Title: Santos-Lozada 1R21AG083393-01 Response

Grant Application Number: 1R21AG083393-01, PI Alexis R. Santos-Lozada, Response to Summary Statement
Grant Application Title: The Impact of the Medicaid expansion on the rural mortality penalty in the United States

This document responds to reviews of 1R21AG083393-01, an initial submission by a New Investigator that received an impact score of 41 (percentile 26). The proposed research seeks to estimate the contribution of state-level variation in Medicaid expansion to rural-urban disparities among people aged 19-64 years. The project is divided in three aims: (1) producing county-level age-specific mortality rates required for the analyses; (2) determine if/how states that expanded Medicaid observed changes in mortality rates and implications for the rural mortality penalty; and 3) determine whether/how the rural-urban mortality penalty varied during the first two years of the COVID-19 pandemic based on 2020 Medicaid Expansion status. The results of the proposed project will further understandings about the roots of disparities by demonstrating how variable Medicaid thresholds might affect rural-urban mortality dynamics.

We thank reviewers for their constructive comments. As noted in the Resume and Summary of Discussion, "*Overall the reviewers agreed that the application is potentially highly significant, but limitations in the approach reduce the overall impact on the field of mortality research to a moderate level*". Most of the critiques gravitated around the need for more information that was not included due to the page limit of the R21 mechanism. While there was consensus on the merits and strengths of the application, there were four overall limitations noted by the reviewers: 1) Need to address the mechanisms through which Medicaid expansion may influence mortality, 2) Need for detailed description of the analytical approach and methods to be used, 3) Considerations of statistical power for the analyses involving population subgroups, and 4) a need for development of the COVID-19 aim. Other minor comments are also included, we discuss these individually. We are confident that we will be able to address these issues as part of the planned activities without major changes in the proposed project.

First, **there is the issue of addressing the mechanisms through which Medicaid expansion may influence mortality and potential factors that affect this effect**. Specifically, Reviewer 2 asks for a "*conceptual framework that would help guide the work and the interpretation of the results*". While not mentioned in our study, we are guided by the Anderson's Behavioral Model and the Social Determinants of Health Framework, which will guide the interpretation of our results. Reviewer 3 commented, "…*the proposal seems to assume, without spelling this out, that the only pathway through which Medicaid matters to health is via individual insurance coverage rather than effects on the local health system*". We will be careful to contextualize any findings emphasizing preexisting risk factors and consider the role of built environments and contextual characteristics. In addition, the NaNDA dataset (available to us) will allow us to use information about health facilities and medical professional availability to account for the influence of these and other related factors during the period of analysis. This will also address Reviewer 3's concerns about "*treatment heterogeneity depending on whether local hospitals continued to operate or closed as a function of lack of Medicaid expansion*".

Second, the reviewers identified issues regarding the need for better outlining our approach and empirical strategy. Reviewers asked about heterogeneous effects by state or by urban/rural within state and "*how will state-level variation in both policy approaches […] be incorporated into the analyses*". Our capacity to analyze these elements depends on the production of reliable estimates of mortality rates for geographies of interest and the feasibility of performing the proposed analyses below the national-level. Given that the non-metropolitan mortality penalty is studied using county-level rural-urban classifications this is the appropriate way to do it. In the proposed exploratory/developmental study, we deal with this by aggregating at the national level focusing on rural-urban disparities and on a well-established pattern (the non-metropolitan mortality penalty). The proposed strategy was written with careful consideration to the exploratory nature of the R21 mechanism, and the feasibility of conducting the proposed analyses. The heterogeneity in such effects, for smaller geographies, could be addressed in the project we hope will emerge from the proposed R21.

Reviewer 1 also asked for more details on the difference-in-difference methodology we will employ. Given the exploratory nature of the proposed project, we sought to implement the model as traditionally done within the population health scholarship. We believe we can address this critique without any substantial deviation from the plan proposed in the original submission. This will be accomplished by implementing the approach described by Sun and Abraham (2021) as suggested by Reviewer 1. Particularly, the operationalization a "*treatment*" that varies by state in terms of timing and rate of expansion. In our revision of Summary Statement Co-Investigator Fisher had suggested implementing the treatment as a continuous process and emphasizing potential heterogeneity.

