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28 Janvier 2021

Longévités extrêmes

Jean-Marie Robine

INSERM - EPHE - INED



SPECIAL ARTICLE

AGING, NATURAL DEATH, AND THE COMPRESSION OF MORBIDITY

JAMES F. FRIES, M.D.

Abstract The average length of life has risen from 47 to 73 years in this century, but the maximum life span has not increased. Therefore, survival curves have assumed an ever more rectangular form. Eighty per cent of the years of life lost to nontraumatic, premature death have been eliminated, and most deaths are now due to the chronic diseases of years. Present data allow calculation of the life span, approximately 85 years. Chron may presumably be postponed by changes in

and it has been shown that the physiologic and psychologic markers of aging may be modified. Thus, the average age at first infirmity can be raised, thereby making the morbidity curve more rectangular. Extension of adult vigor far into a fixed life span com-

THIS article discusses a set of predictions that contradict the conventional anticipation of ever older, ever more feeble, and ever more dependent care-for-populace. These predictions suggest that the number of very old persons will not increase, that the average period of diminished physical function will decrease, that chronic disease will occupy a smaller proportion of the typical life span, and that the need for medical care in later life will decrease.

In forecasting health, the interaction between these two sets of observations has gone unnoticed. The first set demonstrates that the length of the human life span — that man is mortal and that natural death occurs without disease. The second set indicates that chronic disease can be postponed and that the "markers" of aging may be modified. If these premises are granted, it follows that the time between birth and first permanent infirmity must increase and that the average period of infirmity must decrease.

THE LENGTH OF LIFE IS FIXED

Speculation about immortality is rooted in human hope. The bioscientific model of disease, our prevalent model, assumes that death is always the result of a disease process. If there were no disease, there would be no death. This is hard to defend.

If relative immortality were possible, one would expect to find some persons who anticipated it and acted accordingly. Thus, a person who is favored and fortunate enough to avoid disease will live much longer than actuarially predicted. To confirm the existence of such events, for adequate data on the number of centenarians has been available in England since 1837; over 1

NUMBER OF PERSONS

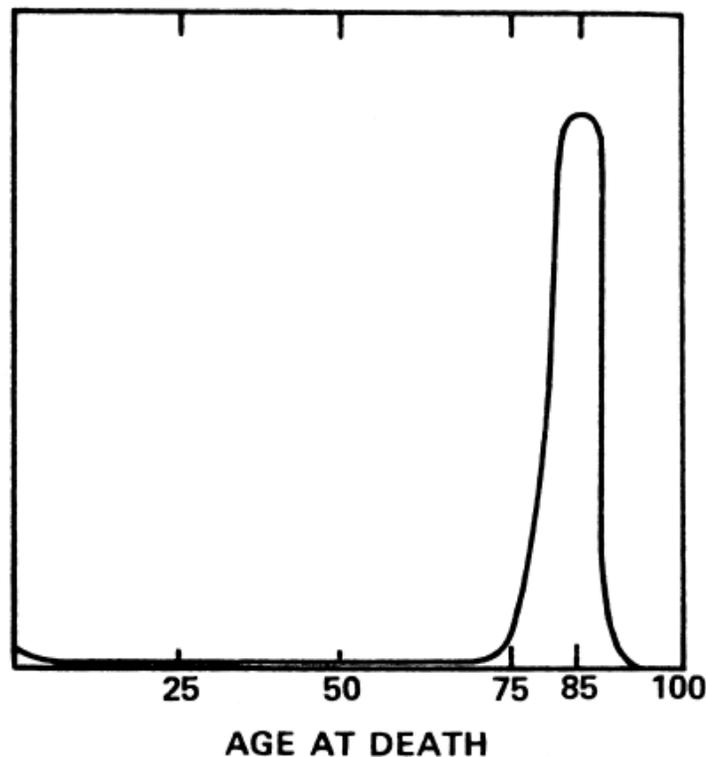


Figure 5. Mortality According to Age, in the Absence of Premature Death.

The morbidity curve is made rectangular, and the period of morbidity compressed between the point of the end of adult vigor and the point of natural death.

Human Aging: Usual and Successful

JOHN W. ROWE AND ROBERT L. KAHN

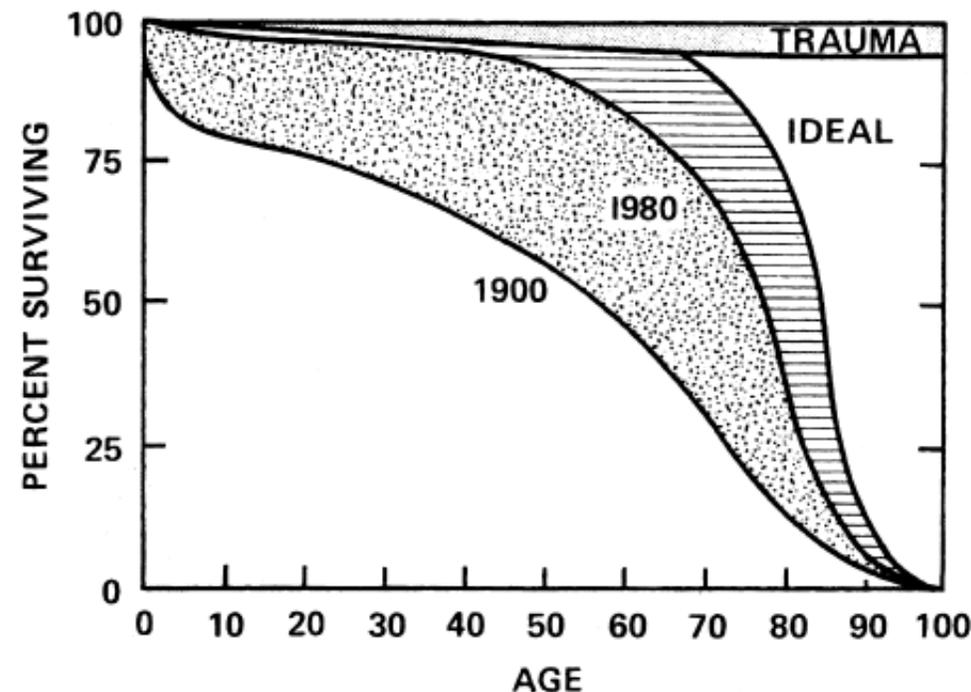


Figure 2. The Increasingly Rectangular Survival Curve.

About 80 per cent (stippled area) of the difference between the 1900 curve and the ideal curve (stippled area plus hatched area) had been eliminated by 1980. Trauma is now the dominant cause of death in early life.

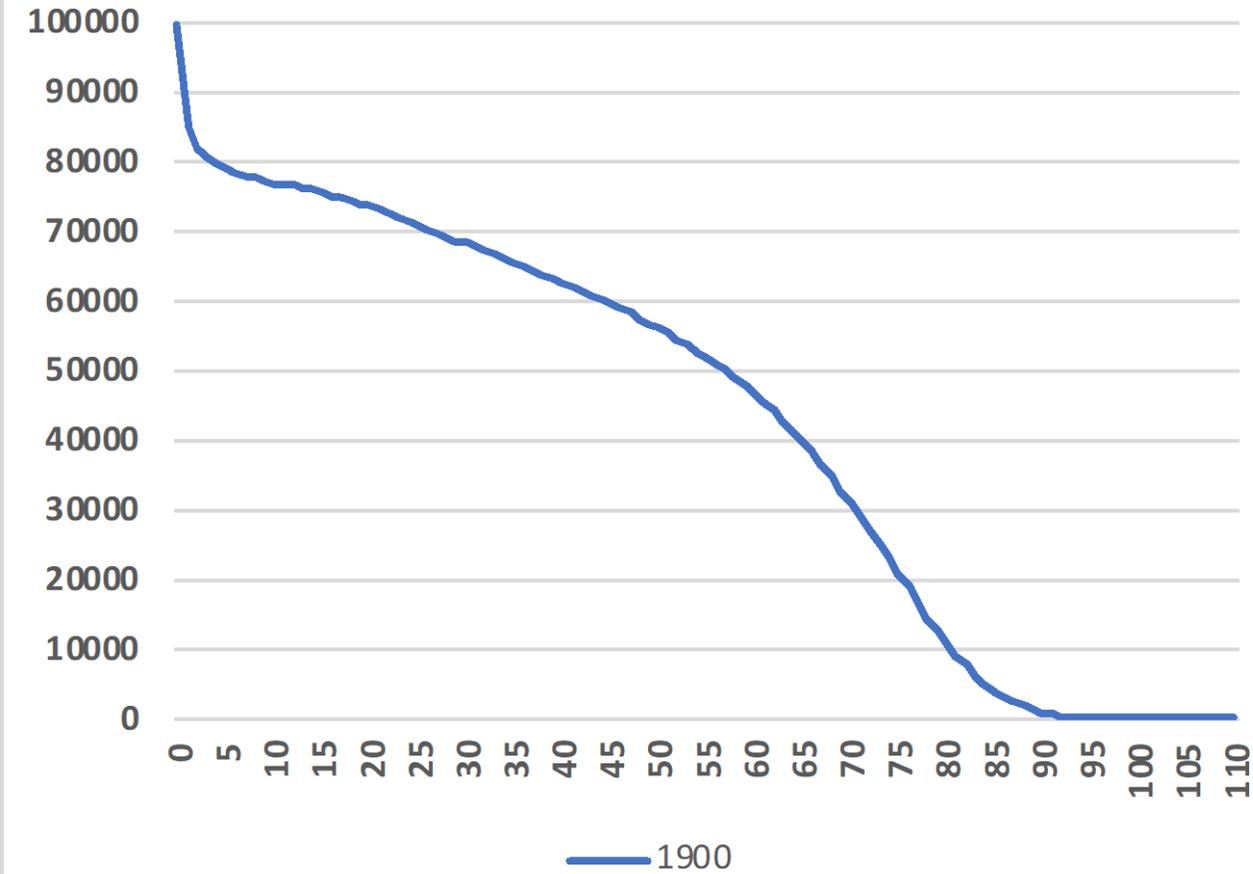
From the Department of Medicine (S102B), Stanford Univ. Center, Stanford, CA 94305, where reprint requests should be directed to Dr. Fries.

This work was performed while the author was a Kaiser I Center for Advanced Study in the Behavioral Sciences, and was part of the 2d Annual Nova Behavioral Conference on Aging, 1979, Ft. Lauderdale, Fla., January 25, 1980.

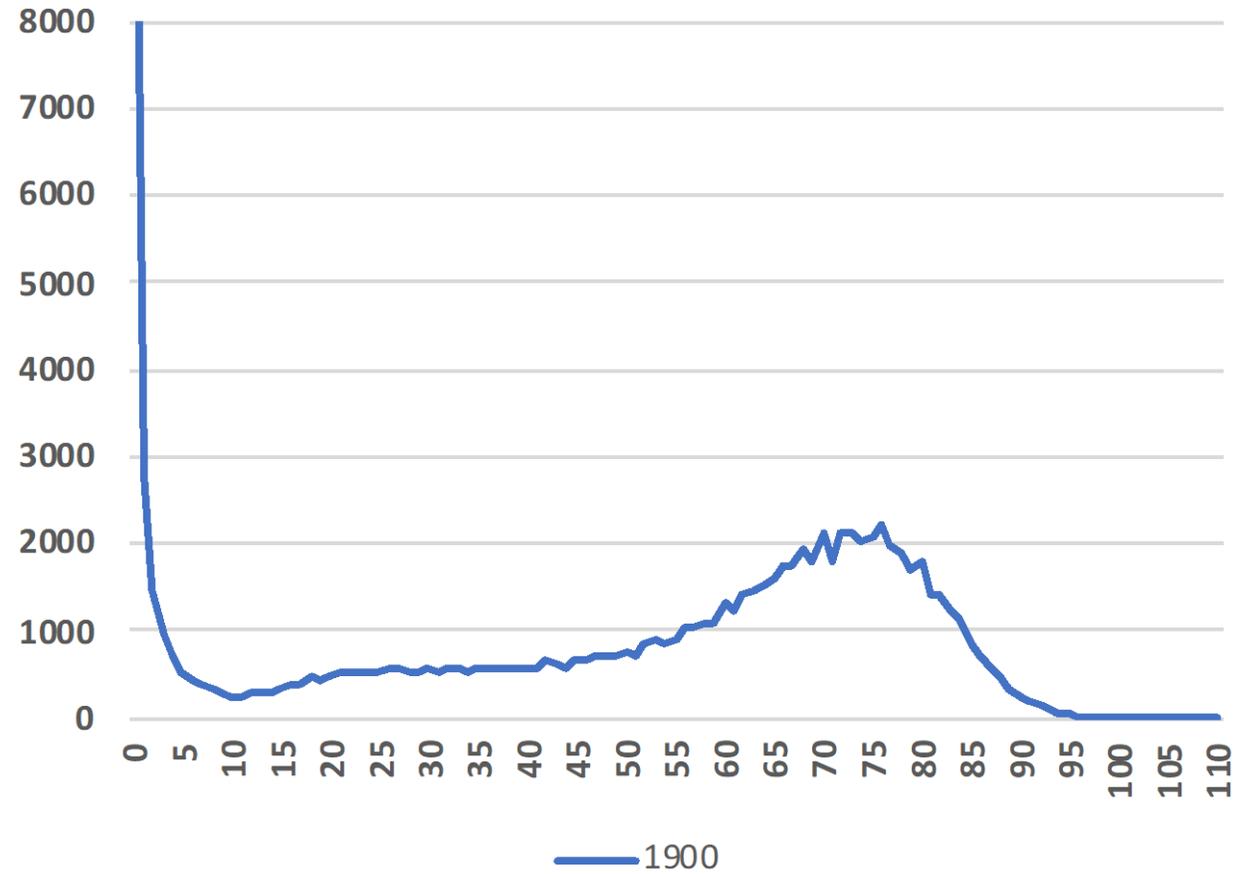
La révolution de la longévité des adultes

