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COVID-19, Cause-Specific Mortality, and Life Expectancy Decomposition: Evidence from the USA and France

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Abstract. *This paper examines post-pandemic trends in life expectancy and cause-specific mortality using a decomposition framework based on three indicators: the average mortality improvement rate and life disparity (combined in the Level 1 term), and their covariance term (Level 2). Drawing on official mortality data from the Human Mortality Database and the Human Cause-of-Death Database, we quantify the contributions of major disease groups, including a separate COVID-19 category, to annual changes in life expectancy during the recovery phase (2020–2022) in the USA and France, distinguishing between Level 1 and Level 2 components. We additionally compare post-pandemic patterns with pre-pandemic mortality dynamics (2015–2019). This contrast highlights how the recovery in 2020–2022 is primarily driven by declining COVID-19 mortality, whereas several non-COVID causes continue to perform worse than before the pandemic. Results show that cardiovascular diseases and malignant neoplasms make substantial but heterogeneous contributions across the two countries, while COVID-19 and other respiratory causes are key drivers of post-pandemic trajectories. Positive Level 1 contributions from circulatory causes and neoplasms reflect survival gains at ages with high remaining life expectancy. In contrast, negative covariance terms for respiratory diseases in the USA indicate mortality reductions concentrated at older ages, tempering their overall impact. In France, several non-COVID-19 groups, notably those related to circulatory, respiratory, and digestive diseases, continue to exert downward pressure on life expectancy, limiting the rebound. Malignant neoplasms yield moderate and consistent gains in both countries, whereas digestive diseases and external causes show heterogeneous and sometimes adverse patterns. Our extension of the Vaupel and Canudas-Romo framework, which considers the cause-specific decomposition, disentangles structural intensity from age-compositional effects in mortality change, clarifying how specific causes of death either accelerate or delay the recovery of life expectancy.*

Keywords: Cause-specific mortality, COVID-19, life expectancy decomposition

JEL Codes: I15, C82, J11

1. Introduction

The COVID-19 pandemic inflicted an unprecedented shock on global mortality patterns, precipitating the sharpest decline in life expectancy recorded in many high-income countries since World War II (Aburto et al., 2022). Although partial recoveries have been documented in the years following the initial outbreak, considerably less is known about the specific causes of death driving this rebound and the cross-country heterogeneities in post-pandemic dynamics. Disentangling the contributions of specific causes to life expectancy recovery is crucial for identifying vulnerable population subgroups, assessing the persistence of indirect health effects, and informing long-term public health strategies, particularly in socioeconomic contexts marked by population ageing and fiscal pressures on welfare systems. Specifically, the pandemic's

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impact on life expectancy varied across different nations, with some experiencing more significant declines and slower recoveries due to pre-existing health disparities and vulnerabilities in their healthcare systems (Wéber et al., 2023).

Most existing studies have focused on aggregate changes in life expectancy or excess mortality (Aburto et al., 2022; Islam et al., 2021), providing valuable insights into the magnitude of the COVID-19 shock but offering limited details regarding the contributions of specific causes of death. Demographic perspectives on COVID-19 mortality also highlight age-specific fatality and baseline vulnerability (Goldstein & Lee, 2020). Only a limited number of works have applied decomposition techniques that separate the magnitude of mortality change from its age pattern (Vaupel & Canudas-Romo, 2003; Vaupel, Zhang, & van Raalte, 2011; van Raalte & Caswell, 2013). This analytical perspective aligns with recent actuarial work on life-expectancy dynamics (Di Palo, 2023), which shows that understanding changes in overall life expectancy requires analysing the pattern of improvements across ages.

Even fewer studies have examined post-pandemic dynamics using decomposition methods that distinguish between the magnitude of mortality change and its age distribution. However, this distinction is fundamental: recovery in life expectancy can arise either through broad, diffuse reductions in mortality across all ages or through concentrated improvements at specific ages or causes. The approach introduced by Vaupel and Canudas-Romo (2003) provides a suitable analytical framework by decomposing changes in life expectancy into a Level 1 component that captures the average rate of mortality improvement and a Level 2 component that reflects covariance patterns between mortality improvements and remaining life expectancy. Together with life disparity, which summarises the average years of life lost due to death, these indicators offer a powerful tool for characterising the structure of post-pandemic mortality recovery.

