**Reply to editors**

We thank the editorial board for the opportunity to revise our manuscript. Our responses to the editors’ comments are outlined below in regular font with editor’s comments in bold font.

**Editor-in-Chief:**

**Your submitted paper has undergone peer review. Even though the topic is of interest, the paper is very difficult to read for a general public health audience and will not be publishable in this journal if an effort is not made to simplify the presentation of the results. We would be interested in reconsidering a revised version for publication in AJPH that follows the guidance of the reviews provided at the end of this correspondence. Because chances of final acceptance are small, you may prefer to withdraw the paper and submit it to a more specialized journal.**

**EIC**

**You have 8 figures but can only have a maximum of 4 figures+tables. Please summarize the findings in less figures and leave the others for the web supplemental files. Make also sure that the figures are properly labeled and the interpretation of the figure is clearly provided in the text. The current figures are extremely difficult to interpret.**

Following your suggestion, we reduce the number of figures. We currently have only two figures and added one table of results; the previous figures are now part of the supplemental material. The new figure is properly labeled and we believe it is easier to interpret.

**Associate Editor:**

**This is a timely and relevant article, but it still requires some work before it can be considered for publication. As a general note, the reviewers require more attention to specific details in changing mortality rates in the studies periods, and more contextual information to help interpreting them. Reviewers #1 and #3 in particular provide helpful guidance for revising the manuscript.**

We followed the reviewer’s suggestions and made several changes to the manuscript. In the next sections, we show our point-by-point reply to reviewers and the steps we took to incorporate those suggestions. We added more context for the upsurge of violence in Mexico during the study period, given the space limitation we kept additional text short and to the point.

**Reply to reviewers**

We appreciate the reviewers' comments; their detailed reading of the manuscript and many suggestions that have greatly improved the article. Our responses to the reviewers’ comments are outlined below in regular font with reviewer’s comments in bold font.

**Reviewer #1**

**The effect of homicide on life expectancy and lifespan inequality is an important public health topic, particularly in the fields of injury prevention and global health. I think this issue is of interest for readers of the American Journal of Public Health, but the data could use some more context. I think describing some of the policies and social context contributing to the increasing homicide rate would help further frame this public health issue.**

We thank the reviewer for the valuable suggestions that helped improved the manuscript. Below, we explain how we incorporated more context regarding the data during the period that we study. In addition, we further described some of the policies and social context that had contributed to the increasing homicide mortality.

**I also recommend expanding on the discussion, particularly to describe some of the limitations of the study and describing more specific policy recommendations and/or future research that these study results suggest.**

We added a subsection where we explain the limitations in our study. We also added specific policy recommendations and future research that would help us understand the several consequences that violence has had on the Mexican population. Below we provide a point-by-point description of our answers.

**-Introduction**

**Although the authors provide more details later in the paper, I would suggest adding at least a sentence in the first few paragraphs about the specific social/political context that contributed to homicide rates doubling between 2007 and 2012 in Mexico, to provide this context upfront.**

We thank the reviewer for this suggestion. We have added more context in the introduction. For example, previous evidence has shown that Mexico’s wave of violence was triggered by the interactions of competitions between drug cartels, enforcement operations trying to mitigate drug trafficking operations after 2005, and the increased profitability in the flow of drug-trade with United States (Rios, 2013; Dell, 2015; Castillo et al. 2014). This interaction led to a cycle of violence and the spillover onto civilians which by 2017, with the newest available data just released by the Mexican Census Bureau (INEGI), has not ended and has even increased in the last couple of years (Hienle et al. 2017).

We have included in the first paragraph the next sentences:

“…In Mexico, homicides rates declined from 1995 to 2006 but these trends were reversed and homicides more than doubled between 2007 and 2012 (Supplementary Material [SM] figure S1). This increase has been associated with more enforcement operations trying to mitigate drug cartel activities, increased territorial competition, and higher profitability in the drug-trade flow with the United States.3-5 This led to a cycle of violence- the so-called war on drugs- and the spillover onto civilians which,6 along with an increasing burden of diabetes, led to stagnating male life expectancy in the period 2000-10.7”

References:

Ríos, Viridiana. "Why did Mexico become so violent? A self-reinforcing violent equilibrium caused by competition and enforcement." *Trends in organized crime* 16.2 (2013): 138-155.

Dell, Melissa. "Trafficking networks and the Mexican drug war." *American Economic Review* 105.6 (2015): 1738-79.

Castillo, Juan, Daniel Mejía, and Pascual Restrepo. "Scarcity without leviathan: The violent effects of cocaine supply shortages in the mexican drug war." (2014).

Heinle, Kimberly, Octavio Rodríguez Ferrerira and David A. Shirk. "Drug violence in Mexico: Data and analysis through 2016." *Trans-Border Institute, University of San Diego, San Diego* (2017).

