RADICAL

#128
2021

STATISTICS

Radical Statistics Group

Radical Statistics was formed in 1975 by researchers and statisticians with a common interest about the political implications of their work, and an awareness of the actual and potential misuse of statistics.

'Radstats' is independent of any other organisation. Members are radical in being committed to helping build a more free, democratic and egalitarian society.

Our particular concerns are:

- The mystifying use of technical language to disguise social problems as technical ones
- The lack of control by the community over the aims of statistical investigations
- The power structures within which statistical workers are employed and which control the work and how it is used
- The fragmentation of social problems into specialist fields, obscuring connectedness

Website and Social Media

Radstats.org.uk has information about all activities, including over 100 back issues of the *journal*. Twitter is *@radicalstats, Radical Statistics* on Facebook.

Website is managed by Robin Rice: *rcrice@ymail.com*

Discussion list

RadStats hosts an open email discussion list. This can be accessed from the website or at: www.jiscmail.ac.uk/lists/radstats.html

List owner is Alison Macfarlane: *a.j.macfarlane@city.ac.uk*

How to subscribe

Radical Statistics is usually produced three times a year.

Rates are £35 per year, £10 for low-income, free for students, and £35 for organisations and institutions, which can be invoiced.

How we are organised

We have an administrator and a managing board or 'Troika' who co-ordinate and promote the work of the group. The editorship of *Radical Statistics* rotates. Sub-groups are open to all members.

Troika are*:*   *troika@radstats.org.uk*
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Contents of this Issue

Following on from the discussions at the London Conference in February 2020, I asked contributors if they would agree to a student converting their power-point presentations into short texts. This has been partly successful this year. We did at last manage to get two of the presentations at the 2020 Conference – those of Danny Dorling and Andy Street - converted to text and these are the first two articles in this issue. The third article is the paper presented by Lynn McDonald at the Conference. The final article is a follow-up by Simeon Scott to an earlier article in Issue 125.

Prospects for RSN 129

We have at least one article promised for RSN 129, but, clearly, we are going to have to rely on contributions from the 2021 Conference. Given that this 2021 Conference hosted by Newcastle will be virtual, it is vital that presenters provide their powerpoints to the organisers and to this editor (roy.carr_hill@yahoo.com) **and that**, if they can't themselves provide a write-up of their presentation, they agree that a student should try and convert their presentation into a write-up, for the author to clear for publication.

Another proposal for generating material was the relatively recent publication of the third RadStats compendium, Data in Society, which was presented by the books' editors on Saturday 28th 2020. It is a landmark publication, bringing together many of the crucial issues around the production and use of quantitative information.

The contributors to Data in Society summarise many of the concerns around the accessibility and use of statistics in contemporary society. Examples include the lack of data from banking and financial organisations hides the extent of tax evasion of taxation. Government agencies are reducing the number of data series they make available for public scrutiny. The number of healthcare treatments in Britain provided by private groups is growing steadily.

The book is an eye-opener on the difficulties in holding governments and large organisations to account. Do you agree with the authors' interpretations?

As the editors acknowledge there are data topics the volume does not cover in detail. These include the use of statistics by legal practitioners, housing and homelessness data and climate change data.

The editors of the RadStats journal have been planning to devote one journal issue to topics raised by Data in Society, and to topics not discussed in the book. Could you write an article for the journal on any of the topics above? Are there are areas of debate missing from Data in Society?

Administrative Issues

As the Administrator informed those receiving printed copies of the issue that, at the AGM held in London at the end of February 2020, the decision was taken to raise the subscription from £25 to £35 for those wishing to continue to receive printed copies (whilst the membership subscription only – with online access - would remain at £25 for those £10 for those on low incomes), otherwise they would be taken off the distribution list which originally includes all 300+ members.

Also, although the2021 Conference will be virtual, there are still preparation and ongoing costs. We are asking for a donation; the suggested amount is £20, however all smaller donations will help cover the costs.

Please make sure you have updated your subscription, *or make a donation*! - by going to www.radstats.org.uk/membership/ where you can pay by cheque, standing order, PayPal - or by filling in your details on page 52.

Significance*

Lawrence M. Lesser

He knew the line,
the red line, bright line,
thin blue line,
the legal line of incitement.
He assumed it was protected
speech to enrage "special" followers
with years of false grievance,
culminating in urging
they "walk to the Capitol",
"show strength", "fight like hell",
and "take back our country".

And he assumed his lawyer calling
for "trial by combat" might
also be excused as not specific
enough.

But like statisticians, judges make
decisions informed by context,
lest we unduly discriminate
between values barely on
opposite sides
of a boundary,
whether bulletproof glass
or the chance
of error
we choose to live
with.

* Our field's newly-revised approach to significance testing (e.g., https://www.tandfonline.com/doi/full/10.1080/00031305.2016.1154108 or https://www.amstat.org/asa/files/pdfs/p-valuestate-ment.pdf)

The UK Health Crisis:
Early 2020 Update

Danny Dorling

Introduction

This short paper is a summary of a talk given in London in February 2020 immediately before the 2020 pandemic began shortening many lives in the UK. On 22 January 2020, in the House of Commons, the Prime Minister said 'The discrepancy in life expectancy in this country is a disgrace. Nonetheless, it is coming down, and it will come down. Life expectancy overall is at an all-time high'.

This was not true as far as the data then available could reveal. According to the Office for National Statistics (ONS), life expectancy in the UK peaked in 2014, and had not yet returned to this level. In addition, the Infant Mortality Rate (IMR) in England and Wales in the years after 2014 had risen for 3 years in a row and, if the UK had achieved the average for the European Union, then 5 fewer babies would have died in the week that the Prime Minister spoke.

Eurostat has helpfully begun reporting on how the UK compares with the EU-27 on a range of health measures. Protection of the health of its people is one of the most important roles for a government. These European comparisons will be especially useful to reveal whether the UK is succeeding in the difficult years ahead.