The empirical analysis focuses on the United States and France, which are the only countries in the Human Cause-of-Death (HCD) database (HCD, 2025), providing complete cause-specific mortality information by single year of age up to age 100 and for all years up to 2022. This unique data availability ensures the consistency and completeness required for a reliable application of the decomposition framework. The United States is characterised by elevated mid-life and external-cause mortality and experienced a severe COVID-19 shock. At the same time, France has historically maintained lower mortality at working ages but exhibits strong population ageing. By analysing the contributions of major cause-of-death groups during the post-pandemic years 2020-2022, this paper sheds light on both shared and divergent pathways of recovery. To contextualise post-pandemic dynamics, the analysis also incorporates a comparison with pre-pandemic trends (2015–2019). These years were characterised by stable or modest gains in life expectancy in the USA and consistently positive improvements in France, offering a valuable benchmark for assessing whether the recovery observed in 2020–2022 reflects a structural return to pre-COVID trajectories or merely a rebound from the initial shock.

Table 1: Life expectancy at birth and changes in life expectancy at birth by country, 2015–2022.

Country	Life Expectancy at Birth (years)					Changes in life expectancy (years)	
	2015	2019	2020	2021	2022	2015-2019	2020-2022
USA	78.75	78.97	77.08	76.47	77.57	+0.22	+0.48
France	82.14	82.72	82.19	82.32	82.29	+0.05	+0.10

(Source: Author's elaboration based on HMD data.)

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Before presenting the decomposition results, Table 1 offers an overview of life expectancy trends in the USA and France between 2015 and 2022. The contrast between the stable pre-pandemic gains and the weaker post-pandemic recovery helps contextualise the cause-specific contributions analysed in the following sections.

The remainder of the paper is organised as follows. Section 2 presents the data sources and decomposition methodology. Section 3 reports the cause-specific and age-specific contributions to changes in life expectancy for the USA and France, including a comparison with pre-pandemic dynamics. Section 4 concludes by summarising the main findings and discussing their implications for public health and future research.

2. Research Elaboration

2.1. Data

The analysis is based on official mortality data for the USA and France for the years surrounding the COVID-19 pandemic and the early recovery period. Annual death counts by age and cause of death, together with population exposures, were obtained from the Human Mortality Database (HMD, 2025). Causes of death were coded according to the International Classification of Diseases, 10th Revision (ICD-10), and subsequently grouped into broad categories, as shown in Table 2.

Table 2: Cause-of-death classification used in the analysis

Group 1	Group 2	HCD cause groups
All-cause		
Circulatory diseases	Ischemic heart disease	33
	Cerebrovascular disease (stroke)	35
	Other circulatory system diseases	31, 32, 34, 36
Malignant Neoplasms	Colon, rectum and anus	10
	Digestive system	12
	Larynx, trachea, bronchus and lung	13
	Breast	15
	Prostate	18
	Other malignant neoplasms of the digestive system	7, 8, 9, 11
	Other malignant neoplasms	14, 16, 17, 19, 20, 21, 22, 23
Respiratory diseases	Influenza and pneumonia	37, 39
	Other chronic obstructive pulmonary disease	41
	Other acute respiratory infections and other diseases of the respiratory system	40, 42
Diseases of the digestive system	Gastric and duodenal ulcer	43
	Liver disease	44
	Other digestive diseases	45
External causes	Transport accidents	52
	Suicide, self-inflicted injury, and	54, 55

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	assault	
	Other external causes	53, 56
Endocrine, nutritional and metabolic diseases	Diabetes mellitus and Other endocrinologic and metabolic diseases	25, 26
Diseases of the nervous system and the sense organs	Other diseases of the nervous system	30
COVID-19		38
Other	Tuberculosis and HIV	2, 5
	Alcohol and drug abuse	27, 28
	Other mental disorders	29
	The rest of the causes	1, 3, 4, 6, 24, 46, 47, 48, 49, 50, 51, 57

(Source: Author's elaboration based on ICD-10 codes.)