**The authors write, "Studying both life expectancy and lifespan inequality adds an important dimension to the study of population health because these indicators represent individuals' decisions based not only on their expected lifetime, but also on the uncertainty in their timing of death." I'm not sure I am correctly understanding what decisions means in this context. Are the authors arguing that these indicators are the consequence of individual decisions?**

Thank you for this observation. We clarified those sentences, in particular we noted the difference between the two indicators we used in the paper. For example, life expectancy represents the average age at death if everyone experiences the prevailing deaths rates throughout their lifetime; while lifespan inequality is an indicator of how similar ages at death are. We believe that analyzing both indicators is important because increases in life expectancy are not necessarily accompanied by reductions in lifespan inequality (Sasson 2016). For instance, large inequality of lifespans implies greater uncertainty in the timing of death at the individual level, and thus have implications for the planning of life’s events (van Raalte et al. 2011, Sasson 2016). We have rephrased the sentence to make it clearer that we do not mean that these indicators are the consequence of individuals’ decisions, but rather individuals consider these indicators when making decisions. It now reads (from line 45):

“…However, life expectancy masks inequality of lifespans or lifespan variation.10 Variability in age at death (lifespan) is important because it addresses the growing interest in health inequalities11 and because larger variation in lifespans implies greater uncertainty in the timing of death at the individual level, and has implications for the planning of life’s events.12,13 From a public health perspective…”

References:

Van Raalte, Alyson A., et al. "More variation in lifespan in lower educated groups: evidence from 10 European countries." *International Journal of Epidemiology* 40.6 (2011): 1703-1714.

Sasson I. Trends in life expectancy and lifespan variation by educational attainment: United

States,1990–2010. *Demography.* 2016;53(2):269-293.

**The authors contrast their focus on "the role of violence" with other literature that "focuses on social determinants of health (e.g., socioeconomic status and health risk factors). Could violence be considered a social determinant of health? I would be interested to hear more about the social context of violence, and the social implications of lifespan inequality, as a public health issue.**

We agree with the reviewer that the ‘role of violence’ and the ‘social determinants of health’ are not completely contrasting but rather complementing. However, the current manuscript aims at describing the observed changes in homicide mortality and their link with lifespan variation and life expectancy. Our goal is not to explain why there are differences in lifespan variation and life expectancy by sex, or by region. Such an analysis requires the inclusion of additional factors, as those mentioned by the reviewer, and would also require different analytic techniques to identify the sources of variation in life expectancy and lifespan.

We made the following changes to the manuscript to address this issue:

Replaced “Most literature in this area focuses on social determinants of health (e.g., socioeconomic status and health risk factors) as proximate determinants of lifespan variation and health inequality.11 In contrast, our paper highlights the role of violence, and its ultimate consequence in the form of homicides, among young adults on increasing lifespan inequality.”

With “Most literature in this area focuses on the social determinants of health such as socioeconomic status or educational attainment as proximate determinants of lifespan variation and health inequality.12,14 Our paper highlights the role of violence, and its ultimate consequence in the form of homicides, among young adults on increasing lifespan inequality. We describe the observed changes in homicide mortality and their link with lifespan variation and life expectancy by sex and by region in Mexico.”

Discussion; line 242: “Moreover, homicides are the ultimate form of violence but they do not fully represent its burden on population health. As a social determinant of health, exposure to violence can increase the likelihood that young people will perpetrate gun violence,31 and increases the risk of depression, alcohol abuse, suicidal behavior, and psychological problems, among other detrimental consequences over the life course.32 Even witnessing violence can affect the wellbeing of the population by increasing rates of post-traumatic stress disorder and depression.33”

We also expanded our discussion regarding lifespan inequality and its social implications from a public health perspective. As noted in the paper, lifespan inequality is a marker of heterogeneity at the population level that highlights a primary health indicator: age at death. At the societal level, larger lifespan variation has been linked with increasing vulnerability, which suggest ineffectiveness of policies aiming to protect individuals against life’s vicissitudes such as social safety nets (van Raalte et al. 2011, Bartley et al. 1997). In the context of rising violence, it implies lack of effectiveness of social protection policies aiming at decreasing homicide/crime rates and increasing vulnerability at the population level beyond homicides. For example, in 2016, 66.5% of the population with children under age 18 reported that they did not let them go out because of fear to be a victim of some crime, while 43.6% reported to stop going out at night for the same reason (ENVIPE 2017). Moreover, larger inequality of lifespans underlies greater heterogeneity in population health. This is important because previous evidence highlighted inequalities in adult health between states in Mexico (Aburto et al. 2018); our paper complements this by showing how homicides also increased inequalities in population health within states. Therefore, preventing homicides will contribute significantly to increases in life expectancy as well as greater equality of individual lifespans in Mexico.

We added the next sentences discussing further the social implications of increasing lifespan inequality:

Introduction, from line 48: “From a public health perspective, larger lifespan variation implies increasing vulnerability at the societal level, which suggest ineffectiveness of policies aiming to protect individuals against life’s vicissitudes.12 In the context of rising violence, it implies a failure of social protection policies aiming at decreasing homicide/crime rates and increasing vulnerability at the population level.”

Discussion, line 222: “Larger variation in lifespans underlies greater vulnerability at the population level. For example, in Mexico the expected years lived vulnerable of becoming victim of violence increased by 30.5 million person-years between 2005 and 2014.29 Moreover, increasing inequality of lifespans means larger heterogeneity in population health which translates into the need for more resources to optimize health over the life course.13…”

Discussion, line 239: “These results complement previous evidence on adult health inequalities between states9,22 by identifying homicides as a direct contributor to inequalities in population health between and within states”.

