EXPLORER LA COMPLEXITÉ GRÂCE AUX « BIG DATA » ?

L'exemple de la polypathologie chronique chez les personnes âgées en fin de vie

Lucas MORIN

Universités de la Recherche
Paris, 25 Octobre 2018

Karolinska Institutet


KAROLINSKA INSTITUTET
ANNO 1810
Karolinska
Institutet

PNAS

PNAS PLUS

The emergence of longevous populations

Fernando Colchero[a,b,c], Roland Rau[c,d], Owen R. Jones[a,e], Julia A. Barthold[a,f], Dalia A. Conde[a,e], Adam Lenart[a,f], Laszlo Nemeth[c], Alexander Scheuerlein[c], Jonas Schoeley[a,c,f], Catalina Torres[a,f], Virginia Zarulli[a,f], Jeanne Altmann[g,h], Diane K. Brockman[i], Anne M. Bronikowski[j], Linda M. Fedigan[k], Anne E. Pusey[l], Tara S. Stoinski[m], Karen B. Strier[n], Annette Baudisch[a,e,f], Susan C. Alberts[h,l,o,p,1], and James W. Vaupel[a,c,f,p,1]

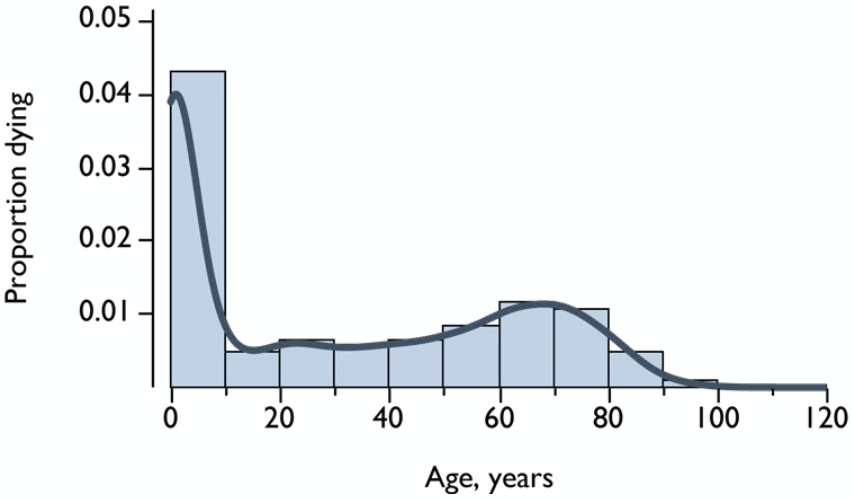
[a]Max-Planck Odense Center on the Biodemography of Aging, University of Southern Denmark, Odense 5230, Denmark; [b]Department of Mathematics and Computer Science, University of Southern Denmark, Odense 5230, Denmark; [c]Max Planck Institute for Demographic Research, Rostock 18057, Germany; [d]Institute of Sociology and Demography, University of Rostock, Rostock 18057, Germany; [e]Department of Biology, University of Southern Denmark, Odense 5230, Denmark; [f]Department of Public Health, University of Southern Denmark, Odense 5000, Denmark; [g]Department of Ecology and Evolutionary Biology, Princeton University, Princeton, NJ 08544; [h]Institute of Primate Research, National Museums of Kenya, 00502 Nairobi, Kenya; [i]Department of Anthropology, University of North Carolina, Charlotte, NC 28223; [j]Department of Ecology, Evolution, and Organismal Biology, Iowa State University, Ames, IA 50011; [k]Department of Anthropology and Archaeology, University of Calgary, Calgary, AB, Canada T2N 1N4; [l]Department of Evolutionary Anthropology, Duke University, Durham, NC 27708; [m]The Dian Fossey Gorilla Fund International and Zoo Atlanta, Atlanta, GA 30315; [n]Department of Anthropology, University of Wisconsin, Madison, WI 53706; [o]Department of Biology, Duke University, Durham, NC 27708; and [p]Duke Population Research Institute, Duke University, Durham, NC 27708

Contributed by James W. Vaupel, October 17, 2016 (sent for review July 26, 2016; reviewed by Michael Murphy and Deborah Roach)

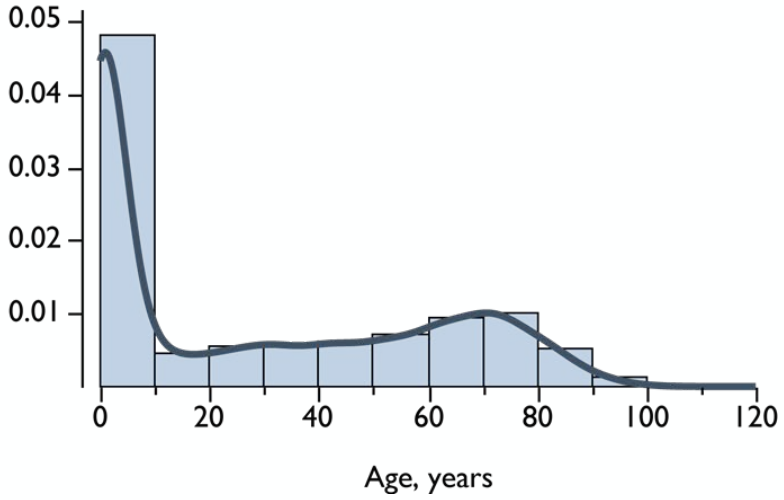
The human lifespan has traversed a long evolutionary and historical path, from short-lived primate ancestors to contemporary Japan, Sweden, and other longevity frontrunners. Analyzing this trajectory is crucial for understanding biological and sociocultural processes that determine the span of life. Here we reveal a fundamental regularity. Two straight lines describe the joint rise of life expectancy and lifespan equality: one for primates and the second one over the full range of human experience from average lifespans as low as 2 y during mortality crises to more than 87 y for Japanese women today. Across the primate order and across human populations, the lives of females tend to be longer and less variable than the lives of males, suggesting deep evolutionary roots to the male disadvantage. Our findings cast fresh light on primate evolution and human history, opening directions for research on inequality, sociality, and aging.

Box 1) requires data on the ages at death of individuals. We examined lifespan distributions for six nonhuman primate populations representing species that span the primate order and for six populations of humans that represent the full range of human experience. The nonhuman primate data, collected with sustained effort and extraordinary dedication from wild populations that have been under continuous observation for between 31 y and 52 y (11, 12), include one Indriid (a lemur-like Madagascan primate), two New World monkeys, one Old World monkey, and two great apes (Table 1). These wild populations all experience natural dispersal patterns; hence, we extended Bayesian methods to estimate age-specific mortality trajectories for males and females from censored and truncated data while accounting for out-migration from the study area (13, 14) (*Materials and Methods*). Human hunter-gatherer data were drawn from published information on two populations, the Hadza and Ache (15, 16),

France (1816–1825)

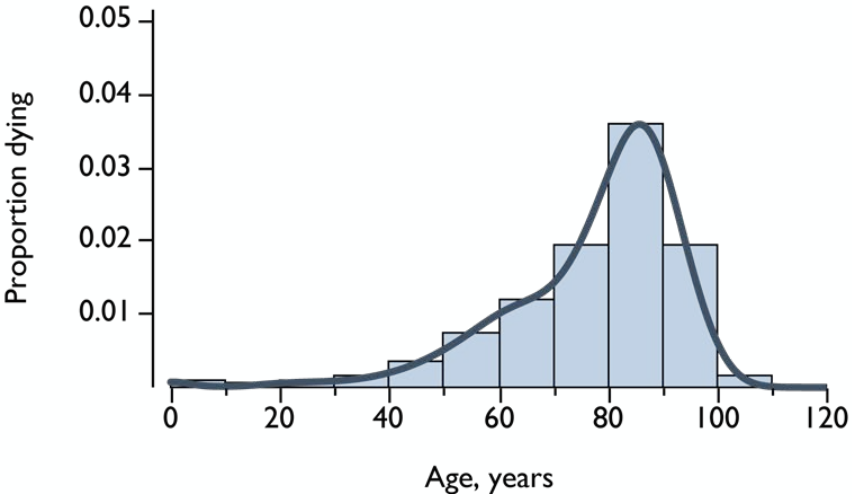


Suède (1751–1759)

