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21st Century Early Adult (55-74) Deaths from Brain-Disease-Deaths Compared to All Other Cause Mortality in the Major Western Countries – Exposing a Hidden Epidemic

Colin Pritchard[a], Lars Hansen[b], Anne Silk[c] and Emily Rosenorn-Lanng[d]

[a]Faculty of Social Sciences, Bournemouth University, Bournemouth, UK; [b]Honorary Senior Lecturer, Dept of Psychiatry, University of Southampton, Bournemouth, UK; [c]Fellow in Public Heath, Bournemouth, UK; [d]Statistician Faculty of Health & Social Sciences, Bournemouth University UK, Bournemouth, UK

ABSTRACT

Objectives: To examine early adult deaths (EAD) – people aged 55–74 due to brain disease deaths (BDD) compared to all other causes (AOC) in the 21st century in 21 major Western countries (MWC).

Method: EAD are below MWCc average life expectancy. All mortality drawn from the latest WHO data. The three global BDD categories consist of mental and behaviour disorder, nervous diseases and Alzheimer and other dementias. Mortality rates per million are analysed for people 55–74 years and total age-standardised death rates (ASDR). BDD rates between 2000–2015 compared against AOC of deaths for EAD and ASDR. Confidence Intervals determine any significant difference AOC and BDD over the period 2000–15, plus an examination of EAD in six separate global mortality categories.

Results: *EAD*: The separate BDD categories for EAD significantly positively correlated, validating their combination as BDD. Every country's AOC 55–74 rates fell substantially, but fourteen country's BDD rose substantially (>20%) and all MWC countries BDD rose significantly more than AOC. *ASDR*: All nations total AOC fell substantially, whereas seventeen BDD rates rose substantially and every country's BDD significantly increased compared to AOC deaths. Six other EAD mortalities, circulatory, cancer, respiratory, compared to BDD produced Odds Ratios ranging from 1:1.54 to 1:2.36 such were the marked differences over the period.

Discussion: Positive news is that AOC are down across all investigated countries in the 21st century. However, the extent of the EAD rises in just 16 years indicates that these BDD conditions are starting earlier suggesting multiple interactive environmental factors impacting upon brain related diseases.

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Introduction

The first comparative international study of changing patterns of brain disease deaths (BDD) covered the period 1979–1997 found that 12 of the 21 major Western countries (MWC) had substantially increased rates of BDD [1]. Subsequent studies over the period 1989–2014 reported that all 21 countries had risen substantially (+20%) in the intervening years [2–5]. However, some had argued that these apparent rises were essentially due to demographics, the presence of more elderly (75+) people in the population and better diagnosis [6–8], indeed, they postulated the 'Gompertzian hypothesis' was the cause of these increases [7,8]. This theory states that because people were now living longer, they were now living long enough to develop age-related diseases. This was challenged by findings that over 25 years the US BDD rates had jumped from being 15th highest of the 21 MWC to becoming the second highest rate despite every other country also increasing its BDD. Even countries with traditional low levels of BDD, such as Austria, Greece and Japan had seen a doubling of their rates over the same period [4,5]. Furthermore, there has simultaneously been a growing number of Western world studies of rises in cases of early-onset dementia and deaths [9–13].

Nonetheless, it is recognised that many of the BDD conditions are age-related, so it was decided to focus on WHO mortality rates of people aged 55–74 year olds which is well below the current average life expectancy in the 21 MWC – now averaging 82 years [14]. Hence, a death in this age band can be said to be an `early-adult death' (EAD).

This population-based study examines any changes in EAD from BDD to be compared with EAD from all other cause of death (AOC) during the 21st century. In addition Total BDD and AOC mortality are also analysed based upon the WHO age-standardised death rates (ASDR) [14].

To provide a wider perspective six separate major global mortality categories are also examined for EAD to explore to what extent have these other six mortality

CONTACT Colin Pritchard cpritchard@bournemouth.ac.uk Faculty of Social Sciences, Bournemouth University, Royal London House, Christchurch Rd, Bournemouth, BH13LT, UK

categories varied over the period compared to the BDD outcomes.

There is one null hypothesis:

During the 21st century there will be no significant differences in EAD and ASDR BDD compared to AOC for the two age-bands over the period.

Method

The 21 MWCs to be reviewed are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the UK and the USA. These countries, it is argued, share broadly the same liberal democratic tradition, having health care systems based on scientific evidence. Life expectancy in these countries ranges from Japan at 84.2 to the USA at 78.5 years. Based upon WHO data [14] we calculated MWC average life expectancy to be 81.98 years (82 years).