Conclusion, line : “Therefore, preventing homicides will contribute significantly to increases in life expectancy as well as greater equality of individual lifespans in Mexico”

References:

Braveman, Paula, and Laura Gottlieb. "The social determinants of health: it's time to consider the causes of the causes." *Public health reports* 129.1\_suppl2 (2014): 19-31.

Van Raalte, Alyson A., et al. "More variation in lifespan in lower educated groups: evidence from 10 European countries." *International Journal of Epidemiology* 40.6 (2011): 1703-1714.

Bartley, Mel, David Blane, and Scott Montgomery. "Socioeconomic determinants of health: Health and the life course: why safety nets matter." *BMJ* 314.7088 (1997): 1194.

Canudas-Romo V, Aburto JM, García-Guerrero VM, Beltrán-Sánchez H. Mexico's epidemic of violence and its public health significance on average length of life. *Journal of epidemiology and community health.* 2017;71(2):188-193.

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Mikton CR, Butchart A, Dahlberg LL, Krug EG. Global status report on violence prevention 2014. *American journal of preventive medicine*. 2016;50(5):652-9

Davidson JR, Hughes DC, George LK, Blazer DG. The association of sexual assault and attempted suicide within the community. *Archives of general psychiatry*. 1996;53(6):550-5.

Buka SL, Stichick TL, Birdthistle I, Earls FJ. Youth exposure to violence: Prevalence, risks, and consequences. *American Journal of Orthopsychiatry*. 2001;71(3):298-310.

Aburto, José Manuel, Tim Riffe, and Vladimir Canudas-Romo. "Trends in avoidable mortality over the life course in Mexico, 1990–2015: a cross-sectional demographic analysis." *BMJ open* 8.7 (2018): e022350.

Sasson I. Trends in life expectancy and lifespan variation by educational attainment: United States, 1990–2010. *Demography.* 2016;53(2):269-293.

Mexican National Institute of Statistics and Geography (INEGI). Mexican National Survey of Victimization and Perception of Public Safety [In spanish: Encuesta Nacional de Victimización y Percepción sobre Seguridad Pública] (ENVIPE 2017). <http://www.inegi.org.mx/est/contenidos/proyectos/encuestas/hogares/regulares/envipe/>

**Does the phrase "working ages" refer to a specific age range, or does it mean any age at which a person might work (which could be a very broad age range)?**

We clarify this in the text. We now refer to specific ages: people between ages 20 and 65 years. We have replaced the term “working ages” and “middle ages” with “between 20 and 65 years” in the manuscript.

**-Methods**

**If there is supporting literature available, I would recommend adding a citation to focusing on deaths below age 95 "since cause-specific coding practices above that age are less reliable."**

We thank the reviewer for this suggestion. We have added Rosenberg’s (1999) reference that shows that cause of death classification at older ages is difficult to ascertain due to multi-morbidities. More specifically, to address the reviewer’s concern, we re-analyzed the data using cause-of-death data below age 85; this is the standard age cutoff used in the World Health organization and in the United Nations Population Division cause-of-death and mortality data, respectively. Moreover, about 99% of homicides are concentrated in ages below age 85 in 2017 (INEGI, 2017), thus our estimates do not change in major ways when we change the age in the upper bound. We have updated the results accordingly and found no major changes from the earlier version.

We have added the next sentence in the methods section:

“To mitigate biases due to misclassification of causes of death, we focused on deaths occurring below age 85 since cause-specific coding practices above that age are less reliable due to the presence of comorbidities22and about 99% of homicide occurred below this age in the study period.”

References

Rosenberg, Harry M. "Cause of death as a contemporary problem." *Journal of the history of medicine and allied sciences* 54.2 (1999): 133-153.

World Health Organization. "WHO mortality database: Tables." *Geneva: WHO* (2018).

United Nations. "World Population Prospects; 2017." *United Nations: Department of Economic and Social Affairs.* (2017).

**-Results**

**"Importantly, homicides declined in 1995-2005 and this contributed to about one-fourth (0.44 years) of the overall gain in life expectancy in this period." Since the authors report that the 1995-2005 gain in life expectancy among men was 1.17 years, I believe they could say about one-third. I think 0.44/1.17=0.376 is closer to one-third than one-fourth.**

We have adjusted as suggested. It now reads:

Line 150: “Importantly, homicides declined in 1995-2005 and this contributed to about 38.5% (0.45 years) of the overall gain in life expectancy in this period.”

**"Life expectancy among males had a larger increase in 1995-2005 than in 2005-2015 across all states (panel A)" Is it possible that Yucatan is an exception to this overall statement? It appears from figure 3, panel A that there was a greater increase in 2005-2015 in Yucatan.**

We have made the changes accordingly. It now reads:

“Life expectancy among males had a larger increase in 1995-2005 than in 2005-2015 across all states (panel A) except for Yucatán, some states even experienced reductions in life expectancy in 2005-2015 particularly in the North (e.g., Chihuahua, Nuevo León and Sinaloa).”