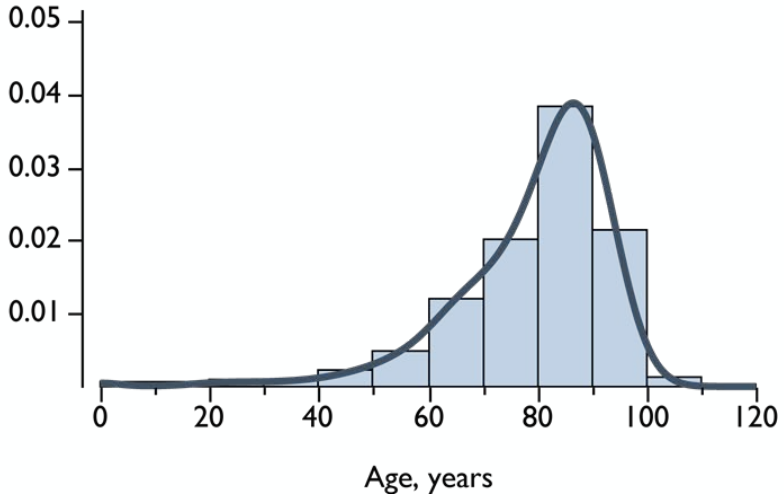


Source: University of California Berkeley (USA) and Max Planck Institute for Demographic Research (Germany). Human Mortality Database. Accessed November 10, 2017

France (2006–2015)

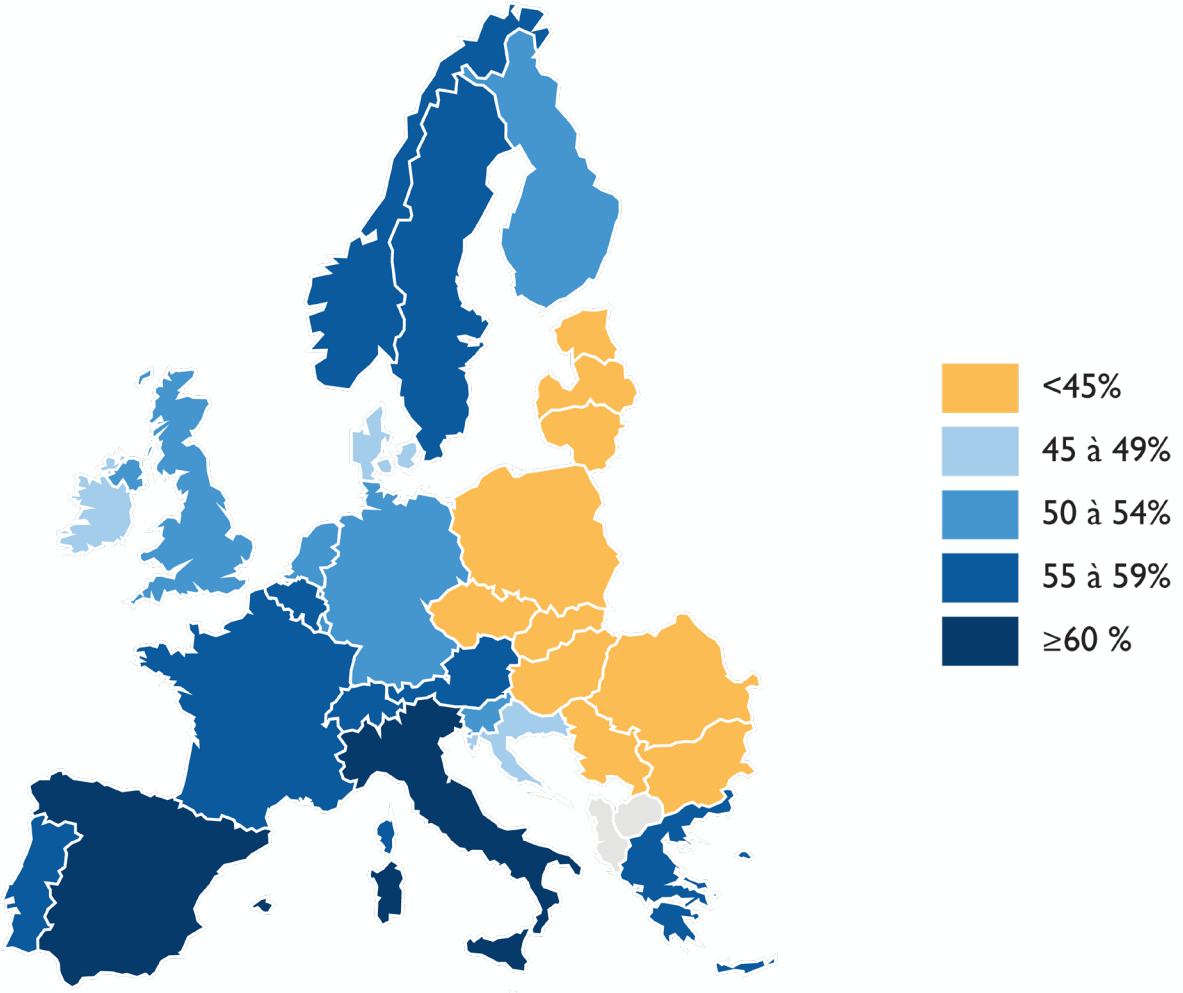


Suède (2006–2015)



Source: University of California Berkeley (USA) and Max Planck Institute for Demographic Research (Germany). Human Mortality Database. Accessed November 10, 2017

Proportion des décès au-delà de 80 ans (2015)



Source: EuroStat, Nombre de décès par pays en 2015.

