The health state of France before COVID-19 pandemic between 1990 and 2019: an analysis of the Global Burden of Disease study 2019

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The Lancet Regional Health - Europe 2024;■: 100848

Published Online xxx
https://doi.org/10.1016/j.lanepe.2024.100848

Summary

Background France faces nowadays some major challenges regarding its health care system including medically underserved areas, social health inequalities, and hospital pressures. Various indicators and sources of data allow us to describe the health status of a population and, consequently, to assess the impact of these challenges. We assessed the burden of diseases before COVID-19 in France in 2019 and its evolution from 1990 to 2019, and compared it with Western European countries.

Methods We used specific Global Burden of Diseases (GBD) metrics: socio-demographic index (SDI), life expectancy (LE), healthy life expectancy (HALE), years of life lost (YLLs), years lived with disability (YLDs), and disability-adjusted life-years (DALYs) with their 95% uncertainty interval (95% UI). We compared French age-standardized metrics to those for other Western European Countries for both sexes and also between 1990 and 2019. We also described the specific causes of these different metrics.

Findings We observed for life expectancy at birth in France a trend to an improvement over time from 77.2 (95% UI: 77.2–77.3) years in 1990 to 82.9 (82.7–83.1) in 2019, which represented the seventh highest life expectancy among 23 Western European countries. HALE at birth in France increased from 67.0 (64.0–69.7) to 71.5 (68.1–74.5), which represented the fourth highest HALE among 23 Western European countries. In France, the total number of DALY per 100.000 population tended to decrease from 25,192 (22,374–28,351) in 1990 to 18,782 (16,408–21,920) in 2019. As compared to other European countries, the burden due to cardiovascular diseases was lower. Neoplasms and cardiovascular diseases were the two leading causes of YLLs. Mental and musculoskeletal disorders were the two leading causes of YLDs.

Interpretation Overall, these results highlight a clear trend of improvement in the health status in France with certain differences between western European countries. The health policy makers need to devise interventional strategies to reduce the burden of diseases and injuries, with specific attention to causes such as cancers, cardiovascular diseases, mental health and musculoskeletal disorders.

Funding Bill & Melinda Gates Foundation.

Keywords: "Global Burden of disease" evolution; France; Western Europe

Introduction

French health care system stands out in Europe, due to some specificities. It is a combination of Bismarckian and Beveridgian models, which lies on a national system of health insurance funded by employee and employer social contributions.[2] Indeed, French healthcare system combined a universal health coverage provided by the "Sécurité sociale" a national health insurance, which

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Research in context

Evidence before this study

France faces nowadays some major challenges regarding its health care system including medically undeserved areas, social health inequalities, and hospital pressures. Various indicators and sources of data allow us to describe the health status of a population and, consequently, to assess the impact of these challenges and evaluate policies implemented to address them. Under this perspective, French health and healthcare system are described periodically by international organisations such as European Observatory on Health Systems and Policies or the Organisation for Economic Co-operation and Development (OECD) who develop Country Health Profiles. Yet, these data concern only OECD or European Union member countries. As health data are extracted from general databases (OECD, Eurostat) that assess various domains (industry, economy, transportation, agriculture ...) without specifically targeting health, there are relatively few health-specific indicators. In contrast, each year Institute for Health Metrics and Evaluation compiled data for the Global Burden of Disease (GBD) Study and provides information on prevalence, incidence, mortality, and their causes (mapped with the international classification of diseases).

GBD 2019 data synthesizes a large number of input sources to estimate indicators from 369 diseases for 204 countries. It gathers data from many sources, which varies according to the countries and specific situations: administrative data, censuses, demographic surveillance, disease registries, reports, scientific literature and surveys, among others. In 2019, to perform the main analysis of GBD data, more than 85,000 different sources have been consulted.[1] Data are then modelled to produce a set of standardized disease burden indicators: years of life lost (YLLs), years lived with disability (YLDs), disability-adjusted life-years (DALYs), and healthy life expectancy.

After a research on Pubmed (2023/10/03) using the key words "Global Burden of Disease" and (French or France), we did not find any article that used GBD data to evaluate French health state in specific.

Added value of this study

This study is important as it reflects the state of health prior to the COVID-19 pandemic and these results might be important for policymakers. It provides a global vision of French GBD indicators through a geographical and temporal comparison over 30 years. To our knowledge, this is the first study using GBD indicators with a specific focus to France. Since 1990, there has been an overall improvement in health leading to a decrease of all-causes age-standardized Years of Life Lost (YLL), Years Lived with Disability (YLD), and Disability-Adjusted Life-Years (DALY) and an increase in life and healthy life expectancy in France, as well as in other Western European countries. France and countries from Western Europe share the same epidemiological profile; i.e., a very low contribution of infectious diseases as compared to non-transmissible diseases to the overall burden of disease. As compared to other European countries, the burden due to cardiovascular diseases was lower in France. Neoplasms and cardio-vascular diseases were the two leading causes of YLLs. Mental and musculoskeletal disorders were the two leading causes of YLDs.

Implications of all the available evidence

Overall, these results highlight a clear trend of improvement in the health status in France with certain differences between western European countries. The health policy makers need to devise interventional strategies to reduce the burden of diseases and injuries, with specific attention to causes such as cancers and cardiovascular diseases for mortality and mental health and musculoskeletal disorders for morbidity.

covers approximately 80% of health expenditures and a supplementary mutual insurance scheme.[3]

Then, the position of the French health care system may seem paradoxical as compared to other European countries showing good performances regarding access to curative care and gaps regarding prevention performances.[4–6] For example, France has one of the best life expectancies in Europe (often in the international top-10 these past years[7]) but more mediocre indicators related to health prevention and promotion. In a ranking from 2017 performed with Global Burden of Disease (GBD) data, considering 33 health indicators, France ranked 24th behind a majority of Western European countries.[6] When looking at the indicators in detail, this poorer performance could be mainly attributed to preventable factors (alcohol, tobacco consumption or even suicides).[6] Indeed, French healthcare system historically prioritized curative care over prevention. Some researchers trace the reasons for this back to the French Revolution, where the medical profession (mainly focused at this time on curative care), established itself as the sole authority in the field of healthcare in France.[5,8–10] Furthermore, the current practice of primary care in France is based on individual consultations and a fee-for-service tarification which reinforces the emphasis on curative treatment.[5,8–10] Finally, the biomedical conceptual model, predominant in France for two centuries, reinforces a technical medicine centered on pathologies and treatments.

Nowadays, as many other European countries, France faces some major challenges regarding its health care system including medically underserved areas, social health inequalities (systematic differences, socially produced, in health status between different

socio-economic groups), or hospital pressures mainly due to shortage of healthcare professionals.[11] These issues may have been exacerbated by the COVID crisis. However, it seems important to get a baseline overview of French health state before COVID in order to subsequently analyse the specific impact of COVID on these various health indicators.[5,12] Thus, to identify these challenges, assess their impact and inform political decisions, it is important to get healthcare system analysis which lean on global and specific health indicators.