**pg. 10: "For example conditions amendable to medical service contributed to reductions in lifespan inequality in most states" Looking at Figure 4, in the region of the south it appears that AMS may be contributing to small increases in lifespan inequality in most states of the south in 2005-2015, and some states of the north and central regions as well. It might be worth noting this apparent contrast with 1995-2005.**

We thank the reviewer for this observation. Indeed, while for the period 1995-2005 all but two states reduced inequality of lifespan due to medically amenable conditions, by 2005-2015 in nine states these conditions increased lifespan variation. We have adjusted the text accordingly and highlighted this contrast.

We have made the changes accordingly. It now reads:

“In the same period, all but two states for males, Baja California Sur in the North and Tlaxcala in the central region decreased lifespan variation attributed to improvements in medically amenable conditions (SM figures 4 and 5).”

**-Discussion**

**"After 10 years of the beginning of the War on Drugs" I would recommend providing more context for the War on Drugs, describing in at least an additional sentence or two more specifically how it started, the policies and social/political impact. Not all readers of AJPH might be familiar with this important context.**

We have followed this suggestion and added more context in the first paragraph of the introduction, as previously suggested by the reviewer:

“…In Mexico, homicides rates declined from 1995 to 2006 but these trends were reversed and homicides more than doubled between 2007 and 2012 (Supplementary Material [SM] figure S1). This increase has been associated with more enforcement operations trying to mitigate drug cartel activities, increased territorial competition, and higher profitability in the drug-trade flow with the United States.3-5 This led to a cycle of violence- the so-called war on drugs- and the spillover onto civilians which,6 along with an increasing burden of diabetes, led to stagnating male life expectancy in the period 2000-10.7”

**Pg. 12 "Rising inequality of lifespans underlies increasing flustered population" I am not quite sure I understand what this means. Might it be possible to re-phrase? I think this point and more generally the discussion of lifespan inequality needs to be made clear and expanded, particularly because this paper's primary contribution seems to be its examination of lifespan inequality, as opposed to how homicides in Mexico have reversed life expectancy gains for men and slowed them for women (as has been previously described in, for example, Aburto et al. 2016, reference #5). So I would be interested to hear more about the public health implications of the lifespan inequality findings and what this suggests about policy and future research.**

We have rephrased the sentence. It now reads:

Line 258: “...Larger variation in lifespans underlies greater vulnerability at the population level.”

In this revised version, we put more emphasis on the importance of lifespan inequality in the context of rising violence and its public health implications. At the individual level, we found that the most violent states showed grater increases in lifespan inequality through homicides, which can affect long-term decision for individuals. This greater uncertainty could well be one of the determinants of the increase of perceived vulnerability of the population between 2005 and 2014. Future research should examine if indeed individuals living in states with higher increases in lifespan inequality do perceive higher vulnerability. These studies should focus on women since there exists a sex paradox between being victim of a crime and perceived vulnerability (Canudas-Romo et al. 2017), i.e. males are more likely to experience a crime but they perceived lower vulnerability. In addition, more research is needed to quantify the long-lasting consequences of rising violence in the context of the war on drugs to anticipate and intervene the pathways through which the current violence might affect future health outcomes, as those mentioned in previous points (e.g. depression, suicide, more violence).

In addition to the sentences added in the previous points, we added s small paragraph on future research and policy:

Line 248: “Here, we quantified the effect of rising homicides on longevity and on increasing lifespan inequality as additional consequences of the upsurge of violence in Mexico. However, our understanding of the consequences of violence would benefit from research examining if indeed individuals living in states with increases in lifespan inequality do perceive higher vulnerability and how this might affect their long-term decisions. These studies should also focus on women since females are less likely to experience a crime but they perceived greater vulnerability.29 In addition, more research is needed to quantify the long-lasting consequences of rising violence in the context of the war on drugs to anticipate and intervene in the pathways through which the current violence might affect future health outcomes. For example, the health system might need to be prepared for mental health issues such as depression, suicidal behavior and post-traumatic stress disorder.”

And added in line 258:

“In an international context, Mexico’s levels of violence are not even the highest around the globe, nor in the region. Countries in central America, such as El Salvador and Honduras, and Venezuela, Colombia and Brazil in south America have higher homicide rates. It is likely that these countries experience higher variation in lifespans which, along with the existence of high levels of homicides, points to possible failure of policies to reduce the burden of violence. These policies should pay more attention to social determinants of premature mortality, psychosocial factors and get to the root of violence to prevent its diffusion towards the young population”

References:

Canudas-Romo V, Aburto JM, García-Guerrero VM, Beltrán-Sánchez H. Mexico's epidemic of violence and its public health significance on average length of life. *Journal of epidemiology and community health.* 2017;71(2):188-193.