All mortality data is taken from the latest WHO annual statistics report (2020), updated May 2018 for the years 2000 and 2015 [14]. Some countries have earlier index years, which are noted in the tables, e.g. Canada 2013, France 2014. Austria, the Netherlands and Sweden have the later year 2016 but in view of the relative short time period being analysed it was decided to report these country's most recent year.

In the earlier comparative international studies of BDD [4,5] only the global categories of nervous disease deaths (NDD) and Alzheimer's and other dementias (Alz) had been used to examine BDD over the years [14]. These global diagnostic categories are based upon the International Statistical Classification of Diagnoses (ICD10th Revision) [15] which are used in the WHO mortality statistics [14]. However, it was realised we had omitted a major global category that includes neurodegeneration conditions that are not reported in the other two neurological categories, which is the mental and behavioural disorder category [15]. To validate combining the three global categories into a total BDD rate, the changing rates of all three categories in all MWC in the 21st-century countries will be examined separately. Spearman rank order correlation tests will be used to determine any statistical congruence between the categories. Theoretically, any general change in overall BDD should be significantly reflected in all three categories. Thus, total rates BDD for both EAD and ASDR age bands will include the three global diagnostic categories to measure BDD rates during the 21st century.

The BDD will be directly compared with AOC for both people aged 55–74 years, the EAD and total mortalities of the ASDR per million (pm), which controls for age, gender and population [14]. To calculate death rates for the 55–74 year olds we examine the numbers of deaths in this age band to be divided by the population of each country's 55–74 year olds to produce an EAD mortality rate per million (pm). The ASDR data is extrapolated directly from the WHO statistics [14].

The three neurological categories are in chapters five and six of the International Statistical Classification of Diseases 10th revision [15], used by the WHO in the reported data [14,15]. The broad outlines are as follows from chapter five:

1. *The Mental and Behavioural Disorder* (M&BD) category (coded F00–F99), note the over-lap in coding of the diagnoses, which covers a wide range of conditions, many `psychological' to include personality disorders, anxiety states, as well as the major psychiatric disorders – the depressions and the schizophrenias. The key neurological conditions not included anywhere else are the organic based mental disorders, systemic brain disease and vascular dementias. In respect to the range of psycho-social diagnoses it is assumed that there will be few death certificates siting the diagnoses such as personality disorders, anxiety disorders, etc., as causes of death. Whilst deaths associated with psychoses and psychological crises mainly result in suicide, found in the Intentional Self-Harm category coded X60-X84 and Y870 outlined in chapter twenty of the ICD [15].

In ICD's chapter six are the two other global brain disease categories:-

2.*Nervous Disease Deaths* (coded G00-G99) include a range of conditions such as motor neurone disease, Parkinson's disease, Huntington's disease, multiple system atrophy, vascular syndromes of brain in cerebrovascular disease, and extra-pyramidal movements disorders, etc. As we are measuring the total category, there is no need to identify the separate diagnostic categories, which are contained in this WHO omnibus category [15].

3. The Alzheimer's and Other Dementias (coded F01, 03, G30-31) include Alzheimer's disease, Pic's disease and other dementias not classified elsewhere and unspecified dementias, etc. [15]. As the analysis is based upon the total category, specific diagnoses are not an issue.

The three categories together, assuming there will be positive statistical significance, can be combined to become BDD.

For clarity purposes in the tables we first present AOC compared to BDD for the age band 55–74 and total deaths in ASDR [14]. To test for any statistically significant changes between AOC and NDD mortality over the period a series of confidence interval calculations are carried out using SPSS statistical programme.

People with neuro-degenerative diseases often face years of chronic disability, which impacts upon patient', families and health and social services. To give a more `clinical perspectives we report upon changes in the numbers of BDD and population in

four countries to exemplify the practical burden of these conditions.

To provide a further perspective we examine changes in six other specific major global mortalities of 55–74 years to compare against the EAD neurological results. These are circulatory diseases (coded I00–I99), cancers (Coo-D48), respiratory (J00–J99), digestive system (K00–K93), diabetic diseases (E10–E14), and genitourinary (N00-N99) [15]. With such broad codes these global categories also include many separate diagnostic conditions within their sphere. In order to avoid repetition, we report only on the ten of largest populated Western countries. We measure any difference via a series of ratios of change 2000–2015 as each country serves as its own control group. We calculate the average EAD ratio of change for each separate mortality category or the ten countries, against average BDD ratio to produce a six other causes to BDD odds ratios. These results are also illustrated in a bar chat of the separate global categories change in the 21st century. The baseline being 1.00 and plus or minus ratios of change.

