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UCLA California Center for Population Research

Session 2: Identify new conceptual, theoretical, methodological, and/or data investments that are needed to move from purely descriptive cross-national analyses to more causal analyses that create a better understanding of how inequality, environmental exposures, and changing family structures impact health and well-being at older ages in LMICs.

Hiram Beltrán Sánchez (UCLA)

Workshop on Developing an Agenda for Population Aging and Social Research in Low- and Middle-Income Countries (LMICs)

September 7–8, 2023

Acknowledgements: Prof Alberto Palloni provided substantial comments to this presentation.

Overarching goal

1. Impact of birth cohort's early conditions on older adult outcomes (delayed effects)

As more biological sample continue to be collected on studies of aging, it would be relevant to study

2. The use of "biological clocks" in assessing senescence (aging)

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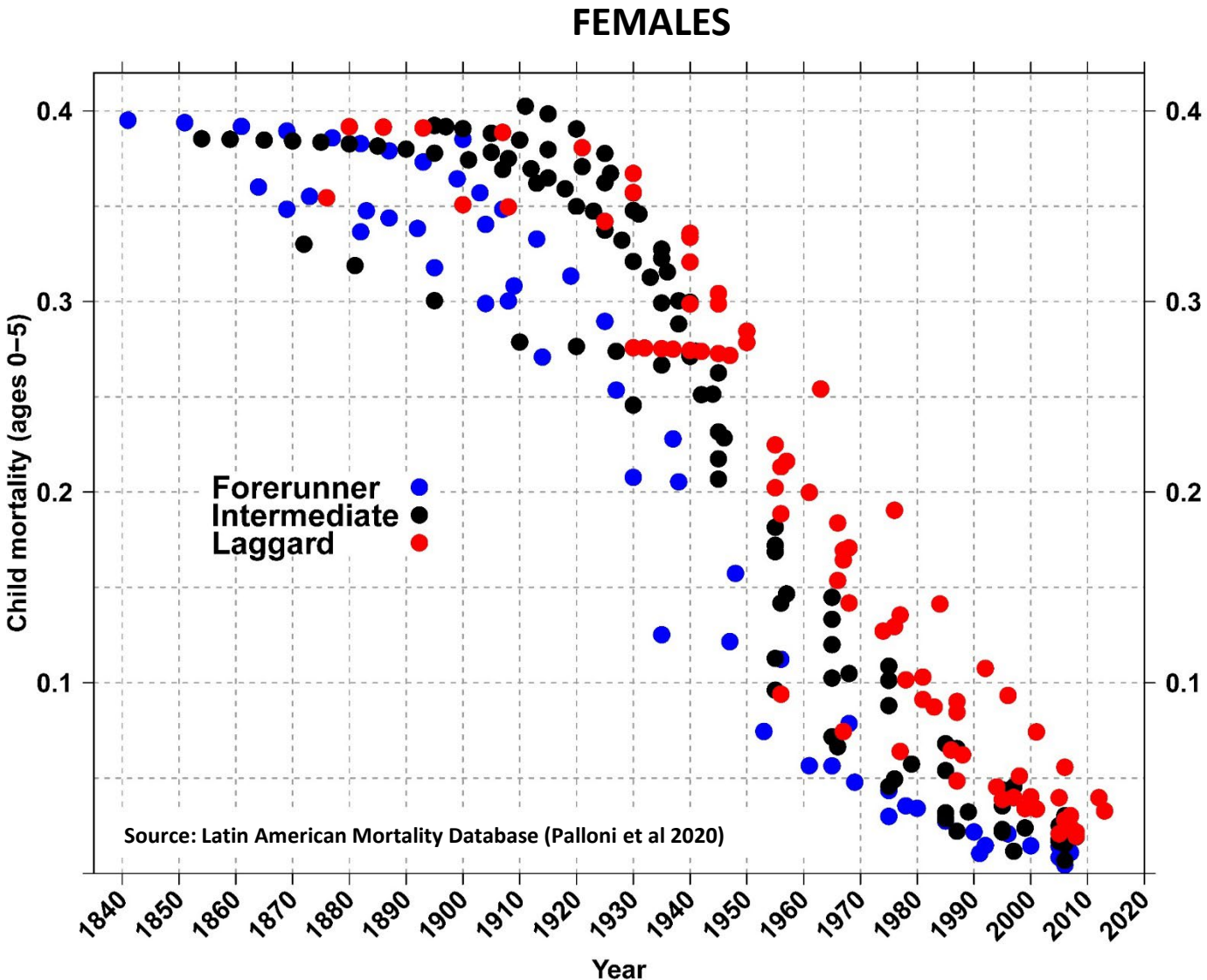
Background: Mortality changes in Latin American countries