1900

Survival curves



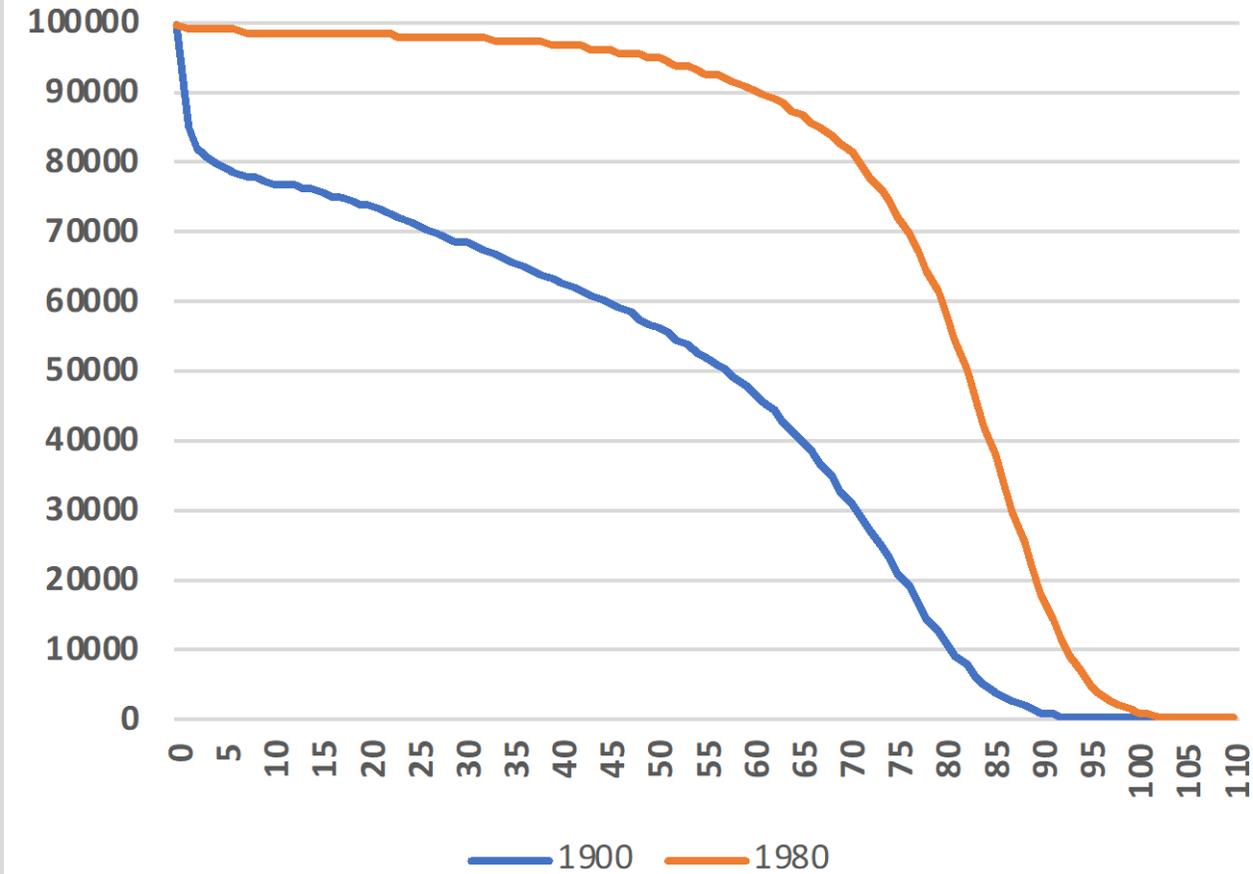
Individual life spans



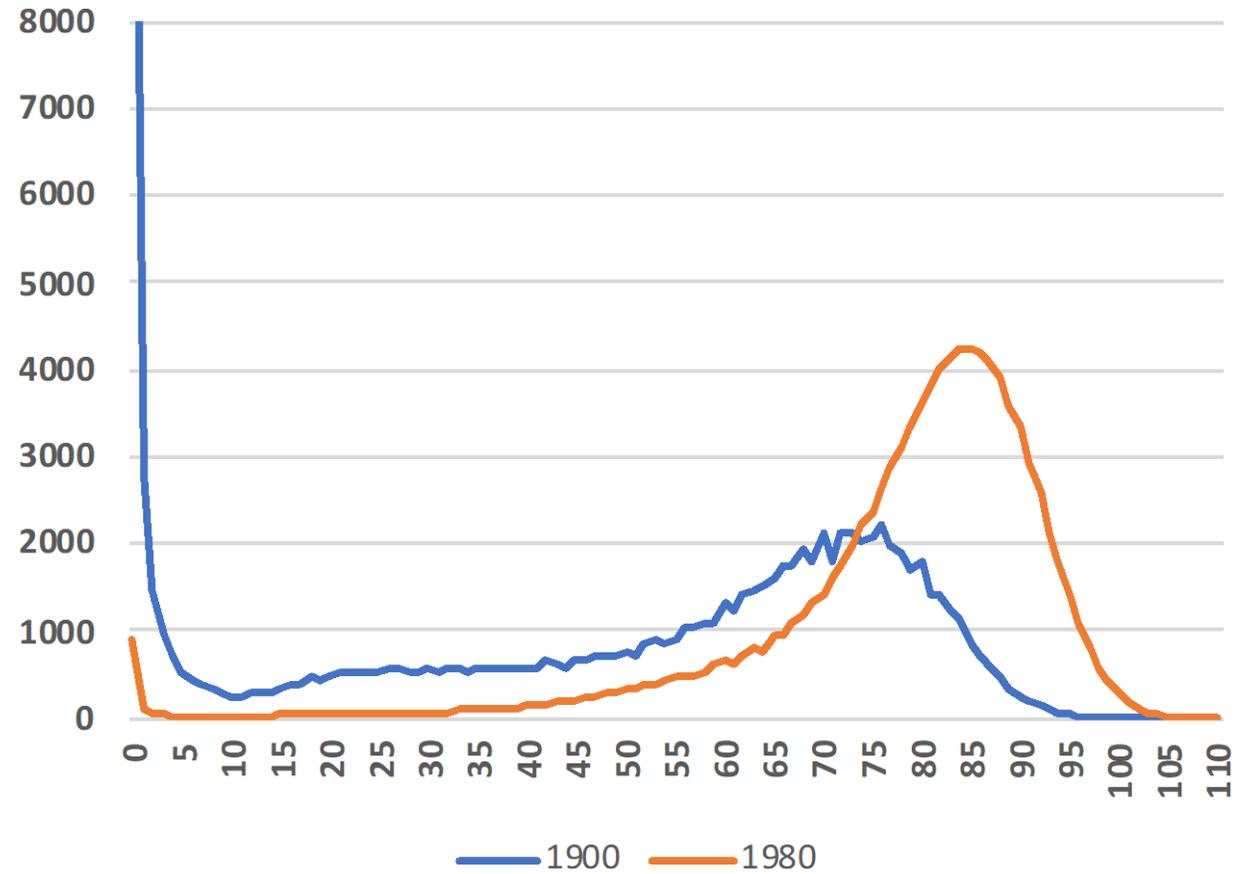
French women

1900 - 1980

Survival curves



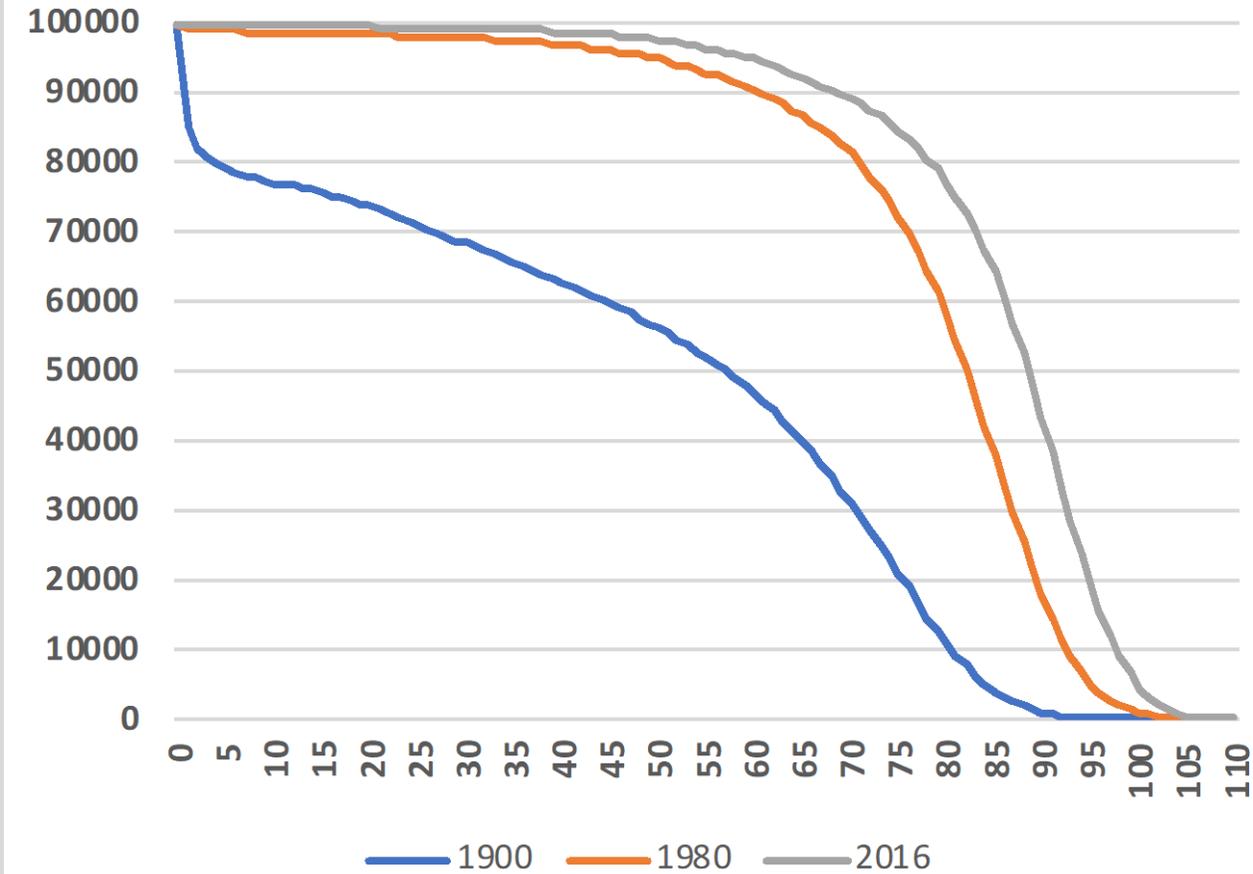
Individual life spans



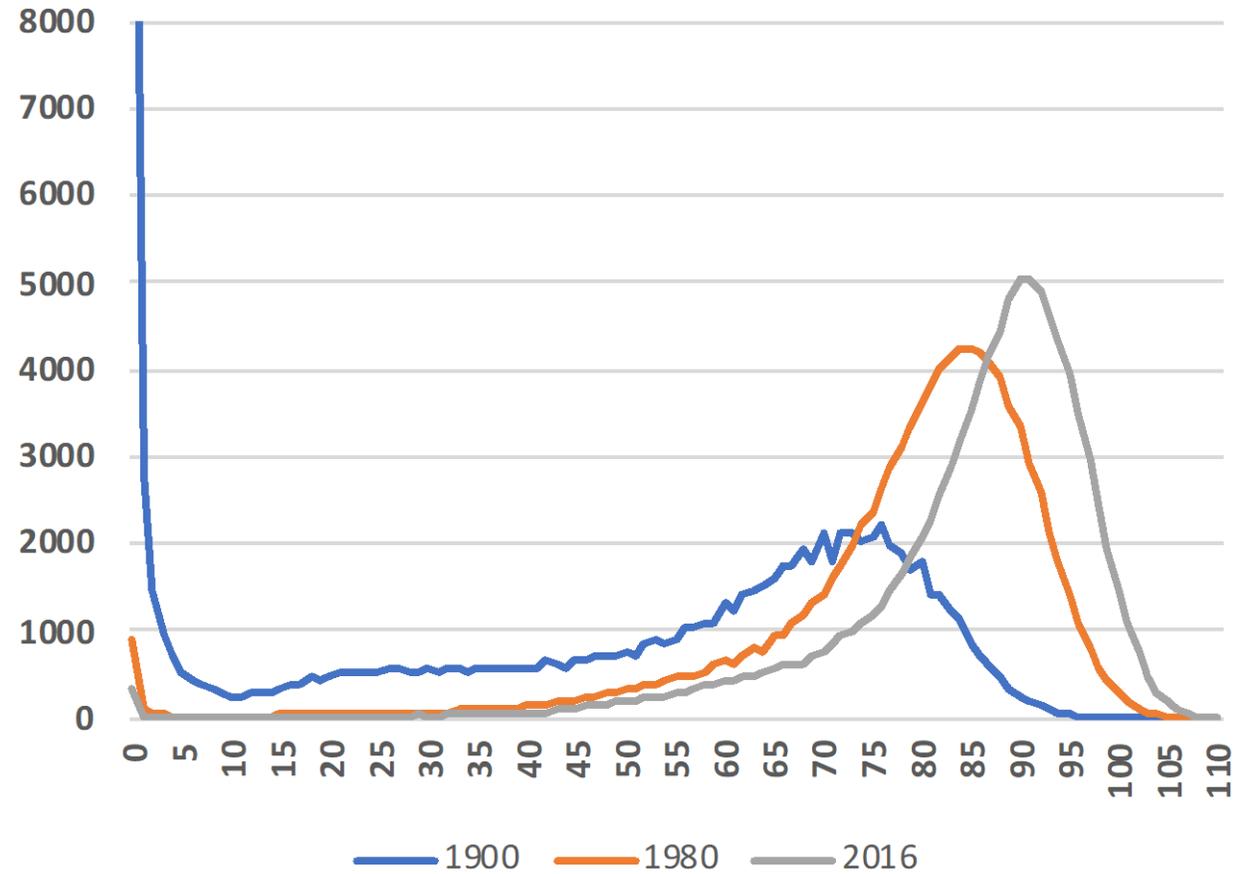
French women

1900 - 1980 - 2016

