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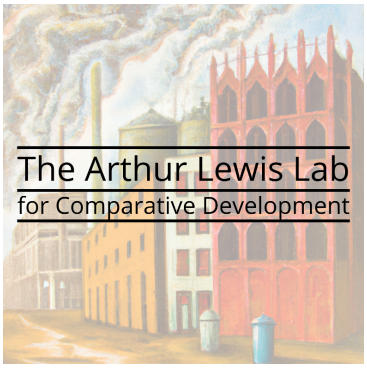

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Economic progress in twentieth-century Portugal: Revisiting the evidence

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Abstract

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JEL Codes: I15, N34, O15

Keywords: anthropometrics, economic development, poverty, child health.

ECONOMIC PROGRESS IN TWENTIETH-CENTURY PORTUGAL: REVISITING THE EVIDENCE[1]

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1. Introduction

Using three archival sources complemented by qualitative historical evidence, we previously documented substantial declines in stunting and wasting in Portugal during the mid-twentieth century (Cermeño et al. 2023). We observe a gradual decline in stunting and wasting from the 1950s, consistent with improvements in child health, nutrition, and broader living standards. A substantial share of the observed decline occurred prior to the democratic transition and the establishment of a universal national health service in 1979.[2] Two of the sources we use to document these patterns relate to children observed in the city of Lisbon, while a third source provide representative evidence for Portugal as a whole. Our analysis is descriptive, tracing the timing and magnitude of anthropometric changes without attributing these patterns to specific political regimes.[3]

A recent commentary by Cardoso and Murray (2025) offers an alternative interpretation, arguing that improvements in living standards occurred primarily after the transition to democracy. This viewpoint rests on concerns regarding the representativeness and treatment of one of our archival sources, as well as on alternative data restrictions and aggregation choices. In the present paper, we revisit our original evidence and clarify its interpretation. We restate our empirical framework, examine how different sample restrictions and data treatments affect measured anthropometric trends, and situate the observed patterns within the broader historical evolution of public health, nutrition, and social policy in mid-twentieth century Portugal. We show that the timing and magnitude of the documented declines in stunting and wasting are robust across data sources and specifications, and that alternative analyses do not alter the findings of our original study.

Neither Cermeño et al. (2023) nor the present paper evaluates relative regime performance or tests differential regime effects. The question under examination concerns the timing and robustness of anthropometric improvements—specifically, whether declines in stunting and wasting began prior to the democratic transition—not whether one political regime outperformed another.

[2] The creation of a public health system was gradual and began before democracy.

[3] Improvements in child health were also observed across other countries during the same period under diverse institutional arrangements, reflecting broader epidemiological, nutritional, and public-health transitions (see, for example, Granados 2010 and Geloso et al. 2020).

More broadly, the twentieth century was characterized across Europe and beyond by substantial improvements in child health associated with epidemiological transition, rising incomes, expanding sanitation, and gradual institutional development; the Portuguese case must be interpreted within this wider historical process rather than as an isolated institutional experiment.

The remainder of the paper is organized as follows. Section 2 clarifies the scope and interpretation of the original analysis. Section 3 addresses issues of representativeness and institutional context. Section 4 examines alternative data treatments and statistical comparability. Section 5 analyses the timing of anthropometric improvements and situates them in historical perspective. The final section concludes.

2. Scope of our original findings and sources

Cermeño et al. (2023) document a sustained decline in stunting and wasting through the twentieth century using three independent sources: the *Hospital Infantil de São Roque*; *Casa Pia de Lisboa*, a residential institution for children who had lost one or both parents; and the *Livros de Recenseamento Militar*, military inspection records of the Portuguese Army.[4] The convergence of results across these datasets is central to our empirical contribution. Although the sources differ in institutional origin and population coverage, they consistently display the same timing and direction of change.

Among the three sources, the *Livros de Recenseamento Militar* merits particular attention because of their scope and coverage. The dataset consists of 26,412 observations of men inspected at age 20 over a six-decade period (Cermeño et al. 2023, p. 8). The military inspection system required all males to be present for examination at that age, prior to any selection for service.[5] As a result, the records provide near-universal coverage of the male population at age 20 and are representative of that cohort at the national level. This dataset provides an independent validation of the results from the other two sources concerning infants and children. As

[4] This source had been previously used by other anthropometric studies, namely Stolz et al. (2013) and Palma and Reis (2021).

[5] The military records include only males; however, this limitation is not material in the present discussion, as Cardoso and Murray (2025) likewise restrict their analysis to male observations. Detailed discussion of the representativeness of the *Livros de Recenseamento Militar* can be found in Palma and Reis (2021, p. 417). Cardoso and Murray (2025, p. 9) refer to the individuals in our sample as "conscripts", but that characterization is inaccurate.

noted in Cermeño et al. (2023, p. 8), the data exhibit the expected lag structure, reflecting childhood nutritional conditions measured at age 20.

Cardoso and Murray (2025) suggest, already in the abstract, that we treated the Lisbon data as representative of Portugal. Our article explicitly compared the Lisbon evidence with nationally representative military inspection data (universal inspection at age 20) to distinguish differences in levels from similarities in trends (Cermeño et al. 2023, p. 8).