Results

Congruence of nervous disease and Alzheimer's and other dementias and mental and behavioural disorders

EADs (55–74): Table 1 presents EAD of the separate three categories changes death rates of all 21 countries. All three mortality categories correlated statistically significant; the nervous disease with Alzheimer (Rho = +0.8893, $p < 0.001$), the nervous disease and mental & MD deaths (Rho = +0.5808, $p < 0.005$) and Alzheimer's and other dementia and mental & BD (Rho = +0.5432, $p < 0.01$). All three categories now form the BDD global category.

Fourteen countries had increased rates in all three separate categories, only France had falls in three and

Table 1. Nervous disease deaths (NDD), Alzheimer and other dementia (Alz), mental and behavioural disorder deaths = brain disease deaths (BDD) 55–74 year olds rates per million 2000–2015 Ratio of Change. Ranked by highest BDD.

Country and % change	NDD 55–74 2000-2015	Alzh 55–74 2000-2015	BD 55–74 2000–2015	BDD 55–74 2000-2015
1.Finland	394– 642	305– 364	225– 188	924– 1194
Ratio change	1.63	1.19	0.84 #	1.29
2.Denmark	339– 398	115– 204	312– 518	766– 1120
Ratio change	1.17	1.77	1.66	1.46
3.USA	364– 455	147– 255	119– 213	630– 923
Ratio change	1.25	1.73	1.79	1.47
4.Netherlands	350– 379	116– 223	151– 245	617– 847
Ratio change	1.08	1.92	1.62	1.37
5.UK	256– 399	164– 254	106– 180	526– 833
Ratio change	1.56	1.55	1.70	1.58
6.Sweden	267– 387	157– 239	241– 198	665– 824
Ratio change	1.45	1.52	0.82 #	1.24
7.Belgium	377– 383	206– 172	188– 218	771 773
Ratio change	1.02	0.83 #	1.16	1.00
8.Switzerland	297– 356	141– 180	165– 215	603– 751
Ratio change	1.20	1.28	1.30	1.25
9.Norway	365– 390	125– 176	161– 182	651– 748
Ratio change	1.07	1.39	1.13	1.15
10.Germany	254– 342	60– 136	149– 271	463– 749
Ratio change	1.35	2.27	1.82	1.62
11.New Zealand 2013 Ratio change	279– 314 1.13	129– 161 1.25	151– 245 1.62	559– 720 1.29
12.Canada 2013	376– 318	159– 168	1.61– 161	696– 647
Ratio change	0.85 #	1.06	1.00	0.93 #
13.Australia	272– 335	105– 171	108– 126	485– 632
Ratio change	1.23	1.63	1.17	1.30
14.France	397– 321	173– 119	225– 188	795– 628
Ratio change	0.81 #	0.69 #	0.84 #	0.79 #
15.Ireland	291– 345	174– 176	147– 95	612– 616
Ratio change	1.19	1.01	0.65 #	1.01
16.Austria	160– 286	74– 129	97– 198	331– 613
Ratio change	1.79	1.74	2.04	1.85
17.Spain	299– 329	195– 179	116– 99	610– 607
Ratio change	1.10	0.92	0.85 #	0.99
18.Italy	266– 327	186– 143	71– 82	523– 552
Ratio change	1.23	0.77 #	1.15	1.06
19.Portugal	230– 290	144– 142	31– 88	405– 520
Ratio change	1.26	0.99	2.84	1.28
20.Greece	213– 279	121– 99	11– 84	345– 462
Ratio change	1.31	0.82 #	7.64	1.34
21.Japan	123– 180	28– 26	19– 28	170– 234
Ratio change	1.46	0.93 #	1.47	1.38

Notes: # fall of BDD.

Spain in two. In every country nervous disease rates of people aged 55–74 were higher than the other two categories but mental & BD rates were higher than Alzheimer's in 10 countries.

The highest EAD total BDD rates were in Finland 1194 per million (pm), then Denmark 1120 pm and the USA 923 pm. Down to lows of 234 pm in Japan, 462 pm Greece and Portugal 520 pm.