Survival curves

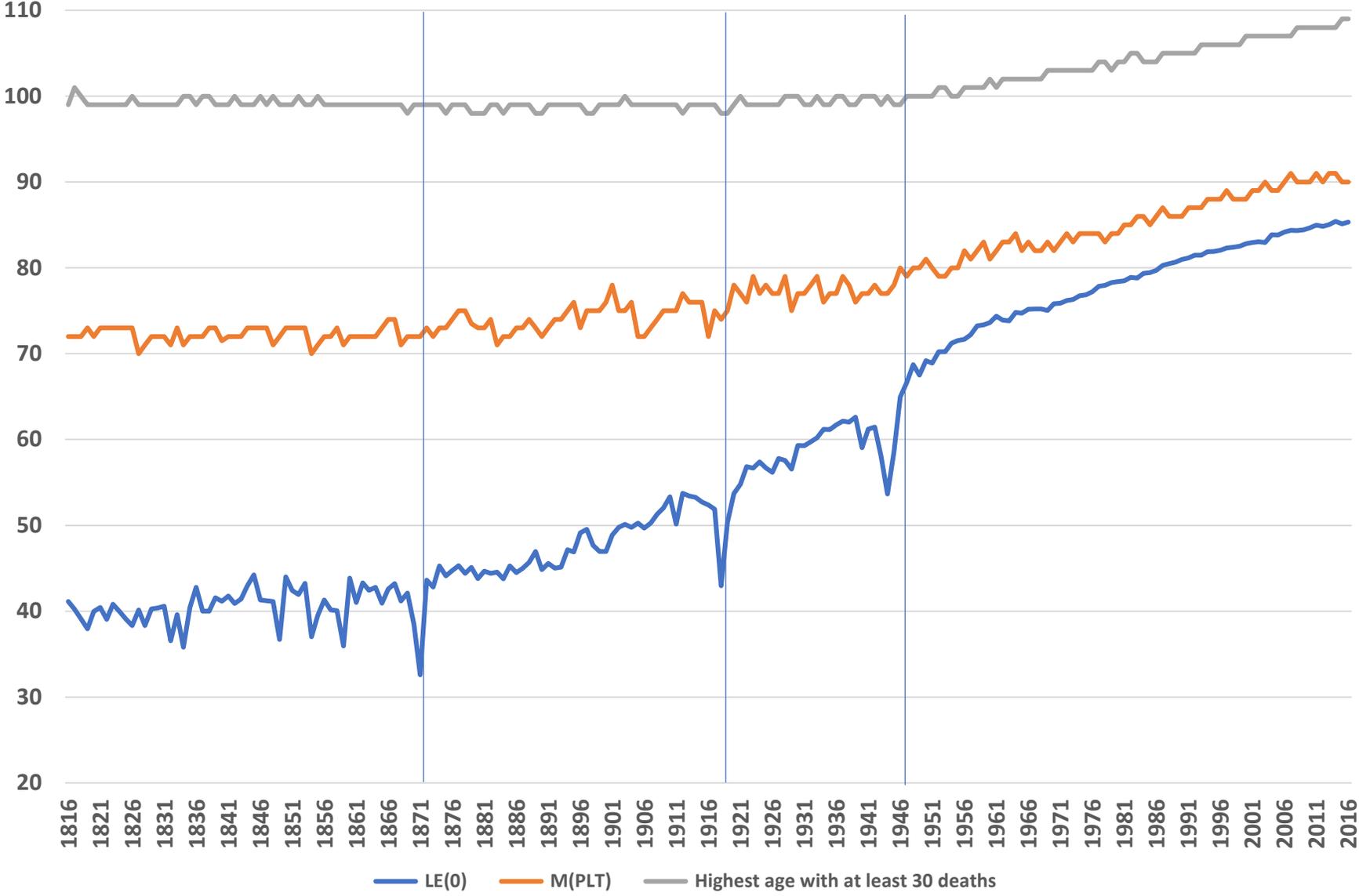


Individual life spans

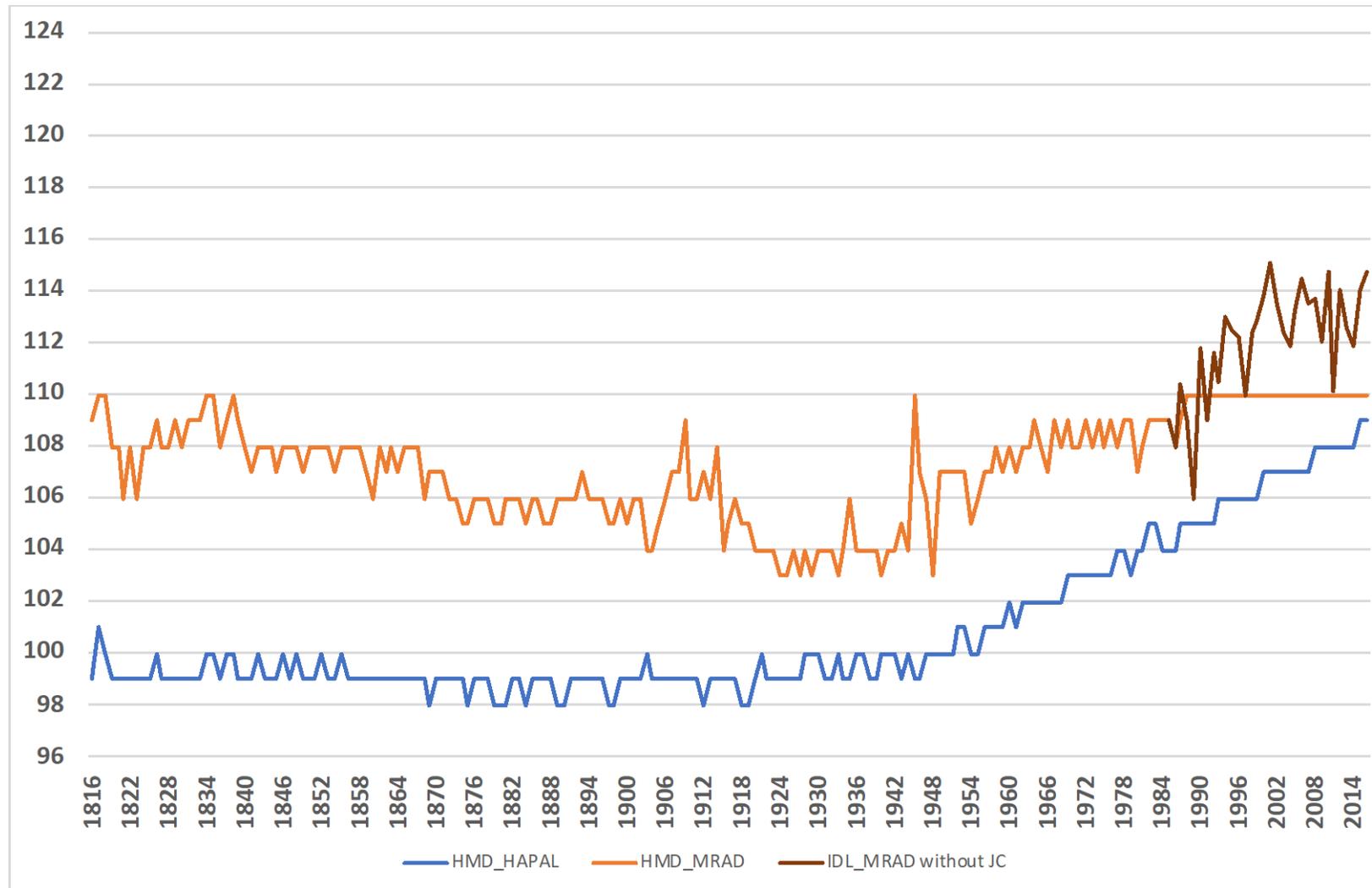


French women

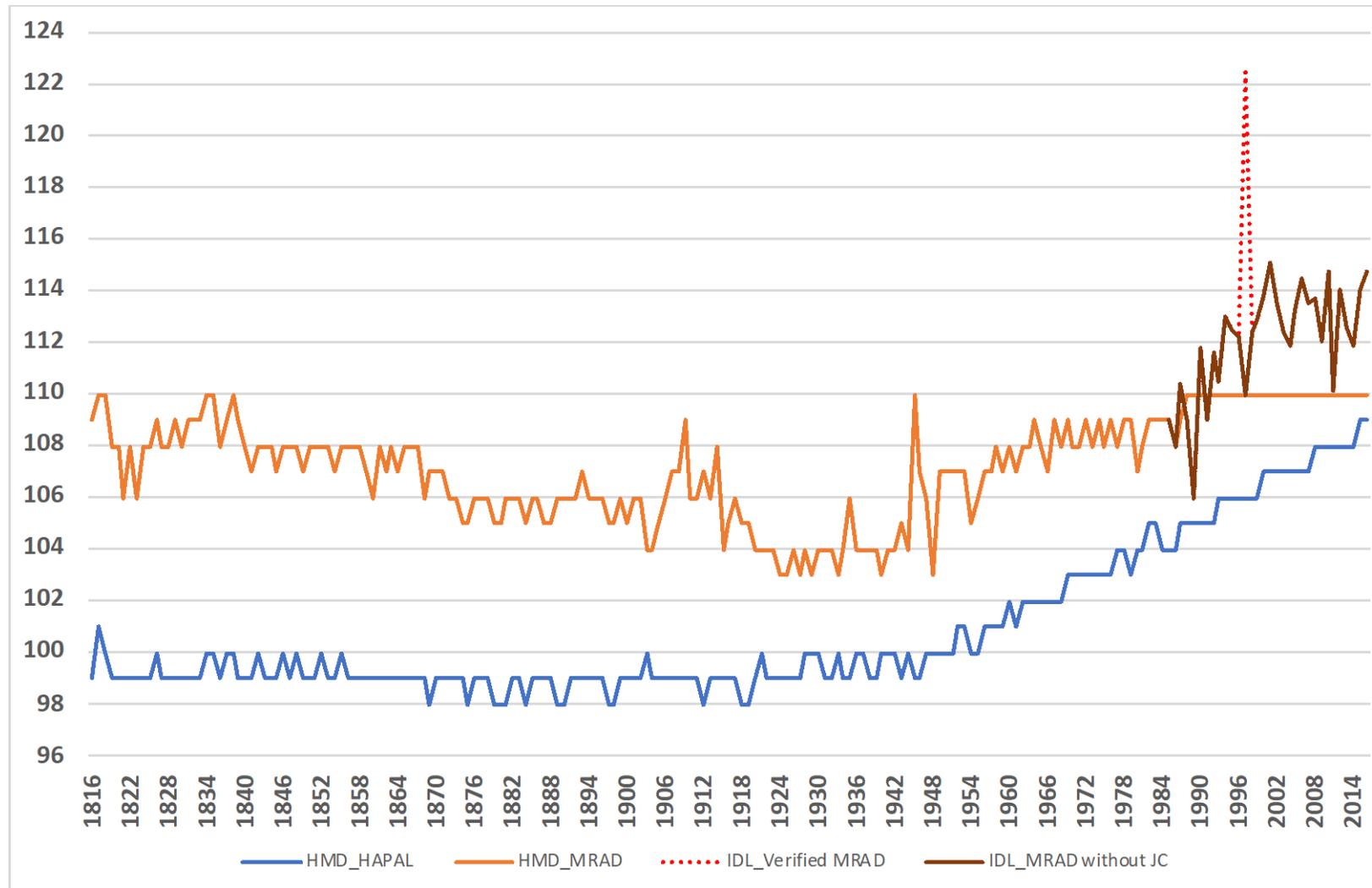
Espérance de vie à la naissance, âge le plus fréquent au décès et âge le plus élevé ou meurent au moins 30 personnes



