 10%, ** 5%, *** 1%.

Pair of years specific effects and the 'recovery' effect

Here we asses whether the impact is driven by any particular interval of time. In fact, we expect it to come mainly from the years which include the outbreak: 2009-10, 2010-11. Table 12 presents results for such type of analysis in its columns 2 to 5, where the sample is restricted to pairs of consecutive years. Such specification might come with an important bias due to the inability to capture long-term variations on the time-series, and as it has less observations, results on less efficient estimators. Aside from such considerations, we observe that the strongest effect corresponds to the 2010-11 specification (however it is not possible to reject that the coefficients in columns 3 and 4 are not the same). That is, between the year of the outbreak, and the recovery one. There are two reasons for this. First, indeed the strongest variation is observed for this pair of years, as shown in the row $E[D_t - D_(t-1)]$ of the table, and graphically by Figure 4 (Figure 5 of the main text). The incidence of severe Dengue was already growing between 2008 and 2009, and while the 2010 outbreak signified a notorious increase, the end of the epidemic period resulted in a minimum of incidence of the illness. The second reason for this, is that the 'recovery' of the number of students per school might be inflated by those students who did not take the test in 2010 might take it in 2011. Column 6 of the table present a subset that covers from 2008 until 2010, and provides a coefficient of around -0.0036 students. One can consider that the true effect might lie between this number and the -0.01 reported in column 1 (and in the main text).

Figure 4: Municipal altitude and yearly incidence of severe Dengue fever



Source: Own calculations using SIVIGILA data and 2005 Census population numbers. Incidence rates are per calendar year.

Table 12: Number of test takers per school and Dengue Incidence by Years

	All	2008/09	2009/10	2010/11	2011/12	2008/10
	(1)	(2)	(3)	(4)	(5)	(6)
S. Dengue 10000h (4M)	-0.0100**	-0.00141	-0.00347	-0.00682**	0.00615	-0.00358*
	(0.00451)	(0.00702)	(0.00247)	(0.00339)	(0.00828)	(0.00207)
Observations	37299	13132	14362	15769	16500	20799
Schools	8839	6910	7870	8312	8553	7988
Avg. periods per school	4.220	1.900	1.825	1.897	1.929	2.604
Municipalities	837	737	835	832	832	837
E[D_t - D_t-1]	-0.160	0.163	0.199	-0.626	-0.0191	0.182

Linear fixed effects panel regression at school level (see Equation 1). S. Dengue is the reported incidence of Severe Dengue in the last 4 months (4M) at municipality level and C. Dengue is the incidence of Classic Dengue at the same level. L.S. Dengue and L.C. Dengue are the lag of Severe and Classic Dengue, respectively. On top of the fixed effects by school and by year, these controls for Inpatient beds and AE positions per 10.000h, Subsidized Health Care registry as a percentage of Population, municipality dependence on central government transfers, municipality per capita income, the incidence rate of influenza-like cases per 1.000h in the municipality during the calendar year, avg. temperature and rainfall for the last 8 months, log-population and the standardized number of people, houses and roads affected by natural disasters. See Table 2 for further details.
Column 1 reproduces the main specification, columns 2 to 6 restrict the sample to the years specified in the title.
Clustered at municipality level SD in parenthesis. Significance: * 10%, ** 5%, *** 1%.

Classroom composition effects

We found no impacts on observed characteristics as the school proportion of female test-takers, to be classified as a SISBEN 1-2 household, or average income of their families (see Table 13). These are our available covariates at school level which typically are good predictors for test-performance and further education decisions.