Life Expectancy and Infant Mortality Rates

One report, entitled "Mortality and Life Expectancy Trends in the UK"[1], issued in November 2019, implied that life expectancy had not fallen and, if it were to do so, it would be a 'subgroup' issue. "No government wants to see the life expectancy of its population fall on its watch. However, the risk of this happening is very real – particularly within specific subgroups of the population. This can only be prevented

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[1] Mortality and Life Expectancy Trends in the UK (2019),
https://www.health.org.uk/publications/reports/mortality-and-life-expectancy-trends-in-the-uk

through coordinated, wide-ranging, long-term action, led from the centre of government."

However, the life expectancy did fall in the UK in 2015 and by 2018, and life expectancy across all groups in the UK remained below its 2014 high when most recently measured, which was for 2018. Figure 1 below shows the most recent European comparisons available for four countries from 2014 to 2017:
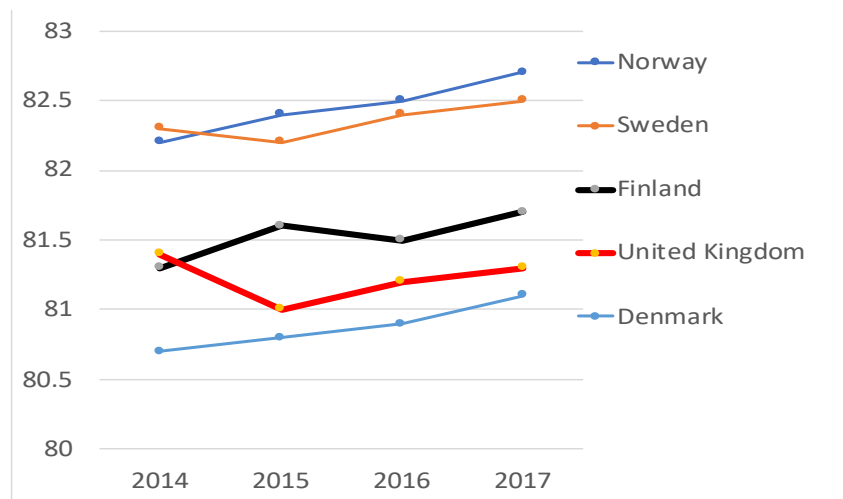
Figure 1: Life Expectancy: North-West Europe, 2014-2017[2]

The deterioration since 2014 is further demonstrated in Figure 2, which shows the changing trends in mortality rates in England and Wales from 2000 to 2018. This figure shows that the age-standardized morality rate was declining steadily until 2011 and reached its lowest rate in 2014. However, the mortality rate rose in 2015 and by 2018 had still not attained its previous low in 2014.

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[2] Data Release (2019), https://ec.europa.eu/eurostat/databrowser/view/sdg_03_10/default/table?lang=en

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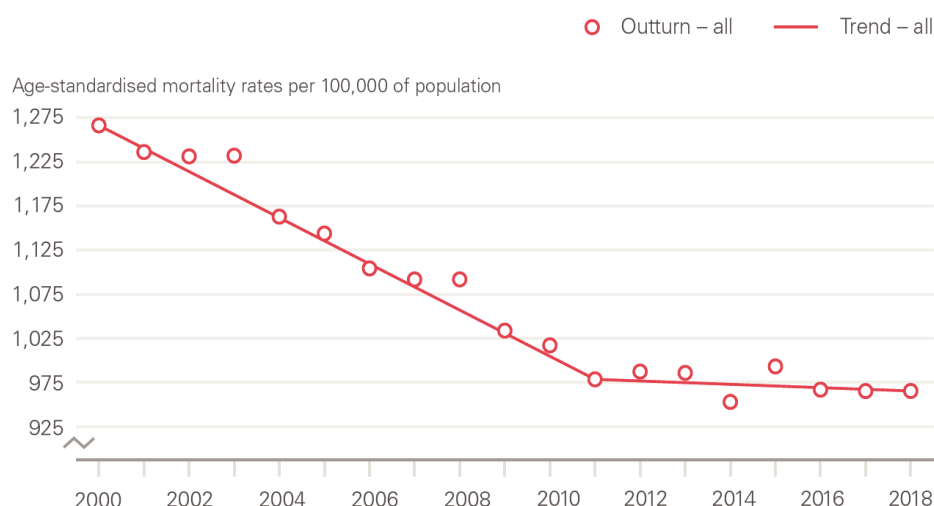
Source: Health Foundation analysis using ONS, Deaths registered in England and Wales, 2018.

Figure 2: Changed Trend in Mortality Rate Improvements, England and Wales, 2000-2018[3]

The IMR has risen significantly in England since 2014 compared to Scotland, as seen below, according to the last line estimate for England & Wales. This means upwards of an estimated additional 1100 infants have died since 2014.

IMR(/1000)	2011	2012	2013	2014	2015	2016	2017	2018	
Scotland	4.1	3.7	3.3	3.6	3.2	3.3	3.3	3.2	
England	4.2	4	3.8	3.6	3.7	3.8	3.9		
Difference	-0.1	-0.3	-0.5	0	-0.5	-0.5	-0.6		**Total**
Babies	72	219	349	0	349	348	407		1745

Figure 3: Single-Year Life Tables- England & Wales[4]

The deteroration in health is also shown by the decrease in life expectancies at birth for males and females between 2014 and 2018, as seen below in red. Life expectancies at birth decreased after 2014 for women in England and for men and women in Scotland, Wales and the UK overall.

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[3] Mortality and Life Expectancy Trends in the UK (2019),
https://www.health.org.uk/publications/reports/mortality-and-life-expectancy-trends-in-the-uk
[4] Hiam, Lu., Dorling, Danny, McKee, Martin (2020) Things fall apart: The British Health Crisis 2010-2020", British Medical Bulletin, February.

