

Appendix
Health and Institutional Risk Factors of COVID-19 Mortality in Mexico, 2020
Najera and Ortega-Avila

Appendix Table 1. Percentage of COVID-19 Officially Registered Deaths by Population's Characteristics

Variable	Without characteristic % (SE)	With characteristic % (SE)
Demographic		
Male	8 (0.08)	13 (0.07)
Indigenous people	11 (0.08)	17 (0.06)
Aged ≤49 years	24 (0.05)	3 (0.09)
Illness		
Obesity	10 (0.08)	14 (0.07)
Diabetes	9 (0.08)	26 (0.07)
Asthma	12 (0.08)	8 (0.08)
Smoker	12 (0.08)	12 (0.07)
Immunosuppressants	12 (0.08)	24 (0.05)
High blood pressure	9 (0.08)	24 (0.05)
Chronic renal disease	12 (0.08)	38 (0.02)
Heart disease	12 (0.08)	28 (0.04)
Institution		
State (local)		12 (0.08)
IMSS		19 (0.06)
ISSSTE		17 (0.07)
PEMEX		15 (0.09)
PRIVATE		4 (0.09)
SEMAR		6 (0.10)
SEDENA		11 (0.09)
SSA		6 (0.06)

Note: Age was included in the model as a continuous variable. Army health system: SEDENA and SEMAR; Mexican Petroleum Institution: PEMEX; Open public health system: SSE; Social security systems: IMSS and ISSSTE.

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Hierarchical Bayesian Model

$$Pr(y_i = 1) = \text{logit}^{-1}(\alpha_{ijk} + X_i\beta),$$

for $i = 1, \dots, n$

Random effects

$$a_j \sim N(\mu_\alpha, \sigma_{state}^2), j = 1, \dots, 32$$

$$a_k \sim N(\mu_\alpha, \sigma_{municipalities}^2), j = 1, \dots, 2137$$

Priors

$$\beta \sim N(0,1)$$

$$\sigma_{state}^2 \sim N(0,1)$$

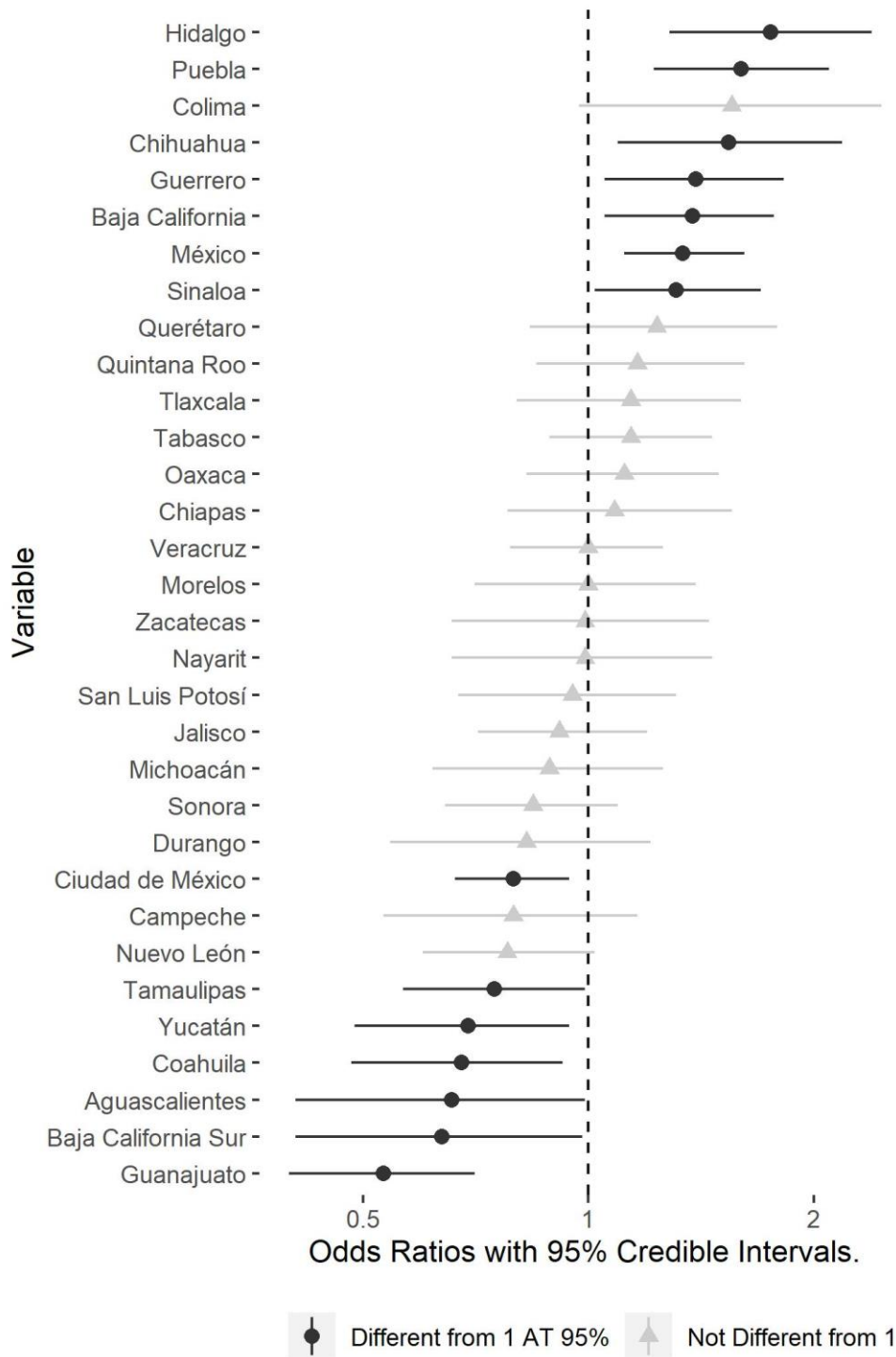
$$\sigma_{municipalities}^2 \sim N(0,1)$$