In 14 countries total EAD had risen substantially (+20%) over the period but Canada fell equivalent to 7% and France 21%. The average MWC ratio of change was 1.27.

Table 2 present changes in EAD between all other causes and brain disease mortality over the period.

In every nation AOC of deaths fell substantially ranging from Ireland, with a ratio of change 0.55 to Japan and Germany 0.79, an overall average of 0.71.

A series of confidence intervals found that every country had a statistically significant proportional rises in EAD BDD compared to AOC, even in the outlier France whose C.I was significant (1.02–1.26).

Total ASDR for all other causes vs. brain-disease-deaths: Table 3 lists total AOC and BDD rates.

Every Western country's total ASDR AOC fell substantially (>20%) except the USA (18%), with an overall average 27% fall.

The highest total BDD rates were in Finland 617 pm, the UK at 517 pm and the Netherlands 498 pm, down to the lowest countries Japan 77 pm, Greece 103 pm and Portugal 192 pm. Seventeen countries rates increased substantially (>1.20) over the period the exceptions being France (1.02), Finland (1.14) and Spain (1.16).

Notable (>50%) AOC to BDD odds ratio occurred in Australia 1.54, Austria 1.95, Denmark 1.64, Germany 1.90, Greece 1.81, Ireland 1.68, Japan 1.75, the Netherlands 1.60, the UK 2.21 and the USA 1.78.

Again every country's total BDD was statistically significantly greater than AOC, which of course had fallen, in contrast to BDD rises, including the relative outliers for EAD in Spain (C.I. 1.36–1.90), Canada (C.I 1.43–1.97) and France (C.I, 1.14 – 1.60).

Examples of EAD other global mortalities. Table 4 presents six separate global mortality rates of EAD between 2000 and 2015 in the 10 biggest population MWC. The average ratio of reduced mortality for these conditions over the period was circulatory 0.53; cancer 0.81, respiratory 0.76. digestive 0.72, diabetes 0.60 and genitourinary 0.77 showing a welcome reduction in EAD in these conditions. Conversely, the average BDD ratio of change was 1.25 producing an AOC to BDD odds ratios ranging from 1.54 to 2.26. To illustrate these difference EAD of the BDD to these six other categories, Figure 1 graphically highlights the changes over the period.

Examples of EAD, ASDR and population numbers. (MWC full numbers of BDD and population are given in a supplementary table.)

Practice perspective in numbers: To give brief examples of the extent of changes in EAD (55–74) BDD, we present numbers of BDD against changes in numbers of population. These countries are Japan, France, the UK and the USA.

French brain EAD numbers went from 8,631 to 8617, down 1% whilst its 55–74 years population rose 31%. UK BDD went from 5,821 to 11,499 up 98%, whilst this population rose 25%. In America EAD went from 26,909 to 62,413, a rise of 132%, with this population up 58%.

Total BDD numbers in France rose from 57,914 to 93,640 up 62%, whilst its total population rose 9%. Britain's numbers went from 38,083 to 157,623 a rise of 314% with a population rise of 9%. American numbers rose from 220,723 to 573,094 up 160% against a rise in total population of 14% in just 16 years.

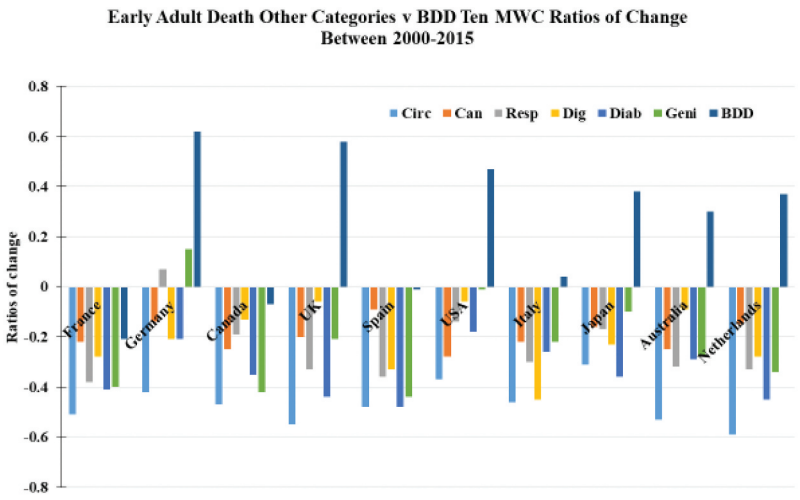

Figure 1.

