Supplemental material for the paper "The upsurge of homicides and its impact on life expectancy and lifespan inequality in Mexico, 2005-2015"

Authors: José Manuel Aburto[a] & Hiram Beltrán-Sánchez[b]

Author affiliations:
[a] Interdisciplinary Center on Population Dynamics (CPop), University of Southern Denmark, Odense 5000, Denmark & Max-Planck Institute for Demographic Research, Rostock, Germany.

[b] Department of Community Health Sciences at the Fielding School of Public Health and California Center for Population Research, University of California-Los Angeles, Los Angeles, California, USA.

Corresponding author:
José Manuel Aburto
Email: jmaburto@sdu.dk
Tel. number: +45 65 50 94 16
Affiliation: Interdisciplinary Center on Population Dynamics (CPop), University of Southern Denmark, Odense 5000, Denmark & Max-Planck Institute for Demographic Research, Rostock, Germany.
Address: J.B. Winsløws Vej 9. DK-5000 Odense C, Denmark

Table A. Classification of causes of death based on Aburto et al 2016

Category	ICD 10	ICD 9
I. Amenable to medical service I.A. AM-Infectious & respiratory diseases : intestinal infections, tuberculosis, zoonotic bacterial diseases, other bacterial diseases, septicemia, poliomyelitis, measles, rubella, infectious hepatitis, ornithosis, rickettsioses/ arthropod-borne, syphilis (all forms), yaws, respiratory diseases, influenza & pneumonia, chronic lower respiratory diseases I.B. AM-Cancers: malignant neoplasm of colon, skin, breast, cervix, prostate, testis, bladder, kidney-Wilm's tumor only, eye, thyroid carcinoma, Hodgkins disease, leukemia I.C. AM-Circulatory: active/acute rheumatic fever, chronic rheumatic heart disease, hypertensive disease, cerebrovascular disease I.D. AM-Birth: maternal deaths (all), congenital cardio-vascular anomalies, perinatal deaths (excluding stillbirths) I.E. AM-Other: disease of thyroid, epilepsy, peptic ulcer, appendicitis, abdominal hernia, cholelithiasis & cholecystitis, nephritis, benign prostatic hyperplasia, misadventures to patients during surgical or medical care, cisticerchosis.	A00-A09, A16-A19, B90, A20-A26, A28, A32, A33, A35, A36, A37, A40-A41, A80, B05-B06, B15-B19, A70, A68, A75, A77, A50-A64, A66, J00-J08, J20-C50, C53, C61, C62, J39, J60-J99, J09-J18, J40-J47 C16,C18-C21, C43-C44, C67, C64, C69, C73, C81, C91-C95 I00-I02, I05-I09, I10-I13, I15, I60-I69, O00-O99, Q20-Q28, P00-P96 E00-E07, 40-G41, K25-K27, K35-K38, K40-K46, K80-K81, N00-N07, N17-N19, N25-N27, N40, Y60-Y69, Y83-Y84, B69	001-009, 010-018, 32, 33, 37, 137, 020-027, 38, 45, 55-56, 70, 73, 080-082, 087, 090-099, 102, 460-479, 500-519, 480-488, 490-496 153-154, 172-173, 174, 180, 185, 186, 188-189, 190, 193, 201, 204-208 390-392, 393-398, 401-405, 430-438, 630-676, 745-747, 760-779, 240-246, 345, 531-533,540-543, 550-553, 574-575.1, 580-589, 600, E870-E876, E878-E879
II. Diabetes	E10-E14	250
III. Ischemic Heart Diseases (IHD)	I20-I25	410-414, 429.2
IV. Lung cancer	C33-C34	162
V. Cirrhosis	K70	571.1-571.3
VI. Homicides	X85-Y09	E960-E969
VII. Road traffic accidents	V01-V99	E810-E819
VIII. Residual Causes : HIV/AIDS; suicide and self-inflicted injuries; other cancers and other heart diseases	B20-B24, U03; X60-X84, Y87.0; C00-D48; I00-I99 if not listed above; R00-R99	042-044; E950-E959; 140-239; 390-459 if not listed above; 780-799

Section A. Lifespan inequality indicator

In lifetable notation, $e_{15}^\dagger$ is defined as:

$$e_{15}^\dagger = \frac{\int_{15}^\omega \ell(x)\mu(x)e(x)dx}{\ell(15)} = \frac{\int_{15}^\omega d(x)e(x)dx}{\ell(15)}, \qquad (1)$$

where $\ell(x)$, $\mu(x)$, $e(x)$, $d(x)$ and ω are the survival function, the force of mortality, life expectancy, the age at death distribution at age x, and the open-aged interval, respectively.