Forerunners:
Argentina
Costa Rica
Cuba
Uruguay

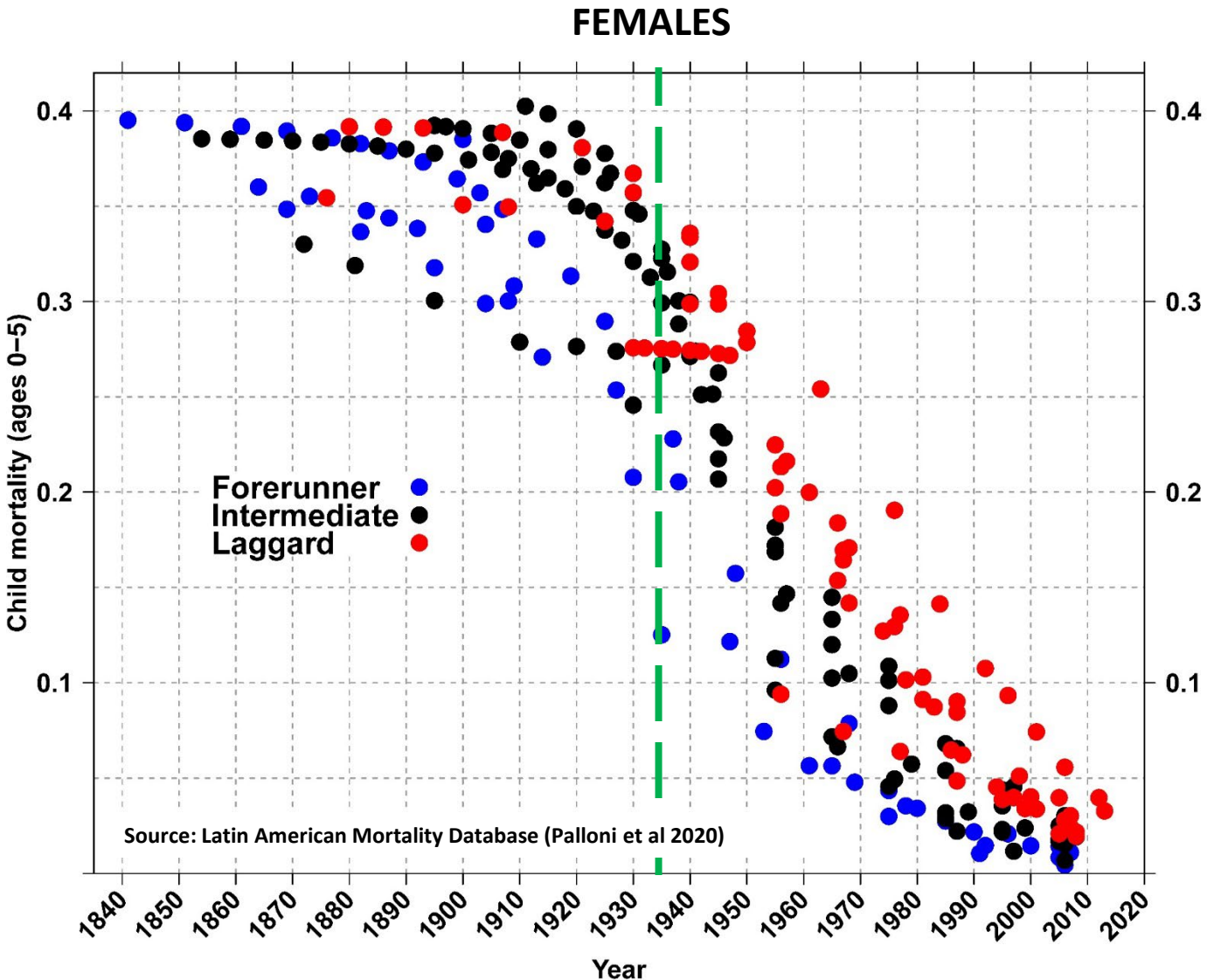
Laggards:
Bolivia
El Salvador
Guatemala
Honduras
Nicaragua
Paraguay
Peru