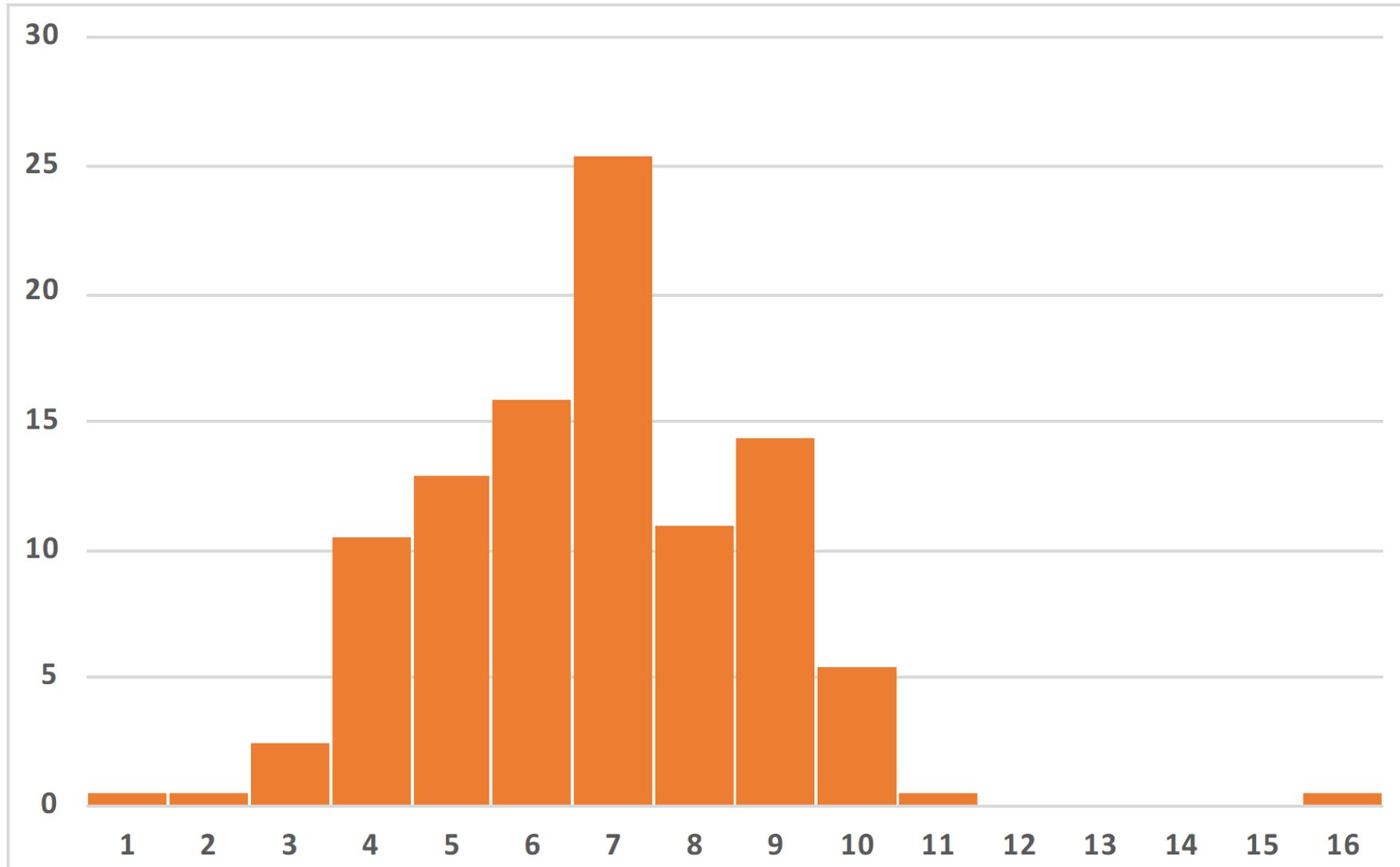
*Individual observations and statistical indicator of Maximum Life Span (MLS):
Maximum Reported Age at Death (MRAD) and Highest Age Providing at Least 30
deaths (HAPaL_30)*



*Individual observations and statistical indicator of Maximum Life Span (MLS):
Maximum Reported Age at Death (MRAD) and Highest Age Providing at Least 30
deaths (HAPaL_30)*