**The discussion section needs a brief discussion of some limitations of the paper, for example, the paper does not address means of homicide, or other potential variables beyond gender that may be relevant, such as socio-economic status**

We followed this suggestion and added a subsection of limitations:

“First, inaccuracies in cause-of-death practices are likely to be present in the data that we used.8 To reduce these inaccuracies, we used broad causes of death and adjusted them with a smoothing process over age to have reliable cause-of-death distributions.24 Second, our estimated effects of homicides could be a lower bound due to undercounting, underreporting, and the large number of missing individuals.8 Third, we were not able to disentangle whether a homicide is drug-related (i.e., a homicide resulting from altercations between drug cartels and army operations).Thus, our results provide an upper bound for the possible impact of the war on drugs at the population level. Finally, we were not able to disaggregate deaths by socioeconomic status and other social factors that are closely linked with homicides given that the data is at the aggregate national-level. Future research should try to shed light into the individual-level pathways of violence and its effects on life expectancy and lifespan inequality.31 This illustrates the need of reliable estimates of mortality by cause of death and population by socioeconomic status and other social factors in Mexico.”

References:

Aburto JM, Beltrán-Sánchez H, García-Guerrero VM, Canudas-Romo V. Homicides in Mexico

reversed life expectancy gains for men and slowed them for women, 2000–10. *Health Affairs.*

2016;35(1):88-95.

Camarda CG. MortalitySmooth: An R Package for Smoothing Poisson Counts with P-Splines.

*Journal of Statistical Software.* 2012;50:1-24.

Braveman P, Gottlieb L. The social determinants of health: it's time to consider the causes of the

causes. *Public health reports.* 2014;129(1\_suppl2):19-31.

**I would like to see more detail and elaboration in the concluding recommendation "Our results from Mexico underscore the need to comprehensively reduce, through public policies and strategies, the impact of violence on population health and in the uncertainty surrounding the age of death" Are there any specific policies or strategies worth mentioning?**

We thank the reviewer for this suggestion.

We elaborated further. We note that violence prevention should focus at the individual, family, community and, as we show, at the state level. Previous evidence suggests that school-based efforts; mental health and child welfare programs, educational programs and placement of graduates in jobs, self-employment, and continuing education, together with programs aimed at reducing alcohol consumption have been successful to mitigate violence diffusion (Hoffman et al 2011, Pinker, 2011, Viner et al, 2012). In the Mexican context, political will is essential since it has been shown that policies pursuing drug prohibition or severe suppression have not worked (Csete et al. 2016). Moreover, Mexico has failed to recognize and correct the health and human rights harms that these policies have caused. In this sense, it has been suggested that military forces’ participations should be phased out as much as possible since it exacerbates violence with drug traffickers.

We have added the next concluding paragraph:

“Mexico has failed to recognize and correct the detrimental consequences in health and human rights that suppressive and drug-prohibition policies have had on the population.34 There is an urgent need to stop these policies and complement them with policies that are less focus on military actions against drug cartels. For example, programs on improving regional and schooling outcomes and educational and community programs to reduce the risk factors of violence (e.g. alcohol consumption)35 among others. This will prevent homicides and contribute significantly to increases in life expectancy as well as greater equality of individual lifespans in Mexico.”

References

Hoffman, Joan Serra, Lyndee M. Knox, and Robert Cohen. *Beyond suppression: Global perspectives on youth violence*. ABC-CLIO, 2011.

Pinker, Steven. "Decline of violence: Taming the devil within us." *Nature* 478.7369 (2011): 309.

Viner, Russell M., et al. "Adolescence and the social determinants of health." *The lancet* 379.9826 (2012): 1641-1652.

Csete, Joanne, et al. "Public health and international drug policy." *The Lancet* 387.10026 (2016): 1427-1480.

**Reviewer #2**

**The article was interesting and well-developed. A few conceptual questions to help strengthen the presentation of the data further:**

**\*When using the lifespan inequality or lifespan variation the cut-off was age 15--surviving to age 15 to capture the onset of homicides. Why is this the threshold set-point? Can the paper describe why this selection was made since the presentation of the data is defined by this choice?**

We clarified our choice for age 15 as the cut-off. The main reason for the cut-off is that homicides in Mexico during the study period are concentrated in ages above 15, for example, over 95% of homicides occurred above this age over the period of study 1995-2015 (see table below).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
| % of homicide deaths | 1995 | 2000 | 2005 | 2010 | 2015 |
| Ages 15+ | 95.4 % | 95.1% | 95.4% | 98.0% | 98.7% |

Source: Own estimates from INEGI data.

We added the next sentence to the manuscript:

“We condition on surviving to age 15 because over 95% of homicides occur above that age and because including infant mortality conceals dynamics of mortality at adult ages.”

**\*How does the distribution of poverty connect with these analysis/findings or not? The introduction mentions that historically poor states concentrated in the south but is very brief. I kept wondering if it too was a driver of the picture that this paper presents but it was never mentioned, controlled for or discussed.**

We concur with the reviewer that poverty is likely linked with homicides. We included additional information about this. However, the current manuscript aims at describing the observed changes in homicide mortality and their link with lifespan variation and life expectancy. Our goal is not to explain why there are differences in lifespan variation and life expectancy by sex, or by region. Such an analysis requires the inclusion of additional factors, as those mentioned by the reviewer, and would also require different analytic techniques to identify the sources of variation in life expectancy and lifespan.

**\*What does flustered mean in line 232?**

We have rephrased the sentence. It now reads:

Line 258: “...Larger variation in lifespans underlies greater vulnerability at the population level.”