Intermediate:
Chile
Colombia
Dominican Republic
Ecuador
Mexico
Panama
Venezuela



Background: Mortality changes in Latin American countries

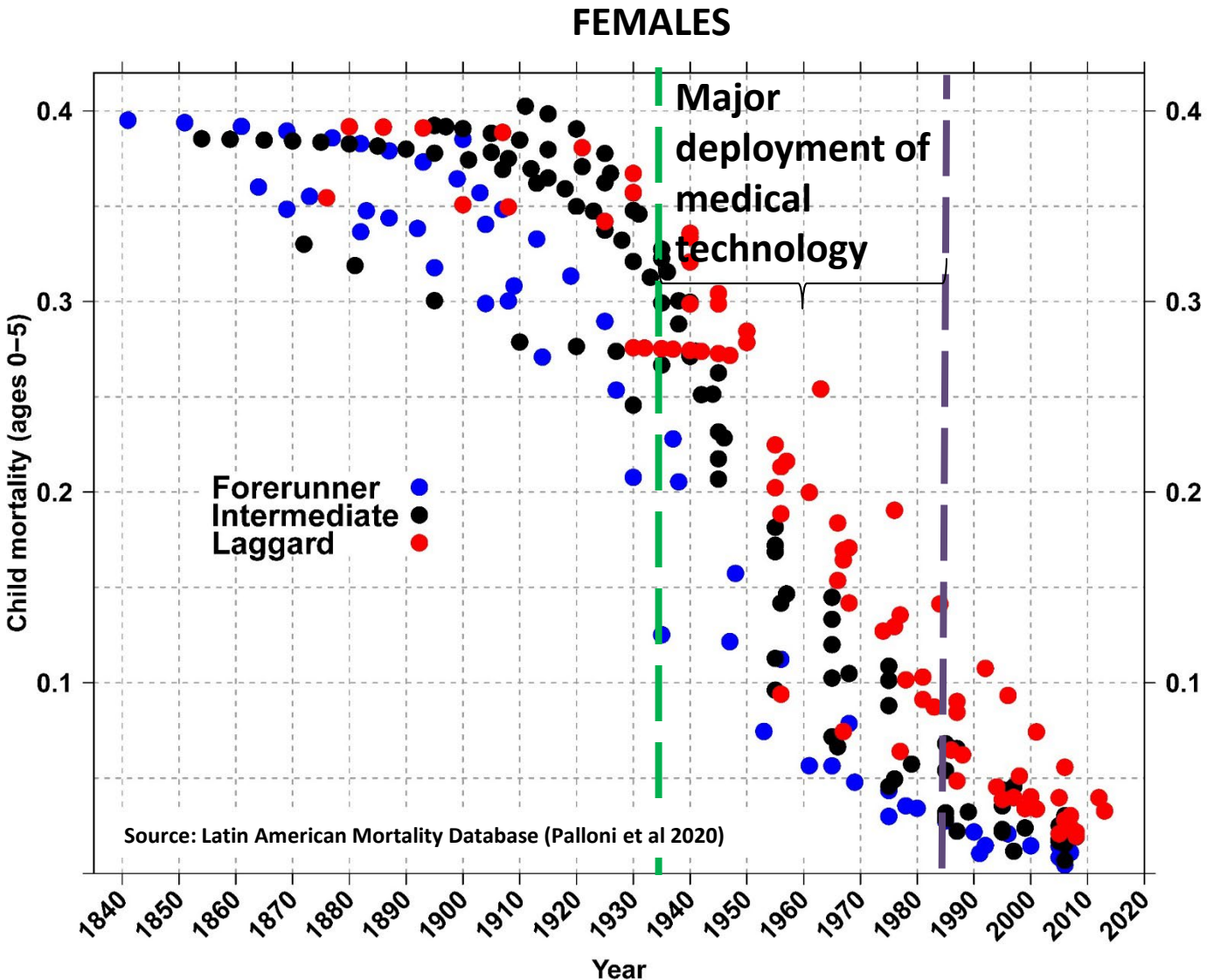
People born after 1935 experienced an improvement in childhood mortality that increase their likelihood of reaching older ages



Background: Mortality changes in Latin American countries

People born after 1935 experienced an improvement in childhood mortality that increase their likelihood of reaching older ages