Section B. Decomposition method summary

The decomposition method used in this paper is based on the line integral model (Horiuchi et al 2008). Suppose f (e.g. $e^\dagger$ or life expectancy) is a differentiable function of n covariates (e.g. each age-cause specific mortality rate) denoted by the vector $A = [x_1, x_2, \ldots, x_n]^T$. Assume that f and A depend on the underlying dimension t, which is time in this case, and that we have observations available in two time points t_1 and t_2. Assuming that A is a differentiable function of t between t_1 and t_2, the difference in f between t_1 and t_2 can be expressed as follows:

$$f_2 - f_1 = \sum_{i=1}^n \int_{x_i(t_1)}^{x_i(t_2)} \frac{\partial f}{\partial x_i} dx_i = \sum_{i=1}^n c_i, \qquad (2)$$

where c_i is the total change in f (e.g. $e^\dagger$ or life expectancy) produced by changes in the i-th covariate, x_i. The c_i's in equation (2) were computed with numerical integration following the algorithm suggested by Horiuchi et al (2008). This method has the advantage of assuming that covariates change gradually along the time dimension.

Section C. Code and data to reproduce results

Available at https://github.com/jmaburto/Violence-and-Lifespan-variation

Shinny app for sensitivity and state specific analysis

Results with starting age 15, available at https://demographs.shinyapps.io/LVMx_15_App/

Supplemental figures. All figures are own calculations based on CONAPO (2017) and INEGI (2017) data.

Figure A. Age standardized homicide rates by sex 1995-2015.

Age-standardized homicide rate by sex

Figures B and C shows age- and cause-specific contributions (in years) to life expectancy and lifespan inequality's changes at age 15 between 1995 and 2005 (Panels A) and between 2005 and 2015 (Panels B). Vertical values in rectangles next to the y-axis represent age-specific contributions, while bars' length correspond to cause-specific contributions by age. Overall cause-specific contributions across all ages are shown in the panel's legend in parenthesis (also in years).