Table 2. EADs (55–74) all other causes vs. BDD rates per million 2000–2015. Confidence intervals AOC vs. BDD. Ranked by highest BDDs.

Country and rank	All other EAD 2000–2015	EAD brain 2000 – 2015	Other: brain odds ratio	C.I other: brain low – high
1.Finland	13,235–9150	924– 1194		1.71- 2.04
Ratio change	0.68	1.29	1.90	
2.Denmark	15,972–10,752	766– 1120		1.97- 2.39
Ratio change	0.67	1.46	2.18	
3.USA	14,603–10,457	630– 923		1.84- 2.27
Ratio change	0.72	1.47	2.04	
4.Netherland	13,804–9233	617– 847		1.84- 2.28
Ratio change	0.67	1.37	2.04	
5.UK	14,982–9771	526– 833		2.17- 2.72
R change	0.65	1.58	2.43	
6.Sweden 2016	11,389–8838	665– 824		1.44- 1.78
Ratio change	0.78	1.24	1.59	
7.Belgium	13,498–9498	771– 771		1.28- 1.58
Ratio change	0.70	1.00	1.43	
8.Germany	13,890–10,907	463– 749		1.83- 2.32
Ratio change	0.79	1.62	2.05	
9.Switzerland	10,660–7574	603– 751		1.57- 1.96
Ratio change	0.71	1.25	1.76	
10.Norway	12,533–8231	651– 748		1.57- 1.95
Ratio change	0.66	1.15	1.74	
11. New Zealand 13 Ratio change	12,847–8281	559– 720		1.78- 2.24
	0.64	1.29	2.02	
12.Canada 2013	11,848–8178	696– 644		1.20- 1.50
Ratio change	0.69	0.93	1.39	
13.Australia	11,090–7458	485– 632		1.72- 2.19
Ratio change	0.67	1.30	1.94	
14.France 2014	11,698–8156	795– 628		1.02- 1.26
Ratio change	0.70	0.79 #	1.13	
15.Ireland	16,021–8843	612– 616		1.63- 2.05
Ratio change	0.55	1.01	1.84	
16.Austria 2016	13,258–9924	331– 613		2.16- 2.84
Ratio change	0.75	1.85	2.47	
17.Spain	12,056–8286	610– 607		1.29- 1.63
Ratio change	0.69	0.99	1.43	
18.Italy	12,098–8351	523– 542		1.33- 1.70
Ratio change	0.69	1.04	1.51	
19.Portugal	14,571–9555	405– 520		1.72- 2.24
Ratio change	0.66	1.28	1.94	
20.Greece	13,281–10,032	345– 462		1.54- 2.04
Ratio change	0.76	1.34	1.76	
21.Japan	10,453–8238	170– 234		1.43- 2.13
Ratio change	0.79	1.38	1.75	

Notes: Correlating EAD AOC v BDD Rho = +0.3370 $p < 0.1$

Even in the country with the lowest rate of BDD Japan their total numbers increased from 17,943 to 69,217, equivalent to a rise of 286%, whilst its population fell 1% over the period.

Discussion

The study's limitations are that although the analysis is of global mortality categories, we know nothing about possible variations within these categories. Whilst mental and behaviour disorder deaths correlated positively with the other two categories, they include many psycho-social diagnoses within the codes than the other organic brain conditions [15] and all three BDD EAD categories rose considerably and are positively correlated over the period . This was the direct opposite of EAD in respect to the other categories such as circulatory, cancer and respiratory deaths, etc., which supports the rational for combing the three global BDD categories.

Whilst most countries BDD rose, the slight outliers, like Canada and Spain, but especially, France, cannot readily be explained. Nonetheless, French total BDD mortality rose over the period and significantly more than its all other cause mortality. This might suggest that people in these countries lived to reach the older (75+) age-band before death. Only country-specific research could provide the answers to these questions, and the extent of such changes need to be investigated further, not least to explain the changes within each separate country.

One feature, linked to the USA, is that during the period they were involved in military activities and over 350,000 US military personnel had sustained a traumatic brain injury, which of course is related to later neurodegenerative conditions [16,17], though this is not without controversy [18]. However, other countries have also reported higher than expected neurological conditions in their former military

Table 3. Age-standardised death rates all other cause vs. brain mortality 2000 vs. 2015: confidence intervals. Ranked by highest brain disease deaths.