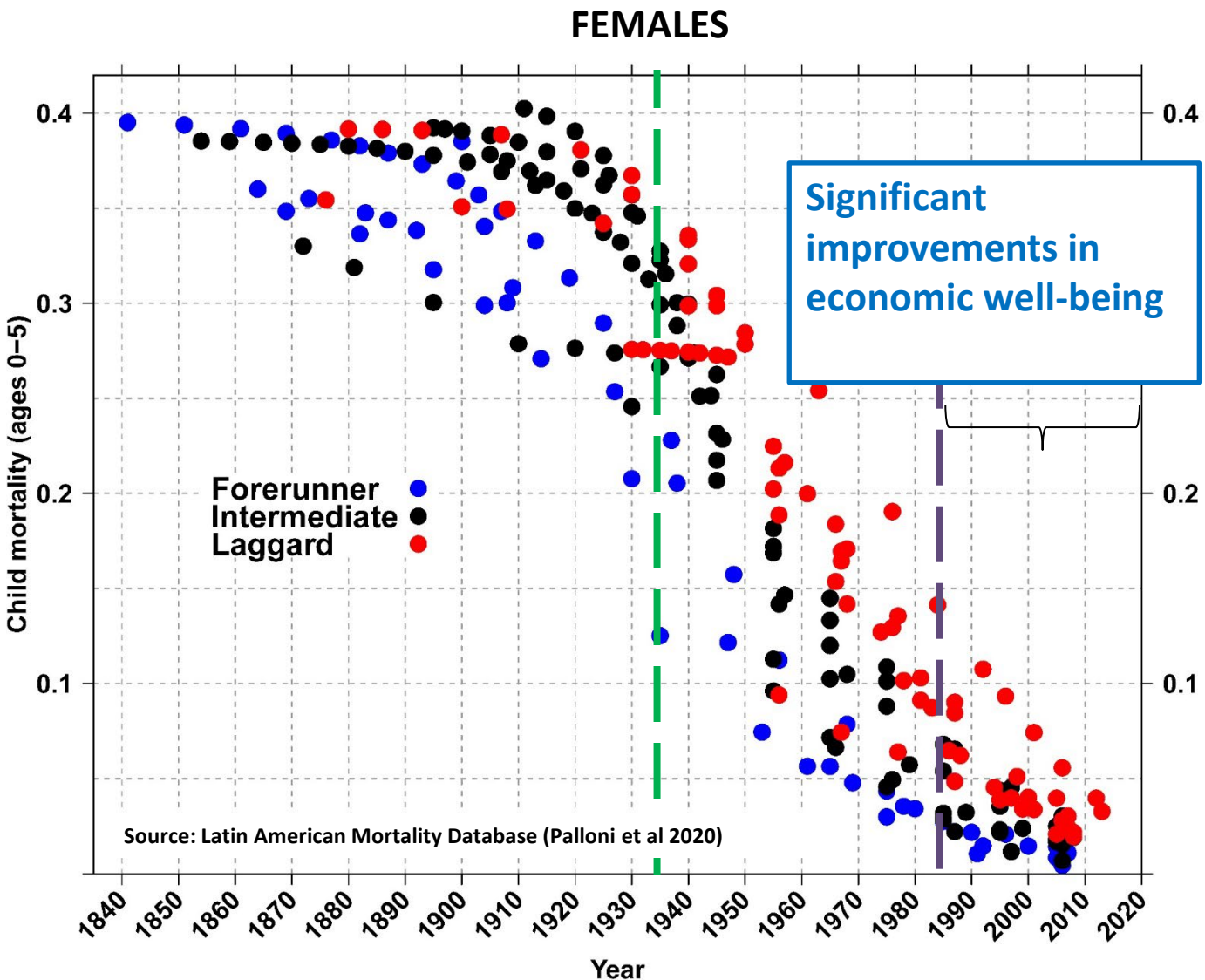
- They grew up in an environment with increasing medical technology



Background: Mortality changes in Latin American countries

People born after 1935 experienced an improvement in childhood mortality that increase their likelihood of reaching older ages