Figure B-1 . Age-cause specific contributions to the changes in national life at age 15 for Males. Panel A refers to 1995-2005 and panel B to 2005-2015. Note: Numbers in boxes are age-specific contributions.
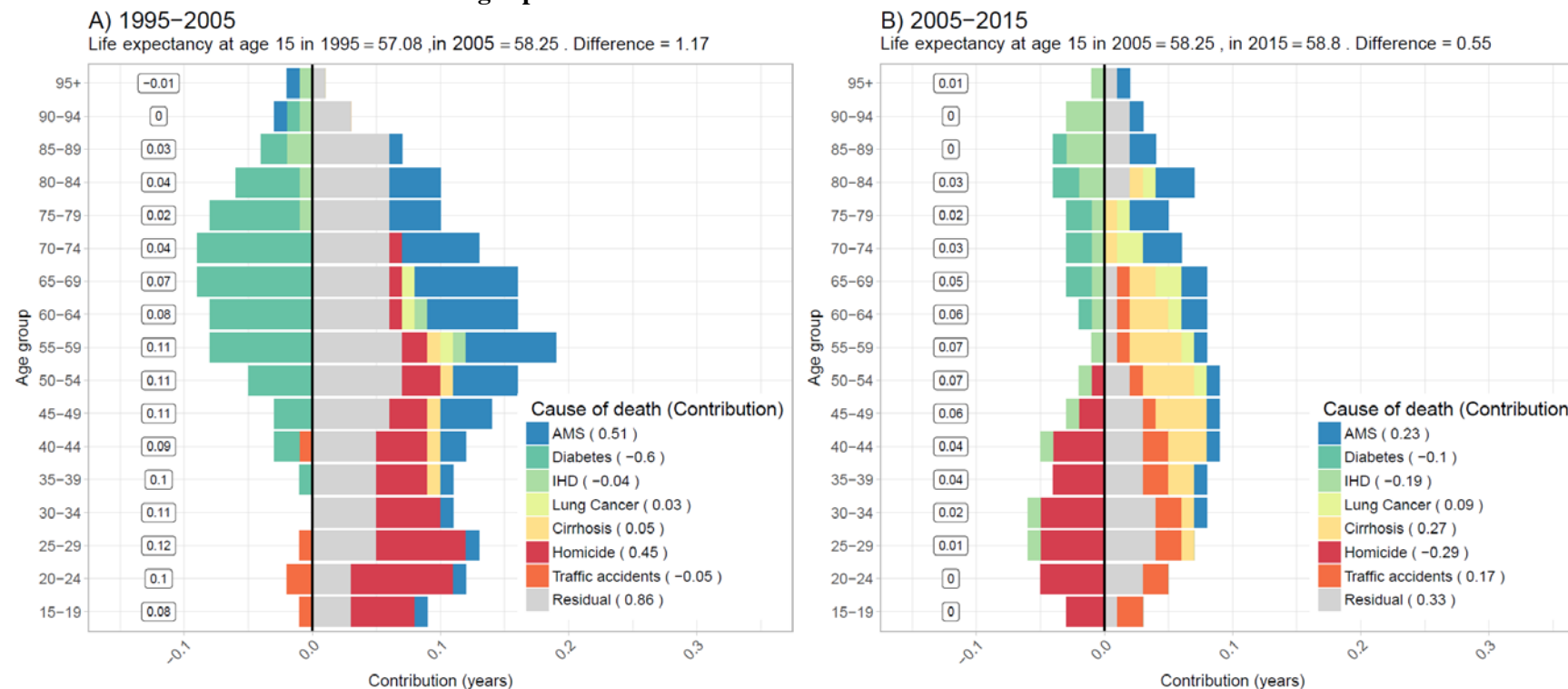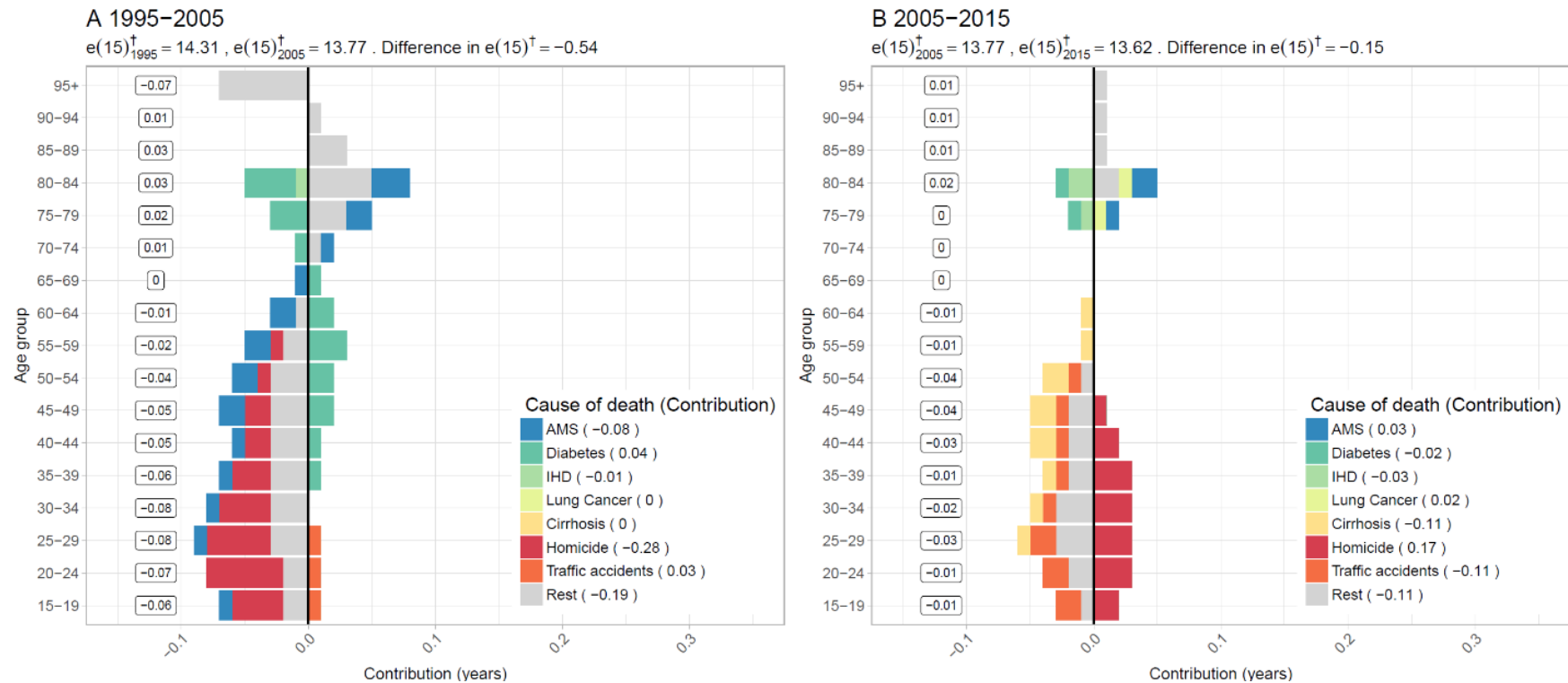
Figure B-2 . Age-cause specific contributions to the changes in national lifespan inequality at age 15 for Males. Panel A refers to 1995-

A 1995−2005
$e(15)^{\dagger}_{1995} = 14.31$, $e(15)^{\dagger}_{2005} = 13.77$. Difference in $e(15)^{\dagger} = -0.54$

B 2005−2015
$e(15)^{\dagger}_{2005} = 13.77$, $e(15)^{\dagger}_{2015} = 13.62$. Difference in $e(15)^{\dagger} = -0.15$

Cause of death (Contribution)
Panel A:
- AMS (−0.08)
- Diabetes (0.04)
- IHD (−0.01)
- Lung Cancer (0)
- Cirrhosis (0)
- Homicide (−0.28)
- Traffic accidents (0.03)
- Rest (−0.19)

Panel B:
- AMS (0.03)
- Diabetes (−0.02)
- IHD (−0.03)
- Lung Cancer (0.02)
- Cirrhosis (−0.11)
- Homicide (0.17)
- Traffic accidents (−0.11)
- Rest (−0.11)

2005 and panel B to 2005-2015. Note: Numbers in boxes are age-specific contributions.