Table 13: School Characteristics and Dengue Incidence

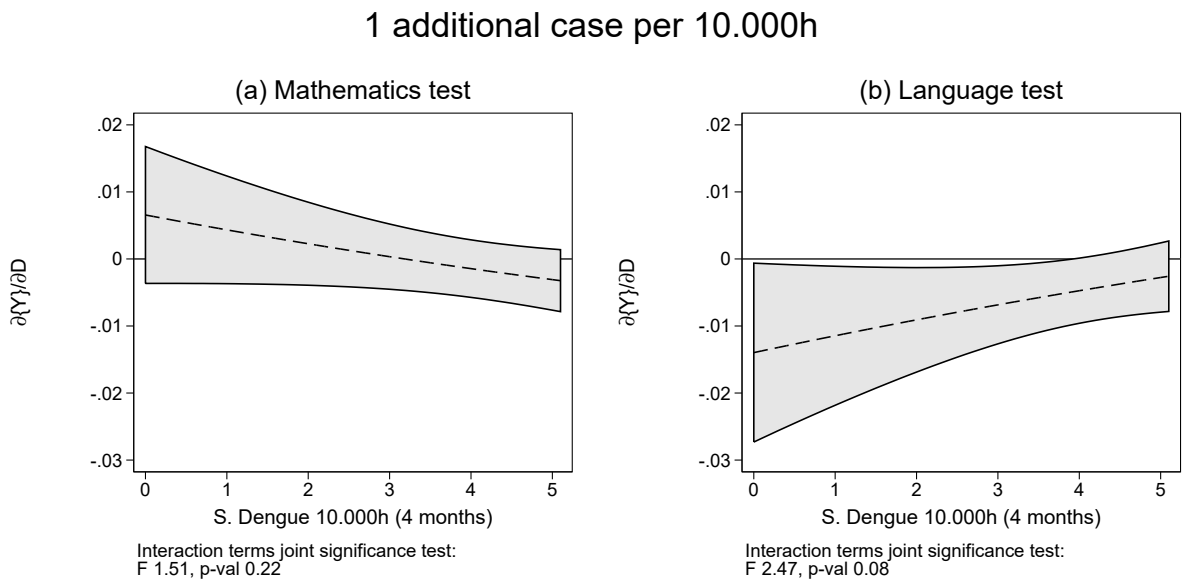
	Female	SISBEN12	INCOME
Panel A: Severe Dengue			
	(1)	(2)	(3)
S. Dengue 10000h (4M)	-0.021	0.012	-0.000
	(0.052)	(0.075)	(0.005)
Observations	37301	37301	37290
Schools	8839	8839	8839
Avg. periods per school	4.22	4.22	4.22
Municipalities	837	837	837
$\bar{Y}$	53.51	66.69	1.73
Adj. R squared	0.0023	0.0173	0.0093
Panel B: Classic Dengue			
	(1)	(2)	(3)
C. Dengue 1000h (4M)	-0.008	-0.005	0.001
	(0.081)	(0.119)	(0.003)
Observations	37301	37301	37290
Schools	8839	8839	8839
Avg. periods per school	4.22	4.22	4.22
Municipalities	837	837	837
$\bar{Y}$	53.51	66.69	1.73
Adj. R squared	0.0023	0.0173	0.0093

Linear fixed effects panel regression at school level (see Equation 1). S. Dengue is the reported incidence of Severe Dengue in the last 4 months (4M) at municipality level and C. Dengue is the incidence of Classic Dengue at the same level. L.S. Dengue and L.C. Dengue are the lag of Severe and Classic Dengue, respectively. On top of the fixed effects by school and by year, these controls for Inpatient beds and AE positions per 10.000h, Subsidized Health Care registry as a percentage of Population, municipality dependence on central government transfers, municipality per capita income, the incidence rate of influenza-like cases per 1.000h in the municipality during the calendar year, avg. temperature and rainfall for the last 8 months, log-population and the standardized number of people, houses and roads affected by natural disasters. See Table 2 for further details.
Clustered at municipality level SD in parenthesis.
Significance: * 10%, ** 5%, *** 1%.

Non-linear effects estimates table and test scores results

In this section we present the non-linear estimates for test scores in the main text. Also, table 14 presents the coefficient estimates of the model from which the marginal effects were derived.