	Life Expectancy at birth				Change 2014-2018			
	2014		2018		Years		Days of life	
	Men	Women	Men	Women	Men	Women	Men	Women
England	79.51	83.23	79.55	83.20	0.04	-0.03	15	-11
Northern Ireland	78.61	82.38	78.84	82.44	0.23	0.06	84	22
Scotland	77.32	81.34	77.05	81.01	-0.27	-0.33	-99	-121
Wales	78.79	82.61	78.23	82.19	-0.56	-0.42	-205	-153
UK	79.25	82.99	79.24	82.93	-0.01	-0.06	-4	-22

Figure 4: Life Expectancy at Birth for Males and Females, 2014 – 2018[5]

In contrast, the lowest IMR in the world was recently recorded in Finland, where life expectancy also continues to rise rapidly. "Finland has long been a country with low maternal and infant mortality. In 2015, the infant mortality rate was 1.7 deaths per 1,000 live births: only 97 children died during their first year of life. This was the lowest figure ever recorded in Finland"[6].

Finland's low IMR is also possibly the lowest rate worldwide in 2015 with only Luxembourg having a lower IMR in the European Union .

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[5] Life Expectancy at Birth for Males and Females, 2014-2018 (2019)
https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/lifeexpectancies/datasets/singleyearlifetablesuk1980to2018

[6] https://blogi.thl.fi/finlands-low-infant-mortality-has-multiple-contributing-factors/

Neonatal mortality rankings, European Union countries, 1990 to 2015

Neonatal Mortality, 1990
Deaths per 1,000 live births

Rank	Country
1	Germany (3.4)
2	Sweden (3.5)
3	France (3.6)
4	Finland (3.9)
5	Luxembourg (4.3)
6	Denmark (4.4)
7	UK (4.5)
8	Austria (4.6)
9	Belgium (4.6)
10	Netherlands (4.6)
11	Ireland (4.7)
12	Cyprus (5.6)
13	Slovenia (5.7)
14	Italy (6.4)
15	Spain (7.1)
16	Portugal (7.2)
17	Malta (7.5)
18	Croatia (8.1)
19	Greece (9.5)
20	Lithuania (9.5)
21	Czechia (10.3)
22	Poland (11.1)
23	Bulgaria (11.6)
24	Latvia (12.0)
25	Slovakia (12.5)
26	Romania (13.5)
27	Hungary (13.6)
28	Estonia (13.8)

Neonatal Mortality, 2015
Deaths per 1,000 live births

Rank	Country
1	(0.9) Luxembourg
2	(1.3) Finland
3	(1.4) Slovenia
4	(1.5) Cyprus
5	(1.5) Estonia
6	(1.6) Sweden
7	(1.8) Czechia
8	(2.0) Portugal
9	(2.1) Germany
10	(2.1) Austria
11	(2.1) Italy
12	(2.2) France
13	(2.2) Belgium
14	(2.3) Ireland
15	(2.4) Netherlands
16	(2.5) Denmark
17	(2.5) Lithuania
18	(2.6) Croatia
19	(2.7) UK
20	(2.8) Spain
21	(2.9) Greece
22	(3.1) Poland
23	(3.5) Hungary
24	(4.2) Slovakia
25	(4.4) Malta
26	(5.2) Latvia
27	(5.6) Bulgaria
28	(6.3) Romania

Figure 5: Neonatal Mortality Rankings, European Union Countries, 1990 to 2015[7]

State Spending and Taxation

EU countries now contrast greatly with other OECD countries, such as Colombia in South America, the UK, USA, Australia and Chile in terms of the proportion of their GDP that they spend on education, with the clear majority of their spending going towards state education rather than private education.

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[7]

https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/childhealth/articles/ukdropsin europeanchildmortalityrankings/2017-10-13

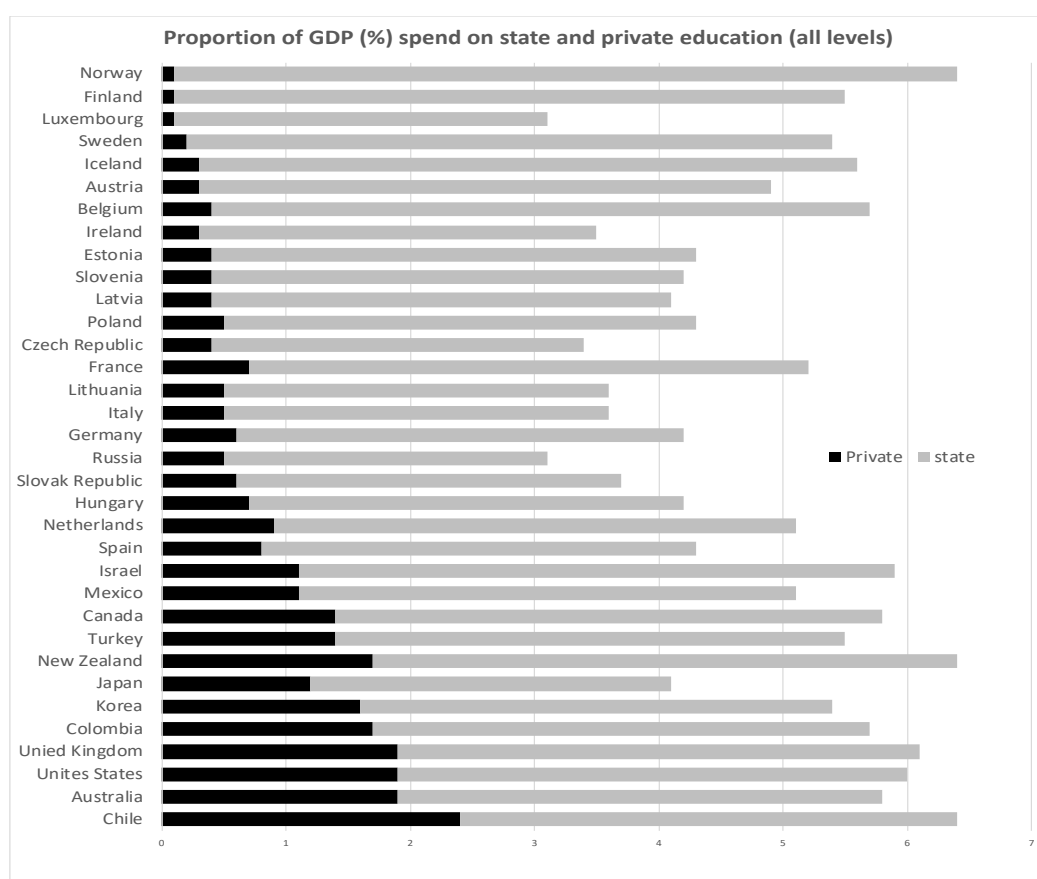**Proportion of GDP (%) spend on state and private education (all levels)**

Figure 6: Proportion of GDP (%) Spend on State and Private Education (All Levels)[8]

In comparison to OECD countries, the UK is a low-tax, low-spend country, as seen in Figure 7.