Country rank and year	All other	Ratio change	Total brain	Ratio change	Other: brain odds ratio	C.I. low –	high
1.Finland	4704	0.72	543	1.14	1.58	1.40 -	1.80
2015	3368		617				
2. UK	4998	0.71	234	2.21	3.11	2.67 -	3.68
2015	3527		517				
3. Netherlands	4885	0.69	312	1.60	2.32	1.99 -	2.68
2014–16	3373		498				
4. USA	5259	0.82	265	1.78	2.17	1.85 -	2.53
2015	4315		471				
5. Denmark	5455	0.69	270	1.64	2.38	2.03 -	2.78
2015	3771		443				
6 = Sweden	4224	0.76	321	1.28	1.68	1.45 -	1.97
2014–16	3206		411				
6 = Switzerland	3983	0.73	310	1.33	1.82	1.55 -	2.12
2015 21	2915		411				
8. Canada	4246	0.71	290	1.30	1.83	1.43 -	1.97
2011–13	3286		377				
9. Norway	4633	0.72	289	1.30	1.81	1.55 -	2.13
2015	3321		376				
10. Germany	5469	0.70	195	1.90	2.71	2.28 -	3.26
2015 2	3803		370				
11. Ireland	5573	0.70	209	1.68	2.40	2.12 -	3.01
2012–14	3713		352				
12. Belgium	4942	0.76	287	1.22	1.61	1.37 -	1.89
2015	3732		349				
13. Australia	4067	0.76	223	1.55	2.04	1.72 -	2.44
2015 19	3075		345				
14. New Zealand	4644	0.77	223	1.41	1.83	1.54 -	2.20
2011–13	3564		315				
15. Spain	4325	0.72	270	1.16	1.61	1.36 -	1.90
2015 18	3110		312				
16. France	4406	0.75	286	1.02	1.36	1.14 -	1.60
2012–14	3313		291				
17. Italy	4296	0.75	181	1.20	1.60	1.30 -	1.95
2015	3238		217				
18. Austria	4879	0.66	103	1.95	2.95	2.32 -	3.77
2014–66	3219		201				
19. Portugal	5549	0.71	97	1.98	2.79	2.17 -	3.57
2012–14	3944		192				
20. Greece	5145	0.76	57	1.81	2.38	1.72 -	3.31
2015	3892		103				
21. Japan	3691	0.81	44	1.75	2.16	1.48 -	3.12
2015 20	3007		77				

Notes: AOC vs. BDD Rho = +0.1354 *n.*sig.

personnel, whose environment often carries a range of various occupational hazards [19–23]

There is the issue of possible better diagnosis of early-onset-dementia and the Gompertzian hypothesis that states people are now living longer to develop age-related diseases [6–8]. This may be a partial explanation, but it is doubtful whether it could explain the extent of the changes over such a short period. Clearly, more targeted country-specific research is needed to explain each country's results. However, despite these limitations, the extent of the widening gap between 2000 and 2015 of brain disease to all other cause of deaths indicates something is happening far, far faster than any possible artefact of population demographics could explain. It must be stressed that these changes have occurred in just the last 16 years, strongly suggesting the changes are accelerating when compared to the late 20th century [1],

As both 55–74 years and total BDD were significantly increased compared to AOC, we can reject the null hypothesis. The speed and extent of BDDs especially in the EAD, strongly indicates that brain disease morbidity is beginning earlier and incident rates appear to be accelerating. What can be said with confidence, is that the demographic and Gompertzian hypothesis cannot account for the size and speed of these changes of EAD during this century. Such increased numbers are reflected in the need for a British charity `Young Dementia UK" and the Parkinson's Disease Society developing a `young persons' section, whilst in America there is now a training scheme for young caregivers for family members with amyotrophic lateral sclerosis [24].

Nonetheless, the BDDs rates must not disguise the good news that except for rises in BDD, general mortality rates have substantially fallen across most of the 21 MWCs. Yet, the remarkable, almost hidden epidemic rise in brain-related disease needs to be confronted. It is the rises in EADs that are the most worrying especially considering the differences between all other cause and the six separate other global categories.

Table 4. Early adult deaths (EAD) (55–74) separate global categories in 10 MWC and average other categories to average BDD odds ratios.