The third major concern was related to statistical power for the analyses involving population subgroups. Reviewer 3 indicated that "*It seems implausible that it will be possible to identify effects, with statistical confidence, for such small populations as rural Asian or Pacific Islander Populations."* We understand the concerns with these issues and have been careful to not make the analyses for these population subgroups the core element around of the proposed analyses gravitate. We recognize this limitation, but note that the key element of our proposal gravitates around the rural-urban dichotomy as implemented in extant scholarship and in the non-metropolitan mortality penalty scholarship. The data collected through both major data sources to be accessed through the Restricted Data Center will allow us to have total coverage of the population, and population subgroups. In addition, given that data are aggregated at the national-level by rural-urban classification there should not be any issue concerning the identification of the effects. It is our belief, and this is backed by our exploration of publicly available records (available until 2016) and our power analyses, that we will be able to conduct the analyses and produce reliable estimates using this dichotomous operationalization of the rural-urban county classification scheme.

The fourth and final major concern was related to Aim 3 (COVID-19). We note the proposed analyses for Aim 3 are descriptive and underscoring the exploratory nature of the R21 mechanism. Given that Medicaid expansion had effects into the health service availability and funding for services, the state of the policy and infrastructure at the onset of the COVID-19 pandemic will have a significant role in pandemic-related dynamics. For instance, Reviewer 3 mentions that COVID treatments were free; however, this ignores the role that accessibility has in the ability of the people to reap benefits from this policy. Thus, Aim 3 is not disconnected from the main project; it simply emphasizes a more recent dynamic through an exploratory approach.

We now address other minor concerns found in the individual reviews that do not fall within the four broad categories (by order of critique). Reviewer 1 indicated "*the proposal does not present a compelling reason to limit the study population to those aged 19-64*". We limited our analyses to this age range because Medicare is generally available for people 65 or older, or possibly earlier for people with a disability. Given this concern was not shared across Reviewers and the positive notes from other panelists we will keep the proposed age restriction in place for this exploratory analyses. The team will consider the inclusion of the study of potential spillover effects in a future project we hope will emerge from the proposed R21. Reviewer 1 also indicated we need to spell out why understanding rural-urban mortality differences is important vs. level of rural mortality. The study of level of mortality is inherently present in the proposed studies, before focusing on any measure of magnitude and differences, the proposed project will describe trends for each specific setting. Reviewer 2 indicated that "*county reclassification may be more challenging in some states than in others, and may require closer attention* …". The proposed project uses the best approaches, to date, to account for this issue but we will pay attention to this as we conduct the proposed analyses.

Reviewer 2 also asked to provide a rationale for the use of RUCC codes versus, RUCA codes or other codes to classify the urban-rural continuum and suggested the introduction of an additional metric for validation. While there are critiques to the measurement of what constitutes "rural", the exploratory nature of the proposed analyses and the well-established non-metropolitan mortality penalty rely in such measure. Nevertheless, we are thankful to Reviewer 2 for this suggestion. Within the proposed analyses, we will include a second measure created using the Urban Influence Codes (UIC). The UIC considers the role that population size and access (adjacency to larger economies) in the creation of a classification scheme for urban/rural status. This will allow us to test the robustness of our findings. The incorporation of the UIC will also address Reviewer 2's final comment in the approach "*Rurality has been shown to be muddier to classify than urbanity*". By incorporating the UIC codes, we are also testing our results using a metric of metropolitan/non-metropolitan that distinguishes between Metropolitan/Micropolitan or Metro/Micro-Adjacent Counties (or Metro) and Not Adjacent to a Metro/Micro Area (Non-Core, Non-Metro or Rural). In addition to serving as a robustness check, this inclusion would deal with one of the mechanisms through which policy changes may affect different locales. It is possible areas adjacent to Metro/Micropolitan counties may benefit from service availability within those areas, while those more distal to these areas may not reap similar benefits from being covered by Medicaid. The final critique by Reviewer 2 deals with dichotomizing rural/urban or metro/non-metro. Our work deals with the non-metropolitan mortality penalty and how the changes in policy affected these patterns. As discussed in the Second and Third Major concern, the dichotomization is crucial to explore the effects in this phenomenon.

Reviewer 3 indicated that "*The statement that age-specific mortality rates are not publicly available past 2016 is puzzling*". This comment was about the Compressed Mortality section of the CDC Wonder, and is still true. Because of this, we are requesting access to the restricted records, as these are also needed to conduct the analyses proposed in Aim 3.