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[8] OECD (2019) Education at a Glance 2019, 10 Sep 2019, https://www.oecd-ilibrary.org/education/education-at-a-glance-2019_f8d7880d-en

Source: The 2010, 2012 and 2015 IMF database, projections after 2014
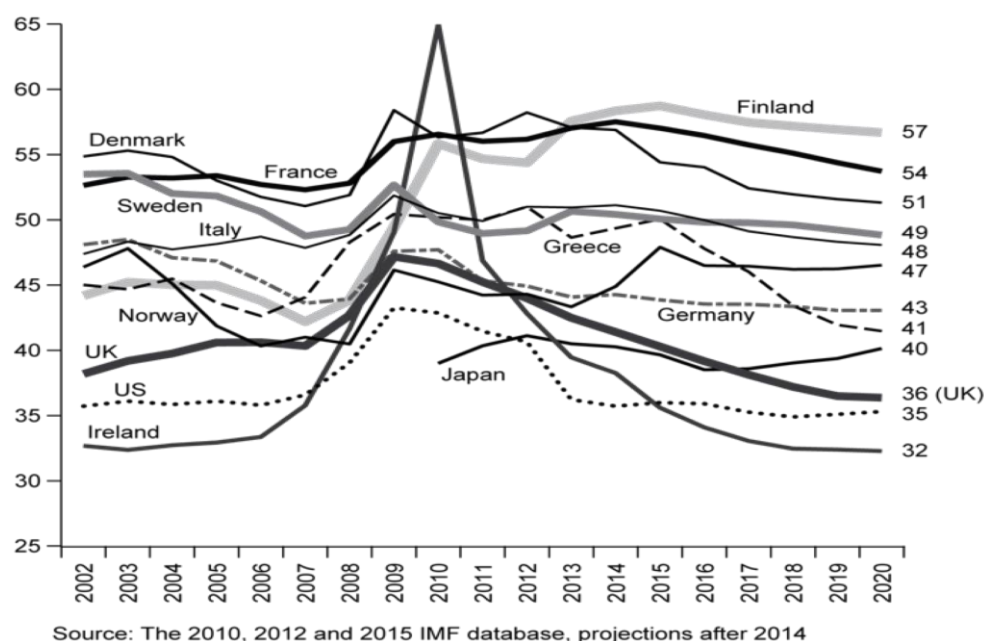
Figure 7: State Spending as a Proportion of GDP, Twelve Richest Countries (%), 2002-2020

Figure 8 shows the take of the 1% in the UK, US, Sweden and Finland. All 4 countries show a U-shaped trend in the take between the 1920s and 2010s, with a significantly higher take amongst the 1% in the US and UK after the 1980s. This data series is detailed in Dorling, Danny (2019) Inequality and the 1%, London: Verso (third edition).

Note: fiscal data for tax units in the USA (1913-2015) and Sweden (1916-2013). For Finland tax units 1920-1969, individual from 1970-1979, and post-tax 1980- 2016. For the UK the data is for 1910-2019, pre-tax, however estimated rates of tax evasion and avoidance by the top 1% are so high in the UK that this is a comparable time series to the post-tax Finish data from 1980 onwards.

Figure 8: The Take of the 1%, USA, UK, Sweden and Finland, 1910-2019[9]

The take of the 1% in the USA, UK, Sweden and Finland, 1910-2019

○ USA　● UK　✕ Sweden　◇ Finland

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[9] World Inequality Database (2019), The Take of the 1% in the USA, UK, Sweden and Finland, 1910-2019

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Death Rates in the UK

On the day of the EU referendum, data from the ONS revealed there had been 52,400 more deaths in the year to June 2015 as compared to the same period a year before. Death rates in England and Wales rose overall by 9% and by: 12% for those aged 90+; by 10% for those aged 85-89; 7% for those aged 80-84; 5% for those aged 75-70; and by 3% for those aged 55-74. Based on the ONS's data, death rates only fell for adults aged 25-29. The death rate increases were unprecedented and were primarily attributed to dementia and Alzheimer's, with influenza being suggested as a contributory factor. Austerity "almost certainly" played a major role. Those with long term care needs were dying earlier. These health and social services crises will worsen further as national finances worsen and as it becomes harder to recruit and retain staff from the European mainland after Brexit.