nature

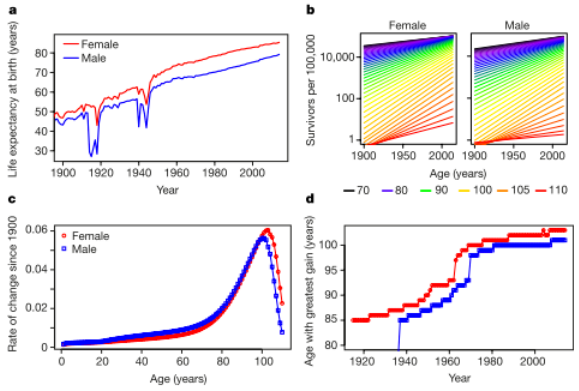
Evidence for a limit to human lifespan

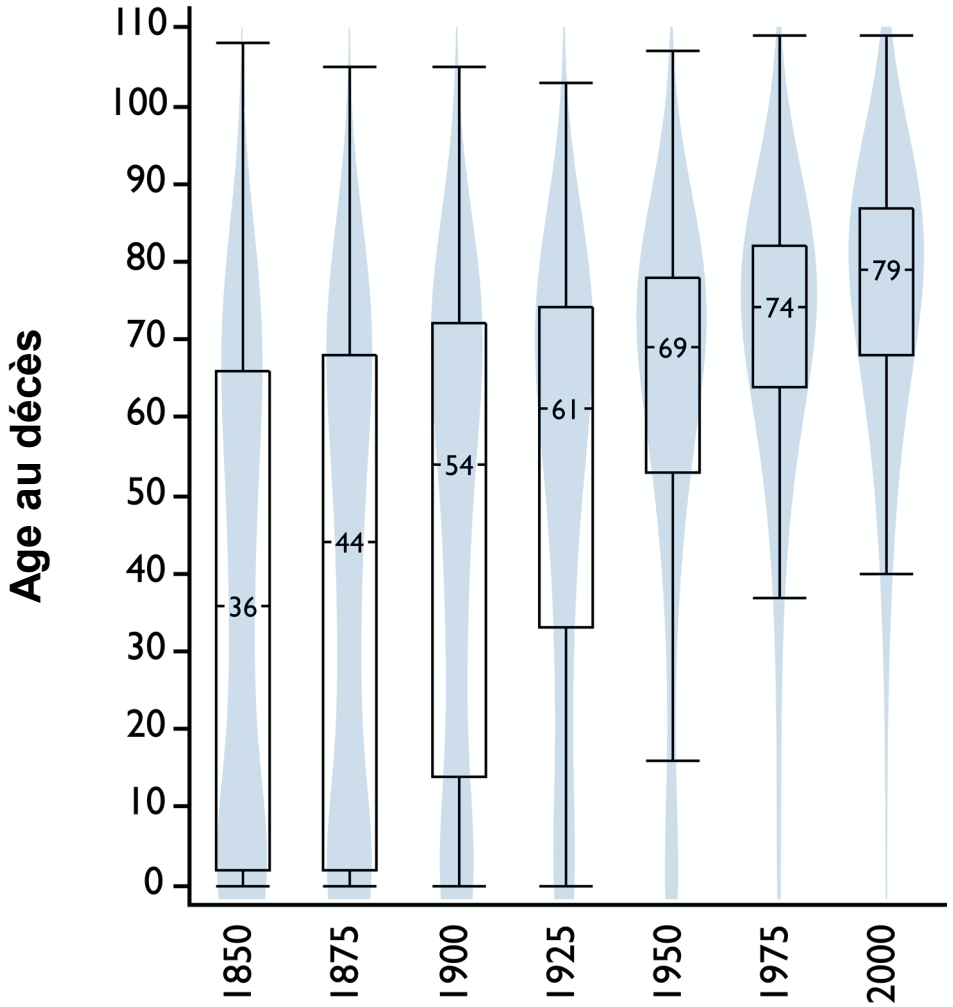
Xiao Dong[1]*, Brandon Milholland[1]* & Jan Vijg[1,2]

Driven by technological progress, human life expectancy has increased greatly since the nineteenth century. Demographic evidence has revealed an ongoing reduction in old-age mortality and a rise of the maximum age at death, which may gradually extend human longevity[1,2]. Together with observations that lifespan in various animal species is flexible and can be increased by genetic or pharmaceutical intervention, these results have led to suggestions that longevity may not be subject to strict, species-specific genetic constraints. Here, by analysing global demographic data, we show that improvements in survival with age tend to decline after age 100, and that the age at death of the world's oldest person has not increased since the 1990s. Our results strongly suggest that the maximum lifespan of humans is fixed and subject to natural constraints.

Maximum lifespan is, in contrast to average lifespan, generally assumed to be a stable characteristic of a species[3]. For humans, the maximum reported age at death is generally set at 122 years, the age at death of Jeanne Calment, still the oldest documented human individual who ever lived[4]. However, some evidence suggests that maximum lifespan is not fixed. Studies in model organisms have shown that maximum lifespan is flexible and can be affected by genetic and pharmacological interventions[5]. In Sweden, based on a long series of reliable information on the upper limits of human lifespan, the maximum reported age at death was found to have risen from about 101 years during the 1860s to about 108 years during the 1990s[6]. According to the authors, this finding refutes the common assertion that human lifespan is fixed and unchanging over time[6]. Indeed, the most convincing argument that the maximum lifespan of humans is not fixed is the ongoing increase in life expectancy in most countries over the course of the last century[1,2]. Figure 1a shows this increase for France, a country with high-quality mortality data, but very similar patterns were found for most other developed nations (Extended Data Fig. 1). Hence, the possibility has been considered that mortality may decline further, breaking any pre-conceived boundaries of human lifespan[1,7].

As shown by data from the Human Mortality Database[8], many of the historical gains in life expectancy have been attributed to a reduction in early-life mortality. More recent data, however, show evidence for a decline in late-life mortality, with the fraction of each birth cohort reaching old age increasing with calendar year. In France, the number of individuals per 100,000 surviving to old age (70 and up) has increased since 1900 (Fig. 1b), which points towards a continuing increase in human life expectancy. This pattern is very similar across the other 40 countries and territories included in the database (Extended Data Figs 2, 3). However, the rate of improvement in survival peaks and then declines for very old age levels (Fig. 1c), which points




Age au décès
110
100
90
80
70
60
50
40
30
20
10
0
36
44
54
61
69
74
79
1850
1875
1900
1925
1950
1975
2000

Prof Carol Jagger
Newcastle University Institute
for Ageing, UK

THE LANCET

Is late-life dependency increasing or not? A comparison of the Cognitive Function and Ageing Studies (CFAS)

*Andrew Kingston, Pia Wohland, Raphael Wittenberg, Louise Robinson, Carol Brayne, Fiona E Matthews, Carol Jagger, on behalf of the Cognitive Function and Ageing Studies collaboration**

Summary

Background Little is known about how the proportions of dependency states have changed between generational cohorts of older people. We aimed to estimate years lived in different dependency states at age 65 years in 1991 and 2011, and new projections of future demand for care.

Table 2. Life expectancy at age 65

	1991	2011	Difference
Men			
Life expectancy	12·9	17·6	4·7
Independent	9·5 (9·3 to 9·7)	11·2 (10·8–11·5)	1·7 (1·2 to 2·1)
Low dependency	2·3 (1·9 to 2·7)	4·0 (3·5–4·5)	1·7 (1·0 to 2·4)
Medium dependency	0·7 (0·3 to 1·2)	1·1 (0·5–1·7)	0·3 (–0·4 to 1·1)
High dependency	0·4 (–0·1 to 0·8)	1·3 (0·7–1·9)	0·9 (0·2 to 1·7)
Proportion of life expectancy spent			
Independent	73·6% (71·8 to 75·4)	63·5% (61·4–65·6)	–10·1% (–12·9 to –7·3)
Low dependency	17·8% (14·5 to 22·2)	22·9% (19·9–25·8)	5·1% (0·6 to 9·5)
Medium dependency	5·8% (2·2 to 9·3)	6·2% (2·9–9·5)	0·4% (–4·4 to 5·2)
High dependency	2·9% (–0·7 to 6·5)	7·4% (4·2–10·7)	4·5% (–0·4 to 9·3)

52%

des personnes âgées de ≥70 ans
ont au moins 2 maladies chroniques

Palladino R, Lee JT, Ashworth M, Triassi M, Millett C. Associations between multimorbidity, healthcare utilisation and health status: Evidence from 16 European countries. *Age Ageing*. 2016;45(3):431-435.