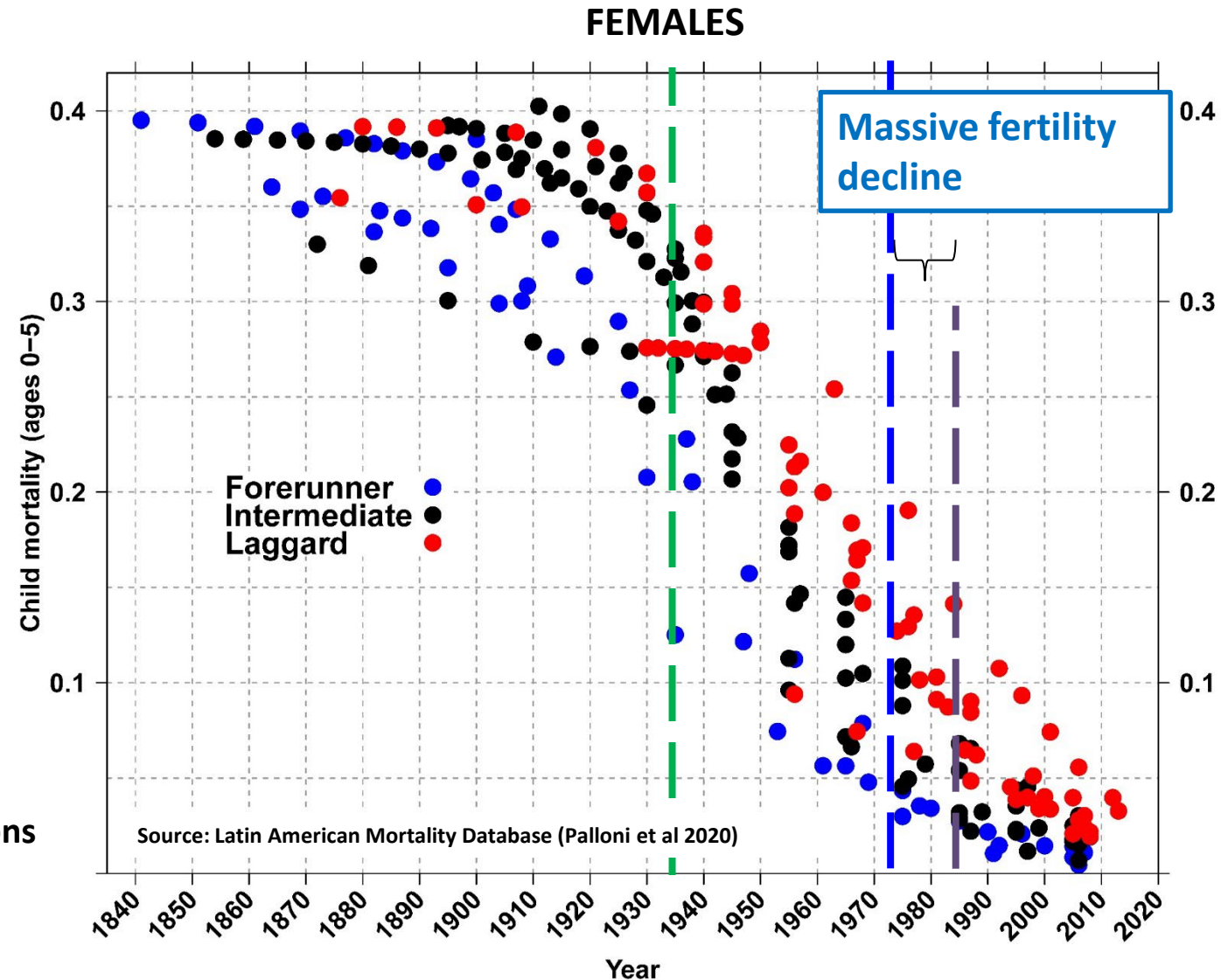
- They grew up in an environment with increasing medical technology
  - low-levels of economic development in the region



Background: Mortality changes in Latin American countries

People born after 1935 experienced an improvement in childhood mortality that increase their likelihood of reaching older ages

- They grew up in an environment with increasing medical technology
  - low-levels of economic development in the region
    - Large reductions in family size



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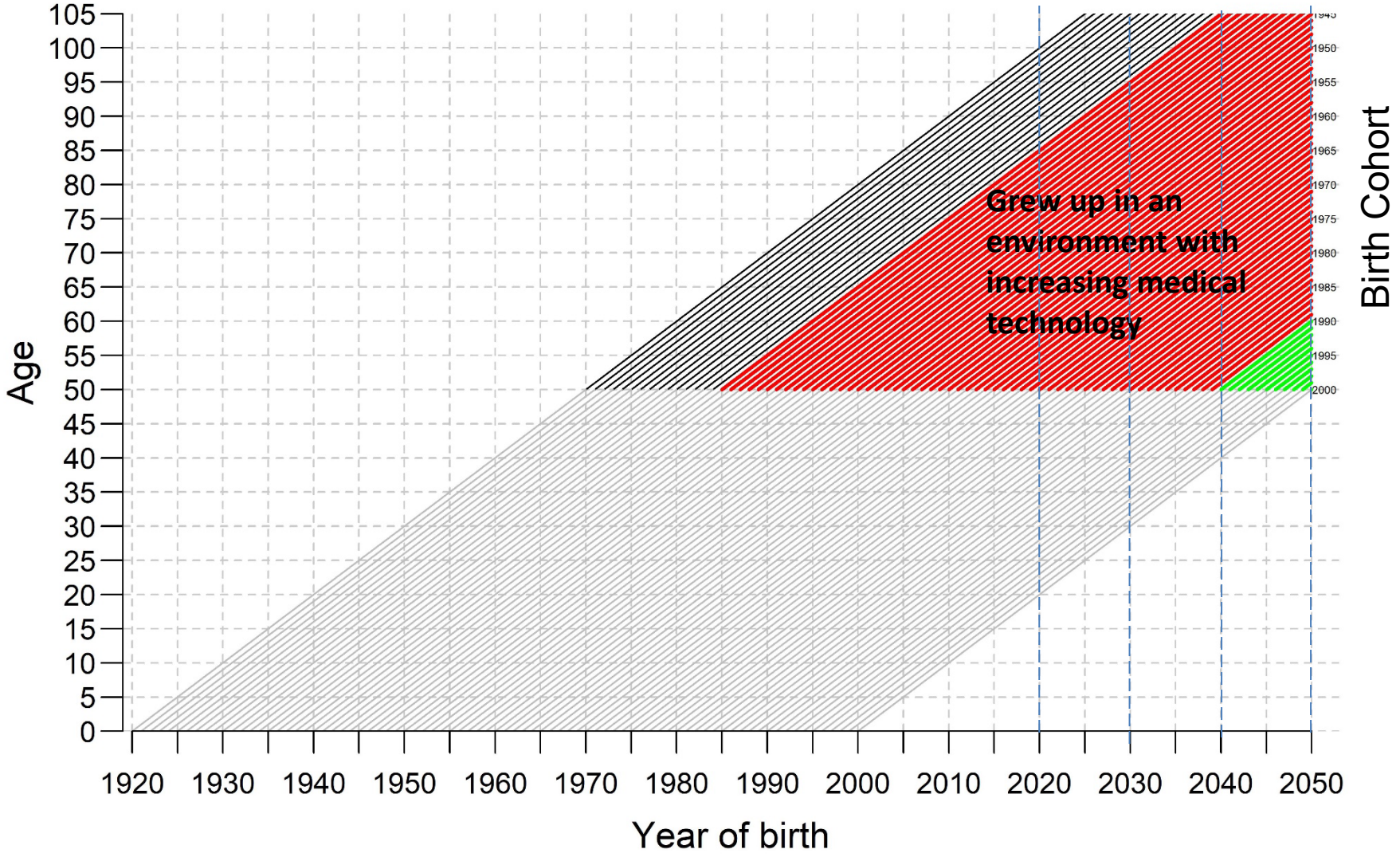