Beyond the issue of national coverage, a central claim in Cardoso and Murray (2025) concerns the comparability of the hospital's data, an issue we address in detail in Section 3. Importantly, even if the hospital was excluded from our analysis, the two remaining datasets – whose representativeness is not disputed – lead to the same patterns. Our findings therefore do not depend on a single institution.

Related to this sample, the authors comment that "stunting – and improvement in living standards – may actually reflect positive changes before the beginning of the Estado Novo dictatorship" (p. 9). A simple inspection of Figure 4 of Cermeño et al., 2023 (p. 8) indicates that, except for the 1924 and 1930 cohorts, individuals in the military sample spent most or all their childhood under the dictatorship. The timing of the improvements is therefore aligned with the period under study.[6]

Cardoso and Murray (2025) also dismiss the military records and Casa Pia sources on the grounds that they do not extend into the democratic period after 1974.[7] Cermeño et al. (2023), however, relies on all three sources to document trends during the dictatorship period. The military inspection records, given their nationwide coverage, function as a population-based validation of the anthropometric patterns identified in the institutional data.

Beyond the micro-level evidence, Cermeño et al. (2023, p. 9) document complementary macroeconomic and demographic indicators that follow similar trajectory. For example, infant mortality (i.e. 0 to 1 years old) declined from 94.1 per 1000 in 1950 to 38.9 in 1975, with subsequent

[6] Note in particular that those observed in 1940 were only around 6 years old in 1926, and all others in subsequent years spent their entire lives under the dictatorship.

[7] In Cermeño et al. (2023, p. 7), we document a decline in the prevalence of stunting among children at *Casa Pia* during the dictatorship (see Figure 3). Cardoso and Murray's (2025) assertion that no "noticeable decrease" occurred is therefore not supported by the evidence presented in our study.

reductions proceeding more gradually.[8] We also documented GDP convergence and improvements in nutritional conditions and reductions in child mortality that took place over the same period.[9] Taken together, our core empirical finding — declining stunting and wasting during the Estado Novo — is consistently supported across three distinct datasets as well as a wide range of complementary macroeconomic and demographic indicators. Yet this broader body of corroborating evidence is not considered in Cardoso and Murray (2025).

Finally, Cardoso and Murray (2025) state that we argue that we "assign most of the progress in the well-being and living standards of the Portuguese population over the second half of the twentieth century to a dictatorship" (Cardoso and Murray 2025, p. 2).[10] Cermeño et al. (2023), however, is descriptive in scope. The analysis documents change over time and situate it within the broader historical and policy context.[11] No counterfactual was calculated, and accordingly we made no claims concerning causality. No normative assessment is offered in our paper.

3. Interpreting the Hospital de São Roque records in historical context

Cardoso and Murray (2025) characterize the Hospital de São Roque as serving "the poorest and the sickest" (pp. 4, 8) and argue that improvements observed in this source are therefore not indicative of broader living-standard changes. This characterization is not consistent with the available historical records.

Their interpretation rests primarily on two claims: (i) that the hospital specialized in infectious diseases—particularly tuberculosis—and (ii) that mortality levels indicate an unusually disadvantaged patient population. The available evidence does not support either claim.

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[8] This had been as high as 164.1 in 1920, and 143.6 in 1930, around the time the dictatorship began.

[9] Improvements in nutrition, sanitation, and access to medical care are well-established determinants of secular gains in height (Fogel 2004; Deaton 2013). A substantial literature documents a strong positive association between per capita income and average stature (e.g., Guntupalli and Baten 2006; Steckel 2009; Case and Paxson 2008; Peracchi 2008). Contrary to the claim that GDP is a "relatively poor predictor of secular gains in height," the studies cited by Cardoso and Murray (2023) likewise acknowledge a robust correlation between height and per capita income, even while emphasizing the roles of inequality and disease environments.

[10] Likewise, Cardoso and Murray (2025, p. 8) challenge "the notion that most of the improvements in living standards over the second half of the twentieth century can be attributed to the dictatorship." Cermeño et al. (2023) do not make such a causal attribution. The paper documents the timing and trajectory of changes in stunting and wasting; it does not estimate regime-level causal effects on aggregate living standards nor child health or nutritional status.

[11] Portugal's experience was not exceptional in a comparative perspective; similar growth occurred under other authoritarian regimes, including Spain under Franco (Prados de la Escosura et al. 2011), contrary suggestion that it was "unusual" (Cardoso and Murray 2025, p. 2).

First, the proposition that the Hospital de São Roque was "specialized in infectious diseases" (p. 2) and concentrated tuberculosis cases is inconsistent with both national epidemiological trends and the hospital's own records. Cardoso and Murray (2025) infer from this alleged specialization that tuberculosis incidence must have been very high in this hospital before 1979. On this basis they describe the children in our sample as "a selected group of the sickest of the sick due to the incidence of tuberculosis" (Cardoso and Murray 2025, pp. 2, 8) and argue that an "extraordinary high incidence of infectious disease, in particular tuberculosis, is an indication of the extremely compromised health and growth of the children in the sample" (p. 8).[12] The available epidemiological and administrative evidence is inconsistent with this conclusion. The hospital's director noted that the hospital served a population of 50,000 individuals in 1960 and around 80,000 in 1969.[13] This would have corresponded to close to 10% of Lisbon's population (Baptista and Rodrigues 1996, p. 64). There is no evidence that this was a selected sample: nothing in the administrative record suggests systematic selection of an exceptionally disadvantaged group; most individuals attending the hospital were as poor as the underlying population.