Where, $Pr(y_i = 1)$ is the probability of death given both state-level and municipal-level α_{jk} random effect (specific intercepts for each unit, 32 for states and 2137 intercepts for municipalities), and the estimated effect β of all X variables included in the model. The model uses weak priors $\beta \sim N(0,1)$ for the individual-level variables and weak priors for the random effects $\mu_{\alpha_{jk}} \sim N(0,1)$

The matrix X is given by all the variables in Table 1.

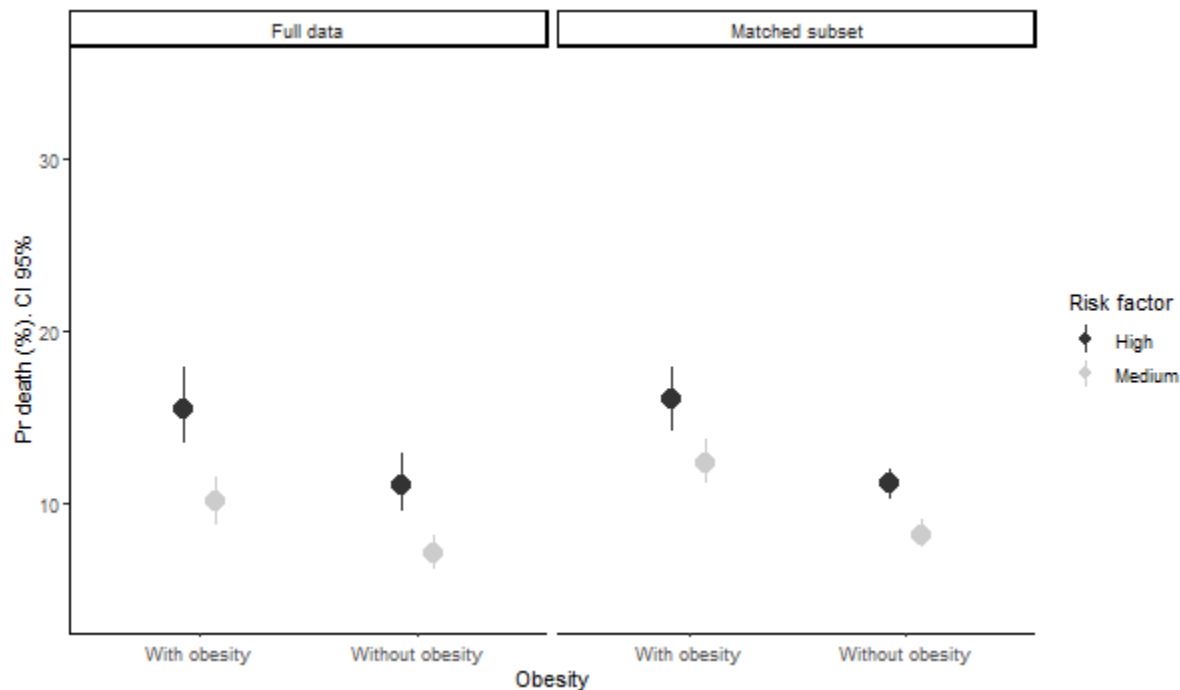
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Appendix Figure 1. State-level random effects (i.e., average mean death risk for each state after adjusting by for all the other observed variables in the model), Hierarchical Bayesian model.