Figure 5: Marginal effect of severe Dengue on test scores: non-linear effects



Marginal effects from a specification with a 4th order polynomial on S Dengue incidence
SE clustered at municipality level for 90% confidence intervals. Incidence defined over the last 4 months before SABER 11 test. Incidence restricted to 5 cases per 10.000 h for easiness of exposition

Table 14: Non-linear Impact at School Level of Dengue Incidence 4th order polynomial

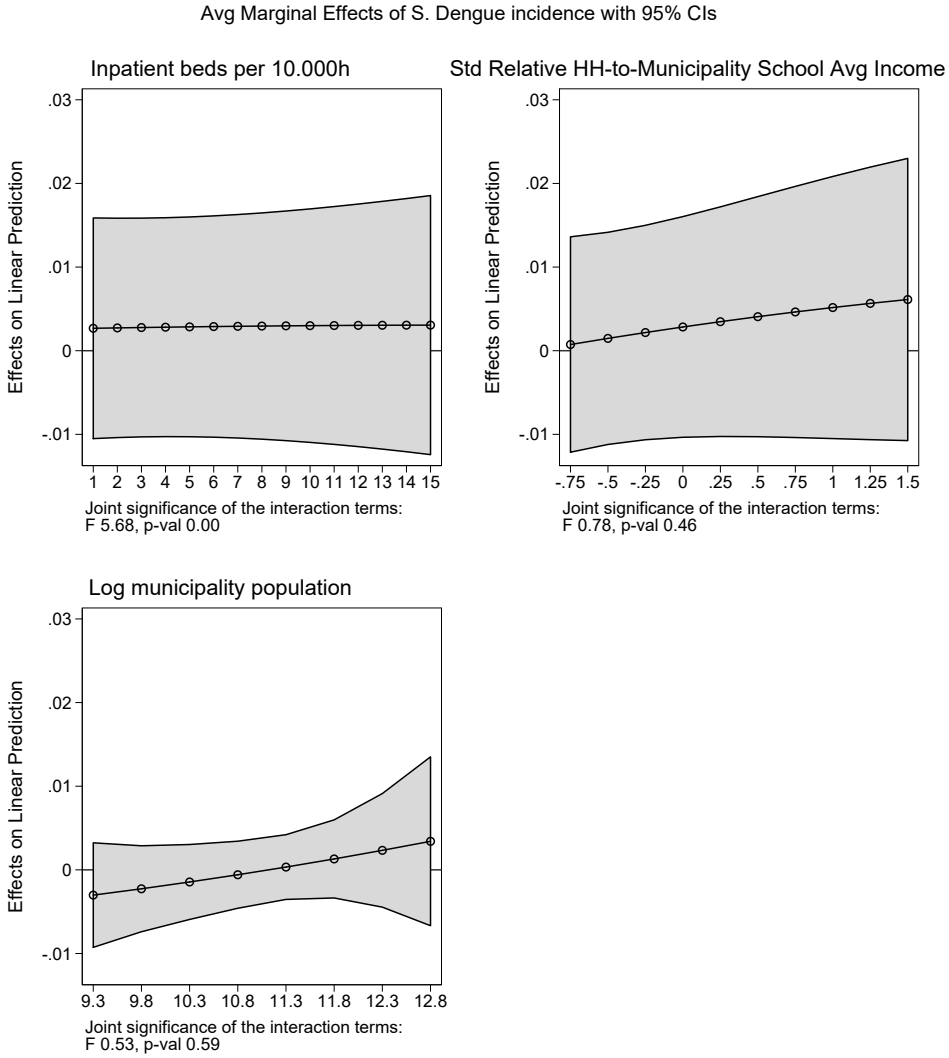
	LOG(EST)	MATH	LANG
	(1)	(2)	(3)
S. Dengue 10000h (4M)	-0.03017***	0.00656	-0.01397*
	(0.01055)	(0.00623)	(0.00814)
S. Dengue 10000h (4M) × S. Dengue 10000h (4M)	0.00207	-0.00114	0.00129
	(0.00133)	(0.00078)	(0.00103)
S. Dengue 10000h (4M) × S. Dengue 10000h (4M) × S. Dengue 10000h (4M)	-0.00003	0.00002	-0.00002
	(0.00003)	(0.00002)	(0.00002)
Std. people affected by emergencies produced by natural events	-0.00099**	0.00118***	-0.00012
	(0.00043)	(0.00033)	(0.00017)
Std. dwellings affected by emergencies produced by natural events	0.00016	0.00156***	0.00146*
	(0.00100)	(0.00047)	(0.00079)
Std. roads affected by emergencies produced by natural events	0.00159	-0.00045	-0.00057
	(0.00113)	(0.00035)	(0.00096)
Std. hects of farm land affected by emergencies produced by natural events	-0.00424	0.00455**	0.00469***