Cardoso and Murray (2025) support their claim that tuberculosis was widespread in this hospital before 1979 by citing an anonymous source stating that, following the hospital's integration into the national health system in that year, it "was no longer mandated to and restricted the care for children with infectious diseases," and that tuberculosis was therefore "virtually absent after 1974–1985".[14] While it is correct that by 1984, children with tuberculosis were referred to other hospitals (Anonymous 1984, pp. 34-37), this administrative change does not imply that the hospital was previously specialized in infectious diseases. Neither national epidemiological data nor the hospital's own diagnostic records indicate high incidence of tuberculosis before 1979.[15]

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[12] The source cited by Cardoso and Murray (2025) in support of the statement that, from 1979 onward, the hospital served the "most deprived and underprivileged social groups in the city of Lisbon" (p. 4) is an interview with a head nurse (Marques 2016, p. 28). In that interview, tuberculosis is not discussed, and the reference to the hospital serving poorer populations appears only in passing. The source does not provide quantitative evidence regarding the composition of the patient population, nor does it specify whether any increase in selectivity occurred immediately after 1979 or at a later date, such as during the mid-1990s.

[13] Braga (1969, p. 2).

[14] The cited source is an unsigned interview with the hospital's clinical director published in 1984 (Anonymous 1984), rather than a systematic clinical or archival record.

[15] Braga (1969, p. 2). Treatment of tuberculosis was provided by the state, using facilities belonging to the *Misericórdia* near the *Hospital de São Roque*, but which were not part of that hospital.

The evidence points in the opposite direction. Tuberculosis incidence and crude mortality declined sharply in Portugal from around 1950 and had become residual by the 1960s. [16] Consistent with this national trend, tuberculosis accounts for only about 5% of recorded diagnoses at the Hospital de São Roque between 1945 and 1994.[17] The hospital records list a broad range of conditions - including flu, anemia, conjunctivitis, dehydration, dyspepsia, dystrophy, jaundice, laryngitis, tonsillitis, and toxicosis, among others- with gastroenteritis being the most frequent cause of admission.[18] The claim that the hospital specialized in infectious diseases and that tuberculosis was "clearly overrepresented in the sample" is not supported by the hospital's diagnostic records.[19]

Cardoso and Murray (2025, p. 8) further suggest that after 1979 the hospital no longer provided care to children with infectious diseases, including tuberculosis, and this change (sic) "seem[s] to coincide" with an increasing number of children being sent there from shelters. This claim is neither quantified nor documented. More importantly, even if one were to accept the premise that tuberculosis cases were common before 1979, and largely absent thereafter, the implied compositional change would bias measured anthropometric outcomes upwards after that date. Arguing that this shift instead undermines the observed improvements would require demonstrating an offsetting effect of comparable magnitude, for which no evidence is provided. A more logical interpretation is that the decline in tuberculosis reflects the broader epidemiological transition observed in Lisbon and Portugal as a whole.[20]

Cardoso and Murray (2025, p. 4) contend that the mortality levels at the hospital indicate an unusually disadvantaged patient population. They report a mortality rate of 7% for children aged 0-4 in 1968 and compare it to 1.05% for the population at large.[21] They acknowledge that

[16] Matos and Santos (2015, p. S103), Morais (2002).
[17] 5% of the cases correspond to (113 out of 2265 observations). Even if we restrict the sample to 1945 to 1979, the incidence of tuberculosis in this hospital was only around 8%.
[18] Some of these could result from being symptoms of an underlying infectious disease, but it is not possible to be sure of how often that may have been the case.
[19] Cardoso and Murray (2025, p. 4) compare tuberculosis incidence among hospitalized children with that of Portuguese population (including adults). Differences in age structure, selection into hospitalization, and diagnostic coverage render these measures non-comparable.
[20] From 1979, when Portugal's national health system formally began, until 1998, this hospital gradually lost relevance within the health care system, with the board deciding to cut the number of beds in *Hospital de São Roque*. However, it was only in the second half of the 1990s that the sample began to be selected in the sense of only the poorest tending to attend this hospital (Cruz and Rodrigues 1999, p. 6).
[21] Cardoso and Murray (2025) report the statistic for 1968. However, mortality in Hospital de São Roque varied from year to year; in 1967, for example, it was lower, at 6.4% (Braga 1969, p. 7).

hospital mortality is not directly comparable to population mortality. The only additional comparison offered is to a children's hospital in Brazil 2018-2022, where the corresponding rate was half that of *Hospital de São Roque* – an implausible benchmark given the five decades of income growth and medical progress separating the two contexts.[22]

A more appropriate comparison is child mortality in Portugal during the period of our study. Infant mortality stood at 7.75% in 1960 and 5.5% in 1970 (Cermeño et al. 2023, p. 9), and under-five mortality stood at 11.4% in 1960 and 6.81% in 1970 (United Nations Inter-agency Group for Child Mortality Estimation 2025). Moreover, Reis (1960) reports under-five mortality of 8,46% in 1958.[23] In light of this, the 7% of the *Hospital de São Roque* is broadly consistent with prevailing conditions rather than indicative of an unusually selected population.