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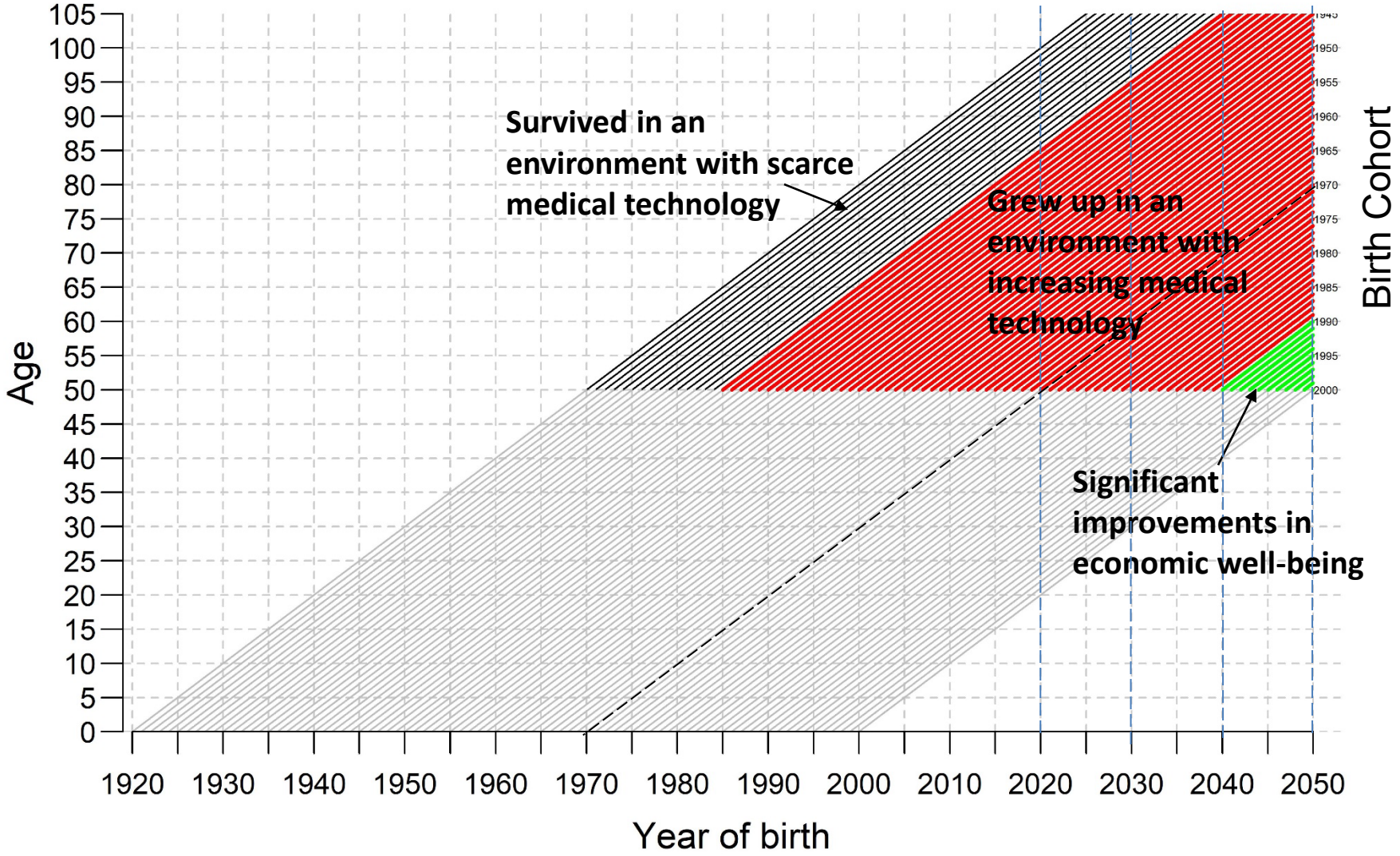