Figure C-1. Age-cause specific contributions to the changes in national life expectancy for females. Panel A refers to 1995-2005 and panel B to 2005-2015. Note: Numbers in boxes are age-specific contributions.
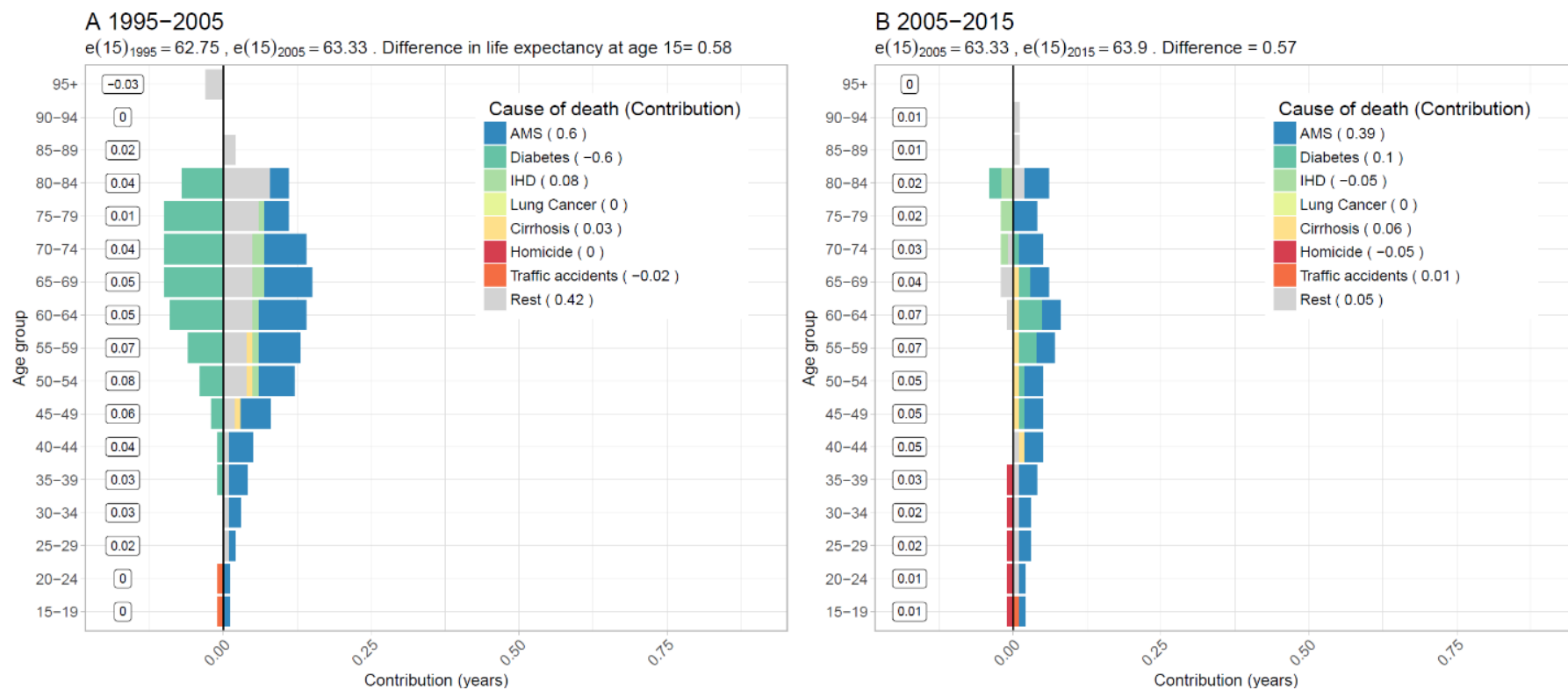
Figure C-2. Age-cause specific contributions to the changes in national lifespan inequality for females. Panel A