Finally, two additional points merit clarification. First, Anonymous (1984)—a source cited by Cardoso and Murray (2025)—notes that free beds were occasionally available in Hospital de São Roque in that year, and that they often had surplus capacity to receive children from other establishments including from two large public hospitals, the Hospital Santa Maria and the Hospital Dona Estefânia.[24] This information sits uneasily with the characterization of the hospital as highly specialized and capacity-constrained after 1979 (Cardoso and Murray 2025, pp. 4, 8).[25]

Second, Cardoso and Murray (2025) question our use of 1994 as a cut-off date for this hospital. However, we explicitly noted that, unlike the institutional change in 1979, evidence from the mid-1990s indicates increasing selectivity in the hospital's patient intake (Cermeño et al 2025,

[22] In constant dollars of 2011, Portugal's GDP per capita in 1968 was $7,767, around half of Brazil's $14,215 corresponding to its 2018-2022 average (Bolt and van Zanden 2025).
[23] Reis (1960, p. 52) also shows that Portugal's child mortality was the highest in Western Europe. The same study reports gradual improvement in nutritional intake during the Estado Novo reflected in increased availability of calories and protein (p. 158) and shows a close correlation between height and weight of children and their socioeconomic status in 1958.
[24] A year later free capacity continued to exist, according to an interview given by the head nurse (Anonymous 1985, pp. 12-17).
[25] Archival evidence shows that the number of children staying at the hospital remained stable during the years for which records survive (Arquivo Histórico da Santa Casa da Misericórdia de Lisboa 1975-1984, 1984-1987).

p. 3).[26] The restriction in 1994 therefore reflects documented changes in sample composition rather than arbitrary truncation.

4. Data treatment, sample restrictions and statistical interpretation

This section clarifies how alternative sample restrictions, variable choices, and statistical treatments affect our empirical results. We examine the implications of restricting the age range, excluding specific anthropometric indicators, and applying additional data-cleaning procedures. We also assess the comparability of alternative institutional sources and the statistical interpretation of small subsamples. Across these exercises, we show that while such adjustments can alter sample composition and precision, they do not materially change the central temporal pattern documented in Cermeño et al. (2023). The evidence continues to support a sustained decline in deprivation measured by anthropometric outcomes over time.

4.1. Sample construction and variable selection

In reassessing our results, Cardoso and Murray (2025) substantially restrict our dataset by excluding two out of three sources, removing all weight information, excluding female observations, and limiting the analysis to children aged 5 and below. These restrictions materially alter both the size and composition of the sample.

The re-analysis also involves additional data cleaning, described as the removal of "unrealistic outliers and other discordant observations" (p. 2).[27] A cleaned version of the dataset had already been provided in our replication files, and no further methodological rationale for additional exclusions is specified.[28] For children aged 5 and below, our original sample for the Hospital de

[26] Cardoso and Murray (2025) do some analysis including the post-1994 data, but this is a selected sample: unlike in their data, representative heights of children and young adults in Portugal did not decrease from the 1990s, and they even improved a little for males (see the Appendix to Rodriguez-Martinez et al. 2020).
[27] We shared our data and replication materials in a public repository, as indicated in Cermeño et al. (2023). Cardoso and Murray (2025) state that their data "will be made available on request" (p. 10). A growing methodological literature has documented that "available upon request" policies are associated with low compliance rates and reduced reproducibility, which is why journals and funding agencies increasingly recommend or require deposition in public repositories (Christensen and Miguel 2018; Bradley 2023; Jamshidi-Naeini et al. 2023; Cobey et al. 2024). Greater transparency in replication practices facilitates constructive scholarly exchange. A few days after Cardoso and Murray (2025) was published, we wrote an email to their corresponding author requesting the data and replication files corresponding to this paper. We obtained no response.
[28] Cardoso and Murray (2025) write that additional outliers were identified via weight-for-length z-scores, in addition to the two height- or weight-for-age z-scores criteria that we used (Cardoso and Murray 2025, p. 2). This is a subjective choice that risks removing individuals at the tail ends of the distribution, but in any case, we have replicated this for the purposes of the present paper, and it leads to the removal of only

São Roque consisted of 1,717 observations; 1,385 of these are retained, corresponding to a reduction of 19.3% (p. 3). When combined with the exclusion of children above 5, more than 27% of the data from the *Hospital de São Roque* (over 300 observations) were omitted. The criteria underlying these exclusions – such as the removal of "clerical errors"- are only briefly described and not documented in sufficient detail to permit independent replication or verification (pp. 2-3).