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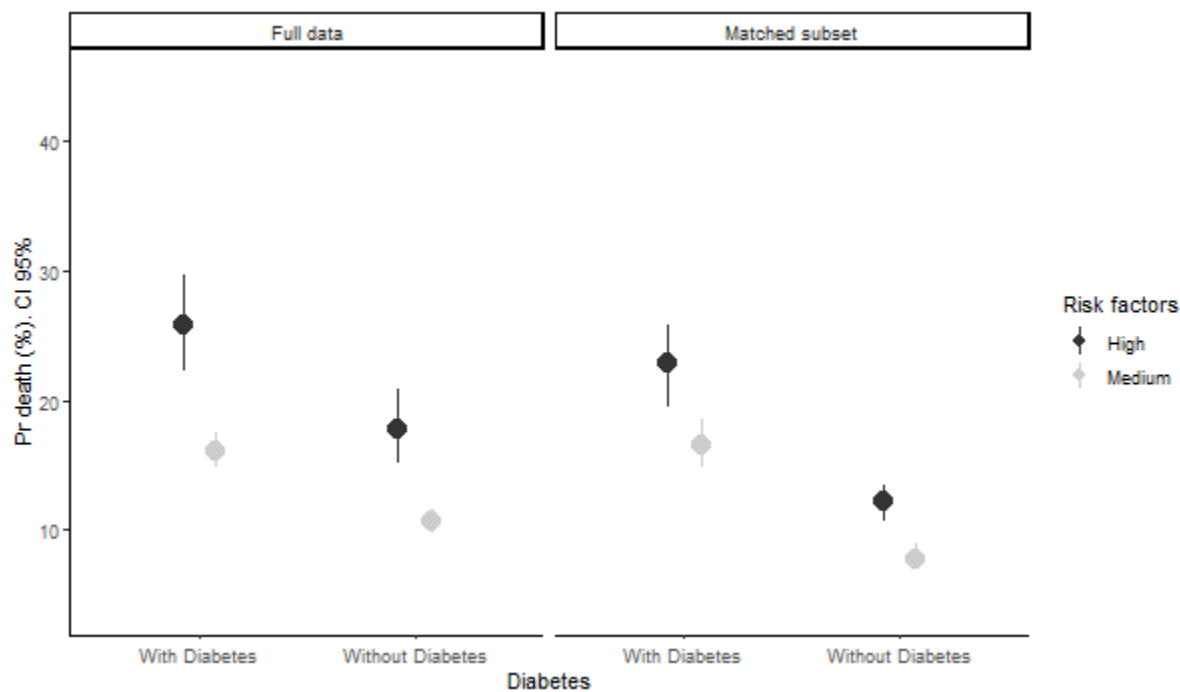
Appendix Figure 2. Estimated effect of obesity upon COVID-19 mortality by risk group.



Notes: Full data vs matched subset from the quasi-experimental analysis, 95% CI. The plot compares the estimates of the Bayesian model (full data) with the estimates from the equivalent subset (similar patient's). The analysis considers the high-risk group and the medium/typical risk group.

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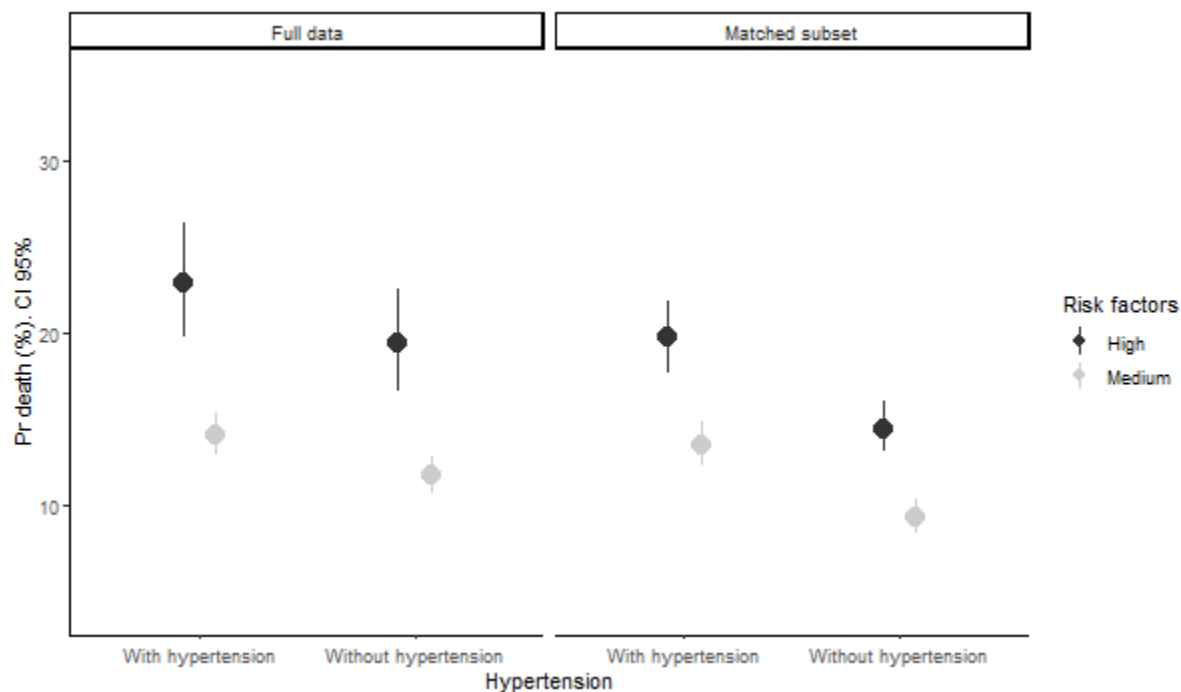
Appendix Figure 3. Estimated effect of diabetes upon COVID-19 mortality by risk group.