Figure 9 shows what a severe influenza epidemic looks like in England and Wales.
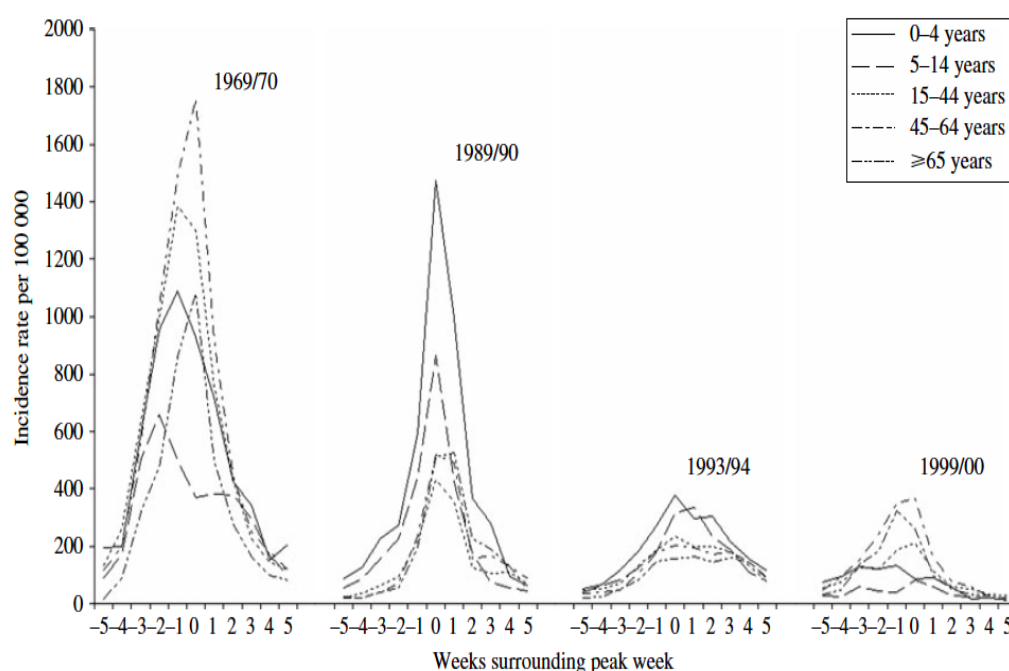

870   D. M. Fleming and A. J. Elliot

Fig. 2. The weekly incidence of Influenza-like illness (ILI) described by age for a selection of the more severe epidemics over the last 40 years. Age-specific rates are presented for the weeks surrounding the peak week of all-age incidence (week 0).

Figure 9: Weekly Incidence of Influenza-like Illness Described by Age for a Selection of the More Severe Epidemics over the Last 40 Years. Age-specific rates are presented for the weeks surrounding the peak week of all-age incidences.

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The largest single-year increases in mortality in England and Wales between 1840 - 2015, meaning the relative increase in mortality rate on the year before were in 1918 (24%), 1940 (16%), 1929 (15%), 1895 (13%), 1846 (10%), 1849 (9%), and 2015 (9%). The rises in mortality rates for 1918, 1940, 1929, 1895, 1846 and 1849 are all attributed to the Influenza pandemic, World War II, The Very Cold Winter, The Great Frost, and Cholera (twice), respectively. However, the 9% increase in 2015 is not yet attributed to a specific cause.

The rise in the overall death rate between the calendar years 2014 and 2015 was 7% - the last time a calendar year rise was a big as that was 1951 (when more people died of influenza in Liverpool than died in the 1918 pandemic[10]).

Before the great rise in deaths, we had some warnings that were dismissed as artifact, with self-reported surveys showing decreasing satisfaction with health in the UK between 2009 and 2013.

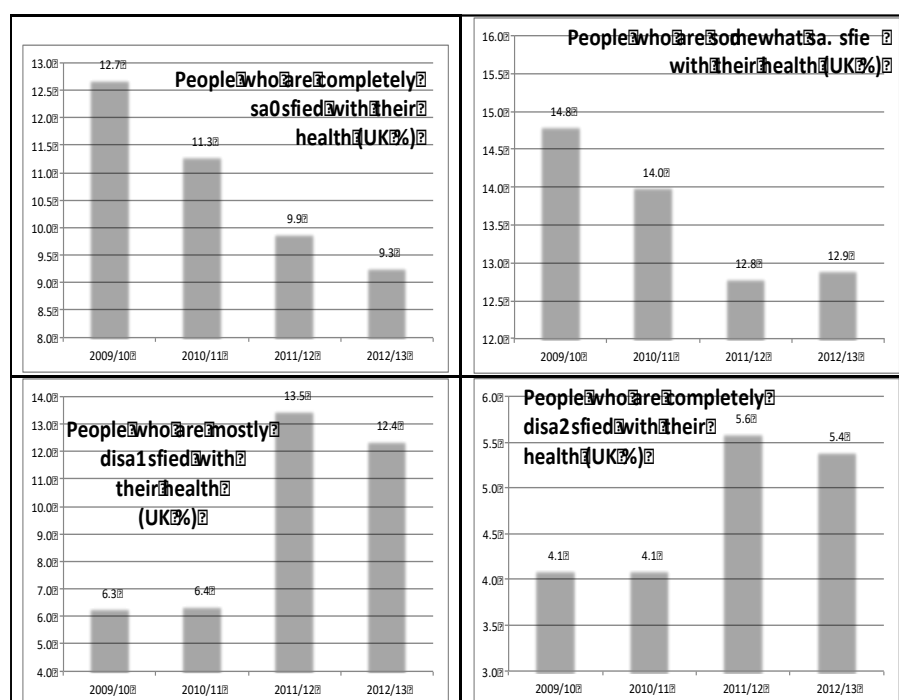**Trends in self-reported health used by ONS in annual well-being reporting**

Figure 10: Trends in self-reported health

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[10] http://wwwnc.cdc.gov/eid/article/12/4/05-0695_article

This is also shown in Figure 11 as cohort life expectancies at age 65 were shown to decrease for men and women between 2009 and 2017.
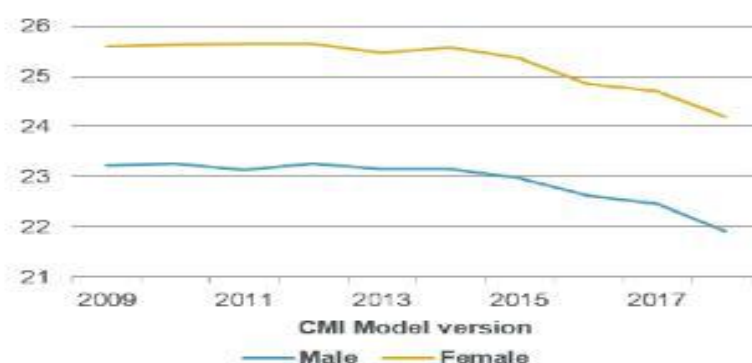

Figure 1: Cohort life expectancies as at 1 January 2019 at age 65.