Within this restricted sample, Cardoso and Murray (2025) report a peak in the prevalence of stunting among children aged 0-2 years in the Hospital de São Roque data during 1965-74, while acknowledging that this result is based on a "very small sample size" (pp. 4-6).[29] We explicitly excluded these observations in our original study for precisely this reason, as discussed in Cermeño et al. (2023). Given the limited number of observations, such fluctuations should be interpreted with caution and do not provide a robust basis for overturning broader trends.[30]

Finally, the re-analysis focuses exclusively on height-based indicators and omits weight and wasting measures. This is justified as a way to "streamline" the analysis and on the grounds that weight is described as a non-cumulative health measure (p. 2). However, the evolution of underweight prevalence is a standard component of nutritional assessment and forms part of the multidimensional evaluation of child growth. Moreover, weight-based indicators (weight-for-age, and weight-for-height/length statistics) are used in the data-cleaning procedures (p. 2). This creates a methodological inconsistency between the stated rationale for excluding weight outcomes and their use in determining the inclusion or exclusion of observations.

4.2. Alternative sources

Cardoso and Murray (2025) introduce two alternative sources in support of their claim that our *Hospital de São Roque* sample is biased. For infants, they rely on a small sample of only 69 observations from a single year (1959) drawn from *Centro de Enfermagem Assistência à*

35 additional observations. It hence leaves unexplained under what criteria Cardoso and Murray (2025) deleted an additional 300 or so observations.

[29] Cardoso and Murray (2025) never explain why they have decided to focus only on the 0- to 2-year-old sample, ignoring the data for children over 2 years old. More generally, the authors change the subsample under study repeatedly without justification or explanation.

[30] In our original paper, we reported that 1965-74 subsample for children aged 0-2 in the Hospital consisted of only 20 observations (9 boys and 11 girls; see Table 3 in Cermeño et al. 2023, p. 4). For this reason, these observations were interpolated in the manuscript and results using the full dataset -including 1965-74- were provided in the Online (Tables A15-A19). By contrast, the results reported by Cardoso and Murray (2025) for this period are based on 9 observations (p. 3).

Maternidade de Infância. Although Reis (1960) is cited as the source for this data, the underlying material comes from a 1958 bachelor's thesis (Lourenço 1958), and Reis explicitly cautions that the limited number of observations likely biased the results (Reis 1960, pp. 67–68).

For children aged 1 to 5, the comparison is made with data from the *Centro de Saúde de Lisboa*, based on summary statistics, namely point estimates and standard errors, reported in Reis (1960, p. 89).[31] Because the underlying microdata are not available, distributional properties such as normality, skewness, age-heaping, or the influence of outliers cannot be independently assessed. Consequently, confidence intervals derived from these summary statistics rest on unverifiable distributional assumptions. Reis (1960, p. 88) further notes that the study was presented as work in progress.[32] Finally, *Centro de Saúde de Lisboa* was not a hospital, but instead a clinical institute with a research focus using cutting-edge technology (Mendes 2009) and located in a wealthy area of Lisbon (Campo de Ourique), raising questions of institutional comparability.[33]

More fundamentally, however, the central object of inference in our study is the evolution of anthropometric outcomes over time within the *Hospital de São Roque*. Our identification relies on temporal variation, i.e., whether stunting and wasting declined across cohorts. For this purpose, absolute cross-sectional differences in height levels between institutions are of secondary importance. Even samples that are not fully representative in levels can provide valid information about trends provided that the underlying selection mechanism remains broadly stable over time.

The relevant methodological question, therefore, is not whether *Hospital de São Roque* perfectly represents the Lisbon child population in any given year, but whether its intake

[31] This work is focused on nutrition and diseases of the Portuguese population. Its presentation of height data for children is incidental and presented as incomplete and not representative Cardoso and Murray (2025) omit these important details.

[32] Reis (1960, p. 88) never suggests that the *Centro de Saúde de Lisboa* data were representative. Cardoso and Murray (2025)'s use of this data, omitting these details from their readers reveals a double standard: they filtered our dataset of 1900 observations based on unspecified "outliers" criteria, but by contrast they retained all observations from a much smaller sample (fewer than 200 observations), where any outlier carries much more weight – and where in fact by construction no outlier cleaning is even possible, since Cardoso and Murray (2025) did not have access to the original individual-level data. This style of inference – calculating precision from inadequate, likely biased, or unverifiable summary data is wrong and advised against in all statistics manuals.

[33] This hospital operated only from 1939 to 1949, when it closed, and it was not repurposed afterwards (Mendes 2009, p. 191). Its archives were destroyed (Mendes 2009, p. 193). Concerning this institution, see also Anonymous (1942, p. 192), and Mendes (2009, pp. 189-190).

composition changed systematically in a way that could mechanically generate the observed decline. Cardoso and Murray (2025) provide no evidence that such changing selectivity occurred before 1994. On the contrary, we have provided evidence that it did not.[34]

4.3. Statistical inference and comparability

The decision to truncate the *Hospital de São Roque* sample at age 5 has direct implications for statistical comparability with the *Centro de Saúde de Lisboa* data. Cardoso and Murray (2025) justify the upper bound at 5 "because this was the age limit for children admitted to the hospital (Anonymous, 1984) and only rarely do we find children over 5 years of age in the records" (p. 2). However, the same source (Anonymous 1984) indicates that the formal age limit was 4 rather than 5 years of age. Moreover, archival records show that neither a 4- nor a 5-year threshold was enforced, as children above these ages were regularly admitted, and hundreds of such observations are present in the dataset to which the authors had access.