Indeed, the use of standardized indicators enables temporal comparisons, comparisons between France and similar countries and offers valuable insights to policy-makers. Health indicators are numeric measures that summarise the health status of an individual or a population. They may reflect morbidity and mortality such as disease prevalence, incidence, life expectancy, or health behaviours like vaccination rates or tobacco use. Periodically, many organisations, like the WHO or the OECD, edit international overviews of country health profiles.[4,13] The Global Burden of Diseases, Injuries, and Risk Factors Study (GBD), which provides data since 1990, is an opportune tool for assessing levels and trends of health outcomes.[1] GBD estimates integrate standard measures such as prevalence and mortality rates into specific rules-based indicators quantifying health loss, and thus provide new insights and add value to standard population health assessment. Moreover, Burden of disease (BoD) estimates allow comparisons between a broad range of conditions diseases, injuries, and risk factors, across geographical regions and different time spans. Indeed, to date it provides the most comprehensive and consistent assessment of global data on descriptive epidemiology.[14] Every year, the Institute for Health Metrics and Evaluation (IHME) provides a large and detailed set of GBD health indicators, even at a regional level when possible, to inform researchers and policy makers.[15] In 2019, GBD compiled data on 369 diseases and injuries in 204 countries and territories.[16]

To our knowledge, data from GBD studies have not been widely used in France.[17] However, GBD estimates allow to carry out precise description of the health status of a specific population and to compare it with others, to analyse trends over the years since 1990, as well as to identify data gaps to fill in. In this paper, we used GBD indicators to assess disease burden in France. Our objective was to describe the evolution of disease burden in France and other Western European countries from 1990 to 2019.

Methods

Data

This work is based on data compiled and computed by the IHME for the Global Burden of Disease Study 2019 (GBD 2019). GBD 2019 synthesizes a large number of input sources to estimate indicators regarding mortality, causes of death and illness, and risk factors. It gathers data from many sources, which varies according to the countries and specific situations: administrative data, censuses, demographic surveillance, disease registries, reports, vital registration, scientific literature and surveys, among others.[1] All data are publicly available on IHME website (https://ghdx.healthdata.org/). In 2019, more than 85,000 different sources have been consulted. In 2019, French estimates have been performed through 2444 data sources (see Supplementary Table S1), and more than half of the French data sources were scientific literature (n = 981, 39.3%) and diseases registries (n = 411, 16.5%). Western European countries estimates have been performed through 31,326 data sources (See Supplementary Table S2).

IHME correct information bias when known. For example, unspecified causes of deaths are redistributed with specific algorithms. Data are then modelled to produce a set of standardized disease burden indicators. IHME uses three major tools to perform these estimations: Causes of Death Ensemble Modelling (CODEm), spatiotemporal Gaussian Process Regressions (ST-GPR), and DisMod MR (a Bayesian meta-regression tool).[1] Figures are generated with R. Previous articles explained the methods used in detail.[1,18,19]

We compared France GBD estimates with countries of GBD "Western Europe" region (Andorra, Austria, Belgium, Cyprus, Denmark, Finland, Germany, Greece, Iceland, Ireland, Israel, Italy, Luxembourg, Malta, Monaco, the Netherlands, Norway, Portugal, San Marino, Spain, Sweden, and the UK) and calculated the mean estimates for Western Europe (by taking into account all countries, including France) between 1990 and 2019. We chose not to use 2020 GBD data, because they reflect an epidemiological landscape modified by the COVID-19 crisis. Data inputs are downloadable from the Global Health Data Exchange (http://ghdx.healthdata.org/).

GBD health indicators

GBD health indicators include standard mortality and morbidity measures such as life expectancy and disease incidence or prevalence. It also includes more specific metrics such as socio-demographic index (SDI), healthy life expectancy (HALE), years of life lost (YLLs), years lived with disability (YLDs), and disability-adjusted life-years (DALYs). Methods used to compute specific GBD measures have been extensively presented elsewhere.[20,21]

The Socio-demographic Index (SDI) has been developed by GBD researchers and is a composite indicator of development status correlated with health outcomes. It is the geometric mean of 0–1 indices of total fertility rate under the age of 25 (TFU25), mean education for those ages 15 and older (EDU15+), and lag distributed income (LDI) per capita.[1]

Unlike life expectancy, HALE quantifies years expected to be lived in good health by taking into account both mortality and nonfatal outcomes.[22]

YLLs are computed by multiplying the estimated number of deaths at each age by the standard life expectancy at this age. Standard expected years of life are obtained for each age in each country with the highest life expectancy for that age.[1,23] Compared to alternate measures of premature mortality, YLLs do not depend from arbitrary age cut-offs and place greater weight on deaths that occur at younger ages.[21]

YLDs are a measure of years of life lived with disability, defined as the number of people with a given disease (prevalence) multiplied by the corresponding disability weight, with different severity levels used for different health states or sequelae.[20] The measure is performed at each age and multiplied by the number of years lived with the disease. DALYs are defined as the sum of YLLs and YLDs and are considered an overall measure of population health that combines mortality and morbidity. DALYs enable ranking of disease burden due to specific causes. Socio-demographic index (SDI) is a composite indicator of development strongly correlated with health outcomes. It is a geometric mean of 0–1 indices of total fertility rate under the age of 25, mean education for those ages 15 and older and lag distributed income per capita.[1]

All estimates were reported with their 95% uncertainty intervals (95% UIs). To analyse trends between 1990 and 2019, we mainly rely on age-standardised (with the GBD reference population[18]) rates and their relative changes since 1990. They are described as rates for 100,000 people. We did not performed any test to compare rates between years or countries. We selected these indicators, which are used to best quantify the health gaps between the actual health of a population and some stated norm or goal for population health.

GBD causes

We extracted from GHDx database estimates for 1990 and 2019 for France and other Western European countries from GBD 2019.[24] We compared French estimates to the mean estimates of Western Europe (by taking into account all included countries). We chose to describe life expectancy and HALE, YLLs, YLDs, DALYs, and causes of deaths. The GBD arranges the over 350 diseases and injuries (causes) into hierarchically nested categories, in four levels of aggregation (Level 1 being the less precise). At every level of aggregation, causes are mutually exclusive and collectively exhaustive. For the sake of this analysis, we focused on the 20 leading level 3 causes.

We followed the guidelines for accurate and transparent health estimates reporting (GATHER statement). As data are publicly available, we did not need to consult an ethic committee.

Role of the funding source

The funders of the study had no role in study design, data collection, data analysis, data interpretation, or the writing of the report. The corresponding author had full access to the data in the study and final responsibility for the decision to submit for publication.