**\*The discussion could be developed more and connected with the data presented. Why is drug trafficking more violent in Mexico than other countries? The article mentioned that establishment of a single payer health system was not enough to change these trends--what are some of the policy approaches that could be adopted (educational, social, justice, etc.)?**

We thank the reviewer for these suggestions. We have added more context in the introduction. For example, previous evidence has shown that Mexico’s wave of violence was triggered by the interactions of competitions between drug cartels, enforcement operations trying to mitigate drug trafficking operations after 2005, and the increased profitability in the flow of drug-trade with United States (Rios, 2013; Dell, 2015; Castillo et al. 2014). This interaction led to a cycle of violence and the spillover onto civilians which by 2017, with the newest available data just released by INEGI, has not end, and has even increased in the last couple of years (Hienle et al. 2017).

We have included in the first paragraph the next sentences:

“…In Mexico, homicides rates declined from 1995 to 2006 but these trends were reversed and homicides more than doubled between 2007 and 2012 (Supplementary Material [SM] figure S1). This increase has been associated with more enforcement operations trying to mitigate drug cartel activities, increased territorial competition, and higher profitability in the drug-trade flow with the United States.3-5 This led to a cycle of violence- the so-called war on drugs- and the spillover onto civilians which,6 along with an increasing burden of diabetes, led to stagnating male life expectancy in the period 2000-10.7”

References:

Ríos, Viridiana. "Why did Mexico become so violent? A self-reinforcing violent equilibrium caused by competition and enforcement." *Trends in organized crime* 16.2 (2013): 138-155.

Dell, Melissa. "Trafficking networks and the Mexican drug war." *American Economic Review* 105.6 (2015): 1738-79.

Castillo, Juan, Daniel Mejía, and Pascual Restrepo. "Scarcity without leviathan: The violent effects of cocaine supply shortages in the mexican drug war." (2014).

Heinle, Kimberly, Octavio Rodríguez Ferrerira and David A. Shirk. "Drug violence in Mexico: Data and analysis through 2016." *Trans-Border Institute, University of San Diego, San Diego* (2017).

Regarding policy approaches we elaborated further. We note that violence prevention should focus at the individual, family, community and, as we show, at the state level. Previous evidence suggests that school-based efforts; mental health and child welfare programs, educational programs and placement of graduates in jobs, self-employment, and continuing education, together with programs aimed at reducing alcohol consumption have been successful to mitigate violence diffusion (Hoffman et al 2011, Pinker, 2011, Viner et al, 2012). In the Mexican context, political will is essential since it has been shown that policies pursuing drug prohibition or severe suppression have not worked (Csete et al. 2016). Moreover, Mexico has failed to recognize and correct the health and human rights harms that these policies have caused. In this sense, it has been suggested that military forces’ participations should be phased out as much as possible since it exacerbates violence with drug traffickers.

We added in line 258:

“In an international context, Mexico’s levels of violence are not even the highest around the globe, nor in the region. Countries in central America, such as El Salvador and Honduras, and Venezuela, Colombia and Brazil in south America have higher homicide rates. It is likely that these countries experience higher variation in lifespans which, along with the existence of high levels of homicides, points to possible failure of policies to reduce the burden of violence. These policies should pay more attention to social determinants of premature mortality, psychosocial factors and get to the root of violence to prevent its diffusion towards the young population”

We have added the next concluding paragraph:

“Mexico has failed to recognize and correct the detrimental consequences in health and human rights that suppressive and drug-prohibition policies have had on the population.34 There is an urgent need to stop these policies and complement them with policies that are less focus on military actions against drug cartels. For example, programs on improving regional and schooling outcomes and educational and community programs to reduce the risk factors of violence (e.g. alcohol consumption)35 among others. This will prevent homicides and contribute significantly to increases in life expectancy as well as greater equality of individual lifespans in Mexico.”

References

Hoffman, Joan Serra, Lyndee M. Knox, and Robert Cohen. *Beyond suppression: Global perspectives on youth violence*. ABC-CLIO, 2011.

Pinker, Steven. "Decline of violence: Taming the devil within us." *Nature* 478.7369 (2011): 309.

Viner, Russell M., et al. "Adolescence and the social determinants of health." *The lancet* 379.9826 (2012): 1641-1652.

Csete, Joanne, et al. "Public health and international drug policy." *The Lancet* 387.10026 (2016): 1427-1480.