refers to 1995-2005 and panel B to 2005-2015. Note: Numbers in boxes are age-specific contributions.
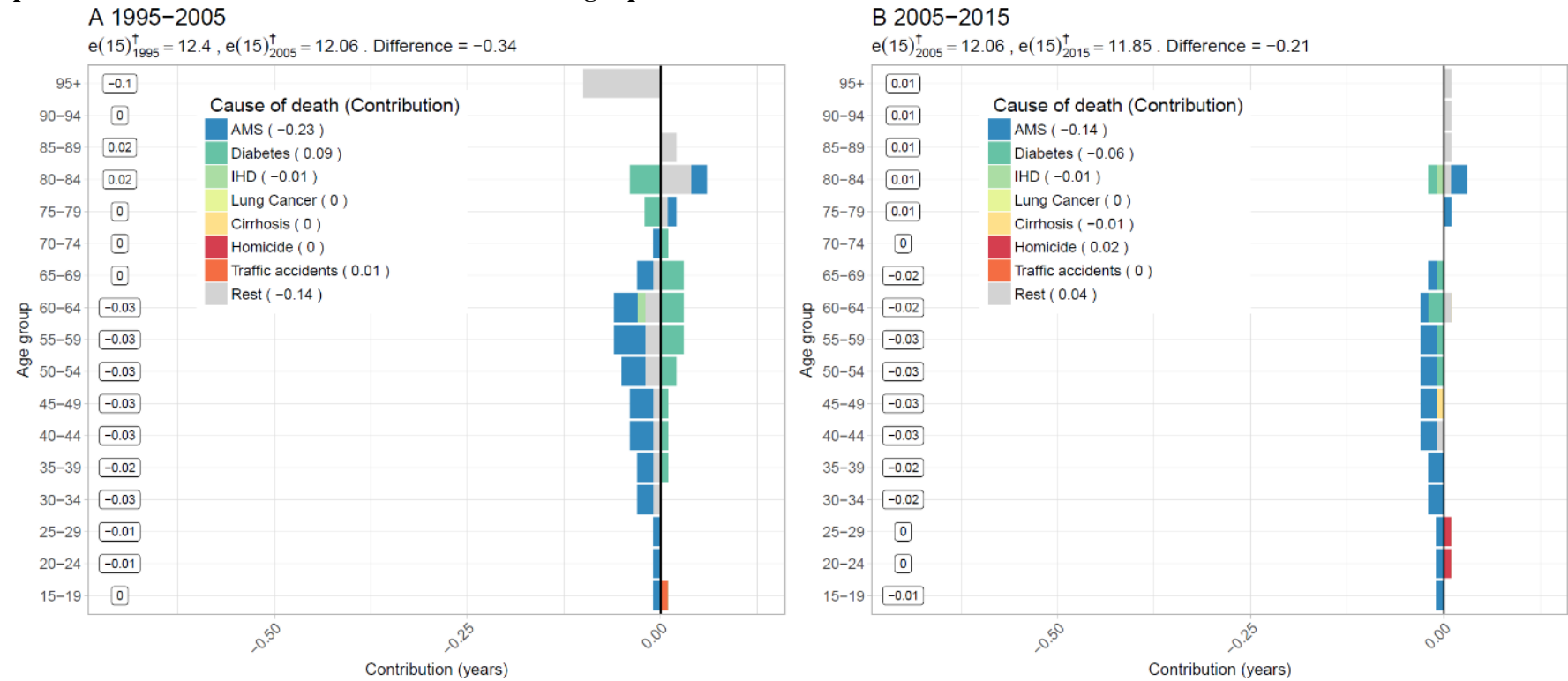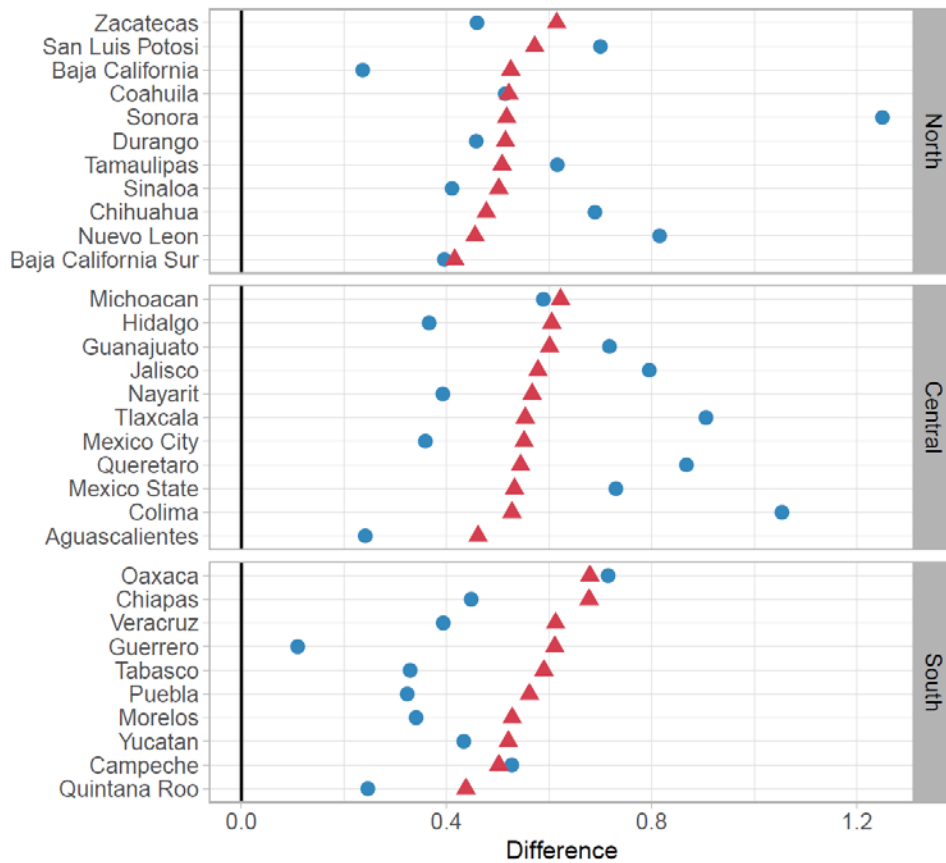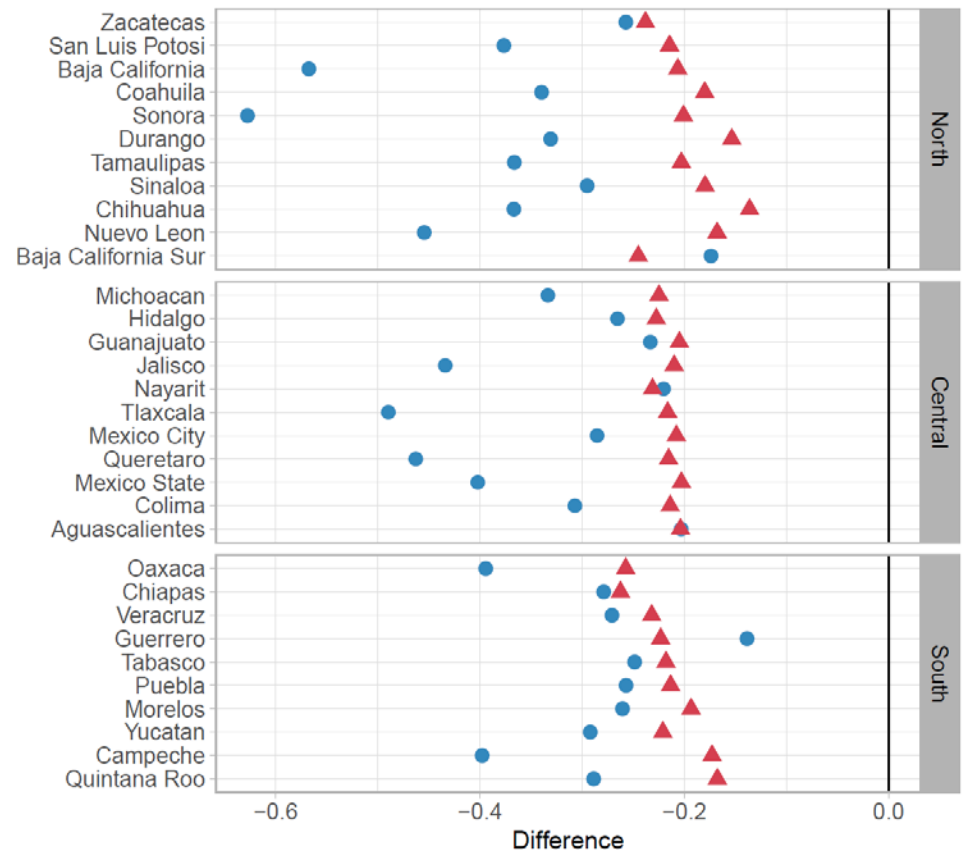
Figure D. Changes in female life expectancy (panel A) and male lifespan inequality (panel B) by state for the periods 1995-2005 and 2005-2015.