Results

Socio-demographic index

SDI improved in France since 1990 from 0.738 to 0.834 which represents an increase of 9.6%, its rank among other European countries remained stable (See Table 1). This increase is near from the one observed in Western European countries from 0.750 in 1990 to 0.843 in 2019.

Life expectancy

Life expectancy at birth in France has dramatically improved since 1990: it was 77.21 (77.17–77.26) years in 1990 and 82.87 (82.67–83.06) in 2019 (Tables 2 and 3). However, this increase occurred for all Western European countries (from 76.42 (76.40–77.01) years in 1990 to 82.09 (81.98–82.20) years in 2019.

Country	Socio-demographic index (SDI)			
	2019		1990	
	Value	Rank	Value	Rank
Switzerland	0.929	1	0.868	1
Norway	0.913	2	0.807	7
Monaco	0.902	3	0.834	2
Germany	0.898	4	0.819	4
Luxembourg	0.895	5	0.815	5
Andorra	0.894	6	0.834	3
Denmark	0.890	7	0.806	8
San Marino	0.884	8	0.814	6
Netherlands	0.883	9	0.796	9
Sweden	0.872	10	0.769	10
Iceland	0.869	11	0.764	11
Ireland	0.867	12	0.73	17
Finland	0.856	13	0.757	12
Belgium	0.851	14	0.746	14
Austria	0.849	15	0.753	13
The United Kingdom	0.847	16	0.745	15
Cyprus	0.841	17	0.662	22
France	**0.834**	**18**	**0.738**	**16**
Israel	0.803	19	0.717	18
Italy	0.801	20	0.712	19
Malta	0.801	21	0.666	21
Greece	0.794	22	0.682	20
Spain	0.767	23	0.647	23
Portugal	0.743	24	0.607	24

Socio demographic index is a composite measure of total fertility rate in a population, lag-distributed income per capita and average years of education in the population older than 15 years. French data are in bold. SDI = Socio-demographic index.

Table 1: **Socio-demographic index in Western European Countries, by country (1990, 2019).**

Country	Life expectancy			
	2019		1990	
	Life expectancy (UI)	Rank	Life expectancy (UI)	Rank
Iceland	84.08 (83.19–84.86)	1	78.11 (77.73–78.50)	3
Italy	83.10 (83.01–83.19)	2	77.16 (77.12–77.20)	9
Spain	83.09 (82.90–83.27)	3	76.96 (76.91–77.01)	11
Israel	83.00 (82.75–83.24)	4	77.31 (77.21–71.41)	6
Luxembourg	82.92 (81.81–83.92)	5	75.25 (74.96–75.53)	19
Norway	82.90 (82.73–83.07)	6	76.86 (76.75–76.97)	12
France	**82.87 (82.67–83.06)**	**7**	**77.21 (77.17–77.26)**	**8**
Sweden	82.83 (82.70–82.95)	8	77.95 (77.87–78.03)	5
Malta	82.57 (81.61–83.51)	9	76.59 (76.23–76.95)	13
Andorra	82.19 (79.91–84.54)	10	79.03 (76.27–81.24)	2
San Marino	82.17 (78.49–85.80)	11	79.70 (78.43–81.04)	1
Austria	82.16 (81.97–82.35)	12	75.97 (75.87–76.07)	15
Ireland	82.02 (81.67–82.35)	13	74.98 (74.86–75.12)	22
Finland	81.87 (81.50–82.21)	14	75.43 (75.27–75.57)	18
The Netherlands	81.74 (81.49–81.98)	15	77.16 (77.08–77.23)	9
Portugal	81.72 (81.46–81.96)	16	74.28 (74.20–74.37)	23
Belgium	81.41 (81.16–81.63)	17	76.15 (76.07–76.23)	14
Germany	81.20 (81.00–81.37)	18	75.66 (75.62–75.70)	17
Denmark	81.13 (80.82–81.44)	19	75.23 (75.12–75.34)	20
United Kingdom	81.07 (81.98–81.16)	20	75.85 (75.80–75.89)	16
Greece	80.94 (80.67–81.19)	21	77.23 (77.14–77.32)	7
Cyprus	80.81 (80.00–81.59)	22	75.07 (74.86–75.29)	21
Monaco	80.06 (78.34–82.12)	23	78.11 (76.33–80.29)	3

Life expectancies are expressed in years. Life expectancy is defined as the average number of years a person can expect to live, assuming that current mortality rates remain constant throughout their lifetime. Countries are listed according to the rank of 2019. French data are in bold. UI = 95% Uncertainty intervals.

Table 2: **Life expectancy in Western European countries by country (1990, 2019).**

Country	Healthy life expectancy (HALE)			
	2019		1990	
	N (UI)	Rank	N (UI)	Rank
Iceland	72.32 (69.06–75.39)	1	67.85 (64.96–70.59)	3
Israël	71.82 (68.65–74.72)	2	67.48 (64.61–69.98)	5
Spain	71.60 (68.26–74.52)	3	66.87 (63.92–69.49)	9
France	**71.50 (68.13–74.45)**	**4**	**66.99 (64.01–69.66)**	**8**
Sweden	71.39 (68.11–74.3)	5	67.75 (64.78–70.38)	4
Italy	71.24 (67.80–74.33)	6	66.36 (63.26–69.14)	12
Malta	71.07 (67.75–74.10)	7	66.71 (63.84–69.32)	11
Luxembourg	70.99 (67.47–74.06)	8	65.37 (62.51–67.99)	20
Andorra	70.88 (67.25–74.37)	9	66.87 (63.92–69.49)	9
San Marino	70.88 (66.54–75.16)	10	69.17 (65.92–72.14)	1
Norway	70.84 (67.41–73.90)	11	66.36 (63.25–69.08)	13
The Netherlands	70.62 (67.47–73.43)	12	67.37 (64.53–69.87)	6
Austria	70.60 (67.21–73.57)	13	65.82 (62.81–68.44)	15
Ireland	70.35 (67.00–73.32)	14	65.28 (62.47–67.79)	21
Finland	70.34 (67.04–73.31)	15	65.41 (62.52–67.96)	18
Portugal	70.21 (66.85–73.17)	16	64.20 (61.28–66.80)	23
Denmark	69.92 (66.74–72.77)	17	65.25 (62.32–67.81)	22
Greece	69.91 (66.69–72.72)	18	67.23 (64.31–69.81)	7
Cyprus	69.90 (66.73–72.87)	19	65.67 (62.91–68.13)	17
Germany	69.72 (66.42–72.69)	20	65.77 (62.87–68.30)	16
Belgium	69.72 (66.28–72.76)	21	66.10 (63.11–68.70)	14
Monaco	69.16 (65.61–72.46)	22	67.98 (64.70–70.99)	2
The United Kingdom	69.11 (65.66–72.15)	23	65.38 (62.30–68.06)	19

Healthy life expectancy are expressed in years. Health life expectancy is defined as the number of years an individual at a specific age can expect to live in good health, free from disability or major illness. Countries are listed according to the rank of 2019. French data are in bold. UI = 95% Uncertainty intervals.