**Reviewer #3**

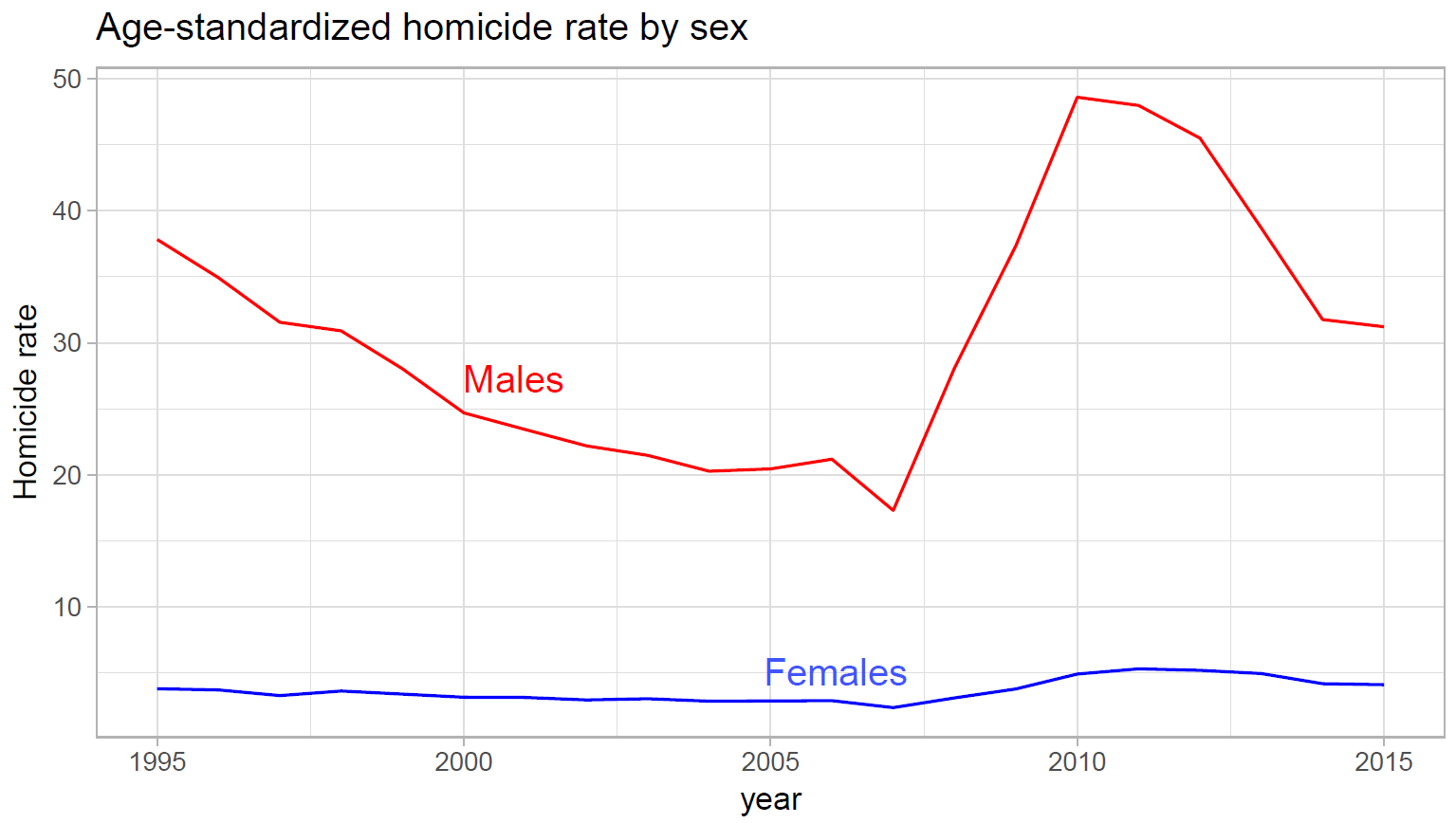
**This is a well-written manuscript describing a life expectancy in the context of severe violence related to death, using an inequity framework. In epidemiological perspective, it may not be novel the result that increasing homicide rate is associated with reducing life expectancy in population level. However, the quantification of homicide in life expectancy is still important. This study has significant policy implication as it providing alternative indicator for population impacts of severe violence.**

**I was therefore a bit disappointed to see some conceptual and logical limitations in the manuscripts. First, the manuscript does not properly address changing patterns of homicide in Mexico especially the period between 1995 and 2015. In particular, few details are provided regarding dividing panel A (1995-2005) and panel B (2005-2015). This manuscript is based on comparison of life expectancy between these two periods. This division should be justified with significant difference of homicide rate between them.**

We clarify this issues in the manuscript. We previously indicated in the methods section that homicide rates declined among young adults between 1995 and 2005, but they increased between 2005 and 2015:

“We study two comparable 10-year periods, between 1995 and 2005, and from 2005 to 2015. This allowed us to identify a period of mortality improvements (1995-2005) in which life expectancy increased by 2.1 and 4.3 years for males and females, respectively, and homicide rates declined among young adults. The second period (2005-2015) is characterized by the upsurge of violence and homicides in Mexico.”

We now provide more context in the introduction and in the methods section. As suggested by the reviewer, we include a figure with time trends in age-standardized homicide rates. Given the space limitations, the figure (below) is shown in the supplemental material but we refer to it in the text. The introduction now states:



“…In Mexico, homicides rates declined from 1995 to 2006 but these trends were reversed and homicides more than doubled between 2007 and 2012 (Supplementary Material [SM] figure S1). This increase has been associated with more enforcement operations trying to mitigate drug cartel activities, increased territorial competition, and higher profitability in the drug-trade flow with the United States.3-5 This led to a cycle of violence- the so-called war on drugs- and the spillover onto civilians which,6 along with an increasing burden of diabetes, led to stagnating male life expectancy in the period 2000-10.7”

The methods section reads (in the subsection on *cause-of-death classification*):

“We study two comparable 10-year periods, between 1995 and 2005, and from 2005 to 2015 that represent periods of major changes in homicides (SM figure S1). The first period corresponds to mortality improvements (1995-2005) in which life expectancy increased by 2.1 and 4.3 years for males and females, respectively, and homicide rates declined among young adults; while the second period (2005-2015) is characterized by the upsurge of violence and homicides in Mexico.”