Standard period life tables were constructed separately for each year and for each cause grouping. Age was treated in single-year and five-year classes up to an open age interval at the oldest ages.

2.2. Methodology

To decompose changes in life expectancy by cause of death, we follow the continuous formulation proposed by Vaupel & Canudas-Romo, as presented in *Demography* (2003).

We consider N causes of death, each denoted by an index i, where $i = 1, \dots N$.

Let $\mu_{\mathrm{i}}(a,t)$ be the mortality rate at age a and time t from cause i, and let $\ell(a,t)$ be the survival function. The life expectancy at birth at time t can be written as the integral of the survival function over age. Vaupel and Canudas-Romo's idea is that the change in life expectancy can be expressed as the sum, over all ages and causes, of the change in cause–specific mortality, weighted by the remaining years of life at each age. In the continuous version, the instantaneous change in life expectancy at birth at time t due to the cause i is equal to

$$\dot{e}_i(0,t) = \int_0^\infty \rho_i(a,t) e\,(a,t) f_i(a,t) da, \qquad (1)$$

where $\rho_i(a,t) = -\dot{\mu}_i(a,t)$ is the rate of improvement in mortality from cause i at age a and time t, $e(a,t)$ is the remaining life expectancy at that age and time t, and $f_i(a,t) = \mu_{\mathrm{i}}(a,t)\ell(a,t)$ is the age distribution of deaths from cause i.

This expression can be rewritten in a more interpretable way. For each cause i, the contribution to the change in life expectancy is essentially the product of two components:

1. $\bar{\rho}_i(t)$ is the average rate of improvement in mortality from that cause (averaged over ages),
2. $e_i^{\dagger}(t)$ is the life disparity, namely the average number of life years lost, when a death from that cause occurs.

An additional covariance term captures the fact that mortality may improve faster at ages where remaining life expectancy is particularly high or low. In this way, the overall change in life expectancy is decomposed into additive contributions from each cause of death, each summarised by an average rate of change times the average years lost term, plus a small interaction component, provided by the covariance.

The basic formula is given by

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$$\dot{e}(0,t) = \sum_{i=1}^{N}\left[\bar{\rho}_i(t)\, e_i^{\dagger}(t) + Cov_{f_i}(\rho_i, e_a)\right] F_i(t), \quad (2)$$

where $F_i(t) = \int_0^{\infty} f_i(a,t)da$ is the total number of deaths from the cause i, and

$$Cov_{f_i}(\rho_i, e_a) = \frac{\int_0^{\infty}[\rho_i(a,t)-\bar{\rho}_i(t)]\left[e(a,t)-e_i^{\dagger}(t)\right]f_i(a,t)da}{\int_0^{\infty} f_i(a,t)da} \quad (3)$$

is the covariance between the rate of improvement in mortality from cause i and remaining life expectancy across ages.

Thus, for each cause i, the contribution to the change in life expectancy is essentially the product of three components: a) the average rate of mortality improvement; b) the average years of life lost per death due to cause i; and c) the total number of deaths due the same cause i, plus a covariance term that captures whether mortality improves faster at ages where remaining life expectancy is particularly high or low.

Component $\bar{\rho}_i(t)\, e_i^{\dagger}(t)$ measures the direct contribution of mortality improvements or deteriorations for the specific cause to the change in life expectancy, and it is referred to as the Level 1 component. $Cov_{f_i}(\rho_i, e_a)$ provides the Level 2 component and captures how these changes are distributed across age groups. Indeed, the covariance term measures the extent to which age-specific mortality improvements for a cause i are aligned with ages where the remaining life expectancy is high. A positive value indicates that mortality improvements occur predominantly at younger ages, a negative value reflects improvements concentrated at older ages, and values near zero suggest no systematic age pattern in the distribution of gains.

For each cause group, as listed in Table 2, we compute $\bar{\rho}_i$, $e_i^{\dagger}$, Level 1 as $\bar{\rho}_i e_i^{\dagger}$, Level 2 as $Cov_{f_i}(\rho_i, e_a)$, and the corresponding weight, F_i, in total mortality, to explain the implied cause-specific contribution to changes in life expectancy at birth in year t, $\dot{e}(0,t)$. These quantities are summarised in the following Tables, which provide the basis for the empirical results reported in Section 3.