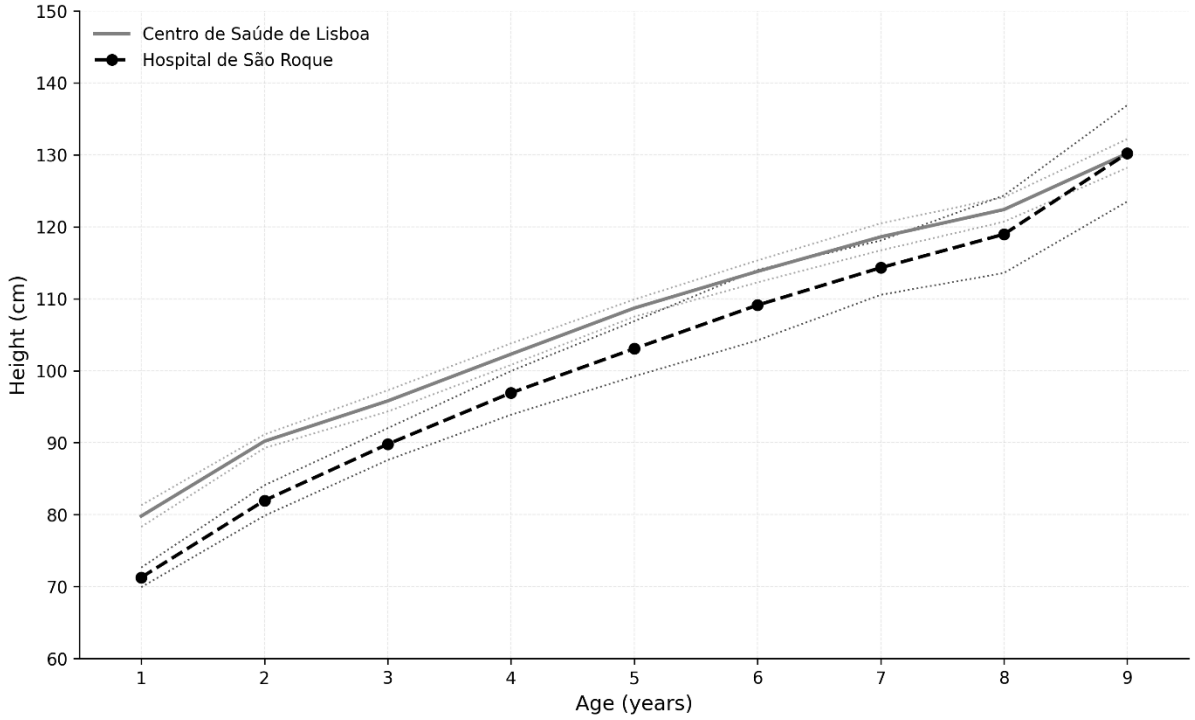
Crucially, the exclusion of children aged 6 and above alters the age-specific height comparison on which Cardoso and Murray (2025) base their inference of divergence between the *Hospital de São Roque* and the *Centro de Saúde de Lisbo*a samples. As shown in Figure 1, for these omitted age groups the confidence intervals for mean height in the two datasets largely overlap.[35] In several cases, the point estimates are also very similar. Once these ages are taken into account, the evidence does not support a claim of systematic divergence between the two sources.[36]

[34] Arquivo Histórico da Santa Casa da Misericórdia de Lisboa (1975-1984, 1984-1987).

[35] Cardoso and Murray (2025) rely on a limited number of observations: 35 for age one; 26 for age two; 49 for age three; 51 for age four; and 65 for age five. The implications of these small age-specific subsamples for statistical precision are not addressed. With samples of this magnitude, confidence intervals are particularly sensitive to outliers and distributional assumptions.

[36] Regular breastfeeding was likely more prevalent in *Centro de Saúde de Lisboa*, which did not admit inpatients, unlike the *Hospital de São Roque*. Such institutional differences could plausibly generate small discrepancies at young ages. However, the estimates converge at later ages, implying that any divergence, whether reflecting selection or measurement, does not persist beyond age 5. Cardoso and Murray (2025) do not report the confidence intervals for our data in their Figures 3 and 4, despite presenting those as central evidence regarding representativeness (pp. 6–7).

Figure 1. Comparison of the mean height of boys aged 1 to 10 years of age, between *Centro de Saúde de Lisboa* circa 1950 (Reis 1960) and *Hospital de São Roque* between 1945 and 1974. Ninety-five percent confidence intervals are represented by the dotted lines.[37]



Note: the confidence intervals for Centro de Saúde de Lisboa are based on summary statistics from Reis (1960).

5. Public health, welfare institutions, and the timing of improvements

Cohort-based estimates reported in the Online Appendix Tables A17–A19 of Cermeño et al. (2023) allow us to trace the evolution of stunting prevalence across birth cohorts. The cohort profile is consistent with a sustained long-run decline in stunting prevalence, without clear evidence of an abrupt discontinuity around the democratic transition. The first substantial reductions occur between the 1945–54 and 1955–64 cohorts, when infant stunting declined by 13.8 percent and stunting among children aged 5–18 fell by 19.6 percent (see Table 1).