**In discussion section, the author attempts to explain the contextual reason of reductions in life expectancy with homicide patterns in the regions. However, the paper fails to provide key difference on patterns and magnitude of homicide between 1995-2005 and 2005-2015.**

**I think the added value of this study is measuring quantified impacts of homicide on life expectancy. Therefore, it is critical to provide more details on a changing patterns of homicide rate especially before and after 2005 which led changes in life expectancy. Again, the causal association between homicide and life expectancy is not new.**

As shown above, we now include a figure showing time trends in age-standardized homicide rates. This figure shows a clear downward trend in homicides among males prior to 2005 and an increase thereafter. Additional evidence of changing trends in homicides by States in Mexico is shown in Espinal-Enriquez and Larralde (2015) and Flores et al. (2015). These papers analyze the extent of the diffusion of violence from to 2005 to 2010. They found that despite army operations being executed in some states, violence displaced to other localities. In addition, Aburto et al. (2016) found that while homicides contributed to increasing life expectancy between 2000 and 2005, they reduced life expectancy in the period 2005-2010, with a large magnitude in the state of Chihuahua.

In addition to the sentences included in the previous point, we included these references to the paper and it reads in the manuscript:

‘We also expect uneven variability across states in the country due to the changing dynamics of violence and homicides in Mexico.16 For instance, states in the Northern part of Mexico (e.g., Chihuahua, Durango and Sinaloa) experienced the largest losses in life expectancy between 2005 and 20108… although this impact may now be larger in other states as homicides spread throughout the country in recent years.17’

“For instance, in 2010 males aged 15-50 in Chihuahua had three times higher mortality than the US-troops in Iraq between 2003 and 2006.”

References

Flores, Miguel, and Amado Villarreal. "Exploring the spatial diffusion of homicides in Mexican municipalities through exploratory spatial data analysis." *Cityscape* 17.1 (2015): 35-50.

Espinal-Enríquez, Jesús, and Hernán Larralde. "Analysis of Mexico’s narco-war network (2007–2011)." *PloS one* 10.5 (2015): e0126503.

Aburto, José Manuel, et al. "Homicides in Mexico reversed life expectancy gains for men and slowed them for women, 2000–10." *Health Affairs* 35.1 (2016): 88-95.

**In addition, similarly, the authors attempted to address regional difference of lifespans using the inequality framework. The lifespan inequality is simply epidemiological results of unequal patterns of violence across the regions. So, here, unequal distribution of homicide is key underlying factors. But its description is also missing in this manuscript.**

We thank the reviewer for this suggestion. We address this comment in two steps. Firs, we clarify in the manuscript that lifespan inequality is an indicator that in itself represents unequal ages at death in the population. For example, large values in lifespan implies greater uncertainty in the timing of death at the individual level which implies an unequal age at death. This approach is different from the inequality framework in public health that addresses inequalities in health arising as a result of socioeconomic and/or racial/ethnic differences. Second, the analytic method we use (decomposition method) takes into account the unequal distribution of homicides by age, sex, and region. This method attributes changes in lifespan inequality and in life expectancy due to changes in homicide mortality every year; thus, regions that experience larger changes in homicide mortality (i.e., those with more unequal distribution of homicides --either increases or decreases) will consequently contribute more to the observed changes in the lifespan and life expectancy.

We thus believe our methods are inherently taking into account the reviewer’s concern.

**Lastly, I would like to suggest the authors to consider that violence rate is highly associated with underlying socioeconomic and political inequalities between regions and between individuals. And, beyond homicide, these factors are significant determinants of premature death due to diverse medical conditions. I do not think the authors have adequately conceptualized the population health impacts of violence using appropriate concept of inequality, although they attempted to measure the most severe form of violence - homicide on population health.**

We agree with the reviewer’s view about the association of homicides with socioeconomic and political factors. Although this link is indeed interesting, we feel it is out of the scope of the current manuscript. The current manuscript attempts to describe the observed changes in homicide mortality and their link with lifespan variation and life expectancy. Our goal is not to explain why there are differences in lifespan variation and life expectancy by sex, or by region. Such an analysis requires the inclusion of additional factors, as those mentioned by the reviewer, and would also require different analytic techniques to identify the sources of variation in life expectancy and lifespan. We included this issue in the discussion as future area of research.

“… Future research should try to shed light into the individual-level pathways of violence and its effects on life expectancy and lifespan inequality.31 This illustrates the need of reliable estimates of mortality by cause of death and population by socioeconomic status and other social factors in Mexico.”

**It is difficult to present a complex study such as this in limited words, as required by AJPH. I would like to make these recommendations in full understanding that it will be difficult to respond to all of them within this constraint, but I do hope the authors at least think about some of the conceptual difficulties I find with the paper.**

We thank you for your suggestions. We took them into consideration as we revised the manuscript. We have made every effort to include them in the text and when space was a limitation, we added figures/text to the supplemental material.