3. Results and Discussions

We use data for the United States and France, the only two countries for which complete life tables by cause of death up to age 100 were available for the year 2022. These countries were selected to ensure complete consistency in the age structure of the data, as both provide mortality rates by sex and age groups from 0 to 100+, allowing reliable comparison and accurate decomposition results. For other countries with cause-of-death data extending to 2022, such as Canada, Sweden, and the United Kingdom, the life tables do not reach age 100 and therefore lack compatibility with the structure required by our analytical framework. For this reason, they were excluded from the comparative analysis.

We retrieved mortality rates by sex, age within interval [0,100+), and calendar year from the Human Cause-of-Death (HCD, 2025) database within the Human Mortality Database (HMD, 2025). The HMD provides high-quality mortality data built through strict demographic protocols, making it a standard reference for comparative mortality research. The HCD dataset offers harmonised cause-of-death time series accounting for changes in the International Classification of Diseases (ICD). Currently, it includes both reconstructed cause-of-death series and original classification series. Reconstructed data are available for 18 countries, while the original classification data used in our analyses are available for the subset of eight countries for which official permission was granted.

For the construction of life tables and for the calculation of life expectancy and decomposition indicators, we follow a standard age-pattern representation: the initial age intervals [0,1) and [1,4), followed by 5-year age groups $[x, x+n)$ for $x=5,10,\ldots,95$, and the open-ended age interval $[100, +\infty)$.

The results of the decomposition are reported in Tables 3 and 4 for the USA and France, respectively, for both sexes.

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For the USA, the decomposition results indicated that the overall annual change in life expectancy, $\dot{e}(0)$, across all causes, was approximately +0.256 years (per year). This aggregate trend reflects the combined influence of Level 1 and Level 2 components across major cause-of-death groups.

Circulatory diseases and malignant neoplasms emerged as key contributors to improvements in life expectancy, with positive Level 1 components (0.093 and 0.147 years per year, respectively), indicating sizeable contributions to the overall increase in life expectancy. For malignant neoplasms, the Level 1 component of 0.147 is accompanied by a small positive covariance term (0.015), suggesting that survival improvements are broadly distributed across the age spectrum, with only a slight tilt towards ages with higher remaining life expectancy. Respiratory diseases displayed a markedly positive Level 1 effect (0.323) and a small negative covariance (–0.008), signalling that mortality reductions were somewhat more concentrated at older ages, thereby slightly attenuating their impact on overall life expectancy (0.026 years). By contrast, diseases of the digestive system, external causes and the residual "all other" group all contribute negatively to life expectancy (see Table 3). Although each effect is modest in absolute terms, their combined impact translates into small net losses in life expectancy. Within this set, diseases of the digestive system stand out as a relevant component for subsequent country-specific comparisons.

These findings are consistent with epidemiological patterns observed in the post-COVID context: gradual normalisation of cardiovascular care, delayed recovery in cancer management pathways, and a persistent vulnerability in respiratory health.

Table 3: Cause-of-Death Decomposition for the Annual Change Over Time in Life Expectancy for the USA Around June 30, 2021, Both sexes

	$\bar{\rho}_i$ (per year)	$e_i^{\dagger}$(years)	$\bar{\rho}_i e_i^{\dagger}$ (Level 1)	Cov_{f_i} (Level 2)	Fi (%)	$\dot{e}_i(0)$
All-cause	0,035	12,309	0,427	-0,171	100,000	0,256
Circulatory diseases	0,010	9,778	0,093	-0,015	29,379	0,023
Malignant Neoplasms	0,012	12,700	0,147	0,015	17,434	0,028
Respiratory diseases	0,031	10,277	0,323	-0,008	8,192	0,026
Diseases of the digestive system	-0,021	15,438	-0,322	-0,003	3,463	-0,011
External causes	-0,039	28,821	-1,132	0,110	7,326	-0,075
Endocrine, nutritional and metabolic diseases	-0,023	12,317	-0,281	0,165	4,917	-0,006
Diseases of the nervous system	0,016	7,743	0,123	-0,083	9,080	0,004
All other causes	0,022	12,962	0,289	-0,513	11,968	-0,027
COVID	0,344	10,610	3,646	-0,296	8,242	0,276

(Source: Author's elaboration based on HMD data for the USA, years 2020-2022.)