[37] As we previously noted, the confidence intervals for the *Centro de Saúde de Lisboa* data should be interpreted with caution, as they are derived from published summary statistics rather than underlying microdata.

Table 1. Cohort-based changes in stunting prevalence.

Age group	Cohort comparison	Start (%)	End (%)	% change	N (start)	N (end)
Infants (0–24 months)	1945–54 → 1955–64	58	50	−13.8	258	485
Children (5–18 years)	1945–54 → 1955–64	56	45	−19.6	559	425

Notes: Percentage changes are computed as $[(p_t - p_{t-1})/p_{t-1})] * 100$ where *p* denotes cohort-level stunting prevalence.

These comparisons rely on large sample sizes and therefore provide the most precisely estimated evidence regarding the timing of the initial decline. By contrast, cohorts born in the late 1960s and early 1970s are represented by substantially smaller samples, limiting the precision with which short-run fluctuations can be interpreted. For infants, the decline between 1975–84 and 1985–94 is numerically larger (−34.4%), but this comparison is based on a much smaller 1975–84 cohort (N = 91), implying wider confidence intervals. For older age groups, the transition-period cohorts are too thin to permit reliable decade-to-decade inference. Accordingly, the available evidence does not support strong conclusions about differential rates of decline across political regimes.

The cohort evidence indicates that improvements were already underway during the later decades of the Estado Novo regime (Amaral 2019, Palma 2023). Portugal experienced rapid economic growth and convergence with the European core during this period (Lopes 1996, Lains 2003), and progress continued under democracy.[38] This pattern is not consistent with an interpretation centred on a discrete post-1974 discontinuity. The timing evidence does not imply that improvements were larger under dictatorship than under democracy, but rather that sustained and continuous gains began prior to the political transition and continued thereafter.

Interpreting differences in the pace of decline also requires attention to baseline conditions. Improvements in anthropometric outcomes are typically nonlinear: when stunting prevalence is high, reductions can be substantial in absolute terms, whereas gains tend to slow as populations approach the biological frontier. Comparative historical evidence indicates that countries starting from very elevated stunting levels experienced rapid subsequent declines, while those

[38] For a review of these matters in the context of Portugal's history since 1926, see Palma (2023).

with relatively better initial conditions saw more moderate absolute improvements (Schneider et al. 2026). This diminishing-returns dynamic complicates simple comparisons of decline rates across political periods. Apparent differences in speed may reflect initial levels rather than institutional regime characteristics. Our cohort-based evidence is consistent with such a cumulative process, in which improvements unfold gradually as nutritional status, disease environments, and public health conditions improve over time. This structural interpretation does not depend on regime classification but situates the Portuguese case within a broader pattern of twentieth-century health transition.

As mentioned above, our original study did not causally attribute the improvements in child health and nutritional status to the dictatorship. However, the historical record documents public actions undertaken during this period which plausibly contributed to development outcomes. Reis (1960, pp. 44-45) observed that mortality had been persistently declining since 1945 owing to improved medical practices, expanding public health measures, and better nutrition, clothing and housing.

Cardoso and Murray (2025, pp. 3-4) describe that welfare provision under the Estado Novo regime "fell largely under the sphere of the family, as well as under the responsibility of the Catholic church and private charity associations" and that it was "based on charity and non-universal social insurance, which resulted in almost inexistent child welfare and protection services until the democracy".[39] However, the historical evidence indicates a more complex institutional evolution. While universal public healthcare was only achieved after 1979, public investment in health infrastructure and social insurance expanded during the later decades of the dictatorship.[40] By the end of the regime, a substantial share of the population had access to publicly funded healthcare services, even if coverage remained incomplete. Charitable institutions, including the *Hospital de São Roque*, operated within a framework of state regulation and subsidy.[41]

[39] Formally, the Estado began in 1933 although it resulted from the evolution of a dictatorship in power since 1926, and its main political figure, Salazar, was in power since 1928 (initially as minister of finance).
[40] Palma (2023, p. 238). This was partly done at the municipal level: one of the first legislative initiatives of the Estado Novo had been to determine that poor individuals could be treated in hospitals with their costs paid by municipalities (Almeida 2018, p. 18).
[41] For some further information including the amounts of public subsidies given to hospitals and other social institutions, see Almeida (2018, pp. 90, 181).

Public health provision expanded markedly in both scale and scope during Estado Novo period in parallel with gradual institutional change.[42] Beginning in the 1930s, the regime established welfare structures organized around occupational groups and compulsory social insurance schemes.[43] Although these offered rudimentary welfare and social security to citizens, the scale was considerable: by 1945, there were 400 clinics staffed by approximately 500 doctors.[44] The Social Security reform of 1945 marked an important institutional shift, expanding state involvement in social policy and broadening access to health services (Almeida 2018, pp. 32, 50-181).