Table 3: **HALE in Western European countries by country (1990, 2019).**

French HALE has also increased between 1990 66.99 (64.01–69.66) and 2019 (71.50 (68.13–74.45) years) (Table 3).

The gap between the highest and lowest ranked countries decreased from 5.4 years to 4 years for LE, and from 5.0 to 3.2 years for HALE between 1990 and 2019.

Mortality

All-causes age-standardised YLL rate per 100,000 population

All-causes age-standardised YLL rate per 100,000 population in France decreased in 30 years from 14,481 (14,419–14,538) in 1990 to 8282 (8061–8526) in 2019, which represents a decrease of almost 43%. In Western Europe all-causes age-standardised YLL rate decreased from 15,093 (15,061–15,126) in 1990 to 8450 (8290–8622) in 2019, which represents a decrease of 44%.

Cause-specific YLL

In France as in Europe, whereas YLL age-standardised rates decreased significantly between 1990 and 2019, neoplasms and cardiovascular diseases remained the two most-leading causes of mortality during these years.

Neoplasms

In France, neoplasms represented in 1990 and 2019 the first leading Level-2 cause of mortality, with an absolute value which has decreased from 4258 (4138–4331) in 1990 to 3136 (2982–3255) age-standardised YLL rate per 100,000 population in 2019 (Supplementary Fig. S2-A). Among neoplasms, in France as in Western Europe, lung cancer was the first leading level-3 cause, and colorectal cancer the second one. In France, lung cancer was the fifth leading Level-3 cause in 1990 with an age-standardised YLL rate of 823 (800–846) and the first one in 2019 (771 (723–818)) (Fig. 1A).

In Western Europe, during the same period, neoplasms switched from the second place Level-2 cause in 1990 (3997 (3901–4047)) to the first one in 2019 (2967 (2842–3045)) (Supplementary Fig. S2-B). In Western Europe, lung cancer was the third leading Level-3 cause of mortality in 1990 with 842 (829–852) age-standardised YLL and ranked to the second position in

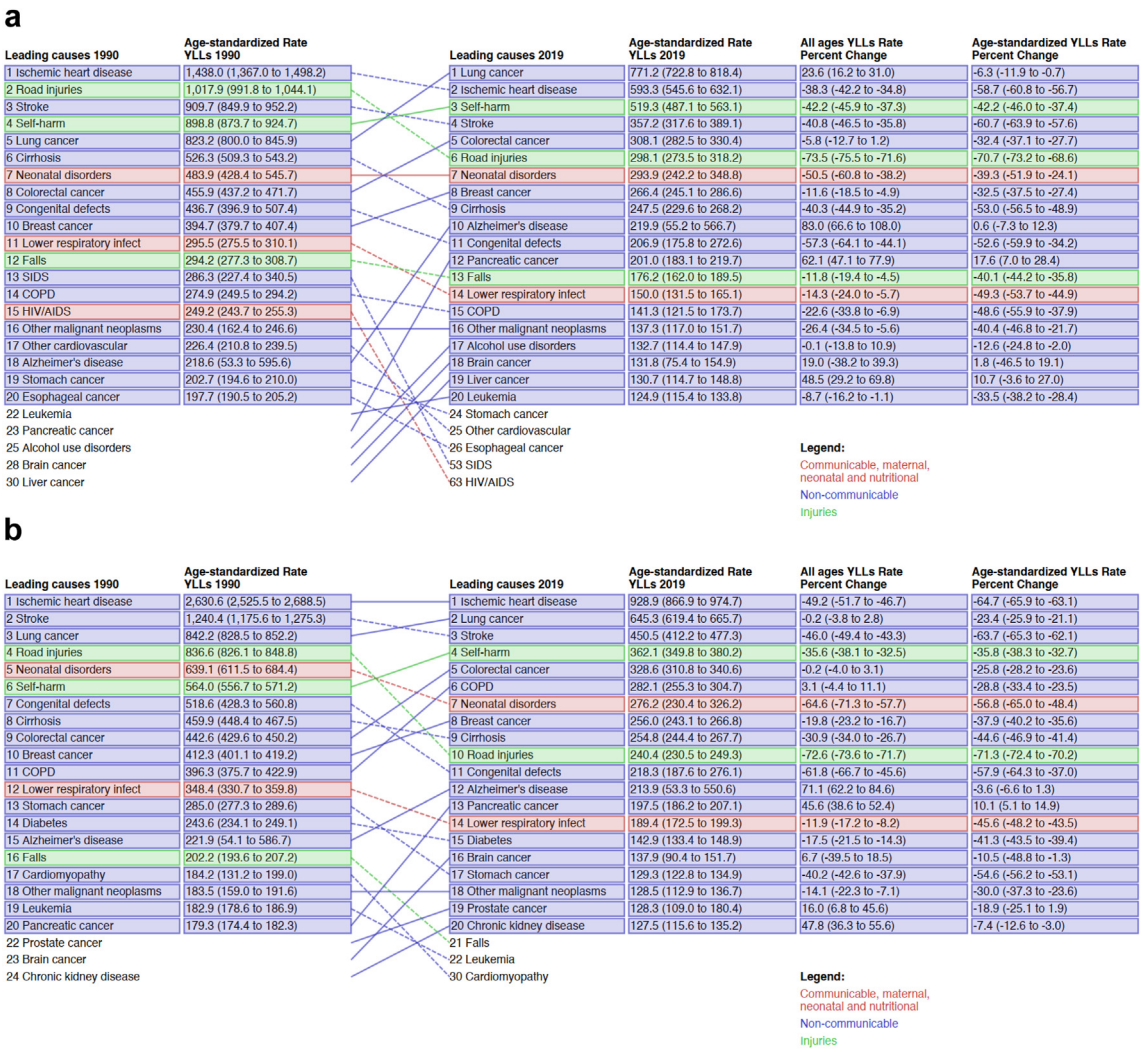

Fig. 1: A: 20 leading Level-3 causes of YLLs in France, with percent change, both sexes 1990–2019. B: 20 leading Level-3 causes of YLLs in Western Europe, with percent change, both sexes 1990–2019.

2019 with 645 (619–666) age-standardised YLL rate per 100,000 population (Fig. 1B). Lung cancer mortality measured by YLL has decreased in France by 6% and in Europe by 23% over the 30 years. Among neoplasms, colorectal cancer was the second leading Level-3 cause in 1990 and 2019 in France and in Europe and decreased by 32 and 26% respectively (Fig. 1A and B).