THE GERONTOLOGICAL SOCIETY OF AMERICA®

Journals of Gerontology: Medical Sciences
cite as: *J Gerontol A Biol Sci Med Sci*, 2016, Vol. 00, No. 00, 1–7
doi:10.1093/gerona/glw233
Advance Access publication December 21, 2016

OXFORD

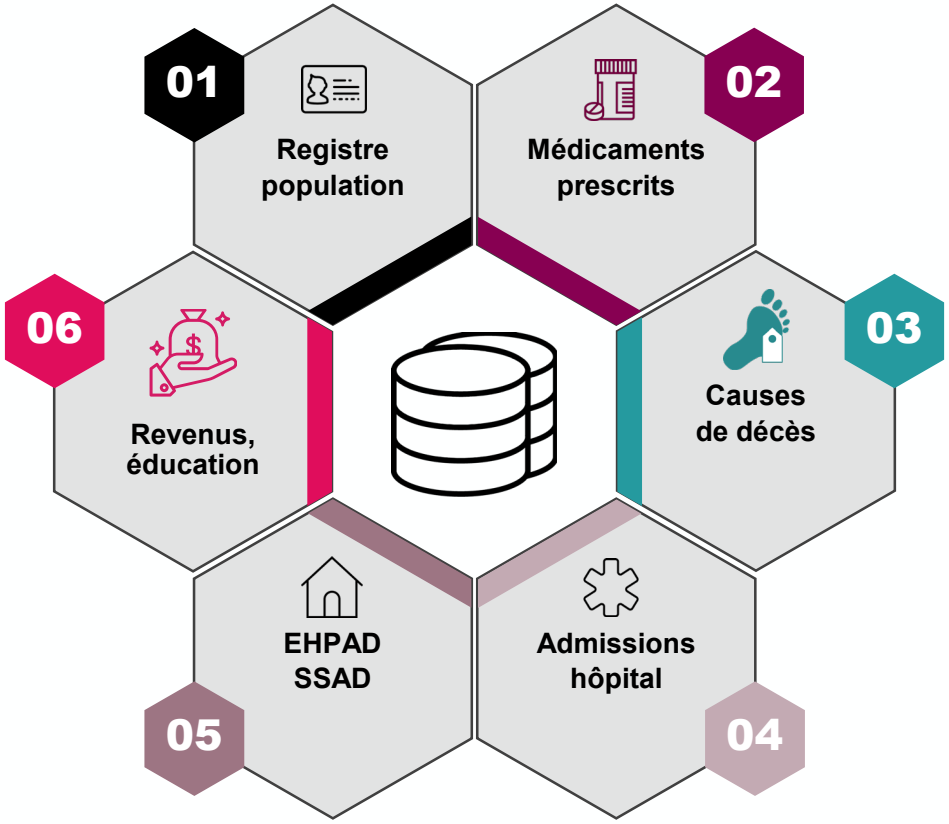
Research Article

Assessing and Measuring Chronic Multimorbidity in the Older Population: A Proposal for Its Operationalization

Amaia Calderón-Larrañaga,[1,2,*] Davide L. Vetrano,[1,3,*] Graziano Onder,[3] Luis A. Gimeno-Feliu,[2,4] Carlos Coscollar-Santaliestra,[2,4] Angelo Carfí,[3] Maria S. Pisciotta,[3] Sara Angleman,[1] René J.F. Melis,[5] Giola Santoni,[1] Francesca Mangialasche,[1] Debora Rizzuto,[1] Anna-Karin Welmer,[1] Roberto Bernabei,[3] Alexandra Prados-Torres,[2] Alessandra Marengoni,[1,6] and Laura Fratiglioni[1,7]

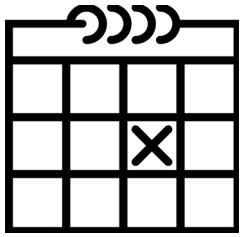
Amaia Calderón-Larrañaga
Karolinska Institutet, Sweden

Dr. Davide L Vetrano
Karolinska Institutet, Sweden


01
Registre population
02
Médicaments prescrits
03
Causes de décès
04
Admissions hôpital
05
EHPAD SSAD
06
Revenus, éducation

78 226

53%



85 years

40%

12%

290 000

causes médicales de décès (CIM-10)

6 millions

diagnostics cliniques (CIM-10)

29 millions

prescriptions médicamenteuses (ATC)

Analyse de données non-structurées à partir de la base de données des médicaments

« indigestion » IPP Esomeprazole

	DOSE	ATC	NAME
1	1 TABLETT PÅ MORGONEN, 1 TABLETT TILL MIDDAG . MOT MAGBESVÄR.	A02BC05	Nexium
2	1 TABLETT PÅ MORGONEN . FÖREBYGGER PROPP.	B01AC06	Trombyl®
3	1 TABLETT PÅ MORGONEN . FÖR HJÄRTAT.	C07AB02	Metoprolol Actavis
4	1 TABLETT TILL NATTEN . SÄNKER BLODFETTERNA.	C10AA01	Simvastatin Actavis
5	3-6 ST DAGLIGEN	A01AA01	Fluorette® Pepparmint
6	3-6 TUGGUMMIN DAGLIGEN	A01AA01	Fluorette® Pepparmint
7	1 DOS UNDER TUNGAN VID KÄRLKRAMP. APPLICERAS UNDER TUNGAN	C01DA02	Nitrolingual
8	1-2 TABLETTER 1-4 GÅNGER DAGLIGEN VID SMÄRTA.	N02BE01	Pamol

« éviter les caillots [de sang]»

antiagrégant plaquettaire

	DOSE	ATC	NAME
1	1 TABLETT PÅ MORGONEN, 1 TABLETT TILL MIDDAG . MOT MAGBESVÄR.	A02BC05	Nexium
2	1 TABLETT PÅ MORGONEN . FÖREBYGGER PROPP.	B01AC06	Trombyl®
3	1 TABLETT PÅ MORGONEN . FÖR HJÄRTAT.	C07AB02	Metoprolol Actavis
4	1 TABLETT TILL NATTEN . SÄNKER BLODFETTERNA.	C10AA01	Simvastatin Actavis
5	3-6 ST DAGLIGEN	A01AA01	Fluorette® Pepparmint
6	3-6 TUGGUMMIN DAGLIGEN	A01AA01	Fluorette® Pepparmint
7	1 DOS UNDER TUNGAN VID KÄRLKRAMP. APPLICERAS UNDER TUNGAN	C01DA02	Nitrolingual
8	1-2 TABLETTER 1-4 GÅNGER DAGLIGEN VID SMÄRTA.	N02BE01	Pamol

« pour le cœur »

Béta bloquant cardio-sélectif

	DOSE	ATC	NAME
1	1 TABLETT PÅ MORGONEN, 1 TABLETT TILL MIDDAG . MOT MAGBESVÄR.	A02BC05	Nexium
2	1 TABLETT PÅ MORGONEN . FÖREBYGGER PROPP.	B01AC06	Trombyl®
3	1 TABLETT PÅ MORGONEN . FÖR HJÄRTAT.	C07AB02	Metoprolol Actavis
4	1 TABLETT TILL NATTEN . SÄNKER BLODFETTERNA.	C10AA01	Simvastatin Actavis
5	3-6 ST DAGLIGEN	A01AA01	Fluorette® Pepparmint
6	3-6 TUGGUMMIN DAGLIGEN	A01AA01	Fluorette® Pepparmint
7	1 DOS UNDER TUNGAN VID KÄRLKRAMP. APPLICERAS UNDER TUNGAN	C01DA02	Nitrolingual
8	1-2 TABLETTER 1-4 GÅNGER DAGLIGEN VID SMÄRTA.	N02BE01	Pamol

« réduit le cholesterol »