Figure 11: Cohort Life Expectancies as at 1 January 2019 at age 65[11]

What does the June 2019 ONS 'MYE' data release tell us about life expectancy? On 26 June 2019, the annual midyear estimates of the population of the UK were released. The headline figure on mortality was that were 623,000 deaths, or 20,000 more than the previous year, meaning a 3% increase. However, the UK is also ageing, so to what extent does the rise in mortality matter?

According to the BBC story "*UK population growth rate stalls, official estimates show*"[12] a spokesperson of the lobby group "Population Matters" (which used to be called "The Optimum Population Trust") said: "*Our already unsustainable population is continuing to rise and that will continue until a positive strategy is put in place to address it*". The Guardian newspaper ran a story about migration saying: "*At 275,000, this net number of immigrants was 6,000 higher than the average for the past five years and 45,000 higher than last year.*"[13] And the Express

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[11] Lucinda Hiam and Martin McKee: The deepening health crisis in the UK requires society wide, political intervention, March 8, 2019: "*These are not just numbers, these are lives*". *https://blogs.bmj.com/bmj/2019/03/08/lucinda-hiam-and-martin-mckee-the-deepening-health-crisis-in-the-uk-requires-society-wide-political-intervention/*

[12] https://www.bbc.co.uk/news/uk-48769175

[13] https://www.theguardian.com/world/2019/jun/26/uk-population-rises-to-664-million-but-rate-of-growth-slows

newspaper reported that: "*The surge is the equivalent of adding a city the size of Coventry to the country.*"[14]

The data released by the ONS was very detailed. For instance, in Coventry, the number of men aged 86, 87, 88, 89 and 90+ who died in the most recent year was revealed to be 49, 45, 33, 49 and 254, respectively. The numbers those who had died the year before for those ages was, in turn: 46, 42, 27, 39, and 216. In each case, more had died, but of course this could just be down to chance and it partly was – but this is not true for England as a whole.

An analysis of ONS mid-year estimates on changes in mortality in England as released on 26 June 2019 shows that the mortality rate increased for several age categories between 2016/2017 and 2017/2018. For men, the mortality rate increased for those aged: 5-9 (14%), 15-19 (7%), 20-24 (12%), 30-34 (9%), 35-39 (3%), 40-44 (6%), 45-49 (2%), 50-54 (6%), 55-59 (5%), 60-64 (1%), 65-69 (3%), 65-70 (2%), 80-84 (2%), 85-89 (1%) and 90+ (1%). This means that there was an average increase in the mortality rate by 3% for men in England and only for men aged 0-4, 10-14, 24-29 and 70-74 did the mortality rate actually decrease between 2016/2017 and 2017/2018.

For women, the mortality rate increased or stayed the same over the same time period for those aged: 5-9 (0%), 20-24 (4%), 25-29 (3%), 45-49 (4%), 55-59 (4%), 60-64 (1%), 75-80 (2%), 80-84 (1%), 85-89 (1%) and 90+ (3%). This means that there was an average increase in the mortality rate by 2% for women in England and only for women aged 0-4, 10-14, 15-19, 30-34, 35-39, 40-44, 50-54, 65-69, and 70-74 did the mortality rate actually decrease between 2016/2017 and 2017/2018.

Figures 12 shows the increase in the mortality rates for both men and women as age increases and Figure 13 shows how the absolute number of people dying generally increases by age but does not impact both genders equally. Elderly women in general were more badly effected than elderly men in both 2015 (not shown in this figure) and very elsely women (aged 90+) in the rises in mortality between 2016-17 and 2017-2018. Elderly women were more likely to be living alone has compared to elderly men. Living alone in a time of austerity is more dangerous as you cannot pool resources. Conversely living alone is more beneficial,

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[14] https://www.express.co.uk/news/uk/1145955/uk-population-office-for-national-statistics-ons

at least directly, in a time when rates of infectious disease deaths are high (although the loneliness may well be hard to bare).

Figure 12: Rise in Mortality Rates by Age, Men and Women, England, 2016-17 to 2017-18, Increase in Mortality Rate per One Thousand People at Risk
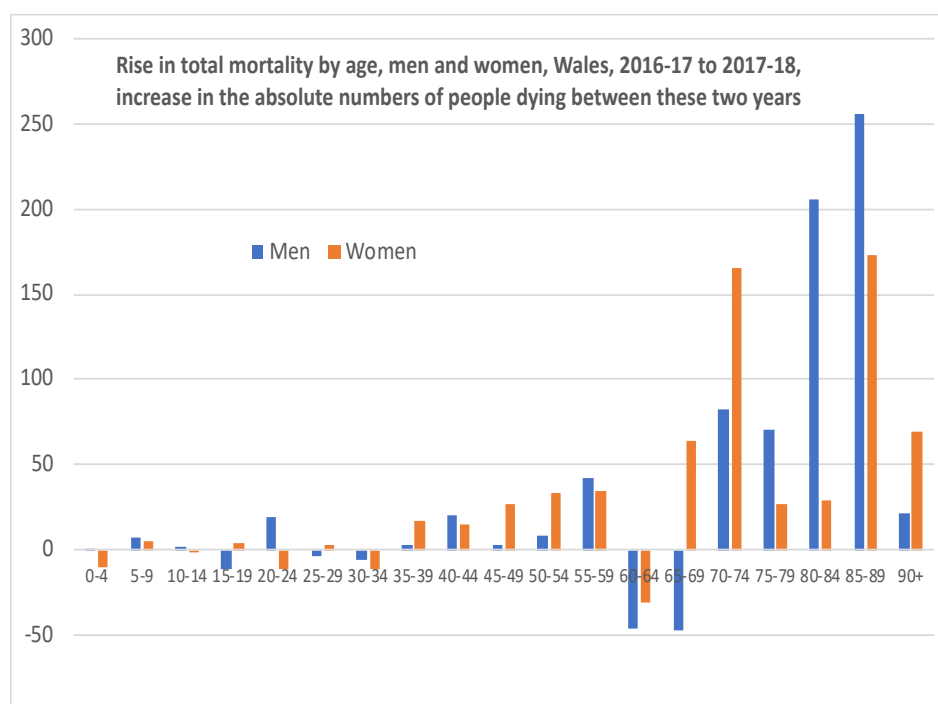

Figure 13: Rise in total mortality by age, men and women, England, 2016-17 to 2017-18, increase in the absolute number of people dying between these two years.