Country EAD	Circ	Can	Resp	Dig	Diab	Geni	BDD
Australia	3545	5112	939	371	349	123	485
2015	1676	3821	636	338	246	89	632
Ratio	0.47	0.75	0.68	0.91	0.71	0.72	1.30
Canada	3893	5719	827	532	451	180	696
2013	2056	4310	673	463	291	105	644
Ratio	0.53	0.75	0.81	0.87	0.65	0.58	0.93 #
France	3033	5910	622	711	295	121	795
2014	1479	4617	386	510	175	72	628
Ratio	0.49	0.78	0.62	0.72	0.59	0.60	0.79 #
Germany	5142	5557	795	849	319	143	463
2015	2991	4767	853	673	252	164	749
Ratio	0.58	0.86	1.07	0.79	0.79	1.15	1.62
Italy	3943	5706	589	712	419	139	523
2015	2114	4438	410	389	311	109	542
Ratio	0.54	0.78	0.70	0.55	0.74	0.78	1.04
Japan	2644	4864	858	473	168	156	170
2015	1828	4071	710	363	108	141	234
Ratio	0.69	0.84	0.83	0.77	0.64	0.90	1.38
Netherland	4632	6003	1094	463	337	148	617
2016	1885	5089	730	333	186	98	847
Ratio	0.41	0.85	0.67	0.72	0.55	0.66	1.37
Spain	3631	5300	1058	745	295	202	610
2015	1897	4289	674	499	154	113	607
Ratio	0.52	0.91	0.64	0.67	0.52	0.56	0.99
UK	5727	5941	1842	684	183	131	526
2015	2557	4733	1228	642	102	103	833
Ratio	0.45	0.80	0.67	0.94	0.56	0.79	1.58
USA	5508	5893	1470	614	606	296	630
2016	3485	4224	1257	649	499	294	923
Ratio	0.63	0.72	0.86	1.06	0.82	0.99	1.47
Average MWC ratios	**0.53**	**0.81**	**0.76**	**0.72**	**0.60**	**0.77**	**1.25**
Average other: BDD odds ratios	2.36	1.54	1.64	1.74	2.08	1.62	1.00

Notes: # BDD fall.
Abbreviations: Circ = circulatory; Can = cancer; Resp = respiratory; Dig = digestive; Diab = diabetes; Genit = genitourinary; BDD = brain disease deaths.

We can only speculate on the underlying reasons for these profound changes other than to say it appears there must be strong environmental elements. This is seen in examples of studies that have found environmental factors associated with different neurological diseases, though not without controversy. These include links with certain occupations [21–23], endocrine disruptive chemicals [25], rises in background electromagnetism [26–30] and the influence of the one of the most frequent chemical in the human environment, organophosphates [31–33]. Thus, these multiple, possibly, interactive environmental factors impact upon individuals with underlying genetic predisposition. This may account for why oxidative stress is linked to both neurological and cancer syndromes, as the environmental factors are not linier but rather as people respond depending upon their individual genetic predisposition [34–39].

When we recall other environmental impacts upon human health such as DDT, smoking, lead in petrol and asbestos, all had 'early warning' indications but slow governmental reaction [40]. This can be seen today in relation to asbestos, which usually takes two decades to manifest itself before serious symptoms emerged, exemplified by the current cohort of Western people dying from asbestosis [41–43]. Further research is needed to explain our results in order to avoid a possible repetition of the unacceptable delays from past health-environmental crises. Such numbers of people and rates dying of brain related diseases in the most advanced countries is a major concern. Urgent answers are needed to explain this `hidden epidemic'. Hopefully finding measures that can redress the underlying environmental factors impacting upon human health.

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Notes on contributors

Professor Colin Pritchard, crosses many disciplinary boundaries having the advantage of being able to look back more than 50 clinical year and see the bigger picture. His comparative international studies have ranged from child-abuse-related-deaths, child mortality and poverty, suicides, truancy an delinquency, and was amongst the first to note substantial changes in brain-related-diseases in the Western world.

Dr. Lars Hansen, Consultant Psychiatrist has shared with Professor Pritchard in their suicide studies, as he is a

specialist in early onset psychosis and problems a pyramidal side affects.

Dr. Anne Silk, Senior Research Fellow in Public Health, has a long research career, especially interested in possible contributory factors that has led to the accelerating of neurological morbidity, especially with its earlier onsets, as she too benefits from longevity that facilitates lateral thinking.

Emily Rosenorn-Lanng, Senior Statistical Research Officer, who has been in a long collaborator in the team and also shares a particular interest in possible environmental factors.

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