Statine

	DOSE	ATC	NAME
1	1 TABLETT PÅ MORGONEN, 1 TABLETT TILL MIDDAG . MOT MAGBESVÄR.	A02BC05	Nexium
2	1 TABLETT PÅ MORGONEN . FÖREBYGGER PROPP.	B01AC06	Trombyl®
3	1 TABLETT PÅ MORGONEN . FÖR HJÄRTAT.	C07AB02	Metoprolol Actavis
4	1 TABLETT TILL NATTEN . SÄNKER BLODFETTERNA.	C10AA01	Simvastatin Actavis
5	3-6 ST DAGLIGEN	A01AA01	Fluorette® Pepparmint
6	3-6 TUGGUMMIN DAGLIGEN	A01AA01	Fluorette® Pepparmint
7	1 DOS UNDER TUNGAN VID KÄRLKRAMP. APPLICERAS UNDER TUNGAN	C01DA02	Nitrolingual
8	1-2 TABLETTER 1-4 GÅNGER DAGLIGEN VID SMÄRTA.	N02BE01	Pamol

« 3-6 par jour »

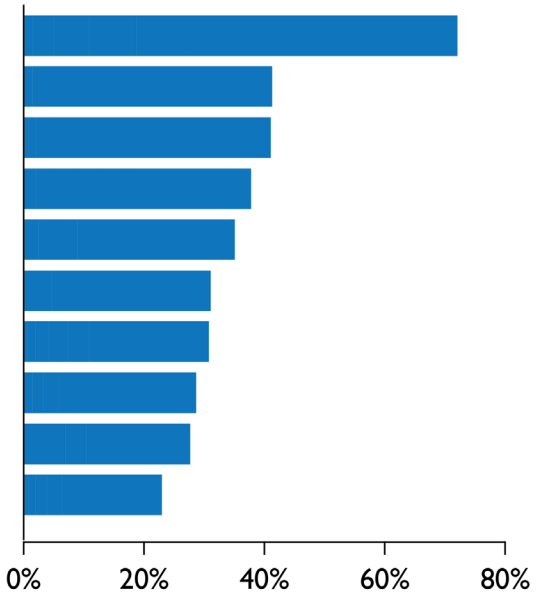
Sodium fluoride

	DOSE	ATC	NAME
1	1 TABLETT PÅ MORGONEN, 1 TABLETT TILL MIDDAG . MOT MAGBESVÄR.	A02BC05	Nexium
2	1 TABLETT PÅ MORGONEN . FÖREBYGGER PROPP.	B01AC06	Trombyl®
3	1 TABLETT PÅ MORGONEN . FÖR HJÄRTAT.	C07AB02	Metoprolol Actavis
4	1 TABLETT TILL NATTEN . SÄNKER BLODFETTERNA.	C10AA01	Simvastatin Actavis
5	3-6 ST DAGLIGEN	A01AA01	Fluorette® Pepparmint
6	3-6 TUGGUMMIN DAGLIGEN	A01AA01	Fluorette® Pepparmint
7	1 DOS UNDER TUNGAN VID KÄRLKRAMP. APPLICERAS UNDER TUNGAN	C01DA02	Nitrolingual
8	1-2 TABLETTER 1-4 GÅNGER DAGLIGEN VID SMÄRTA.	N02BE01	Pamol

6,9 maladies chroniques

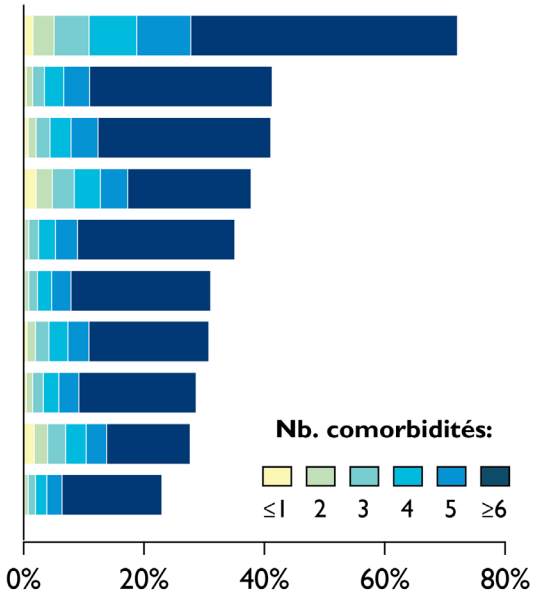
Rang, maladie chronique	Prévalence Nb. (%)
01. Hypertension	56 420 (72.1%)
02. Insuffisance cardiaque	32 264 (41.2%)
03. Maladie ischémique	32 159 (41.1%)
04. Cancer solide	29 608 (37.8%)
05. Fibrillation auriculaire	27 424 (35.1%)
06. Cataracte	24 399 (31.2%)
07. Dépression et troubles de l'humeur	24 050 (30.7%)
08. Maladies cérébrovasculaires	22 447 (28.7%)
09. Démence	21 643 (27.7%)
10. Diabète	18 022 (23.0%)

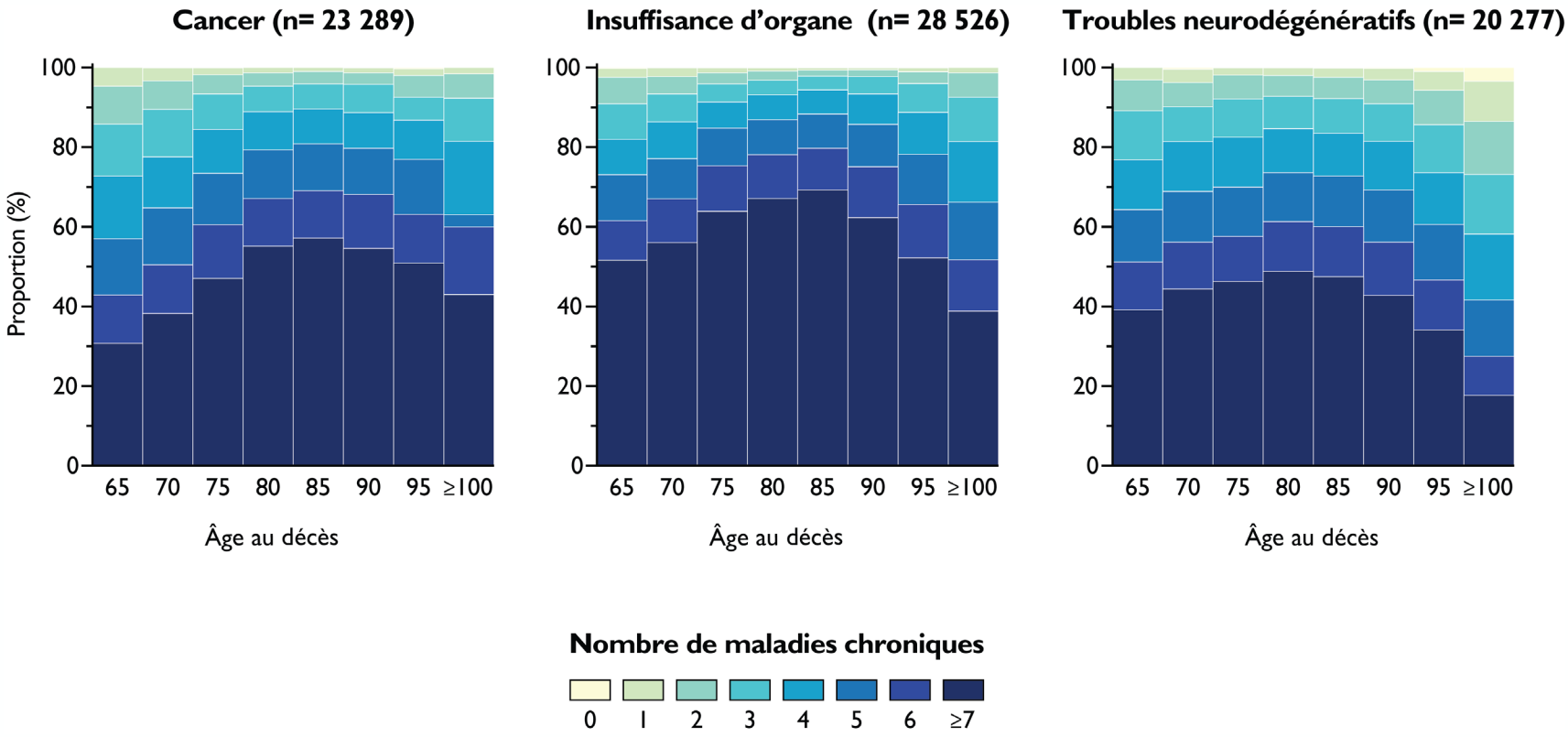
Prévalence en fonction du nombre de comorbidités chroniques