Cardiovascular diseases

In France, cardiovascular diseases represented in 1990 and 2019 the second Level-2 cause of mortality, with an age-standardised YLL rate per 100,000 people in 2019 which has decreased from 3021 (2887–3155) in 1990 to 1349 (1227–1428) (Supplementary Fig. S2-A). Ischemic heart disease was the first leading Level-3 cause of age-standardised YLL in 1990 (1438 (1367–1498) and the second leading cause in 2019 with a rate of 593 (546–632). Stroke was the third Level-3 cause of mortality in 1990 (910 (850–952), and the fourth one in 2019 (357 (318–389)) (Fig. 1A).

In Western Europe, between 1990 and 2019, cardiovascular diseases switched from the first place in 1990 (4614 (4421–4712)) to the second one in 2019 (1873 (1725–1947)) (Supplementary Fig. S2-B). Ischemic heart disease was the first leading Level-3 cause of mortality in 1990 and 2019 with an age-standardised YLL rate of 2631 (2526–2689) and 929 (867–975) respectively (Fig. 1B).

Ischemic heart disease mortality measured by YLL was higher in all Western European countries than in France and has decreased in France by almost 59% and 65% in Europe over the 30 years. During the same

period, among cardiovascular diseases, stroke was the second leading Level-3 cause of mortality in France as well as in Europe and decreased by almost 61% and 65% respectively (Fig. 1A and B).

Transport injuries

In France, transport injuries were the third leading Level-2 cause of mortality in 1990 and the eighth one in 2019, with an age-standardised YLL rate which has decreased from 1046 (1020–1073) in 1990 to 328 (303–348) in 2019 (Supplementary Fig. S2-A). Among them, road injuries were the second leading Level-3 cause of mortality of YLL in 1990 (1018 (992–1044)) and the sixth cause in 2019 (298 (273–318)) (Fig. 2A).

In Western Europe, between 1990 and 2019, transport injuries switched from the third (871 (860–881)) to the eleventh rank (266 (263–287)) (Supplementary Fig. S2-B). Road injuries was the fourth leading Level-3 cause of mortality in 1990 (837 (826–849)) and the tenth one in 2019 (240 (231–249)) (Fig. 1B).

Regarding mortality, the largest decrease (i.e., almost 71%) was observed for road injuries in France as well as in Western Europe (but remained higher in France) (Fig. 1A and B).

Alcohol-related disorders

In France, cirrhosis occupied the sixth Level-3 cause of mortality in 1990, with an age-standardised YLL rate of 526 (509–543) and the ninth in 2019, with an age-standardised YLL rate of 248 (230–268) (Fig. 1A). Moreover, it should be noticed that liver cancer was in France in 2019 the sixth cancer totalising a rate of 131 (115–149) YLL per 100,000 people, and almost 35% of this mortality rate was due to alcohol use (46 (32–61)).

In Western Europe, cirrhosis occupied the eighth Level-3 cause of mortality in 1990 with an YLL age-standardised rate 460 (448–468). This rate decrease of 44.6% (–46.9 to –41.4) between 1990 and 2019. In Western Europe, YLL rate for liver cancer was 97 (92–103) and 36% of this rate was due to alcohol use (35 (28–42)).

Morbidity

All-causes age-standardised YLD rate per 100,000 people

In France, the all-causes age-standardised YLD rate per 100,000 population remained stable from 10,711 (7893–13,870) in 1990 to 10,499 (7720–13,653) in 2019 (Fig. 2, Supplementary Fig. S3). As well as for Western Europe YLD rate which was 10,917 (8087–14,144) in 1990 and 10,835 (7984–14,083) in 2019. All-causes morbidity rate per 100,000 in France has decreased by almost 2% in last 30 years and by 1% in Western Europe.

Cause-specific YLD

Mental disorders. In France, in 1990 as well as in 2019, mental disorders were the first leading Level-2 cause of morbidity. We observed a decrease with an absolute value which was 2160 (1586–2845) in 1990 and 2044 (1487–2716) age-standardised YLD rate per 100,000 population in 2019. Among mental disorders, depressive disorders were the first cause of morbidity, and anxiety disorders, the second one. Depressive disorders were the second Level-3 cause in 1990 with an age-standardised YLD rate of 799 (566–1082) and the third one in 2019, with a rate of 674 (461–935) (Fig. 2A).

In Western Europe, during the same period, mental disorders occupied the second position of Level-2 causes in 1990 with an age-standardised YLD rate of 2009 (1478–2656) and a rate of 2001 (1465–2655) in 2019 (Supplementary Fig. S2-B). In Europe, depressive disorders occupied the third place of Level-3 causes in 1990 (702 (492–951)) as well as in 2019 (677 (475–930)) (Fig. 2B).

Depressive disorders morbidity measured by YLD has decreased in France by 15.7% (–24.3 to –6.8) and in Europe by 3.6% (–6.6 to 0.4) between 1990 and 2019.

Musculoskeletal disorders. In France, in 1990 and 2019, musculoskeletal disorders were the second leading Level-2 cause of morbidity with a rate of 1945 (1386–2588) in 1990 and of 2044 (1487–2716) age-standardised YLD rate per 100,000 population in 2019. Among them, low back pain was the first leading Level-3 cause of morbidity, with an age-standardised YLD rate of 1082 (762–1460) in 1990, and 1086 (755–1464) in 2019 (Fig. 2A).

In Europe, musculoskeletal disorders were the first Level-2 cause of morbidity in 1990 (2111 (1513–2807)) as in 2019 (2103 (1506–2788)) (Supplementary Fig. S3-B). Low back pain was the leading Level-3 cause of morbidity with an age-standardised YLD rate of 1134 (798–1521) in 1990 and 1063 (746–1442) YLD in 2019 (Fig. 2B).

Low back pain in France has increased by 0.3% (–4 to 5) between 1990 and 2019, whereas it decreased in Europe by 6.3% (–8.2 to –4.4) during the same period.

Morbi-mortality

All-causes age-standardised DALY rate per 100,000 people

In France, total number of DALY per 100,000 population decreased from 25,192 (22,374–28,351) in 1990 to 18,782 (16,408–21,920) in 2019 (Fig. 3). In Western European countries this age-standardised DALY rate also decreased from 26,010 (23,180–29,215) in 1990 to 19,285 (16,408–22,526) in 2019.

All-causes age-standardised DALY rate per 100.000 population decreased by 26% (–29 to –23) in France and by 25% (–29 to –22) in Western European countries in 30 years. France's position among other European Western countries evolved from the 11th in 1990 to the ninth in 2019.