Overall, the analysis reveals that Level 1 improvements make a significant contribution to the short-term gains in life expectancy. In contrast, Level 2 covariance effects highlight the limitations imposed by the age distribution of mortality improvements on the scale of the improvement. This distinction is crucial for understanding not only how much life expectancy changes, but also where within the age structure those changes occur. In addition, COVID-19 emerges as the single most influential factor in shaping the post-

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pandemic improvement in life expectancy at birth in the USA. The decomposition shows that the decline in COVID-related mortality contributed +0.276 years to the annual increase in life expectancy, which is a larger contribution than the overall observed gain of +0.256 years. This implies that, in the absence of improvements in COVID mortality, the aggregate life expectancy trend would have remained negative or stagnant, due to persistent deficits in other major causes of death. The exceptionally high Level 1 component (3.646) reflects the rapid reduction in COVID-related mortality following the initial shock. At the same time, the negative covariance (-0.296) indicates that most of these improvements occurred at older ages with lower remaining life expectancy. Despite this attenuation effect, COVID-19 remains the primary driver of life expectancy improvement in the considered years. In contrast, several non-COVID-19 causes, such as external factors, digestive diseases, and selected chronic conditions, continue to exert downward pressure on the life expectancy at birth, revealing a broader pattern of delayed healthcare recovery and persistent indirect effects of the pandemic. Overall, the evidence suggests that improvements in COVID mortality were necessary not only to offset declines in other causes but also to restore a positive trajectory in national life expectancy.

Table 4: Cause-of-Death Decomposition for the Annual Change Over Time in Life Expectancy for France Around June 30, 2021, Both sexes

	$\overline{\rho}_i$ (per year)	$e_i^{\dagger}$(years)	$\overline{\rho}_i e_i^{\dagger}$ (Level 1)	Cov_{f_i} (Level 2)	Fi (%)	$\dot{e}_i(0)$
All-cause	0,011	10,366	0,113	-0,064	100,000	0,048
Circulatory diseases	-0,006	8,088	-0,048	-0,020	21,365	-0,015
Malignant Neoplasms	0,008	13,123	0,106	0,062	23,661	0,040
Respiratory diseases	-0,057	8,203	-0,468	-0,082	6,489	-0,036
Diseases of the digestive system	-0,032	11,680	-0,371	-0,005	3,729	-0,014
External causes	-0,048	16,096	-0,772	0,059	6,067	-0,043
Endocrine, nutritional and metabolic diseases	-0,024	8,777	-0,209	-0,033	3,700	-0,009
Diseases of the nervous system	0,017	8,840	0,152	-0,192	5,823	-0,002
All other causes	-0,026	10,123	-0,262	-0,125	20,457	-0,079
COVID	0,272	7,784	2,119	0,128	8,709	0,196

(Source: Author's elaboration based on HMD data for France, years 2020-2022.)

COVID-19 played a significant but more moderate role in the improvement in life expectancy in France compared to the USA. The decomposition shows that the reduction in COVID-related mortality contributed +0.196 years to the annual change in life expectancy, which is substantial, but notably lower than that observed in the USA, see Table 4. The Level 1 contribution (2.119) indicates a significant decline in COVID mortality following the initial shock, though less pronounced than the American pattern. The average disparity value (7.784 years) suggests that COVID deaths in France occur at older ages, with a smaller loss of remaining life expectancy than in the USA. This pattern is reinforced by the positive covariance term (+0.128), which indicates that mortality improvements were relatively aligned with ages where the life

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expectancy at birth is above average, unlike in the USA, where the covariance was negative. Nevertheless, while the COVID contribution is clearly positive, several non-COVID causes, including circulatory diseases, respiratory diseases, digestive diseases, and external causes, continue to exert downward pressure on the life expectancy at birth. These negative contributions, combined with a more modest decline in COVID-19 mortality, explain why the overall annual gain in life expectancy in France ($\dot{e}(0) = +0.048$ years) remains substantially lower than that observed in the USA.