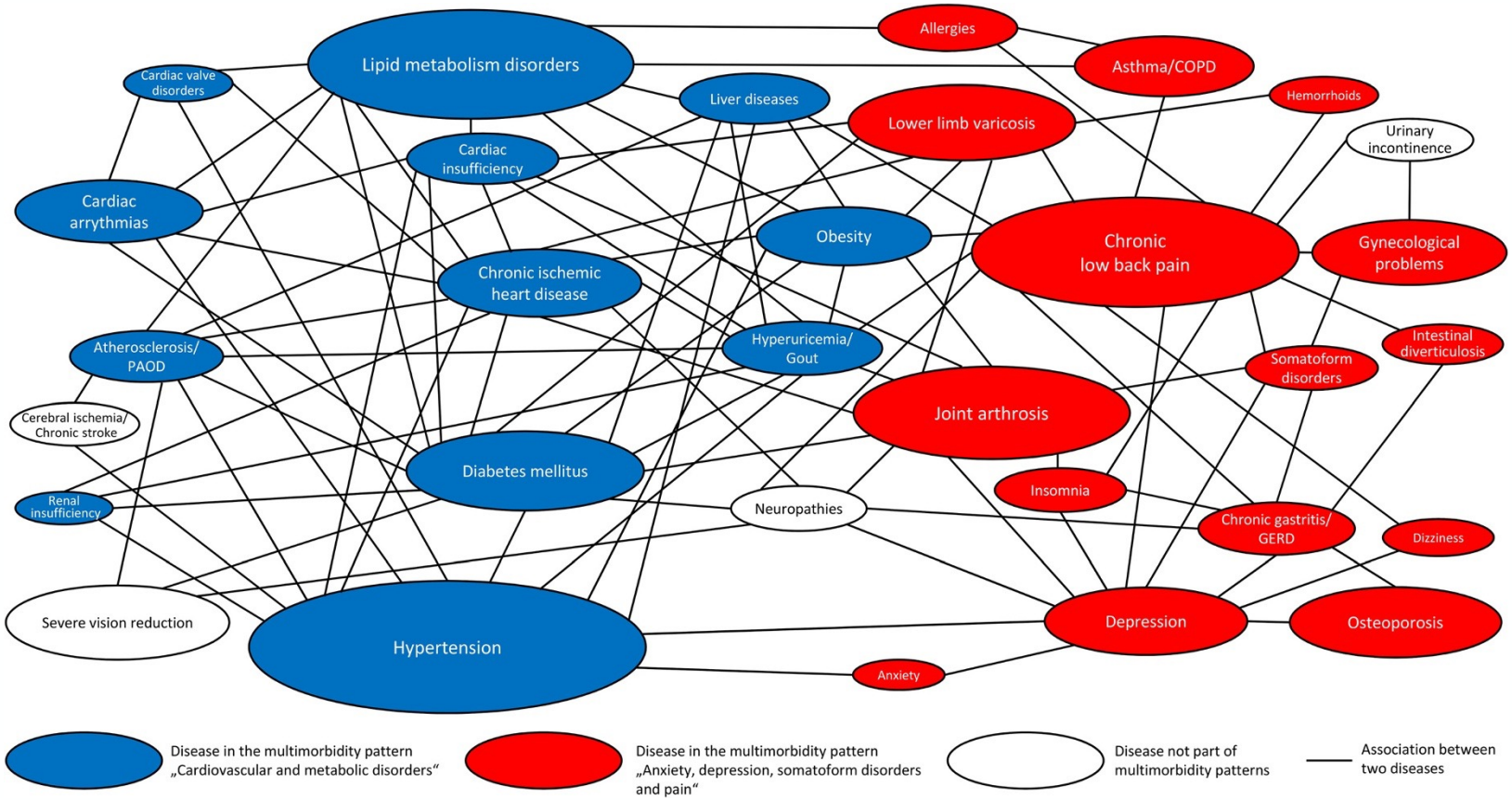
Rang, maladie chronique	Prévalence Nb. (%)
01. Hypertension	56 420 (72.1%)
02. Insuffisance cardiaque	32 264 (41.2%)
03. Maladie ischémique	32 159 (41.1%)
04. Cancer solide	29 608 (37.8%)
05. Fibrillation auriculaire	27 424 (35.1%)
06. Cataracte	24 399 (31.2%)
07. Dépression et troubles de l'humeur	24 050 (30.7%)
08. Maladies cérébrovasculaires	22 447 (28.7%)
09. Démence	21 643 (27.7%)
10. Diabète	18 022 (23.0%)