Figure E. Cause-specific contributions to changes in male lifespan inequality at age 15 by state for the periods 1995-2005 and 2005-2015 (x-axis in different scale than the paper).
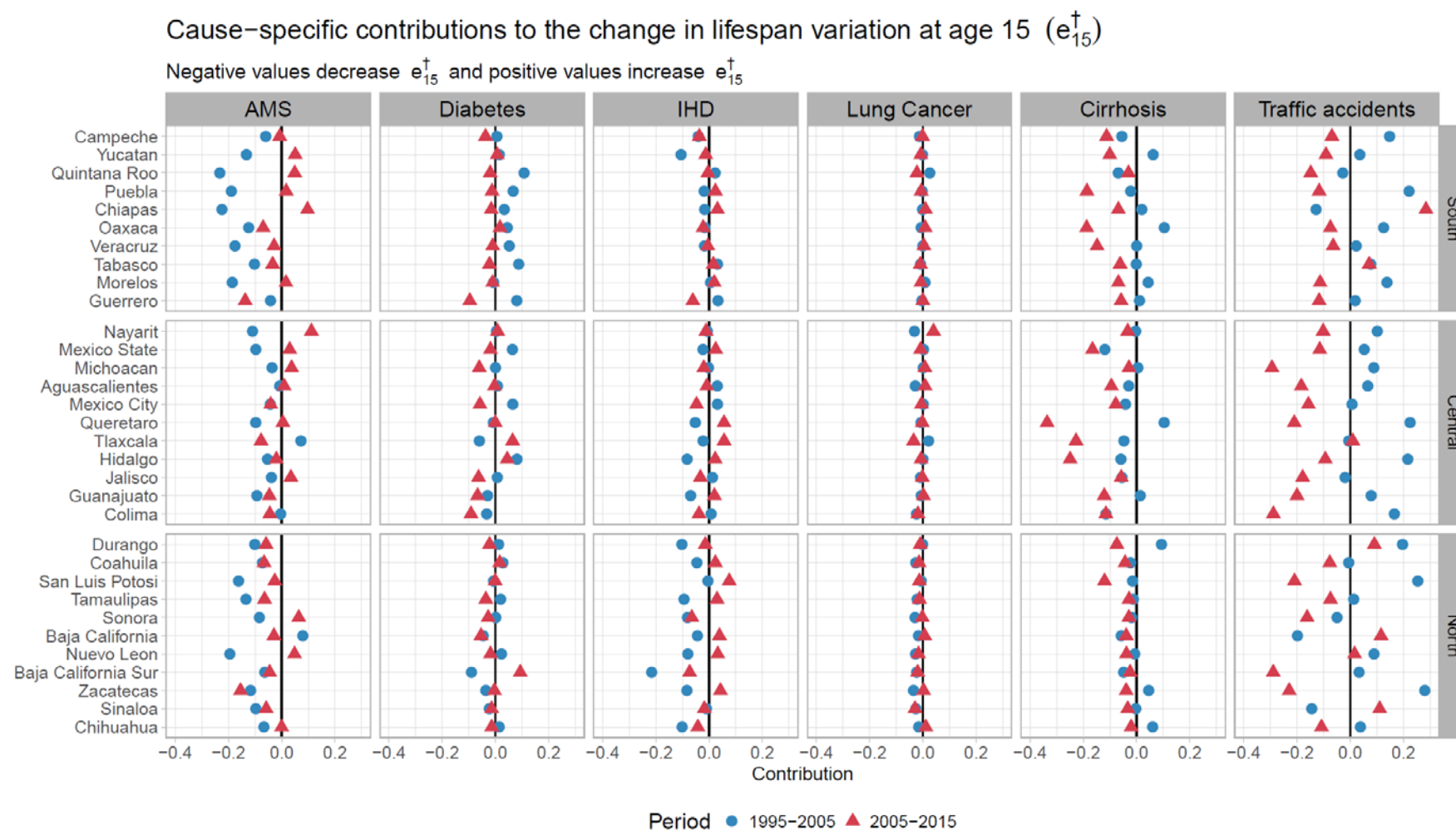