A comparison between the USA and France highlights both common patterns and important structural differences in the post-pandemic dynamics of life expectancy. In both countries, COVID-19 emerges as the dominant driver of life expectancy improvement, contributing more than any other cause of death. However, the magnitude of this contribution differs substantially: +0.276 years in the USA vs. +0.196 years in France, reflecting a faster and larger reduction of COVID mortality in the USA. At the same time, the age pattern of COVID improvements diverges. The higher life expectancy disparity in the USA (10.6 vs. 7.8 years in France) suggests that COVID-19 deaths were relatively younger in the USA during the pandemic's peak. In contrast, they were more concentrated among older age groups in France. Covariance values, however, reflect the age pattern of post-peak mortality improvements: the USA exhibits a negative covariance (-0.296), indicating that mortality reductions were concentrated at older ages, whereas France shows a positive covariance (+0.128), suggesting that improvements occurred at ages where remaining life expectancy is higher.

Non-COVID causes also differ markedly. In the USA, external causes and digestive diseases significantly hinder overall improvement, while malignant neoplasms and circulatory diseases make moderate positive contributions. In France, by contrast, several major cause groups (circulatory diseases, respiratory diseases, digestive diseases, endocrine conditions) remain negative contributors, yielding a much smaller net gain in life expectancy at birth. As a result, while both countries benefit from declining COVID mortality, the USA experiences a faster improvement in life expectancy due to stronger COVID improvements and a more favourable balance across remaining causes. France, instead, shows a slower and more fragile recovery, where persistent deficits in non-COVID causes partly offset the gains from declining pandemic mortality.

3.1. Comparing Pre-Pandemic (2015–2019) and Post-Pandemic (2020–2022) Decomposition

The decomposition for the USA from 2015 to 2019 shows a modest but stable annual increase in life expectancy (+0.060 years per year), primarily driven by sustained improvements in malignant neoplasms and circulatory diseases. External causes emerge as the primary negative contributor in this period, reflecting the impact of the opioid epidemic and rising accidental mortality. Other causes remain relatively small and stable. In this regard, see Table 5.

The post-pandemic period (2020–2022) displays a radically different structure. The overall annual increase (+0.256 years) is almost entirely driven by the decline in COVID-19 mortality (+0.276 years), without which life expectancy would still be stagnating. Improvements in neoplasms and circulatory diseases are weaker than in the pre-pandemic baseline, likely reflecting diagnostic delays and disruptions in healthcare services. Respiratory diseases display a more substantial positive contribution than before the pandemic, consistent with a rapid decline of COVID-related respiratory mortality. Negative contributions from external causes become even larger than in 2015–2019, signalling a worsening crisis in injuries, overdoses and violence. Digestive diseases also deteriorate more markedly than before.

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Table 5: Cause-of-Death Decomposition for the Annual Change Over Time in Life Expectancy for the USA Around June 30, 2017, Both sexes

	$\overline{\rho}_i$ (per year)	$e_i^{\dagger}$(years)	$\overline{\rho}_i e_i^{\dagger}$ (Level 1)	Cov_{f_i} (Level 2)	Fi (%)	$\dot{e}_i(0)$
All-cause	0,009	11,880	0,112	-0,051	100,000	0,060
Circulatory diseases	0,013	9,421	0,118	-0,018	31,894	0,032
Malignant Neoplasms	0,018	12,437	0,228	0,040	21,319	0,057
Respiratory diseases	0,028	9,669	0,267	-0,099	10,213	0,017
Diseases of the digestive system	0,005	14,254	0,078	-0,129	3,608	-0,002
External causes	-0,025	27,466	-0,682	-0,094	6,867	-0,053
Endocrine, nutritional and metabolic diseases	-0,021	12,171	-0,255	0,079	4,508	-0,008
Diseases of the nervous system	-0,031	7,743	-0,243	0,053	8,437	-0,016
All other causes	0,027	12,417	0,334	-0,129	13,153	0,027

(Source: Author's elaboration based on HMD data for the USA, years 2015-2019.)