	(0.00377)	(0.00189)	(0.00161)
Inpatient Beds per 10.000h	0.00042	-0.00046**	-0.00072***
	(0.00043)	(0.00018)	(0.00012)
A&E positions per 10.000h	0.00007***	0.00011***	0.00009***
	(0.00001)	(0.00002)	(0.00001)
Subsidized Health Care / Population	0.00060	-0.00490	-0.00371
	(0.00295)	(0.00795)	(0.00844)
logingresospc	-0.00059	0.00985	-0.04528
	(0.02909)	(0.01552)	(0.03499)
Municipality dependence on central Gov. transfers	0.01968	0.12460***	0.00633
	(0.05277)	(0.03405)	(0.05406)
Influeza-like per 1000h, Cal Y	-0.00919*	0.00361	-0.01702*
	(0.00489)	(0.00529)	(0.00981)
Log-population	0.45030**	0.15717	0.52293**
	(0.22494)	(0.15267)	(0.24083)
Avg. 2m temperature (C), last 8 months (Aug)	-0.03823	0.06935***	0.04612**
	(0.02764)	(0.01682)	(0.02074)
Avg. Precipitation (mm)*100, last 8 months (Aug)	-0.05287	-0.04617	0.01808
	(0.05446)	(0.03363)	(0.03747)
year=2009	0.03640	-0.02580	-0.00659
	(0.02986)	(0.01954)	(0.01988)
year=2010	0.05453	-0.05097**	-0.01259
	(0.04023)	(0.02376)	(0.03214)
year=2011	0.07854***	0.01314	-0.01207
	(0.03018)	(0.01652)	(0.02421)
year=2012	0.11975***	-0.00493	-0.00510
	(0.03769)	(0.02031)	(0.03536)
Observations	37299	37299	37301
Schools/Municipalities	8839	8839	8839
Municipalities	837	837	837
Adj. R squared	0.02223	0.01699	0.01205