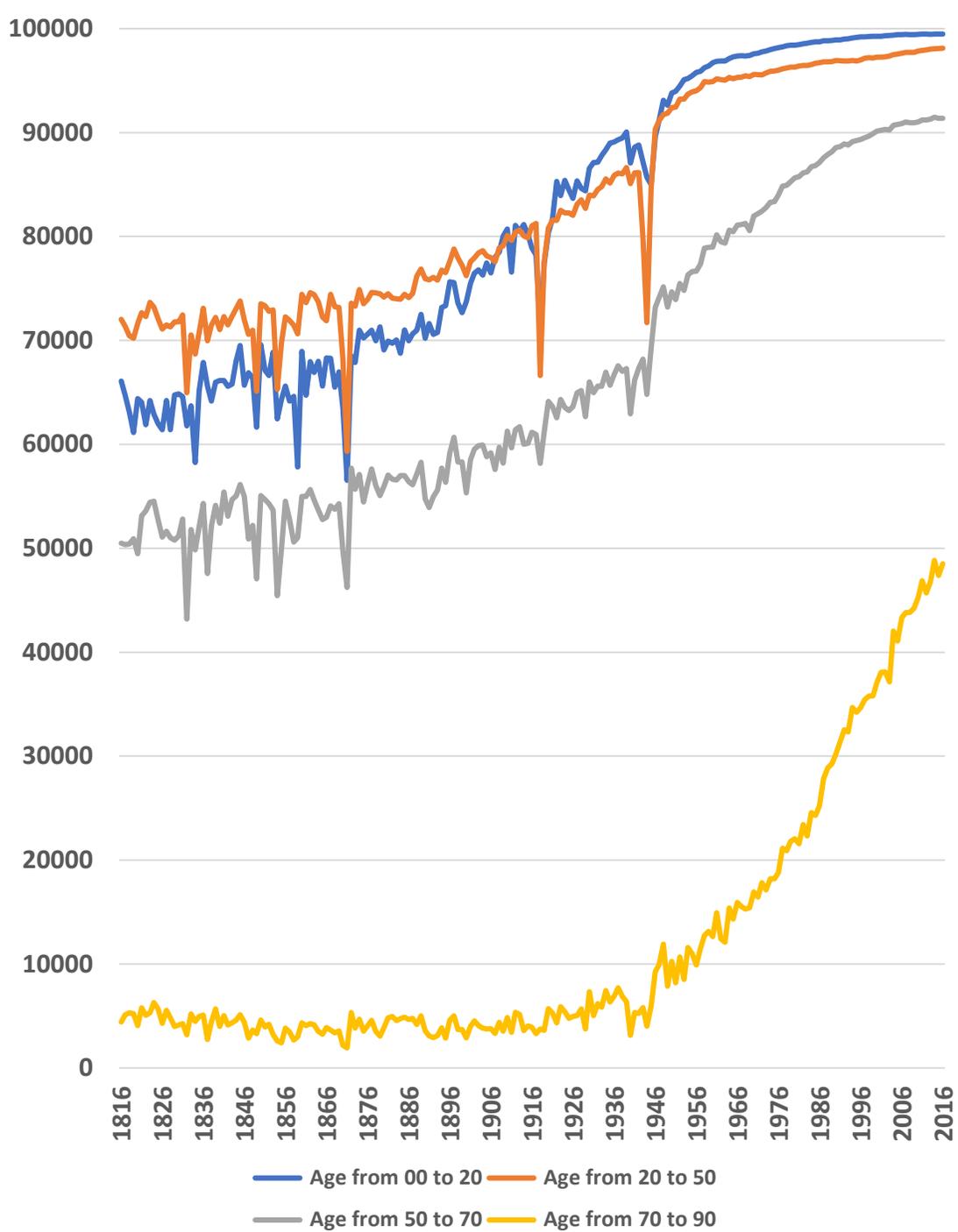


Distribution de l'écart entre MRAD et HAPaL30, France, sexe féminin, 1816 à 2016

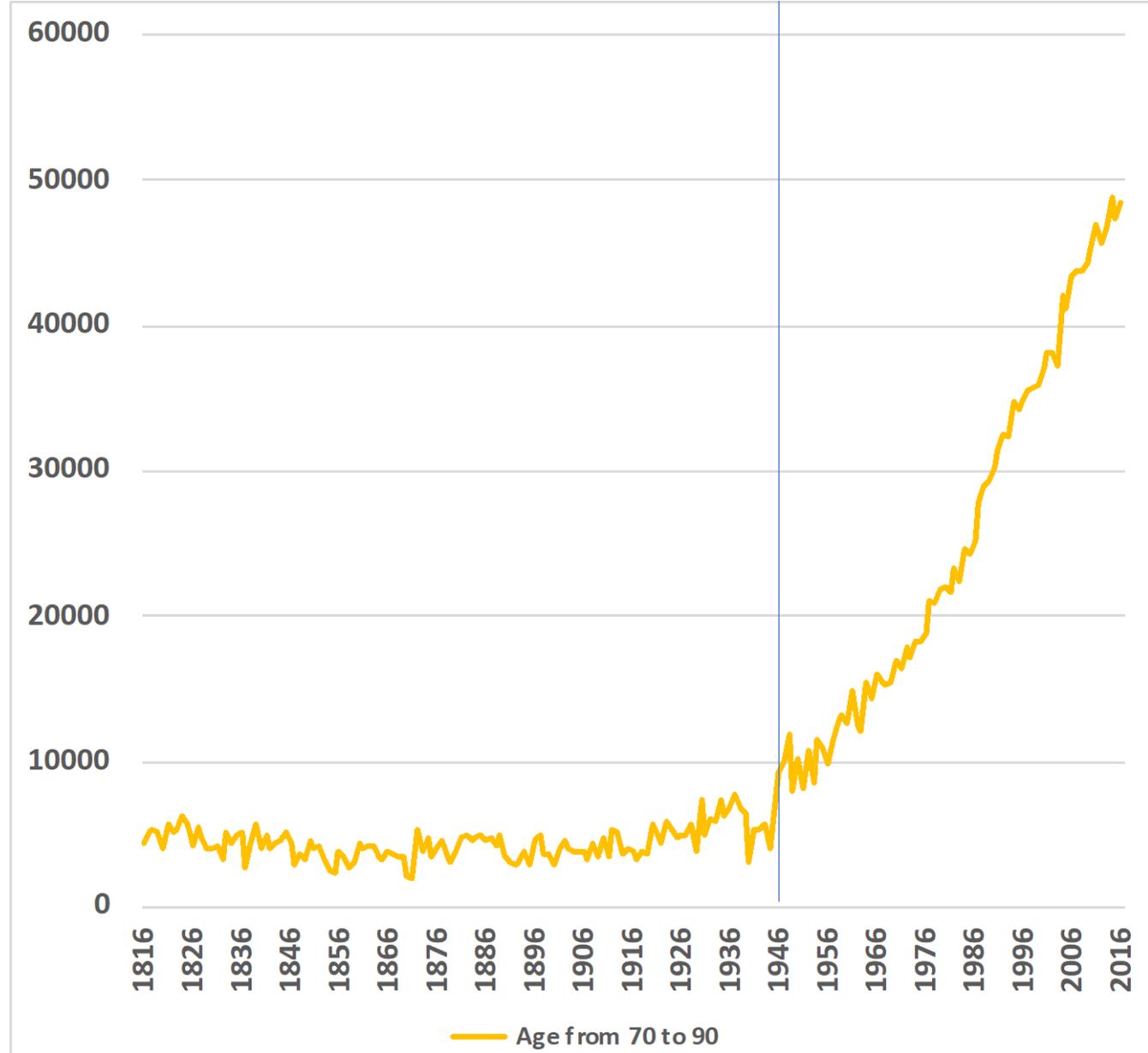


Survivre de plus en plus
et de plus en plus longtemps

Probabilité d'atteindre 20, 50, 70 et 90 ans



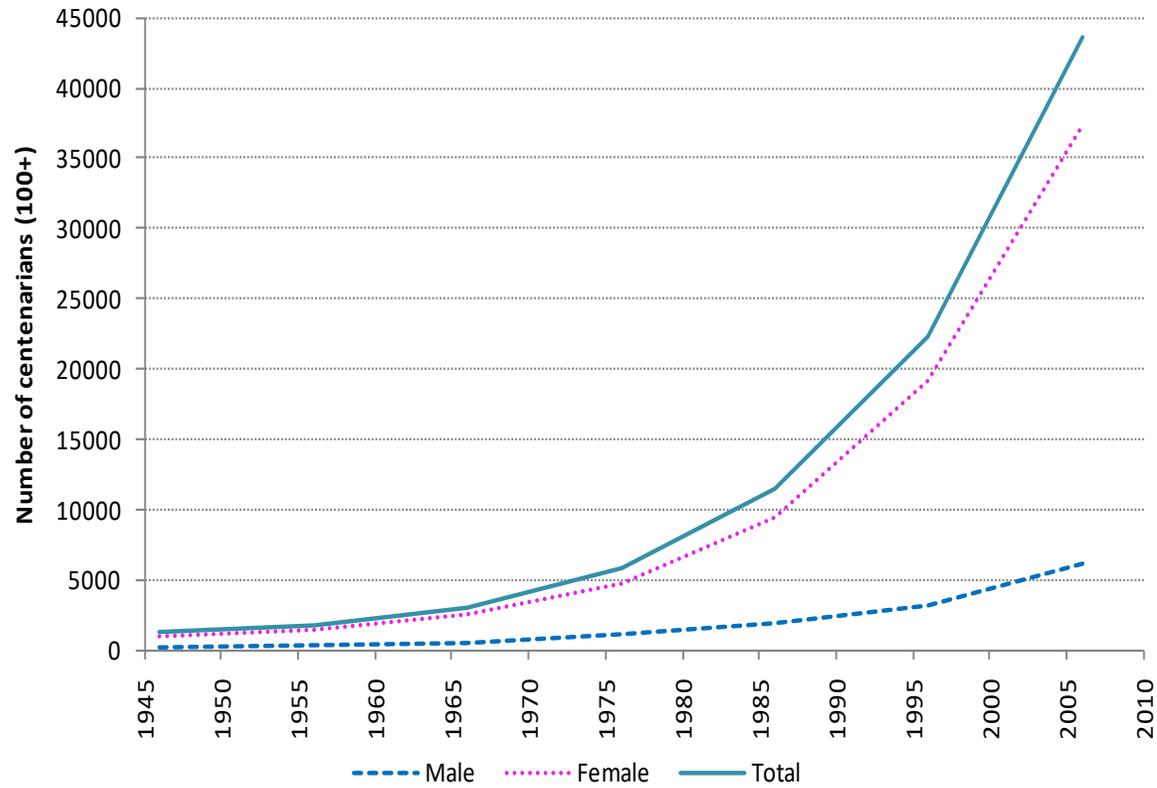
L'augmentation de la survie des personnes âgées



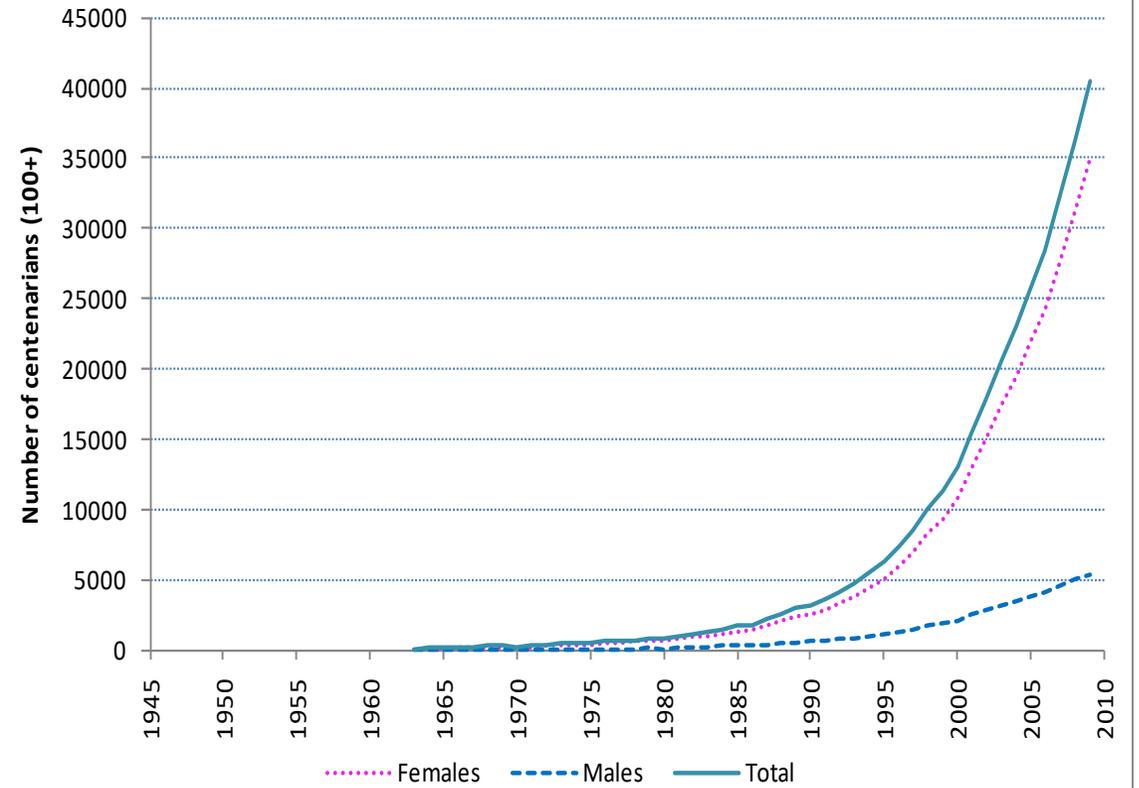
De plus en plus de personnes très âgées

Nombre de centenaires en Europe vs. Japon

Fourteen European countries



Japan



Nombre de super-centenaires vivant en France

**Number of living supercentenarians in France
(n=34/33 on November 17, 2016)**

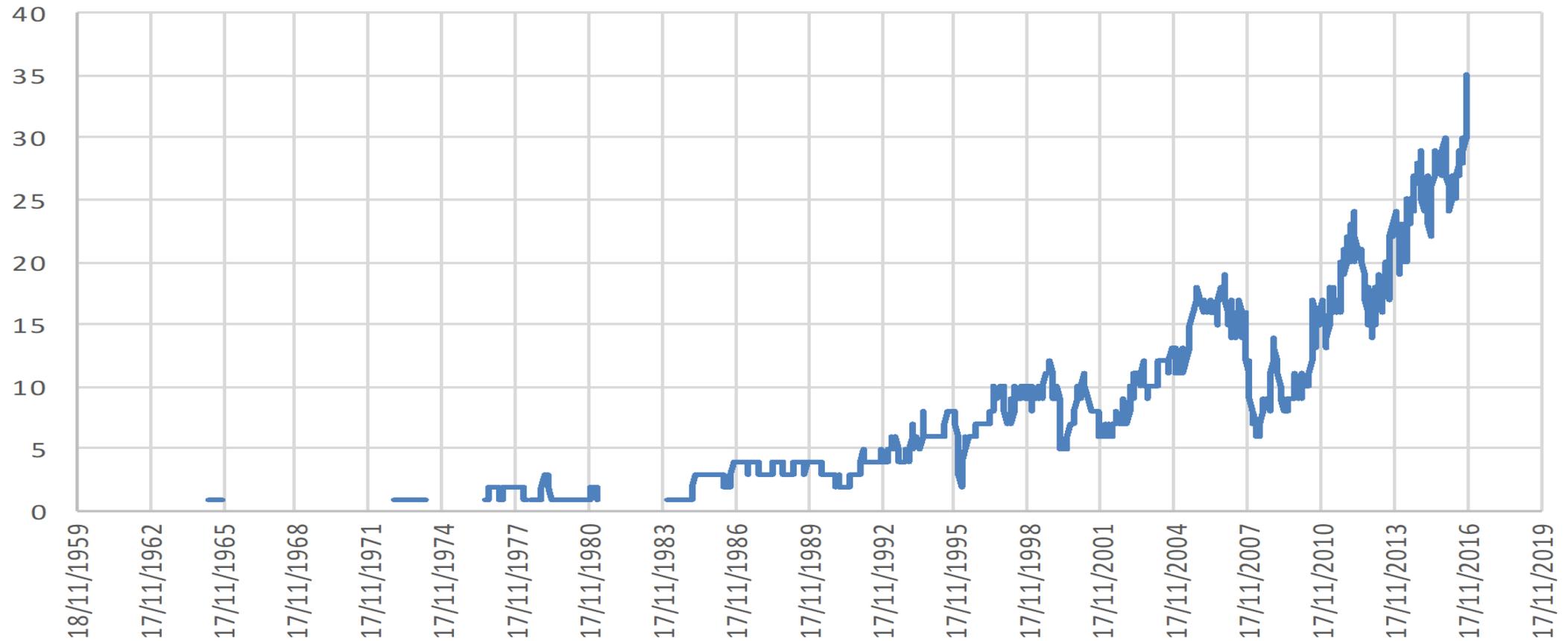


Table 2: Number of centenarians in the United Kingdom

Number of Future Centenarians

December 2010

Year	100+	110+
1980	2,300	-
1985	3,400	-
1990	4,400	-
1995	5,700	-
2000	6,800	-
2005	8,900	-
2010	11,800	-
2015	15,000	-
2020	21,900	-
2025	37,600	-
2030	58,800	100
2035	97,300	100
2040	148,900	400
2045	202,100	1,000
2050	276,600	2,100
2055	306,200	3,500
2060	378,200	5,600
2065	487,400	7,200
2066	507,000	7,700
2070	563,500	10,700
2075	587,000	16,200
2080	626,900	21,000

Numbers rounded to nearest 100. Population estimates have been used prior to 2009, and 2008-based population projections from 2010

Source: Office for National Statistics, 2008-based Population Projections (UK)

Estimates of the very elderly:

www.statistics.gov.uk/statbase/Product.asp?vlnk=15003



21 000 centenaires en 2016 en France, 270 000 en 2070 ?

Au 1^{er} janvier 2016, 21 000 centenaires vivent en France : c'est près de vingt fois plus qu'en 1970. Cinq centenaires sur six sont des femmes et parmi les « supercentenaires », c'est-à-dire les personnes de 110 ans ou plus, il n'y a quasiment que des femmes. Près d'un centenaire sur deux vit à domicile, qu'il soit seul, en couple, ou avec une autre personne que son conjoint. Les hommes centenaires, plus souvent en couple, sont plus fréquemment à leur domicile que les femmes.

En 2070, neuf femmes sur dix et huit hommes sur dix nés en 1990 deviendraient octogénaires, tandis que 13 % des femmes et 5 % des hommes nés en 1970 atteindraient leur centième anniversaire. Si les tendances actuelles se prolongent, la France pourrait compter à cette date 270 000 centenaires, soit treize fois plus qu'aujourd'hui.

Nathalie Blanpain, Guillemette Buisson, division Enquêtes et études démographiques, Insee

En 2016, 21 000 centenaires vivent en France. C'est vingt fois plus que dans les années 1960-1970. Entre 1960 et 1975, leur nombre était stable ; on en comptait 1 100 chaque année. Depuis 1975, leur effectif augmente continuellement au rythme de 7 % par an. Toutefois, comparé à la taille de la population, le nombre de centenaires reste modeste : ils ne représentent que 0,03 % de la population française.

La très grande majorité des centenaires est loin du record d'âge de la doyenne de l'humanité, Jeanne Calment, décédée à 122 ans. En 2016, en France, les trois quarts sont âgés de moins de 103 ans et neuf sur dix de moins de 105 ans (figure 1). Au 1^{er} janvier 2016, la doyenne française avait 114 ans.

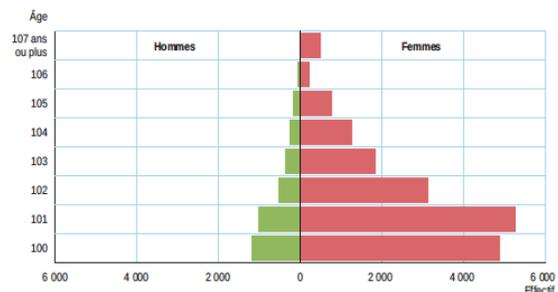
Cinq centenaires sur six sont des femmes

Il naît, naturellement, davantage de garçons que de filles. En France, comme dans la plupart des pays, 51 % des nouveau-nés sont des garçons. À tout âge, la mortalité des hommes est

plus forte que celle des femmes. Si cela a peu de conséquence sur la parité hommes-femmes avant 65 ans, étant donné le risque relativement faible de mourir avant cet âge, ce n'est plus vrai ensuite. Alors que 52 % des sexagénaires

sont des femmes, elles représentent 63 % des octogénaires, 73 % des nonagénaires et 84 % des centenaires. Après 110 ans, ceux que l'on appelle les « supercentenaires » sont quasiment tous des femmes.