Notes: Full data vs matched subset from the quasi-experimental analysis, 95% CIs. The plot compares the estimates of the Bayesian model (full data) with the estimates from the equivalent subset (similar patient's). The analysis considers the high-risk group and the medium/typical risk group.

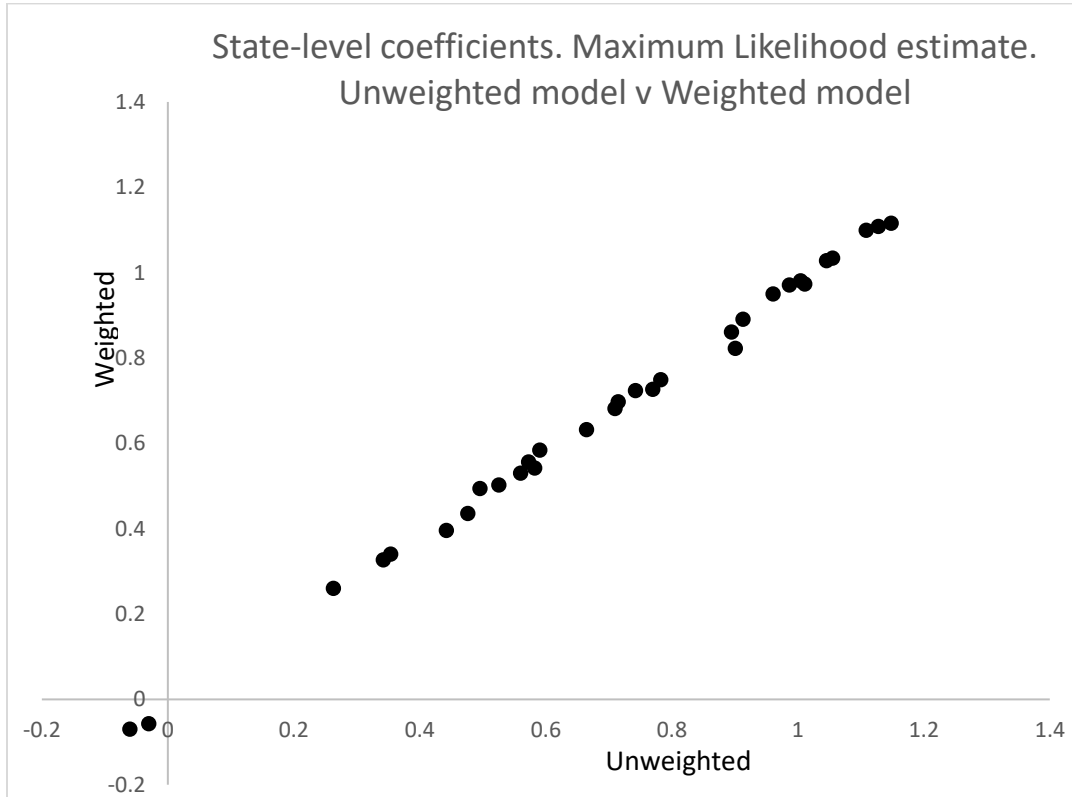
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Appendix Figure 4. Estimated effect of hypertension upon COVID-19 mortality by risk group.



Notes: Full data vs matched subset from the quasi-experimental analysis, 95% CIs. The plot compares the estimates of the Bayesian model (full data) with the estimates from the equivalent subset (similar patient's). The analysis considers the high-risk group and the medium/typical risk group.

Appendix Figure 5. Assessment of the effect of population differences upon the state-level coefficients.



Notes: Maximum Likelihood estimates. Correlation=0.98. The estimates on the y-axis correspond to ML population weighted estimates and the estimates on the x-axis correspond to ML unweighted estimates. As can be appreciated, after adjusting for individual-level variables, the observed differences in risk are virtually equivalent.