Cause−specific contributions to the change in lifespan variation at age 15 $(e_{15}^{\dagger})$

Negative values decrease $e_{15}^{\dagger}$ and positive values increase $e_{15}^{\dagger}$

Period ● 1995−2005 ▲ 2005−2015

Figure F. Cause-specific contributions to changes in female lifespan inequality at age 15 by state for the periods 1995-2005 and 2005-2015.
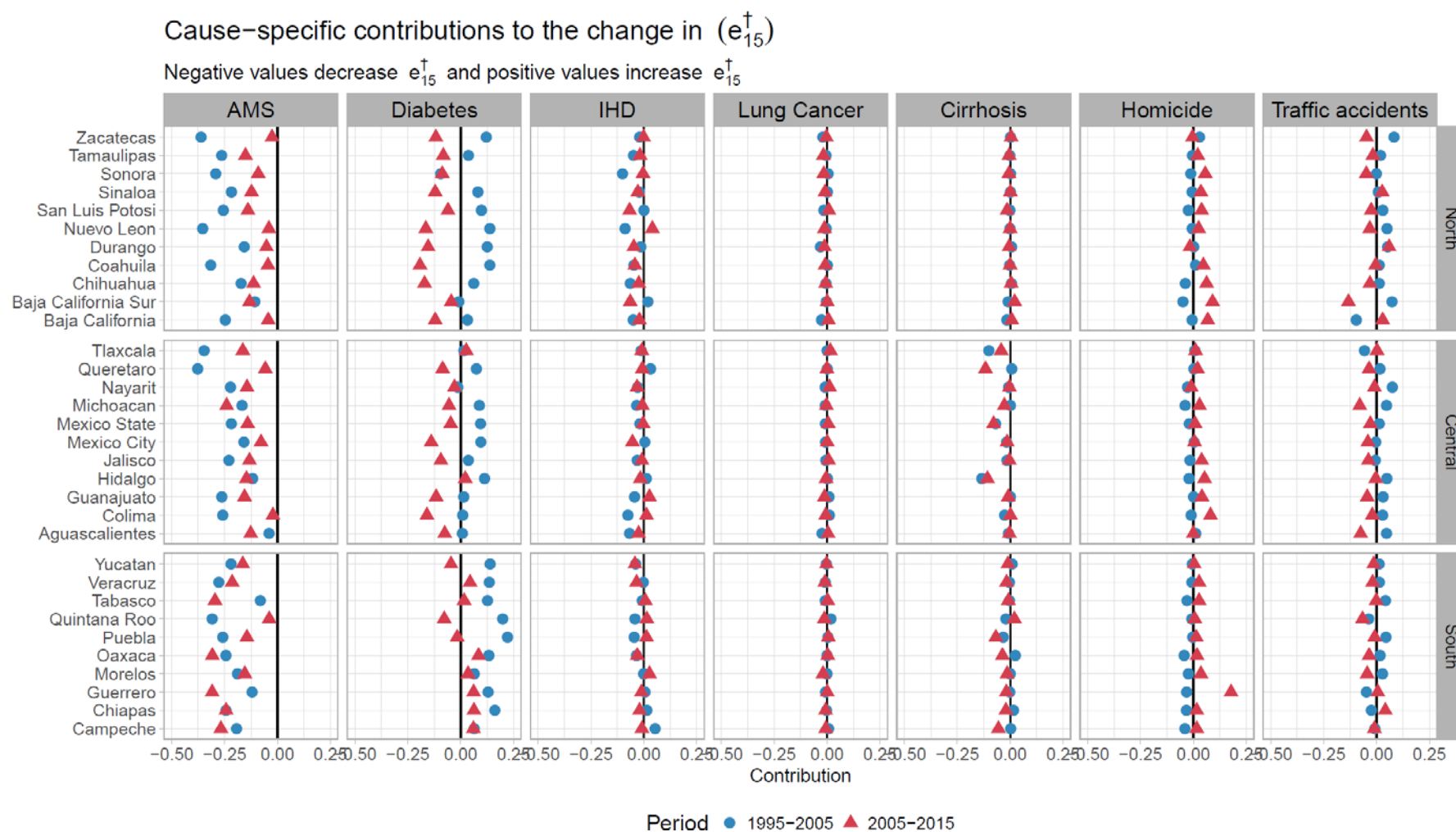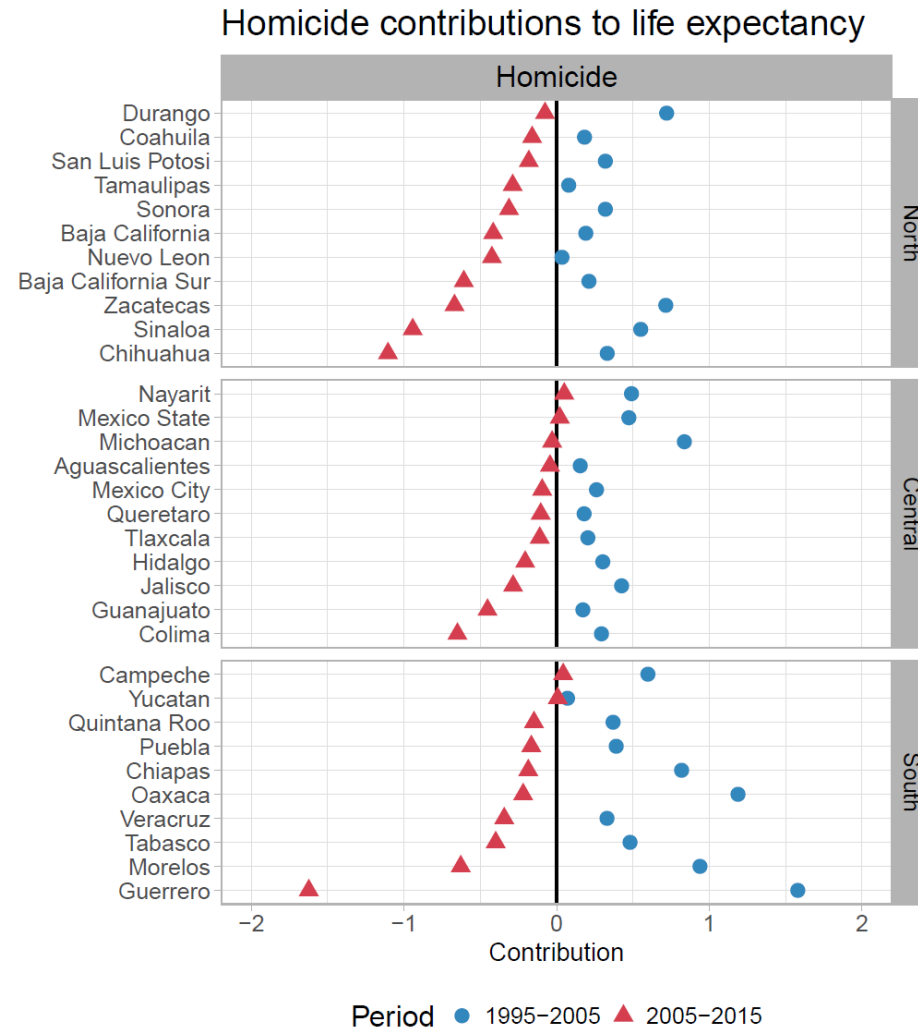

Cause-specific contributions to the change in $(e_{15}^{\dagger})$

Negative values decrease $e_{15}^{\dagger}$ and positive values increase $e_{15}^{\dagger}$

Period ● 1995−2005 ▲ 2005−2015

Figure G. Homicide contributions to changes in male life expectancy at age 15 by state for the periods 1995-2005 and 2005-2015.

Homicide contributions to life expectancy

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INEGI. (2017). National Institute of Statistics: Micro-data files on mortality data 1995-2015. Retrieved from http://www.beta.inegi.org.mx/proyectos/registros/vitales/mortalidad/default.html