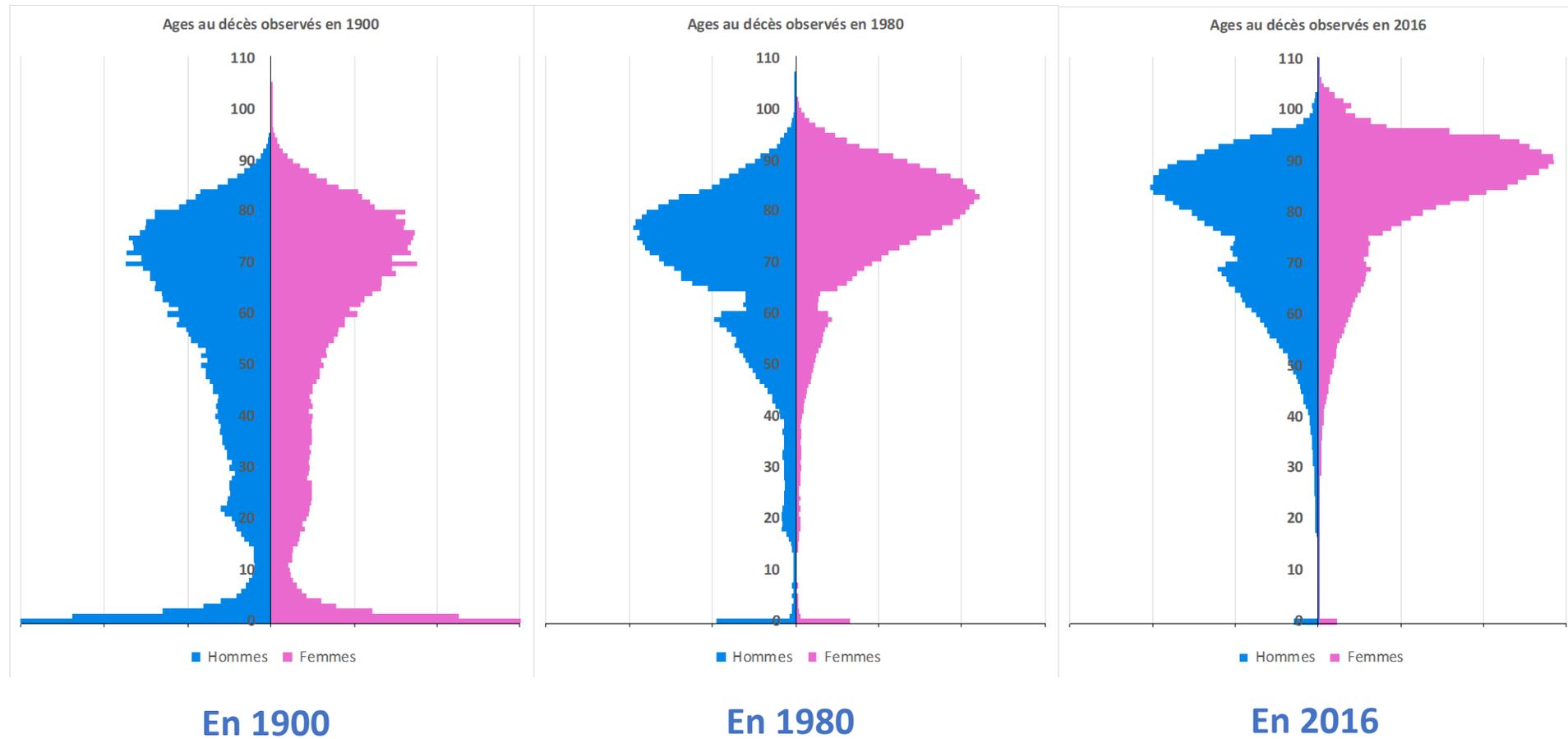
1 Population des centenaires au 1^{er} janvier 2016



Note : les données au-delà de 106 ans ou plus sont indiquées à titre illustratif : elles sont très fragiles, étant donné le faible effectif.
Lecture : au 1^{er} janvier 2016, 4 882 femmes âgées de 100 ans vivent en France métropolitaine.
Champ : personnes âgées de 100 ans ou plus, France y compris Mayotte.
Source : Insee, estimations de population et statistiques de l'état civil, 2016.

Des décès de plus en plus tardifs

Age au décès dans la population française



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Trajectories of Disability in the Last Year of Life

Thomas M. Gill, M.D., Evelyne A. Gahbauer, M.D., M.P.H., Ling Han, M.D., Ph.D., and Heather G. Allore, Ph.D.

ABSTRACT

BACKGROUND

Despite the importance of functional status to older persons and their families, little is known about the course of disability at the end of life.

METHODS

We evaluated data on 383 decedents from a longitudinal study involving 754 community-dwelling older persons. None of the subjects had disability in essential activities of daily living at the beginning of the study, and the level of disability was ascertained during monthly interviews for more than 10 years. Information on the conditions leading to death was obtained from death certificates and comprehensive assessments that were completed at 18-month intervals after the baseline assessment.

RESULTS

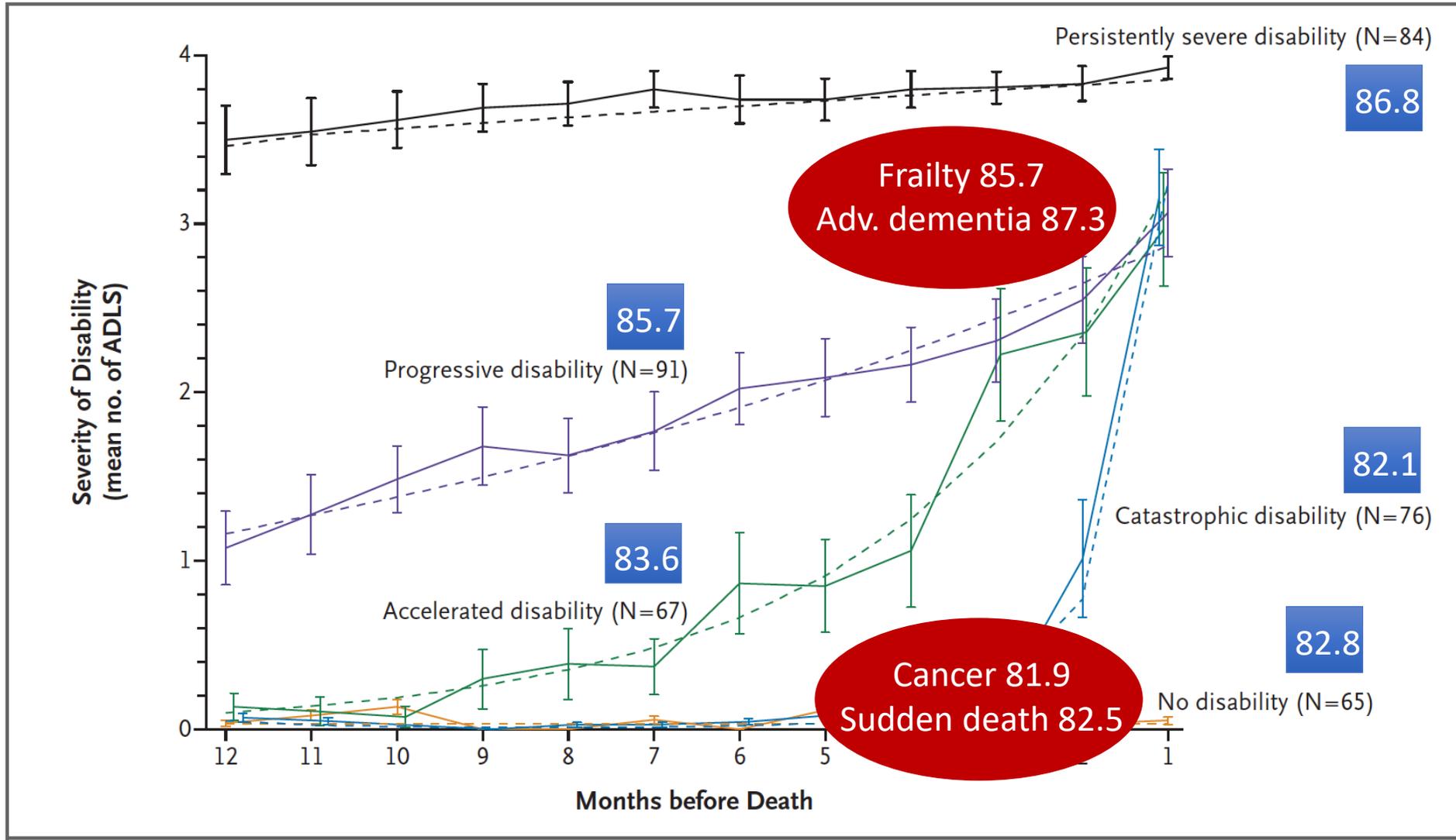
In the last year of life, five distinct trajectories were identified, from no disability to the most severe disability: 65 subjects had no disability (17.0%), 76 had catastrophic disability (19.8%), 67 had accelerated disability (17.5%), 91 had progressive disability (23.8%), and 84 had persistently severe disability (21.9%). The most common condition leading to death was frailty (in 107 subjects [27.9%]), followed by organ failure (in 82 subjects [21.4%]), cancer (in 74 subjects [19.3%]), other causes (in 57 subjects [14.9%]), advanced dementia (in 53 subjects [13.8%]), and sudden death (in 10 subjects [2.6%]). When the distribution of the disability trajectories was evaluated according to the conditions leading to death, a predominant trajectory was observed only for subjects who died from advanced dementia (67.9% of these subjects had a trajectory of persistently severe disability) and sudden death (50.0% of these subjects had no disability). For the four other conditions leading to

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N Engl J Med 2010;362:1173-80.

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Trajectoires d'incapacité en fin de vie (70+)



Jusqu'ou peut augmenter l'espérance de vie?

Frailty in Older Adults: Evidence for a Phenotype

Linda P. Fried,¹ Catherine M. Tangen,² Jeremy Walston,¹ Anne B. Newman,³ Calvin Hirsch,⁴
John Gottdiener,⁵ Teresa Seeman,⁶ Russell Tracy,⁷ Willem J. Kop,⁸ Gregory Burke,⁹
and Mary Ann McBurnie² for the Cardiovascular Health Study
Collaborative Research Group

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⁴The University of California at Davis, Sacramento.

⁵St. Francis Hospital, Roslyn, New York.

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⁸Uniformed Services University of the Health Sciences, Bethesda, Maryland.

⁹Wake Forest University School of Medicine, Winston-Salem, North Carolina.

Background. Frailty is considered highly prevalent in old age and to confer high risk for falls, disability, hospitalization, and mortality. Frailty has been considered synonymous with disability, comorbidity, and other characteristics, but it is recognized that it may have a biologic basis and be a distinct clinical syndrome. A standardized definition has not yet been established.

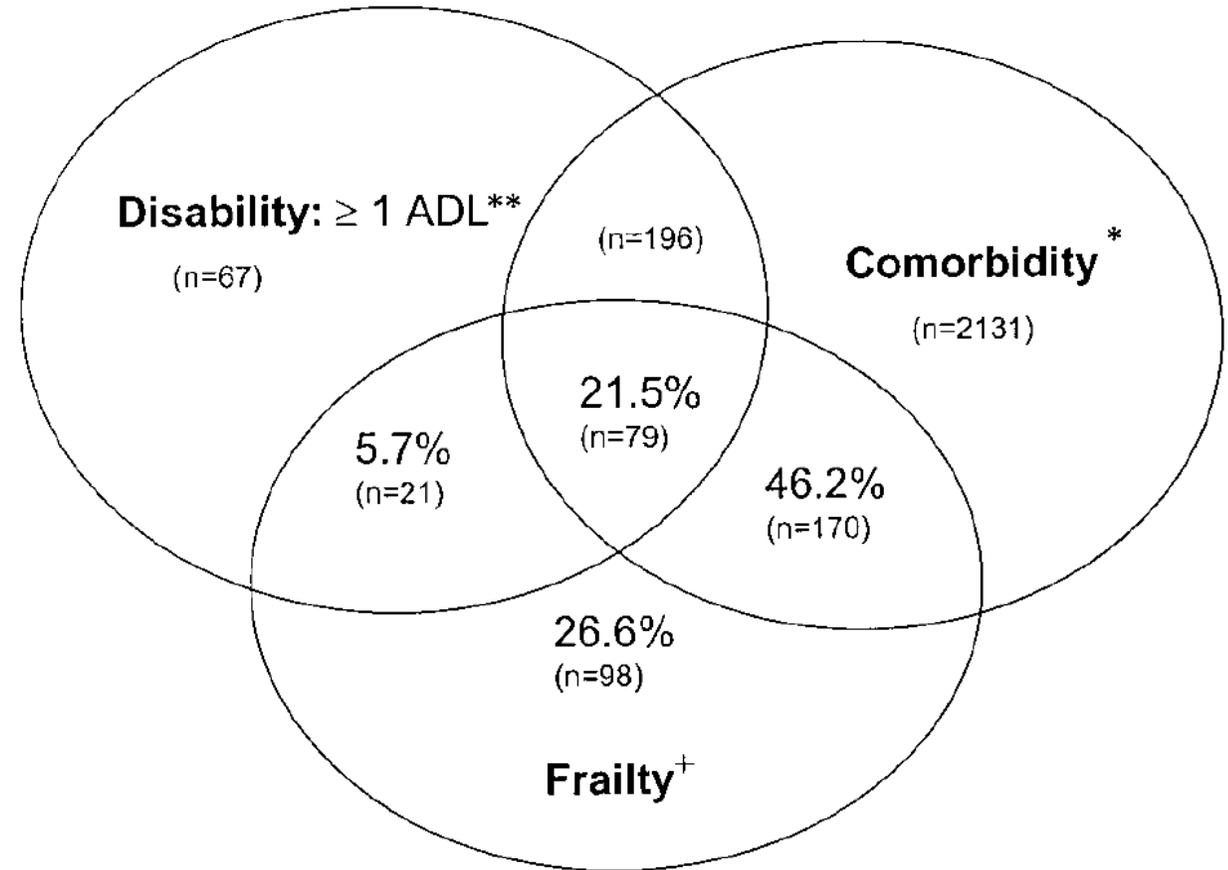
Methods. To develop and operationalize a phenotype of frailty in older adults and assess concurrent and predictive validity, the study used data from the Cardiovascular Health Study. Participants were 5,317 men and women 65 years and older (4,715 from an original cohort recruited in 1989-90 and 502 from an African American cohort recruited in 1992-93). Both cohorts received almost identical baseline evaluations and 7 and 4 years of follow-up, respectively, with annual examinations and surveillance for outcomes including incident disease, hospitalization, falls, disability, and mortality.