Linear fixed effects panel regression at school level (see Equation 1). S. Dengue is the reported incidence of Severe Dengue in the last 4 months (4M) at municipality level and C. Dengue is the incidence of Classic Dengue at the same level. L.S. Dengue and L.C. Dengue are the lag of Severe and Classic Dengue, respectively. On top of the fixed effects by school and by year, these controls for Inpatient beds and AE positions per 10.000h, Subsidized Health Care registry as a percentage of Population, municipality dependence on central government transfers, municipality per capita income, the incidence rate of influenza-like cases per 1.000h in the municipality during the calendar year, avg. temperature and rainfall for the last 8 months, log-population and the standardized number of people, houses and roads affected by natural disasters. See Table 2 for further details.
Clustered at municipality level SD in parenthesis. Significance: * 10%, ** 5%, *** 1%.

Heterogeneous effects estimates table and test scores results

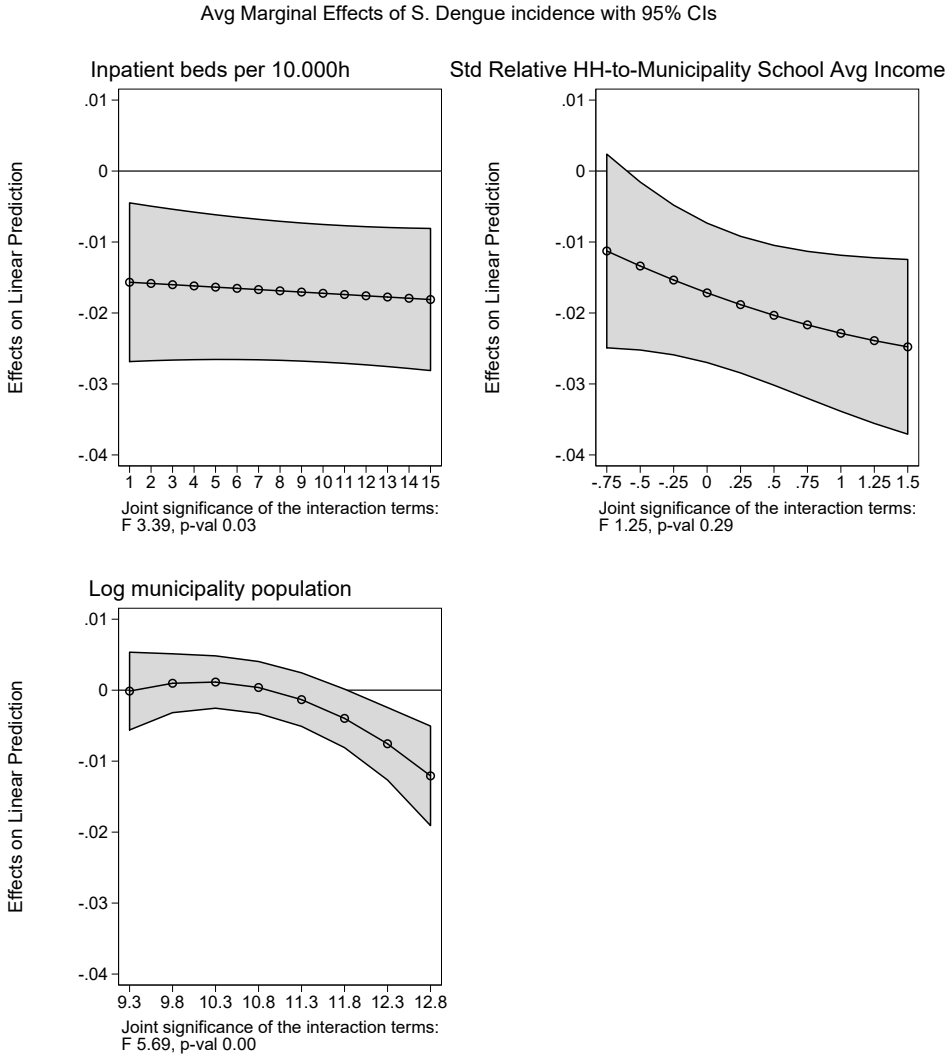
In this section we present the marginal effects for the heterogeneous estimates for test scores which are discussed in the main text. Also, table 15 presents the coefficient estimates of the model from which the marginal effects were derived.

Figure 6: Mathematics Heterogeneous effect



Domain of Z: 5%-95%. Polynomial of order 3 on Z.
Std Relative HH-to-Municipality School Avg Income refers to the standard deviations of the average HH income index of a school from the value of the municipality

Figure 7: Language heterogeneous effect



Domain of Z: 5%-95%. Polynomial of order 3 on Z.
Std Relative HH-to-Municipality School Avg Income refers to the standard deviations of the average HH income index of a school from the value of the municipality

Table 15: Heterogeneous Impact at School Level of Dengue Incidence 2nd order polynomial