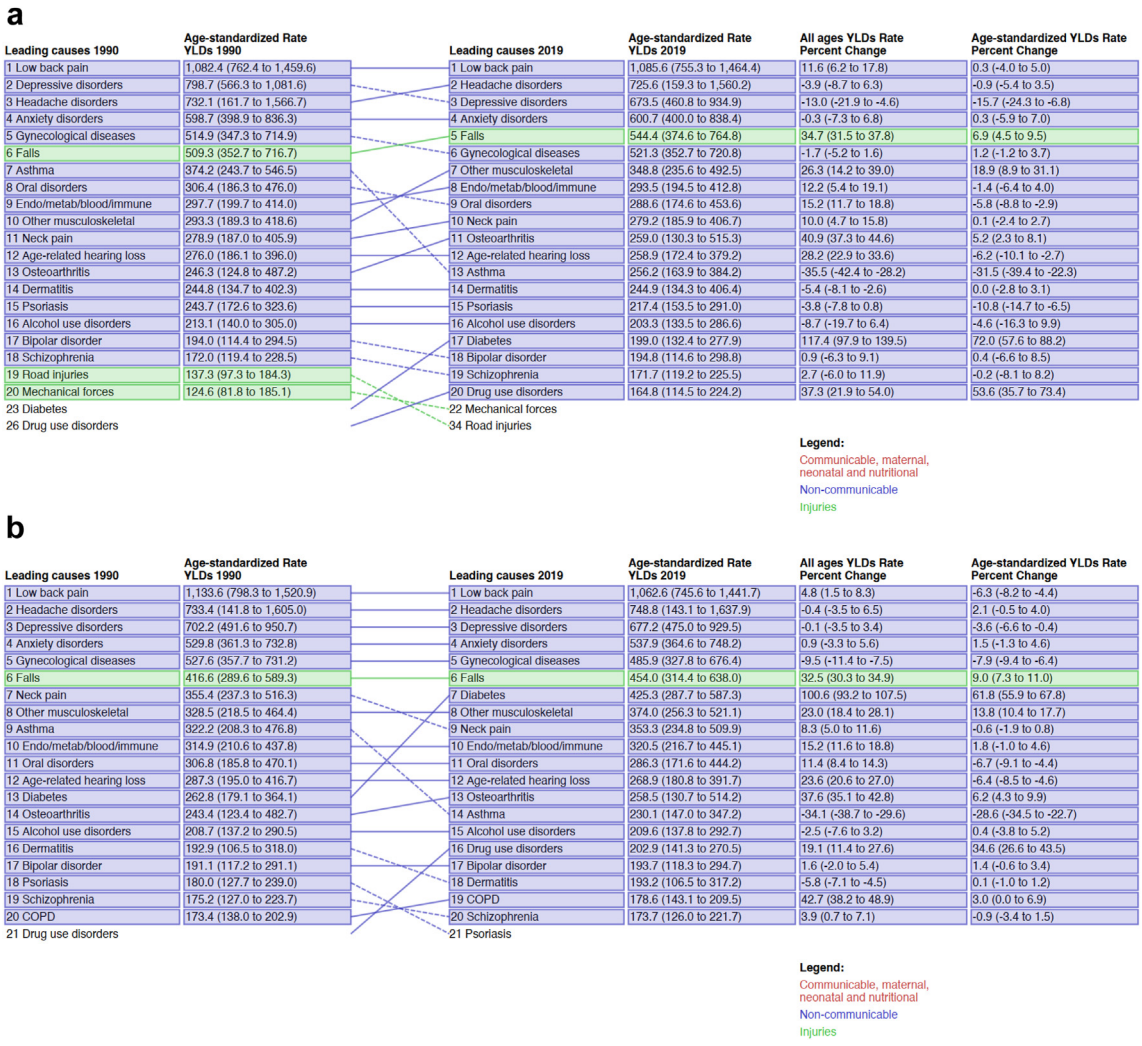

Fig. 2: A: 20 leading Level-3 causes of YLDs in France, with percent change, both sexes 1990–2019. B: 20 leading Level-3 causes of YLDs in Western Europe, with percent change, both sexes 1990–2019.

Cause-specific DALYs

Neoplasms. The main leading Level-2 cause of DALYS in France in 1990 as well as in 2019 was neoplasms, with a DALY age-standardized per 100.000 population rate which has decreased from 4407 (4284–4492) in 1190 to 3311 (3153–3473) in 2019 (Fig. 3A). Among neoplasms, lung cancer was the first leading cause of morbi-mortality and colorectal cancer the second one. Lung cancer was the sixth leading Level-3 cause of DALYs in 2019 with an age-standardized rate of 831 (808–854) and the second one in 2019 with a rate of 781 (731–829) (Fig. 3A).

In Western Europe, during the same period, neoplasms switched from the second place in 1990 (4146 (4046–4218)) to the first one in 2019 (3144 (3005–3250)). In Europe, lung cancer was the fifth leading cause of morbi-mortality in 1990 with 851 (836–862) age-standardised DALY per 100.000 population and in 2019 with 654 (628–676) (Fig. 3B).

Lung cancer morbi-mortality measured by DALY has decreased in France by 6% (–11.7 to –0.2) and in Europe by 23% (–25.7 to –20.8) over the 30 years. Among neoplasms, colorectal cancer was the second leading cause in 1990 and 2019 in France and in Europe and decreased by 31.0 and 24.0% respectively.

Musculoskeletal disorders. In France, in 2019, musculoskeletal disorders were the second leading Level-2 cause of DALYs which was of 1976 (1416–2618) in 1990 and of 2055 (1474–2732) age-standardised DALYs rate per 100.000 population in 2019. Among them, low back pain was the first leading Level-2 cause of