Together, these results suggest that the apparent improvement in life expectancy in 2021-2022 is primarily a rebound effect from the decline in COVID-19 mortality, rather than an organic recovery of the underlying mortality structure. In fact, several major cause groups perform worse than in the pre-pandemic years, suggesting that the USA has not yet returned to its pre-COVID mortality trajectory.

With reference to France, the decomposition for 2015-2019 reflects a significant pre-pandemic improvement in mortality, with an annual increase in life expectancy of +0.142 years (see Table 6). Gains were driven by sustained improvements in malignant neoplasms and circulatory diseases, combined with positive contributions from digestive, endocrine and external causes. The mortality structure of this period was highly favourable, characterised by broad improvements across major causes and the absence of negative shocks, in sharp contrast with the United States.

The post-pandemic period (2020-2022) presents a markedly different profile. Overall life expectancy increased by only +0.048 years per year, roughly one-third of the pre-pandemic rate. Several major cause groups, including circulatory diseases, respiratory diseases, digestive diseases and external causes, shifted from being positive contributors to exerting adverse effects on life expectancy. Improvements in cancer mortality, though still positive, weakened substantially. COVID-19 emerges as the primary driver of the post-pandemic recovery, contributing 0.196 years to life expectancy; however, its impact is insufficient to restore France to its pre-pandemic trajectory. These findings indicate that while direct COVID mortality has declined, the indirect consequences of the pandemic on non-COVID causes remain significant and weigh heavily on the overall recovery of the French mortality profile.

Table 6: Cause-of-Death Decomposition for the Annual Change Over Time in Life Expectancy for France around June 30, 2017, Both sexes

	$\overline{\rho}_i$ (per year)	$e_i^{\dagger}$(years)	$\overline{\rho}_i e_i^{\dagger}$ (Level 1)	Cov_{f_i} (Level 2)	Fi (%)	$\dot{e}_i(0)$
All-cause	0,012	10,497	0,130	0,012	100,000	0,142

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Circulatory diseases	0,032	7,937	0,255	-0,002	25,044	0,063
Malignant Neoplasms	0,018	13,389	0,245	0,020	25,605	0,068
Respiratory diseases	0,009	7,727	0,070	-0,045	7,842	0,002
Diseases of the digestive system	0,010	11,615	0,117	0,004	3,866	0,005
External causes	0,008	16,216	0,128	0,166	6,184	0,018
Endocrine, nutritional and metabolic diseases	0,010	8,816	0,085	0,076	3,733	0,006
Diseases of the nervous system	0,026	8,467	0,217	-0,098	6,695	0,008
All other causes	-0,017	10,116	-0,168	0,036	21,031	-0,028

(Source: Author's elaboration based on HMD data for France, years 2015-2019.)

4. Conclusions

This study provides new evidence on how cause-specific mortality shaped the post-pandemic evolution of life expectancy, highlighting the usefulness of decomposition techniques based on the rate of mortality improvement, life disparity, and covariance. By applying this framework to the USA and France (the only two countries with complete cause-of-death life tables up to age 100 and for all years up to 2022), we illustrate that COVID-19 reductions were crucial in restoring a positive trajectory in life expectancy. Declining COVID-19 mortality acted as the primary driver of improvement in both countries; however, the overall post-pandemic dynamics differed substantially due to persistent deficits in several non-COVID-19 causes. These patterns underline the importance of monitoring both direct and indirect effects of major health shocks.

The results have broader implications for public health systems. Rapid improvements in cause-specific mortality may mask deeper structural vulnerabilities that require long-term attention, particularly in areas such as external causes, chronic diseases, and the organisation of healthcare services. The decomposition approach used here demonstrates the value of separating magnitude and age-pattern effects when assessing mortality change, offering a more nuanced understanding of recovery processes.

Future research could further extend this analysis by integrating regional variations, socio-economic disparities, and gender differences, as well as expanding the comparison to countries for which extended life table structures will become available. Moreover, linking decomposition outcomes with healthcare utilisation data may help clarify the mechanisms through which health crises reshape mortality profiles. Such developments would contribute to a richer understanding of resilience and vulnerability in population health after major shocks.

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