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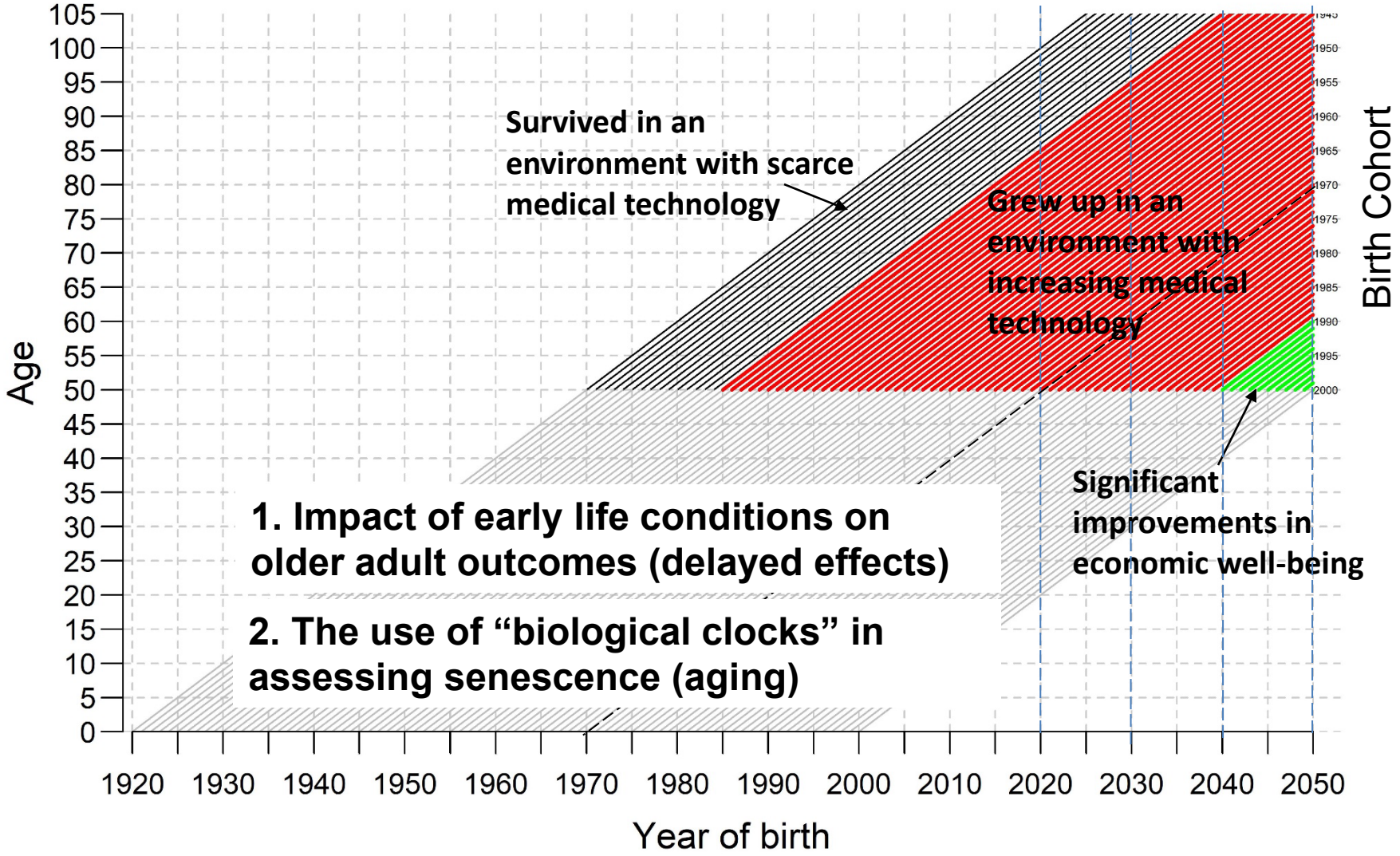
Background: Mortality changes in Latin American countries