Other key data is hard to find. For countries with data up to 2016, we can see female life expectancy change over 2-year periods. In the UK, this shows a decrease in female life expectancy from 2013-2015 and again from 2014-2016[15]. Other countries with decreases in female life expectancy from 2013-2015 are Spain and Australia, but the life expectancy recovered from 2014-2016. For men, the worst effects come later on. For countries with data up to 2016, we can also see male life expectancy change over 2-year periods. Here too, Spain and Australia have decreases in male life expectancy from 2013-2015 that later recover in 2014-2016. However, a key difference is the male life expectancy in the UK which only decreases from 2014-2016[16].

Conclusion

To begin to conclude, it is interesting to look at the age distribution of voting verses rising elderly mortality rates. In the 2019 General election, of the 66 million people living in the UK[17]:

- 20 million did not vote or were eligible but not registered to vote ● Did Not Vote
- 14 million vote Conservative (365 seats of 650) ●●●●● ●●●●● ●● Conservative
- 12 million were children (and UK citizens) ● X
- 10 million voted Labour (203 seats) ●●●●● ●● Labour
- 4 million voted Liberal (11 seats) ● Liberal
- 3 million were not UK citizens● Not UK citizens
- 1 million voted in Northern Ireland (18 seats) ● Nth. Ireland
- 1 million voted Scottish National Party (48 seats) ● ● Scottish NP
- 1 million voted Green/Plaid or other (5 seats) ● Green/ Plaid

These 9 groups have been approximately assigned to 11 equal sized age groups in Figure 14.

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https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/lifeexpectancies/articles/changingtrendsinmortalityaninternationalcomparison/2000to2016

16

https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/lifeexpectancies/articles/changingtrendsinmortalityaninternationalcomparison/2000to2016

[17] https://www.ipsos.com/ipsos-mori/en-uk/how-britain-voted-2019-election

Age Group	Main Parties Recipient of Votes; Each square represents c.1 million people				
0-6	X	X	X	X	X
7-14	X	X	X	X	X
15-22	Labour	Labour	X	Did Not Vote	Did Not Vote
23-28	Labour	Labour	Green/ Plaid	Did Not Vote	Did Not Vote
29-35	Labour	Labour	Not UK Citizens	Did Not Vote	Did Not Vote
36-42	Labour	Not UK Citizens	Did Not Vote	Did Not Vote	Scottish N.P.
43-49	Labour	Did Not Vote	Did Not Vote	Liberal	Conservative
50-56	Labour	Did Not Vote	Did Not Vote	Liberal	Conservative
57-64	Labour	Did Not Vote	Did Not Vote	Conservative	Conservative
65-73	Nth. Ireland	Did Not Vote	Did Not Vote	Conservative	Conservative
74+	Did Not Vote	Did Not Vote	Conservative	Conservative	Conservative

Figure 14: Age Distribution of 2019 General Election Voters[18]

And some headlines from late 2019:

BBC news – 27 December 2019

"A 'vulnerable' woman gave birth in the centre of Cambridge on the day before Christmas Eve, it has been confirmed. Cambridge News reported twins were delivered in Sidney Street, near Trinity College, on 23 December… 'Accommodation had been provided to her and her partner for several weeks before the birth, along with other practical support to relieve their homelessness. We are not clear why this accommodation was not being used.'"[19]

26th February 2019

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[18] https://blogs.lse.ac.uk/politicsandpolicy/young-cosmopolitans-and-ge2019/

[19] https://www.bbc.co.uk/news/uk-england-cambridgeshire-50926784

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Homeless deaths: Oxford second worst in country - 33 in 5 years[20]

"In one electoral ward alone – Carfax – there were 91 premature deaths [2002-2016]. This number had almost doubled since we last looked at these issues in the 1980s. In Carfax, deaths amongst the homeless population accounted for 88% of all deaths under age 65 between 2014 and 2016. The majority of these homeless deaths were males. Homelessness not only cuts short lives; it increasingly dominates the profile of who dies young in Oxford."[21]

The situation as concerned health in late 2019 and early 2020 in the UK was very bad. No other European country had reported lower life expectancy in 2018 as compared to 2014. Adult social services in the UK had been repeatedly decimated since 2010 with only a fraction of those who kept an eye on the frail elderly employed still by the start of 2020. Public health surveillance had been cut severely. NHS funding had not risen in line with need or inflation and the number of hospital beds, especially intensive care beds, had been cut per 100,000 people. By some estimates more than 130,000 people had died prematurely in the years before 2020 due to austerity.[22] Just a small fraction of this number were infants or homeless and otherwise destitute younger adults. Most were out of sight out of mind frail and elderly people. Looking back it is hard to imagine how little we then cared about so many lives. Perhaps because we thought it would not be us.

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[20] https://www.oxfordmail.co.uk/news/17458981.homeless-deaths-oxford-second-worst-country---33-5-years/

[21] https://blog.geographydirections.com/2019/12/05/who-dies-young-in-a-rich-city-increasingly-the-homeless/

[22] https://www.theguardian.com/politics/2019/jun/01/perfect-storm-austerity-behind-130000-deaths-uk-ippr-report

Revisiting Nightingale´s vision to assess the outcomes of hospital treatment

Andrew Street

Abstract

Millions are admitted to hospital every year but very little is known about the impact that hospital treatment has on their health status. It is extraordinary that this is the case. In the 1860s Florence Nightingale led efforts to collect information about whether and by how much hospital treatment aided recovery and hospitals published results for their patients. But publication suddenly ceased and has only recently recommenced. I describe Florence Nightingale's vision for the use of information about health outcomes and the medico-political tensions that prevented this vision being realised for so many years. I then summarise research that uses this information to improve the quality of care of those who use the health service.