Results. Frailty was defined as a clinical syndrome in which three or more of the following criteria were present: unintentional weight loss (10 lbs in past year), self-reported exhaustion, weakness (grip strength), slow walking speed, and low physical activity. The overall prevalence of frailty in this community-dwelling population was 6.9%; it increased with age and was greater in women than men. Four-year incidence was 7.2%. Frailty was associated with being African American, having lower education and income, poorer health, and having higher rates of comorbid chronic diseases and disability. There was overlap, but not concordance, in the occurrence of frailty, comorbidity, and disability. This frailty phenotype was independently predictive (over 3 years) of incident falls, worsening mobility or ADL disability, hospitalization, and death, with hazard ratios ranging from 1.82 to 4.46, unadjusted, and 1.29-2.24, adjusted for a number of health, disease, and social characteristics predictive of 5-year mortality. Intermediate frailty status, as indicated by the presence of one or two criteria, showed intermediate risk of these outcomes as well as increased risk of becoming frail over 3-4 years of follow-up (odds ratios for incident frailty = 4.51 unadjusted and 2.63 adjusted for covariates, compared to those with no frailty criteria at baseline).

Conclusions. This study provides a potential standardized definition for frailty in community-dwelling older adults and offers concurrent and predictive validity for the definition. It also finds that there is an intermediate stage identifying those at high risk of frailty. Finally, it provides evidence that frailty is not synonymous with either comorbidity or disability, but comorbidity is an etiologic risk factor for, and disability is an outcome of, frailty. This provides a potential basis for clinical assessment for those who are frail or at risk, and for future research to develop interventions for frailty based on a standardized ascertainment of frailty.

FRAILTY is considered to be highly prevalent with increasing age and to confer high risk for adverse health outcomes, including mortality, institutionalization, falls, and hospitalization (1-3). Numerous geriatric interventions have been developed to improve clinical outcomes for frail older adults (3-7). A major obstacle to the success of such interventions has been the absence of a standardized and valid method for screening of those who are truly frail so as to effectively target care (1,3).

Potential definitions of frailty abound, defining frailty as synonymous with disability (1,8,9), comorbidity (8), or advanced old age (3). Increasingly, geriatricians define frailty as a biologic syndrome of decreased reserve and resistance to stressors, resulting from cumulative declines across multiple physiologic systems, and causing vulnerability to adverse outcomes (9-13). This concept distinguishes frailty from disability (9,10,14,15). There is a growing consensus that markers of frailty include age-associated declines in



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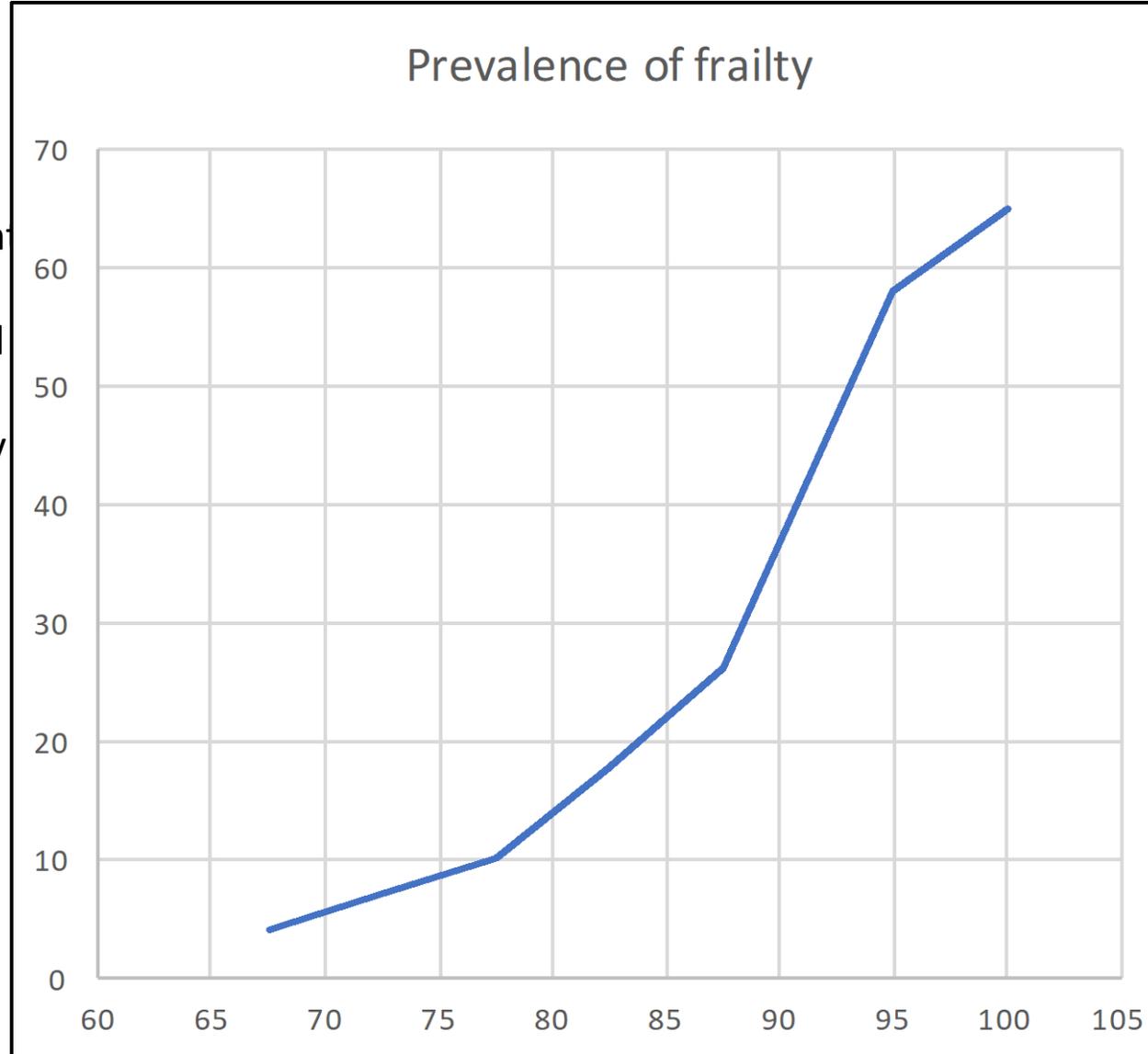
Figure 3. Venn diagram displaying extent of overlap of frailty with ADL disability and comorbidity (≥ 2 diseases). Total represented: 2,762 subjects who had comorbidity and/or disability and/or frailty. *n* of each subgroup indicated in parentheses. + Frail: overall *n* = 368 frail subjects (both cohorts). *Comorbidity: overall *n* = 2,576 with 2 or more out of the following 9 diseases: myocardial infarction, angina, congestive heart failure, claudication, arthritis, cancer, diabetes, hypertension, COPD. Of these, 249 were also frail. **Disabled: overall *n* = 363 with an ADL disability; of these, 100 were frail.

Définition de la fragilité

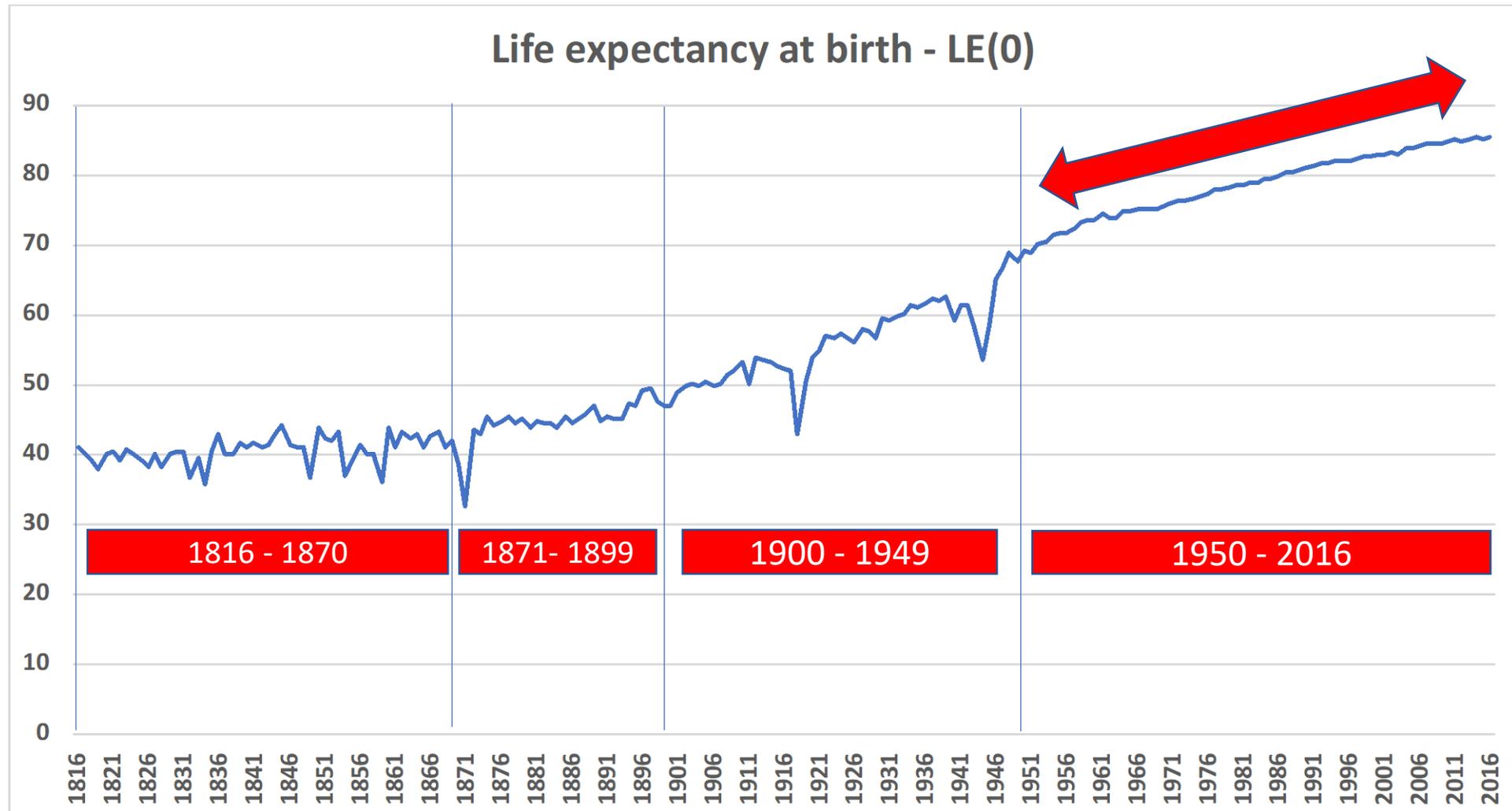
selon Fried et al, J Gerontol 2001

5 criteria

- Unintentional weight loss
- Weakness
- Poor endurance and exhaustion
- Slowness
- Low physical activity



Les faits: Augmentation de l'espérance de vie féminine, France, 1816 - 2016



Espérance de vie à la naissance en France, 1947-2018

Life expectancy at birth

95

Le Monde

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Pourquoi l'espérance de vie ne progresse plus