The regime also undertook major health infrastructure construction, including the *Hospital de Santa Maria* in Lisbon and the *Hospital de São João* in Porto. By 1965, dozens of tax-funded public health institutions—including hospitals and outpatient clinics—were in operation.[45] In 1968, the majority of public health investment was undertaken by the state, with hospital infrastructure accounting for most of the expenditures.[46] Portugal's National Health Service achieved full nationwide implementation only after 1979. Nevertheless, parts of the infrastructure and administrative foundations were developed during preceding decades under the authoritarian regime.[47] Over this period, access to publicly financed health services expanded gradually: the share of the population formally covered increased from less than 10% in 1954 to 30% in 1965, reaching 78% by 1975.[48]

The funding structure is central to the interpretation of the system. Although service delivery was frequently managed privately, financing relied predominantly on taxation, and services were generally free of charge to covered users. Supplementary schemes further contributed to coverage, including a dedicated system established in 1963 for civil servants, which covered about 8% of the population by 1975, alongside a dedicated health system for the military and

[42] This discussion is in part based on Palma (2023, pp. 238-9), to which we refer our readers for further details and information.
[43] The comparative evidence relevant: in France, for example, only a third of the citizens had access to social insurance as late as 1939 (Almeida 2018, p. 17), and in the UK the National Health Service only began operating in the late 1940s.
[44] Ramos et al. (2009, p. 644).
[45] Diário do Governo (1965).
[46] Almeida (2018, p. 123).
[47] Campos and Simões (2002, pp. 111-159). Public health success was also evident in the National Vaccination Program, initiated in 1965, which resulted in the largest-ever reduction in mortality from communicable diseases in the country's history, cutting childhood mortality (ages one to four) by more than half within a decade. See Campos (2000, p. 406).
[48] Carreira (1999, p. 412).

their families.[49] While Portugal's welfare state reached full institutional consolidation only after democratization, several components of its financing structures had been established earlier.

Within this broader context of expanding public health provision, improved sanitation and rising incomes, declining stunting is consistent with the epidemiological and nutritional transitions documented in economic history literature.[50]

The Estado Novo coincided with a period of structural change during which child mortality declined and nutrition and sanitation improved, as documented in our original paper. There is evidence that some of these developments were associated with policy interventions implemented during the period. In addition to health infrastructure, school-based interventions directly targeted child nutrition. For example, the state invested in the construction of schools from the early 1940s onward (Gomes and Machado 2020, 2021) and developed public canteens and related school support programs.[51] Archival evidence indicates that only a small proportion of pupils paid for school meals, even though primary schooling was close to universal by then.[52] Cod liver oil was distributed to schoolchildren as a nutritional supplement.[53] Finally, clothing and footwear were provided through subsidized *Caixas Escolares*.[54] Such measures are directly relevant for child caloric intake, micronutrient status, and disease resistance, and therefore plausibly linked to anthropometric outcomes.

6. Conclusion

A dominant paradigm in Portugal's historiography has emphasized the constraining effects of the Estado Novo on economic and social modernization. However, macroeconomic evidence indicates sustained growth and convergence in the post-World War II decades (Lopes, 1996; Lains, 2003). In Cermeño et al. (2023), we used individual-level data for infants, children, and

[49] Carreira (1999, p. 412). Despite this significant groundwork, it is undeniable that the welfare state grew substantially after 1974, a shift for instance reflected in public expenditure as a percentage of GDP, which had been only about 20% in the early 1970s, so lower than the over 35% average among other Western European countries at the time (Amaral 2019, p. 241). During this period, Portugal invested only 1.3 percent and 0.8 percent of its GDP in education and social affairs, respectively, while European averages stood at 3.5 percent and 3.9 percent (Amaral 2019, pp. 181–82).
[50] Amaral (2019), Palma (2023).
[51] See, for example, Instituto Nacional de Estatística (n.d.).
[52] See, for example, Arquivo da Direção Geral da Educação e Ciência (1955, 1970).
[53] Arquivo da Direção Geral da Educação e Ciência (1960).
[54] Arquivo da Direção Geral da Educação e Ciência (1955, 1970).

young adults from three independent sources to document a sustained reduction in stunting prevalence and improvements in child nutritional status starting before democracy.

Cardoso and Murray (2025) raise concerns regarding our sources and the historical interpretation of the period. As shown above, several of these concerns stem from alternative data restrictions and interpretations and are not consistent with the cohort-based evidence and the broader economic history literature. At the same time, their paper acknowledges noticeable improvements in living standards during the later decades of Estado Novo. In this respect, there is greater convergence between our findings than earlier formulations might have suggested.[55]

The remaining disagreement concerns timing and interpretation. The anthropometric evidence does not indicate a deterioration during the dictatorship, nor does it suggest that improvements were confined to the democratic era. At the same time, this paper does not evaluate relative regime performance. Rather, the cohort-based record indicates a gradual and cumulative process of improvement beginning well before the institutional break of 1974 and continuing thereafter. This pattern aligns with the broader macroeconomic and institutional evidence discussed above.

[55] Cardoso (2008, pp. 270–272) argued that Portugal "did not experience major social and economic changes after World War II like other European countries" and that "changes were occurring at an unbearably slow rate". Cardoso and Murray (2025) moderated the tone adopted in an earlier working version which contained multiple factual mistakes and accusations (Cardoso and Murray 2024). However, the published article continues to assert that "the Estado Novo was actually responsible for a decrease in the standard of living (a rise in stunting prevalence)" and that subsequent improvements largely reflected predictatorship dynamics (Cardoso and Murray 2025, p. 9). These claims sit uneasily with both the authors' own empirical reasoning and the broader historical record.

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