Prévalence en fonction du nombre de comorbidités chroniques



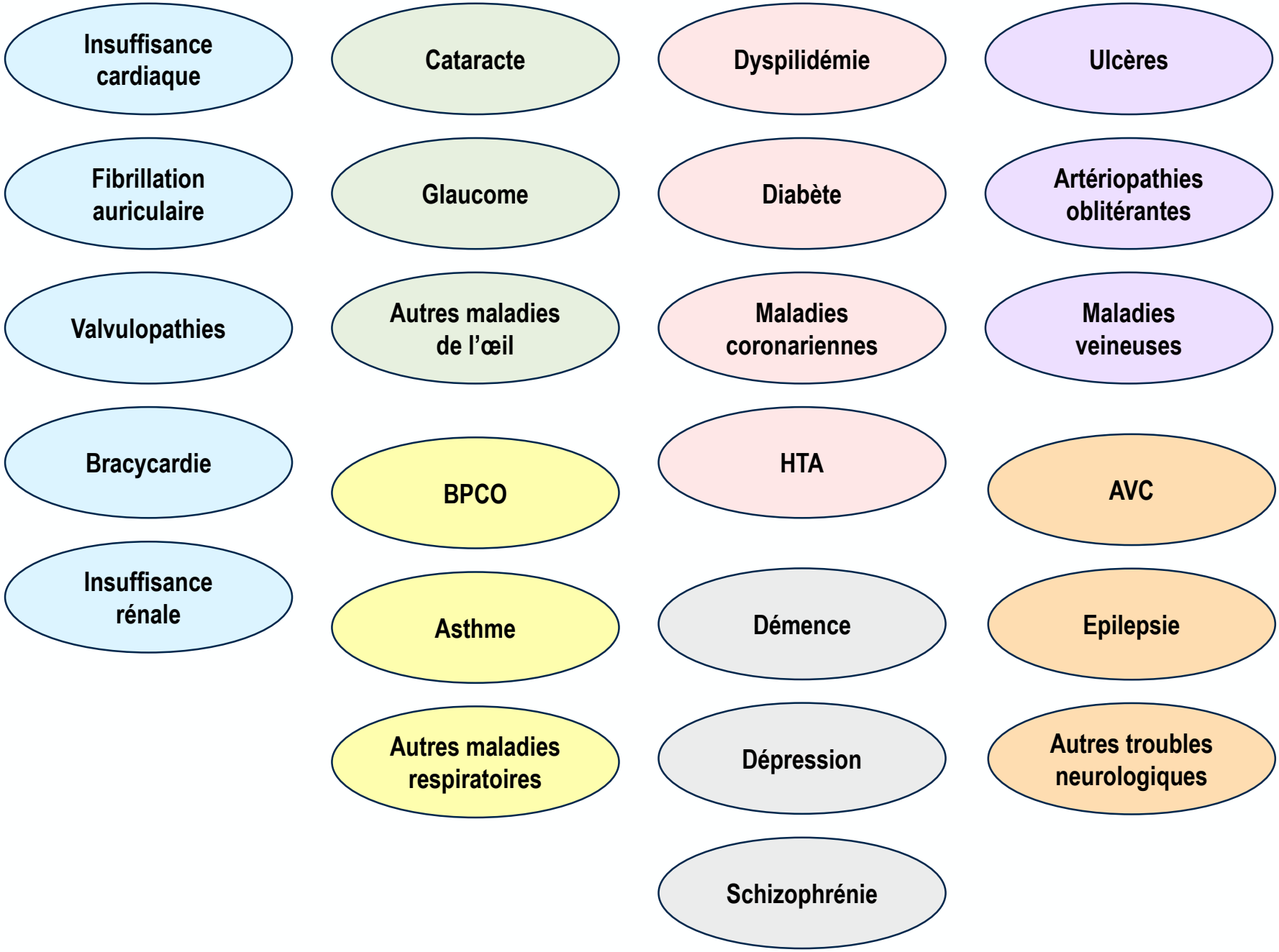

Cancer (n= 23 289)
Insuffisance d'organe (n= 28 526)
Troubles neurodégénératifs (n= 20 277)
Proportion (%)
100
80
60
40
20
0
65 70 75 80 85 90 95 ≥100
Âge au décès
Nombre de maladies chroniques
0 1 2 3 4 5 6 ≥7

Comment visualiser les relations entre maladies chroniques ?



Schäfer et al. BMC Public Health 2014

Analyse factorielle


Insuffisance cardiaque
Fibrillation auriculaire
Valvulopathies
Bracycardie
Insuffisance rénale
Cataracte
Glaucome
Autres maladies de l'œil
BPCO
Asthme
Autres maladies respiratoires
Dyspilidémie
Diabète
Maladies coronariennes
HTA
Démence
Dépression
Schizophrénie
Ulcères
Artériopathies oblitérantes
Maladies veineuses
AVC
Epilepsie
Autres troubles neurologiques

CLINICAL RESEARCH STUDY

THE AMERICAN JOURNAL of MEDICINE®

Choosing Wisely? Measuring the Burden of Medications in Older Adults near the End of Life: Nationwide, Longitudinal Cohort Study

Lucas Morin, MS,[a] Davide L. Vetrano, MD,[a,b] Debora Rizzuto, PhD,[a] Amaia Calderón-Larrañaga, PhD,[a,c] Johan Fastbom, MD, PhD,[a] Kristina Johnell, PhD[a]

[a]Aging Research Center, Karolinska Institutet, Stockholm, Sweden; [b]Department of Geriatrics, Catholic University of Rome, Italy; [c]EpiChron Research Group on Chronic Diseases, Aragon Health Sciences Institute, IIS Aragon, Miguel Servet University Hospital, Zaragoza, Spain.

ABSTRACT

BACKGROUND: The burden of medications near the end of life has recently come under scrutiny, because several studies suggested that people with life-limiting illness receive potentially futile treatments.

METHODS: We identified 511,843 older adults (>65 years) who died in Sweden between 2007 and 2013 and reconstructed their drug prescription history for each of the last 12 months of life through the Swedish Prescribed Drug Register. Decedents' characteristics at time of death were assessed through record linkage with the National Patient Register, the Social Services Register, and the Swedish Education Register.

RESULTS: Over the course of the final year before death, the proportion of individuals exposed to ≥10 different drugs rose from 30.3% to 47.2% (P <.001 for trend). Although older adults who died from cancer had the largest increase in the number of drugs (mean difference, 3.37; 95% confidence interval, 3.35 to 3.40), living in an institution was independently associated with a slower escalation ($\beta = -0.90$, 95% confidence interval, −0.92 to −0.87). During the final month before death, analgesics (60.8%), antithrom-botic agents (53.8%), diuretics (53.1%), psycholeptics (51.2%), and β-blocking agents (41.1%) were the 5 most commonly used drug classes. Angiotensin-converting enzyme inhibitors and statins were used by, respectively, 21.4% and 15.8% of all individuals during their final month of life.

CONCLUSION: Polypharmacy increases throughout the last year of life of older adults, fueled not only by symptomatic medications but also by long-term preventive treatments of questionable benefit. Clinical guidelines are needed to support physicians in their decision to continue or discontinue medications near the end of life.

 • The American Journal of Medicine (2017) ■, ■-■

KEYWORDS: Elderly; End of life; Medications; Polypharmacy

See related Editorial, pXXX

Funding: See last page of article.

Conflict of Interest: See last page of article.

Authorship: See last page of article.

Ethical Approval: This study was approved by the Ethical Review Board in Stockholm, Sweden.

Availability of Data and Materials: Clinical data and individual data from the Swedish Prescribed Drugs Register data cannot be made publicly available. Interested researchers can access the aggregated data from the Swedish Prescribed Drugs Register (http://www.socialstyrelsen.se/statistik/statistikdatabas/lakemedel).

Requests for reprints should be addressed to Lucas Morin, MS, Karolinska Institutet, Aging Research Center, Gävlegatan 16, 11330 Stockholm, Sweden.