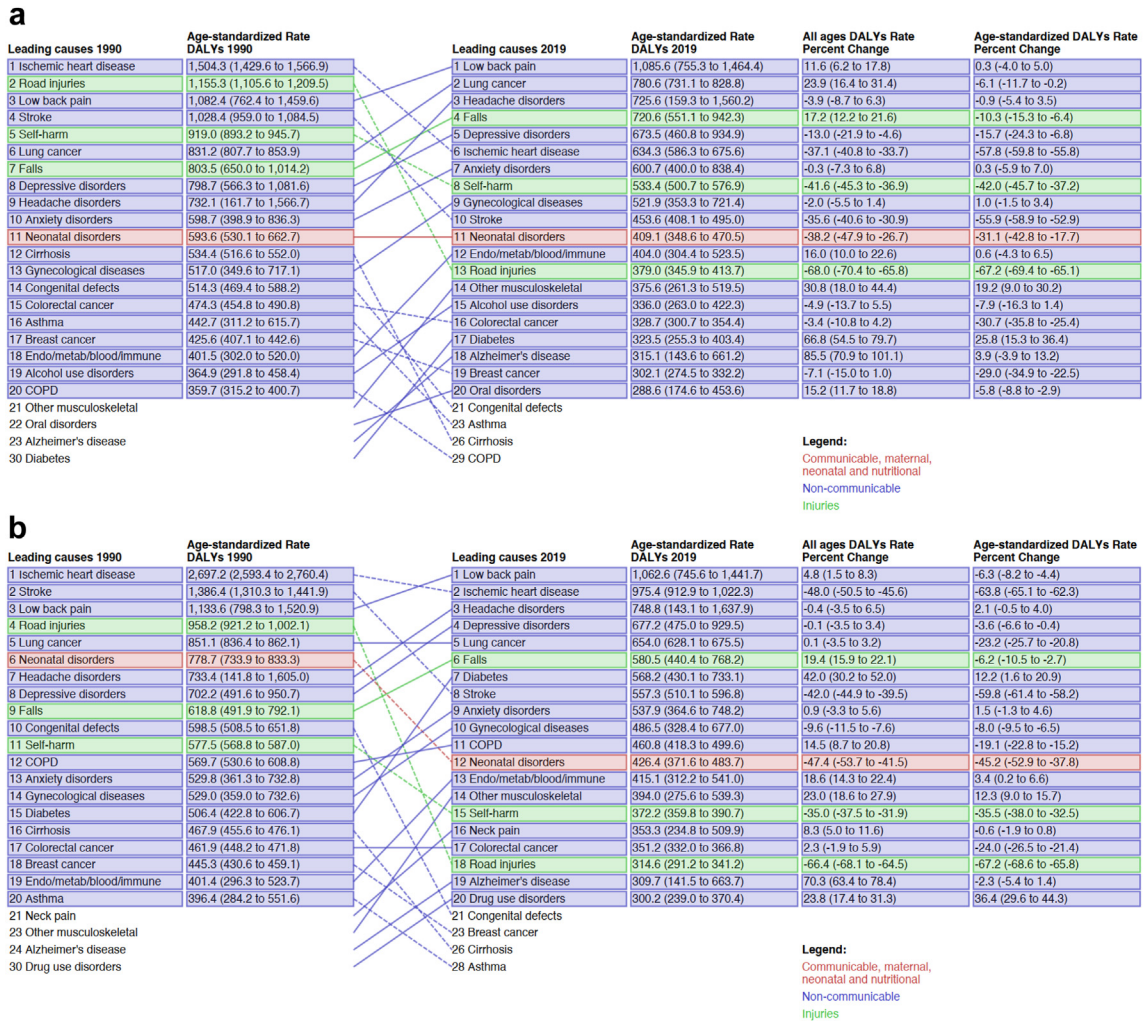

Fig. 3: A: 20 leading Level-3 causes of DALYs in France, with percent change, both sexes 1990–2019. B: 20 leading Level-3 causes of DALYs in Western Europe, with percent change, both sexes 1990–2019.

morbi-mortality, with an age-standardised DALY rate of 1082 (762–1460) in 1990 and 1086 (755–1464) in 2019 (Supplementary Fig. S4-A).

In Europe, musculoskeletal disorders were the third Level-2 cause of morbidity in 2019 (2130 (1534–2815)) as well as in 1990 (2146 (1549–2843)). Low back pain was the third Level-3 cause of morbidity with a DALY with the same values as YLD (Fig. 3).

DALY due to low back pain in France have remained stable around 0.3% (–4 to 5) between 1990 and 2019, whereas they decreased in Europe by 6.3% (–8.2 to –4.4) during the same period.

Other cause-specific DALYs. Rates of DALY decreased since 1990 due notably to the decrease of some causes in France as well as in Western European countries: cardio-vascular diseases (stroke and IHD), neonatal disorders, road injuries and self-harm. Indeed, in France, for example, age-standardised rate of DALY due to ischemic heart disease has fallen from 1504 (1430–1567) in 1990 to 634 (586–676) in 2019 (Fig. 3A). The same decrease, with higher absolute value yet, has been observed for all European countries falling from an age-standardised rate of 2697 (2593–2760) DALY per 100.000 population in 1990 to 975 (913–1022) (Fig. 3B). Concerning DALY, France differs from Europe by having lower rates for cardio-vascular diseases. In 2019, age-standardised rate of DALY due to stroke was of 454 (408–495) in France, versus 557 (510–597) in Europe. In the contrary, in 2019, self-harm (533 (501–577) versus 372 (360–391) and tracheal, bronchus and lung cancer (781 (732–829) versus 654 (628–676) were at higher levels in France than in Europe (Fig. 3B).

Discussion

This study presents an overview of health state of France and compared it with other western European countries between 1990 and 2019. Since 1990, there has been an overall improvement in health leading to a decrease of all-causes age-standardized YLL, YLD and DALY rates and to an increase in life expectancy and HALE in France, as well as in other Western European countries. France and countries from Western Europe share the same epidemiological profile; i.e., a very low contribution of infectious diseases as compared to non-transmissible diseases to the overall burden of disease.[1] This global improvement could be partly explained by medical advances and also by some major health policies, which occurred during the period such as placing children on their back to sleep, major driving safety campaigns, major cancer screening campaigns or quit smoking campaigns.[25] However, part of morbi-mortality due to infectious diseases could rise in the years to come with the proliferation of multi-resistant bacteria.

This analysis also showed that France has among the best general health indicators in Europe. Indeed, when focusing on all-causes indicators for DALYs, YLLs and YLDs, we observed everywhere a trend towards better results than other European mean regarding the same indicators. For example, France has the fourth position among other Western European countries regarding its HALE. These results could be explained by the fact that French health economic model is based on universalism, and offers one of the best financial access to health care with universal medical coverage, with limited out-of-pocket payments.[2,3]

We also observed through GBD data a less important burden due to cardiovascular diseases (stroke and ischemic heart diseases) in France as compared to other Western Europe countries. This result previously observed[26] could be explained by a lower prevalence of many cardiovascular (hypertension, diabetes) and lifestyle risk factors (exercise, diet) in France than in Western Europe, as well as a good access to care. For example, the prevalence of type 2 diabetes mellitus in France and in Western Europe are 2.7% [2.4–3.1] versus 5.9% [5.3–6.5], which is, among others, a major risk factor of stroke of ischemic heart diseases. Projections of increased incidence and prevalence in the coming years as well as a very marked social gradient may qualify these good results.[27,28] We also observed for cardiovascular diseases in Western Europe, major improvement in acute management of myocardial infarction and stroke between 1990 and 2019, with the implementation of stroke units and cardiology intensive care units, patient-centred clinical pathways and development of new therapeutic strategies of revascularization.

Yet, France and Western Europe share some common issues regarding burden of disease.

Cancers are the highest cause of mortality (first Level-2 cause of age-standardised YLD and DALYs in 2019). To face challenges such as prevention, limitation of sequelae, improvement of the prognosis of aggressive cancers and limit health inequalities, a new National Cancer Plan 2021–30 was introduced by the French Government.[29] It follows four axes: strengthen cancer prevention, limit sequels and improve patient's quality of life, fight against poor prognosis cancers and ensure that progress benefits everyone.