► L'espérance de vie des Français, c'est-à-dire la durée de vie moyenne d'une génération, a gagné trente ans au XX^e siècle, mais a cessé de croître depuis 2015

► Elle est de 79,4 ans pour les hommes et de 85,3 ans pour les femmes en 2018. La crise est mondiale, notamment aux Etats-Unis et dans les pays européens

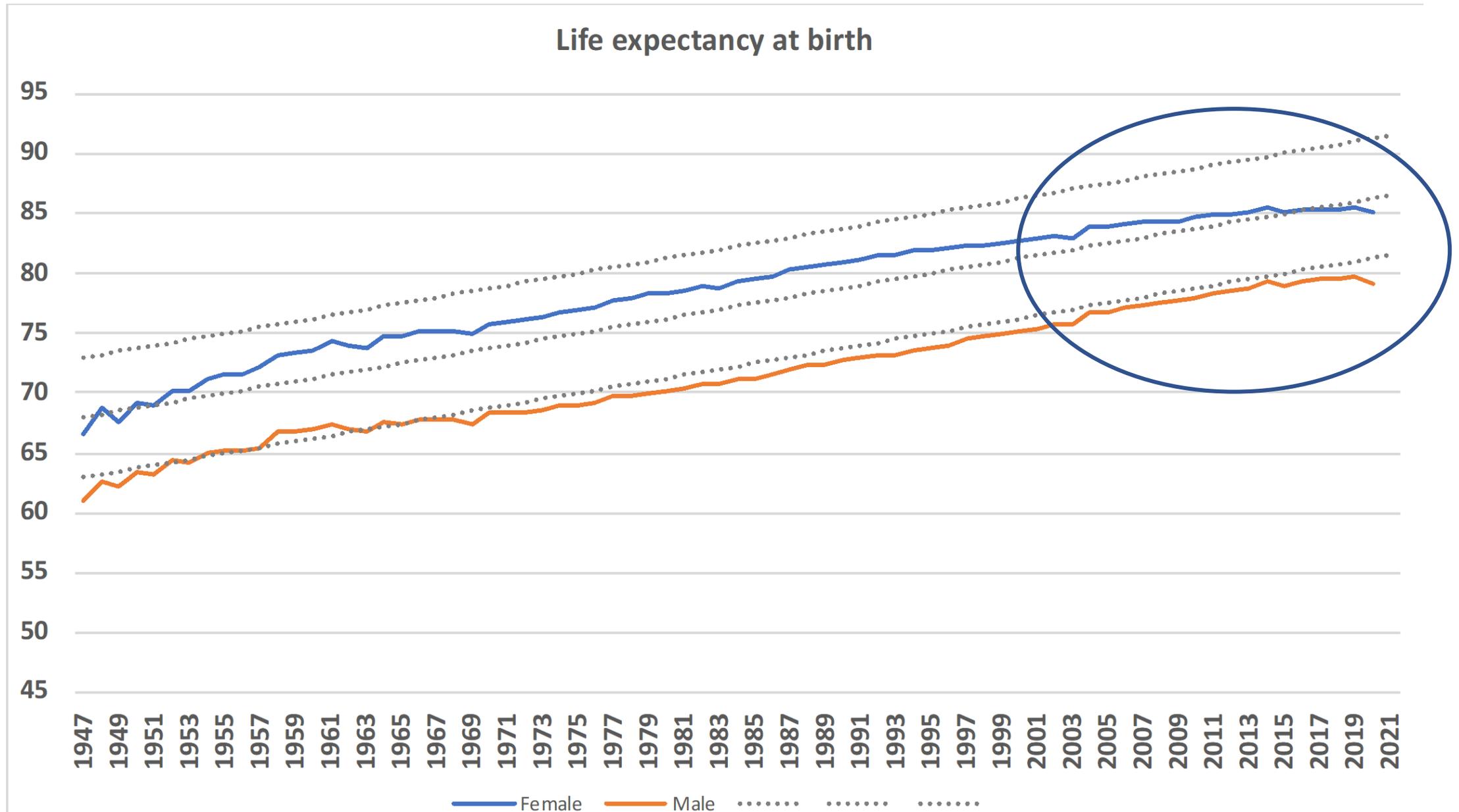
► Ce coup d'arrêt s'explique en partie par la baisse du niveau de vie, 1,2% en moyenne de 2008 à 2016 : les hommes les plus riches vivent jusqu'à 84,4 ans

► Mais l'espérance de vie « en bonne santé » est de 62,7 ans chez les hommes, 64,1 ans pour les femmes : la France est sous la moyenne européenne

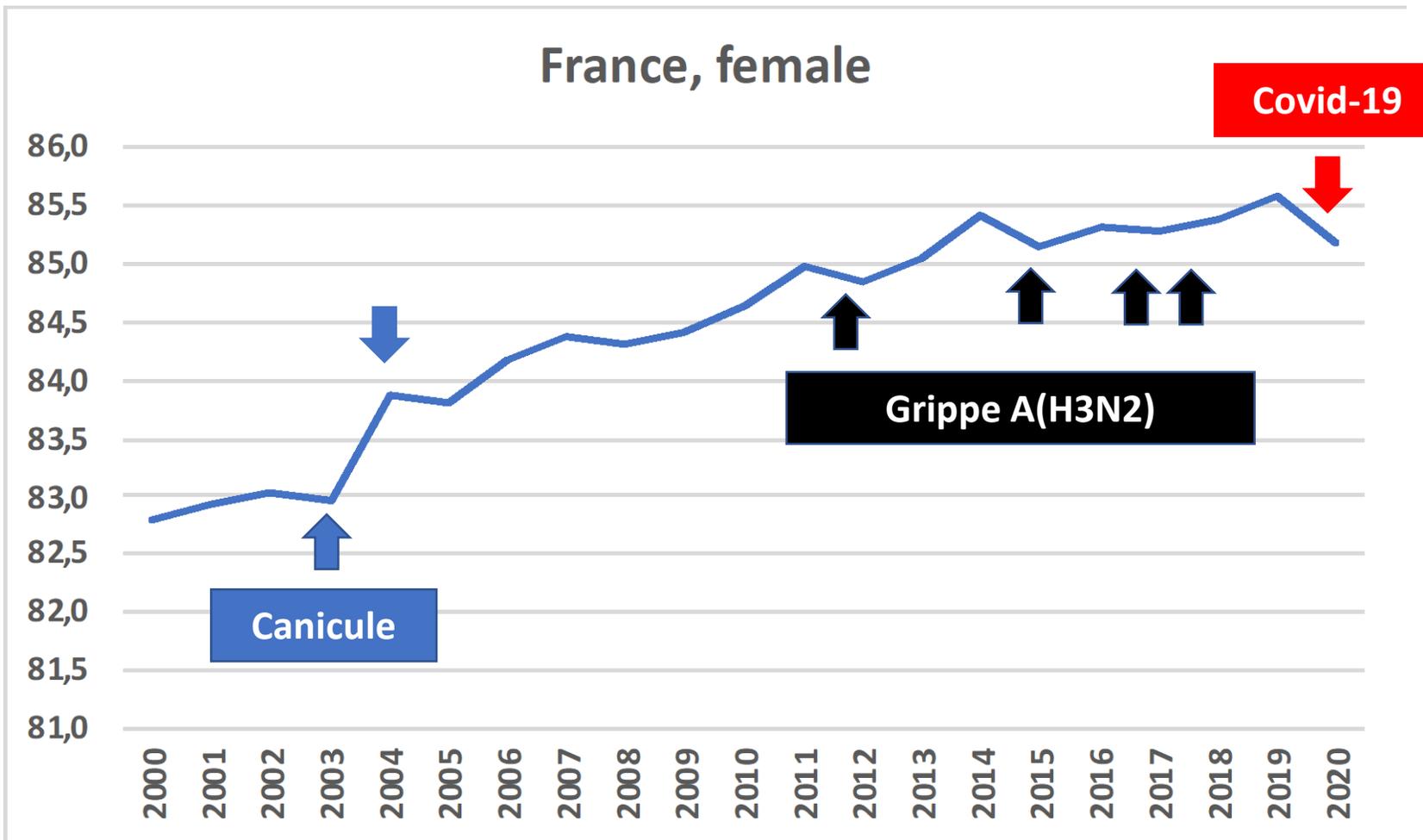
► L'écart est de presque dix ans avec la Suède, pour une espérance de vie à la naissance pourtant quasiment identique

SUPPLÉMENT ET ÉDITORIAL - PAGE 24

Espérance de vie à la naissance en France, 1947-2020



Espérance de vie à la naissance en France, sexe féminin, 2000-2020



- 2003: Canicule
- H. 2011/12: Grippe A(H3N2)
- H. 2014/15: Grippe A(H3N2)
- H. 2016/17: Grippe A(H3N2)
- H. 2017/18: Grippe A(H3N2/H1N1)
- 2020: SARS-CoV-2 (Covid-19)

Je vous remercie de votre attention!



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« Vieillir vulnérable »

28 Janvier 2021

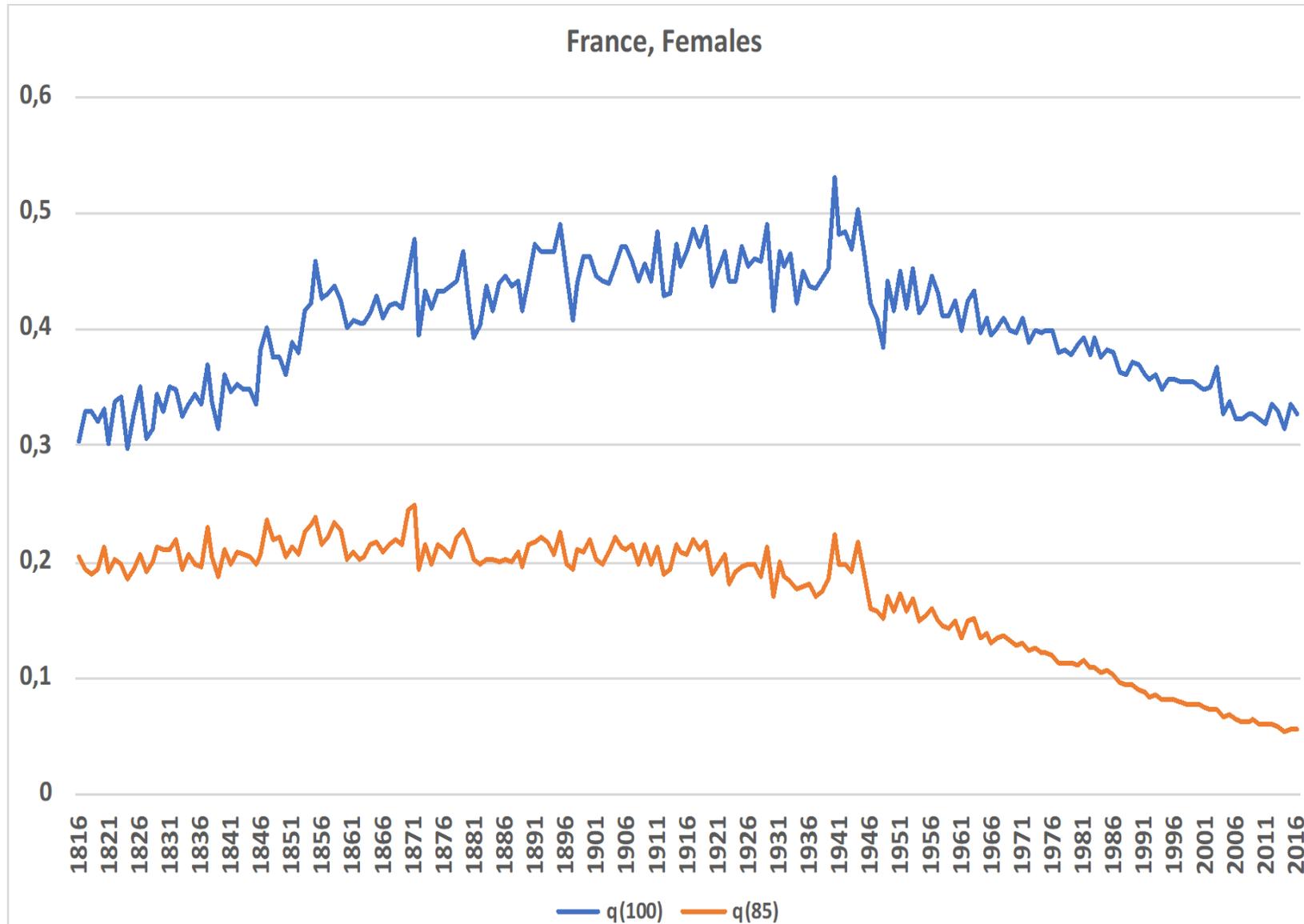
Longévités extrêmes

Jean-Marie Robine

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Probabilité de décéder à 100 ans et à 85 ans, France, sexe féminin, 1816 à 2016 (n=201)



Probabilité de décéder à 100 ans et à 85 ans, France et Japon, sexe féminin, 1947 à 2017