	LOG(EST)	MATH	LANG
	(1)	(2)	(3)
S. Dengue 10000h (4M)	-0.13607	-0.00733	-0.19098**
	(0.15071)	(0.09724)	(0.09171)
S. Dengue 10000h (4M) × Inpatient Beds per 10.000h	0.00044	0.00005	-0.00017
	(0.00054)	(0.00040)	(0.00032)
S. Dengue 10000h (4M) × Inpatient Beds per 10.000h × Inpatient Beds per 10.000h	-0.00000	-0.00000	-0.00000
	(0.00000)	(0.00000)	(0.00000)
Inpatient Beds per 10.000h	0.00396*	-0.00110	-0.00123
	(0.00234)	(0.00111)	(0.00105)
Inpatient Beds per 10.000h × Inpatient Beds per 10.000h	-0.00001*	0.00000	0.00000
	(0.00000)	(0.00000)	(0.00000)
S. Dengue 10000h (4M) × Std Relative Wealth-Index	-0.02309***	0.00260	-0.00694
	(0.00841)	(0.00324)	(0.00459)
S. Dengue 10000h (4M) × Std Relative Wealth-Index × Std Relative Wealth-Index	0.00323**	-0.00027	0.00125
	(0.00132)	(0.00075)	(0.00090)
Std Relative Wealth-Index	0.04096***	0.04844***	0.04282***
	(0.01303)	(0.00880)	(0.01258)
Std Relative Wealth-Index × Std Relative Wealth-Index	-0.00600	-0.00598***	-0.00516*
	(0.00405)	(0.00228)	(0.00273)
S. Dengue 10000h (4M) × Log-population	0.02845	-0.00055	0.03802**
	(0.02887)	(0.01859)	(0.01678)
S. Dengue 10000h (4M) × Log-population × Log-population	-0.00155	0.00011	-0.00187**
	(0.00138)	(0.00088)	(0.00077)
Log-population	4.06736***	-1.59302***	-5.82797***
	(0.78667)	(0.46841)	(0.89673)
Log-population × Log-population	-0.15569***	0.07343***	0.27561***
	(0.03254)	(0.02075)	(0.04122)
Std. people affected by emergencies produced by natural events	-0.00067*	0.00103***	-0.00044*
	(0.00035)	(0.00035)	(0.00025)
Std. dwellings affected by emergencies produced by natural events	0.00081	0.00129***	0.00058
	(0.00091)	(0.00049)	(0.00052)
Std. roads affected by emergencies produced by natural events	0.00186	-0.00072***	-0.00100*
	(0.00132)	(0.00028)	(0.00054)
Std. hects of farm land affected by emergencies produced by natural events	-0.00424	0.00444**	0.00417***
	(0.00360)	(0.00205)	(0.00156)
Subsidized Health Care / Population	0.00138	-0.00618	-0.00479
	(0.00288)	(0.00865)	(0.00773)
Log-income per capita	-0.01380	0.01470	-0.01299
	(0.02387)	(0.01421)	(0.02039)
Municipality dependence on central Gov. transfers	0.00200	0.13105***	0.02977
	(0.04977)	(0.03611)	(0.03976)
Influeza-like per 1000h, Cal Y	-0.01108*	0.00340	-0.01364*
	(0.00607)	(0.00541)	(0.00717)
year=2009	0.02102*	0.01311	0.00710
	(0.01194)	(0.01018)	(0.00934)
year=2010	0.01523	0.02632**	0.01990**
	(0.01232)	(0.01036)	(0.00897)
year=2011	0.06509***	0.05018***	-0.01023
	(0.01327)	(0.01076)	(0.01183)
year=2012	0.12008***	0.03181***	-0.02114
	(0.01638)	(0.01103)	(0.01332)
Observations	37559	37559	37561
Schools/Municipalities	8904	8904	8904
Municipalities	857	857	857
Adj. R squared	0.02560	0.01801	0.02160

Linear fixed effects panel regression at school level (see Equation 1). S. Dengue is the reported incidence of Severe Dengue in the last 4 months (4M) at municipality level and C. Dengue is the incidence of Classic Dengue at the same level. L.S. Dengue and L.C. Dengue are the lag of Severe and Classic Dengue, respectively. On top of the fixed effects by school and by year, these controls for Inpatient beds and AE positions per 10.000h, Subsidized Health Care registry as a percentage of Population, municipality dependence on central government transfers, municipality per capita income, the incidence rate of influenza-like cases per 1.000h in the municipality during the calendar year, avg. temperature and rainfall for the last 8 months, log-population and the standardized number of people, houses and roads affected by natural disasters. See Table 2 for further details.
Clustered at municipality level SD in parenthesis. Significance: * 10%, ** 5%, *** 1%.

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