Here again, France has a paradoxical situation: the CONCORD Programme showed that France had amongst the best age-standardised 5-year net survival for various cancers, but presents low performances regarding prevention (screening rates or tobacco or alcohol prevention).[30] For example, we observed a less marked reduction in lung cancer mortality in France than in the rest of Europe (6% versus 23%) during our study period, probably due to a higher prevalence of smokers in France. Indeed, despite recent progress regarding tobacco reducing policies (taxation and regulation), daily smokers prevalence in France remains high (31% in 2021), and characterised by social inequalities.[31,32] Vaping is used in France as a means of quitting smoking but has not modified substantially tobacco smoking prevalence.[33]

This highlights one major challenges to take up in France: tobacco consumption prevention. This constitutes a real necessity for the French health system which has been historically focused on curative rather than preventive health.[9,34,35] In this perspective, improve access to preventive care by diversifying remuneration methods to reduce the share of fee-for-service payments could also be an opportunity to follow.[36] Moreover, dietary risk factors (unbalanced diet, lack of physical activity and associated problems such as obesity, hypertension, etc.) are also major modifiable causes of death and among the main cancer and CVD risk factors (with tobacco and alcohol).[23] While some progresses have been made under the impulsion of the successive Nutrition and Health programs PNNS (1–4),[37] challenges remains to be addressed. For example, make the nutritional logo Nutri-Score (already official in France and 6 European countries) mandatory in Europe, as recommended by many scientists, learned societies and WHO-IARC.[38,39] Musculoskeletal disorders and particularly low back pain, which remained stable over the 30 years of study, are an important cause of morbidity.

The main form of low back pain is non-specific, which means that the pathoanatomical cause of the pain cannot be determined.[40,41] In GBD classification, low back pain does not have a further definition in level-4 causes specifying degenerative or non-degenerative lower back pain. In this perspective, it is difficult to make conclusive statements about the actual burden of certain clinical presentations (such as wider degenerative osteoarthritis), their risk factors and potential

subsequent policy implications. Nonetheless, other data show that France has one of the highest rates of hip replacement rates in the world (number 7 among OECD countries), meaning that accessibility to curative solutions for osteoarthritis in France is good, even compared with other Western European countries.[31]

Moreover, in high-income countries, low back pain is directly linked to socioeconomic status and other psycho-social factors (work or living places, social position...) as stated by the biopsychosocial model.[42,43] This highly prevalent disease worldwide raises many challenges regarding its prevention such as education or promotion of physical activity and treatment such as improving the appropriateness of treatment and development of coping strategies for patients.

Our study showed that mental health is a growing concern in Europe. It has been exacerbated recently by the COVID-19 crisis.[44] To address mental health issue, European governments have implemented measures. Among them, we can cite the European joint action aiming at improve implementation of best practices regarding mental health in Europe.[45] One of its main objective is to transfer and implement at European level national successful policies regarding mental health. To meet this challenge, WHO also created the Pan European Mental Health Coalition.[46]

This study is important as it reflects the state of health prior to the COVID-19 pandemic and these results might be important for policy-makers. It provides a global vision of French GBD indicators through a geographical and temporal comparison over 30 years. To our knowledge this is the first study using GBD indicators with a specific focus to France.

This study presents some limitations. First, this study present French health state as it was before COVID-19 crisis. Event though French situation described in this article may not perfectly reflect the 2023 situation, we can assume that COVID at least has not resolved all challenges highlighted in our discussion and that they are still up to date.

Then, we plan to perform the same study with GBD data after the syndemic of COVID-19 in a next paper in order to compare the impact of the COVID crisis on all these key indicators. This future study will then permits us to observe whether the public health issues highlighted in this paper will be altered, accentuated, or if new ones emerge.

Second, wt used estimates calculated by the GBD 2019 study, and hence shares the same inherent limitations with other GBD studies, first, the availability of primary data to produce GBD estimates.[1] In 2019, 2444 French data sources have been used to perform GBD estimates. Nature of data were similar to other Western European Countries, they were mainly data from scientific studies, vital registration, diseases registries and surveys. If results from scientific studies are population-specific and could suffer from external validity, French national surveys and diseases registries are more generalizable. Indeed, French national surveys are performed with national statistic organisation and French diseases registries are exhaustive for example to describe cancers incidence.

When non-available, data are generated through predictive models of various accuracy, and thus may be interpreted with cautiousness.[1] This could explain some large uncertainty intervals. This information bias is however taken into account and lead to substantial improvements year after year.[1] Nonetheless, GBD data allow to describe trends and compare health indicators over time. Second, GBD metric apply the same disability weights and severity distribution for all countries and regions. Third, GBD calculated the age-standardized rates based on a world standard population, which may not be representative for the age structure in the EU.[47] To address these limitations, France and other countries would need to improve the quality and performance of their health information systems, strengthening and integrating data available through disease registers, claims data, primary care data, hospital discharge data, and health surveys. Finally, GBD estimates represent the "mean" French health status and do not reflect disparities among people or territories, like health social inequalities, which are important determinants of modifying the burden of disease.

Some countries like United Kingdom, shared their data with IHME to produce GBD estimates at regional level. Moreover, COVID-19 crisis had considerably modified epidemiological landscape in France as well as in Europe. The inputs from IHME will be valuable to analyse COVID-19 impact on burden of disease and better prepare health care systems to face future crises.[48,49]

Overall, these results highlight a clear trend of improvement in the health status in France with certain differences between western European countries. The health policy makers need to devise interventional strategies to reduce the burden of diseases and injuries, with specific attention to causes such as cancers and cardiovascular diseases for mortality and mental health and musculoskeletal disorders for morbidity. A further dedicated study on risk factors will be needed to better explain the results presented in this paper. Finally, latest French data from INSEE show that life expectancy has declined slightly in 2020 and has stagnated since.[50] In this perspective, GBD data will be useful and a further article will be dedicated to assess what COVID-19 pandemic changed for French health compared to other European countries.

Contributors

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Data sharing statement

To download the data used in these analyses, please visit the Global Health Data Exchange GBD 2019 website. https://vizhub.healthdata.org/gbd-results/.

Declaration of interests

M Béjot reports payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from BMS, Pfizer, Medtronic, Amgen, NovoNordisk, and Servier and support for attending meetings and/or travel from Medtronic, all payments made to them, and an unpaid leadership or fiduciary role for the French Neurovascular Society, all outside the submitted work. M Pigeolet reports grants or contracts from Belgian Kids' Fund for Pediatric Research, outside the submitted work. M Raad is the founder and an employee of Smartbiotic and reports consulting fees from Fondation Mérieux, all outside the submitted work. D-J Zeitoun reports consulting fees from Boehringer Ingelheim and IQVIA and stock or stock options from Allurion, all outside the submitted work.

Acknowledgements

The authors would like to thank the GBD publications team as well as health professionals and researchers producing data. We thank IHME, Seattle USA and the Bill and Melinda Gates Foundation which supports this project. We would like to thank Margaux Duboeuf and Océane Phanatzis for their help in this work. The content is solely the responsibility of the authors and does not necessarily represent the official views of the funders.

Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.lanepe.2024.100848.

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