E-mail address: lucas.morin@ki.se

http://dx.doi.org/10.1016/j.amjmed.2017.02.028

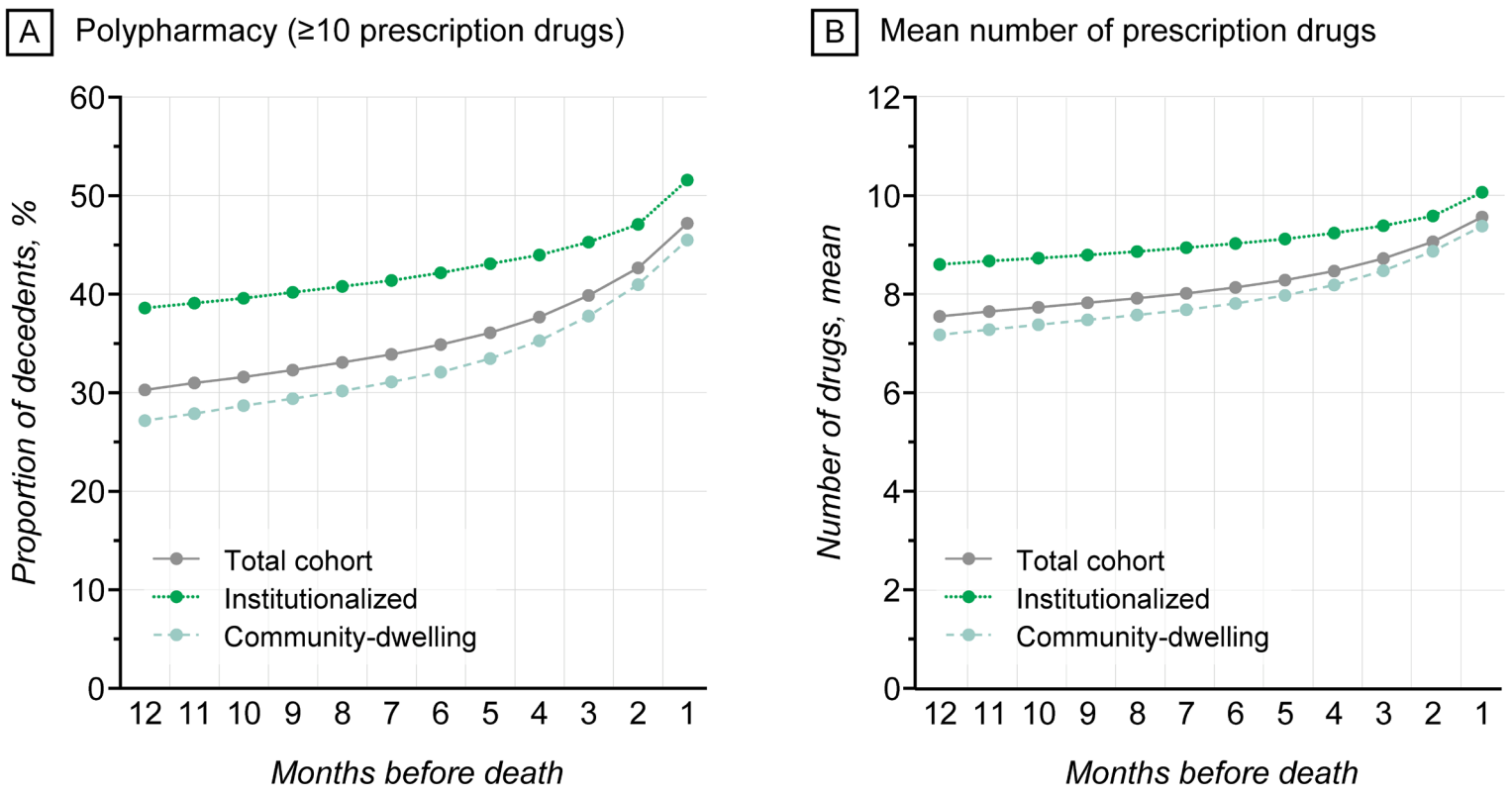


Figure 1

(A) Polypharmacy and (B) number of prescription drugs over the course of the last 12 months of life of older people in Sweden, by living arrangement. Proportions and means are standardized for both sex and age, using the total population as reference. All trends statistically significant (P <.01).

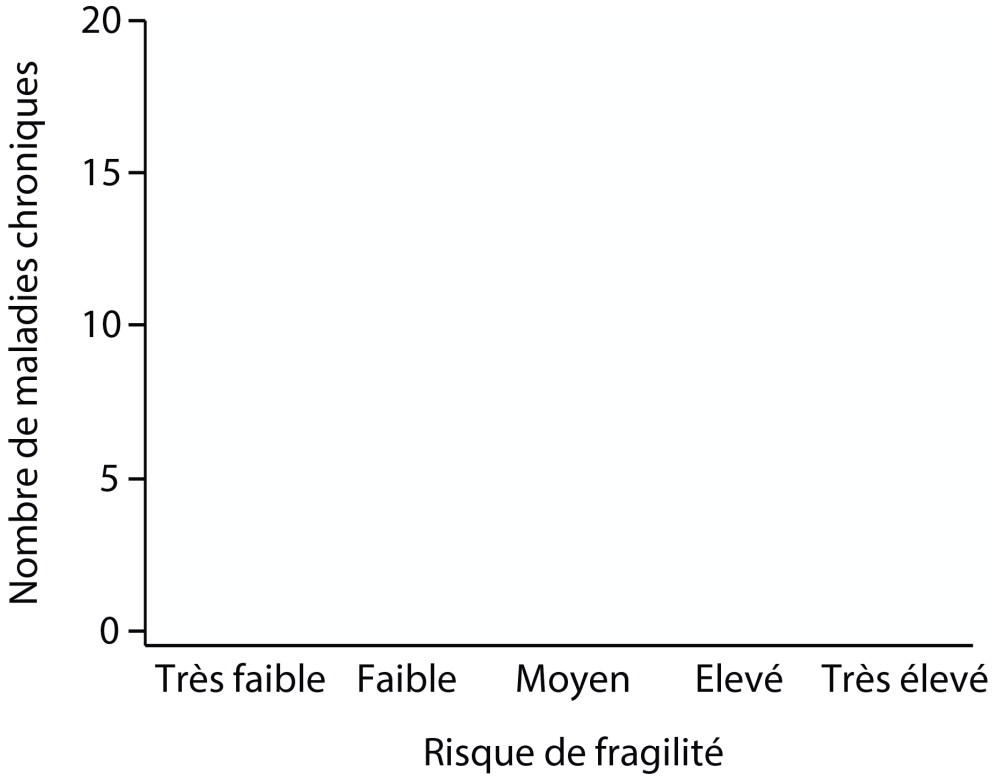
Source: Morin L., et al. Choosing wisely? Measuring the burden of medications in older adults near the end of life: Nationwide, longitudinal, cohort study. *Am J Med.* 2017; doi: 10.1016/j.amjmed.2017.02.028

ATC	Drug class	Prevalence of use (%)			Absolute change
		12th month	6th month	Last month	Percentage points (95% CI)
B01	Antithrombotic agents	52.5%	53.5%	53.8%	+1.3 (1.1 to 1.5)
C03	Diuretics	47.1%	49.2%	53.1%	+6.0 (5.8 to 6.2)
N02	Analgesics	40.2%	45.9%	60.8%	+20.6 (20.4 to 20.8)
N05	Psycholeptics (e.g. anxiolytics)	39.5%	42.8%	51.2%	+11.7 (11.5 to 11.9)
C07	Beta blocking agents	39.4%	40.3%	41.1%	+1.7 (1.5 to 1.9)
C09	ACE Inhibitors / ARBs	31.8%	31.9%	30.6%	-1.2 (-1.4 to -1.0)
B03	Anti-anemic preparations	30.6%	32.9%	34.6%	+4.0 (3.8 to 4.2)
N06	Psychoanaleptics	27.4%	29.5%	32.6%	+5.2 (5 .0 to 5.4)
A02	Drugs for acid related disorders	23.8%	27.4%	35.1%	+11.3 (11.1 to 11.5)
C01	Cardiac therapy	22.2%	23.0%	24.3%	+2.1 (1.9 to 2.3)
D02	Emollients and protectives	22.1%	25.3%	28.7%	+6.6 (6.4 to 6.8)
C10	Lipid modifying agents	18.7%	18.1%	16.3%	-2.4 (-2.5 to -2.3)
C08	Calcium channel blockers	17.8%	17.1%	15.4%	-2.4 (-2.5 to -2.3)
A12	Mineral supplements	17.6%	18.7%	20.5%	+2.9 (2.7 to 3.1)
A10	Drugs used in diabetes	15.1%	15.3%	15.4%	+0.3 (0.2 to 0.4)

THE LANCET

Development and validation of a Hospital Frailty Risk Score focusing on older people in acute care settings using electronic hospital records: an observational study

Thomas Gilbert, Jenny Neuburger*, Joshua Kraindler*, Eilis Keeble, Paul Smith, Cono Ariti, Sandeepa Arora, Andrew Street, Stuart Parker, Helen C Roberts, Martin Bardsley, Simon Conroy*


20
15
10
5
0
Nombre de maladies chroniques
Très faible
Faible
Moyen
Elevé
Très élevé
Risque de fragilité

lucas.morin@ki.se