1. Impact of early life conditions on older adult outcomes (delayed effects) at the national level

Two types of inferences:

1. Macro-aggregate: cannot make causal inferences

2. Micro: using individual-level data

1. Impact of early life conditions on older adult outcomes (delayed effects) at the national level

Two types of inferences:

1. Macro-aggregate: cannot make causal inferences

a) We developed a model to investigate what are the impacts on adult mortality patterns if there were an association (causal or not) between early conditions and adult health/mortality
(Palloni & Beltrán-Sánchez 2016, 2017, Beltrán-Sánchez, Palloni et al. 2022)

b) We are developing an Age-Period-Cohort model that can detect a signal in adult mortality that could be consistent with model in (a) (but whether is causal or not, we cannot say)

2. Micro: using individual-level data

1. Impact of early life conditions on older adult outcomes (delayed effects) at the national level

Two types of inferences:

1. Macro-aggregate: cannot make causal inferences

- **birth cohort's early conditions are linked with** deceleration in mortality improvements at older ages, and as a result, life expectancy at older ages may actually decrease in successive cohorts **(Palloni & Beltrán-Sánchez 2016, 2017).**
- **birth cohort's early conditions are linked with** increases in the incidence and prevalence of obesity and Type-2 diabetes (T2D) with associated decreases in healthy life expectancy **(Beltrán-Sánchez, Palloni et al. 2022) .**

2. Micro: using individual-level data

1. Impact of early life conditions on older adult outcomes (delayed effects) at the national level

Two types of inferences:

2. Micro: using individual-level data

- a. Randomized control trials (e.g., economists have tried this when studying cognitive and non cognitive factors but now on adult mortality too)
- b. "Natural experiments", e.g., using cohorts that experienced some shocks on event and then studying their adult conditions. *This is subject to selection biases*
- c. Mendelian Randomization: It is more commonly used in epidemiologic studies and less so on nationally representative survey studies.

In recent work we use data from Puerto Rico to create a "double quasi-natural experiment" to identify effects of exposure to the 1918 flu pandemic in utero and postnataly and those of the devastation left by an earthquake-tsunami that struck the island in 1918 (Palloni et al 2020).

The main results provide empirical evidence supporting the conjecture that effects of the 1918 flu and/or the earthquake are associated not just with disruption experienced during the fetal period but also postnatally.

2. The use of "biological clocks" in assessing senescence (aging)

"Biological clocks" are generally defined as indicators of accumulated age-related latent physiological change computed with the aid of a battery of biological markers of major physiological domains.

Epiclocks: use epigenetic markers and chronological age (first generation epiclocks (Horvath 2012)) or additionally incorporate blood biomarkers and/or health behaviors such as smoking (second generation epiclocks (e.g.,Levine et al 2018)), and in other cases use a cohort study to derive an indicator of pace of aging (rate of biological decline with age)

2. The use of "biological clocks" in assessing senescence (aging)

Nature of the problem: targeting senescence or speed of biological aging.

May ways to measure biological aging, most common approach is "accelerated aging" measured as the difference between biological age (BA) and chronological age (CA).

Nature of the problem: find causal determinants of the differences BA-CA

2. The use of "biological clocks" in assessing senescence (aging)

In previous work we constructed a biological clock (BA) and have shown that in the U.S. (Beltrán-Sánchez, Palloni et al 2022)

- **Accelerated aging (higher BA relative to CA) is associated with excess mortality and shorter life expectancy, particularly among older adults**
- **Among women age 65, a five year increase in accelerated aging (i.e., biologically "older") leads to a 50% decline in life expectancy at age 65 —E(65)— while being five years biologically "younger" increases E(65) by 70%**

2. The use of "biological clocks" in assessing senescence (aging)

Nature of the problem: targeting senescence or speed of biological aging.

May ways to measure biological aging, most common approach is "accelerated aging" measured as the difference between biological age (BA) and chronological age (CA).

Nature of the problem: find causal determinants of the differences BA-CA

Approach: have **repeated measures** of clocks and health status, and then use the causal machinery toolkits that can be deployed using panels.

Summary

1. Impact of early life conditions on older adult outcomes (delayed effects)

a. Macro-aggregate: cannot make causal inferences

b. Micro: using individual-level data

1. Randomized control trials
2. "Natural experiments" (*this is subject to selection biases)*
3. Mendelian Randomization

2. The use of "biological clocks" in assessing senescence (aging)

1. Find causal determinants of the differences BA-CA
2. Requires using panel data with repeated individual observations

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Thank you

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