Introduction

Nightingale faced a similar problem in her role as superintendent of the female nursing team working in the English general military hospitals in Turkey. On arrival in Scutari in November 1854 she found three separate registers of those dying in hospital: the Adjutant's daily head-roll of soldiers' burials, the Medical Officers' Return and the Orderly Room return, all of which gave a different account of the number of deaths. She soon set about rectifying this "statistical carelessness" in order to record accurately how many soldiers had died. Unfortunately, we are still a long way from being able to compare meaningfully the death toll from coronavirus between one country and another.

Classifying diseases

On returning to England in 1856 Nightingale realized that each hospital had its own approach to recording information about its patients. So she created Model Hospital Statistical Forms which were recommended for widespread adoption in 1860 at the London meeting of the International Statistical Congress.

Nightingale had the forms printed and hospitals started using them. Guy´s Hospital published details of its cases from 1854 to 1861, including a table reporting fifteen Classes of Diseases and another reporting Causes of Accidents, categorized into twenty-two groups.

Group 21, for example, records all those hospitalized having suffered "Bites of animals, 7 dogs, 2 adders, monkey, horse, rat, elephant, and woman", revealing a somewhat surprising assortment of assailants on the streets of London back then or indeed whenever.

TABLE XI.—*The following Table gives the Causes of the Accidents, with the Sexes and Mortality.*

Causes of Accidents.	Total Cases.	Cured or Relieved.		Died.	
		Male.	Female.	Male.	Female.
1. Accidents on the river, in barges, and shipboard	90	78	3	9	—
2. Assaults	173	102	56	14	1
3. Accidental poisoning	37	15	14	5	3
4. Attempts at suicide	87	36	35	11	5
5. Burns from clothes taking fire	213	34	60	37	82
6. ,, heated fluids	177	90	46	26	15
7. ,, explosion of gas	12	11	1	—	—
8. ,, gunpowder	23	16	2	3	2
9. Collisions between opposing forces	108	90	14	4	—
10. ,, with street vehicles	416	299	55	54	8
11. Cuts and blows from sharp instruments	175	138	28	8	1
12. Falls down stairs	155	69	78	4	4
13. ,, from a height, scaffolding, &c.	832	679	83	62	8
14. ,, from curb stones and on the ground	553	417	116	18	2
15. Fall of heavy weights on patients	427	364	17	45	1
16. Gunshot wounds	16	14	—	2	—
17. Machinery accidents	233	216	2	15	—
18. Railway ,,	84	51	4	28	1
19. Sudden torsions of the body	64	60	4	—	—
20. Foreign bodies lodged in natural passages	22	15	3	1	3
21. Bites of animals, 7 dogs, 2 adders, monkey, horse, rat, elephant, and a woman	14	13	1	—	—
22. Causes of accident not ascertained	9	3	5	—	1
Total	3,920	2,810	627	346	137

From 1862 hospitals in London began to publish their data annually in the Journal of the Statistical Society of London. By 1866, the fifth and final year that the series was published, the statistics covered 29 hospitals across England (see Figure ??)

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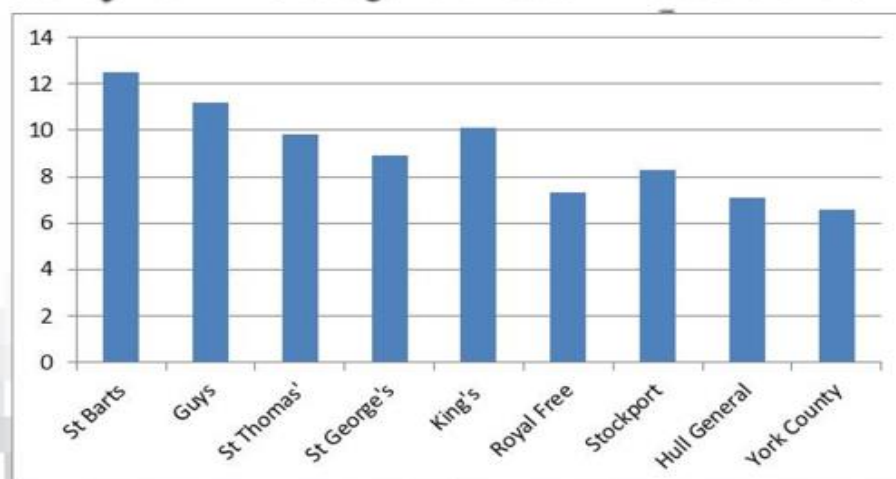
Publication ceased after a committee formed by the Royal College of Surgeons "reported adversely upon Miss Nightingale's Forms" claiming it was too costly to collect the data and the difficulty of securing actual as well as apparent uniformity to make valid comparisons. (reported in Cook,1913)

Nightingale´s ideas were eventually resurrected by Jacques Bertillon whose system was adopted in 1900 as the first International Classification of Causes of Death. In June 2018, the World Health Organisation (WHO) launched the 11th revision, now known as the International Classification of Diseases, with 16,000 codes.

Protecting staff

Nightingale herself used data about those who suffered disease and died to push for improvements in care both for patients and staff. In 1858 one of her papers with William Farr was presented at the Liverpool meeting of the National Association for the Promotion of Social Science comparing mortality rates of hospital nurses with civilian women of a similar age. She identified a higher mortality rate among nurses, demonstrating that they had greater exposure to fever and cholera. She used the data to maintain her pressure on hospitals to improve hygiene and to provide better protection of staff.

Florence Nightingale devoted herself to evidence based analysis of disease and health care "for the surer advance of medical knowledge and in the interests of good administration". Thanks in no small part to her efforts, our understanding of disease has improved enormously in

the 200 years since Nightingale´s birth, as has our knowledge of how to provide effective care in safe environments. Even so the coronavirus crisis has demonstrated the limits of our ability to combat new threats and that health and care systems still need strengthening to meet the demands being placed upon them.

Things began to change with the Korner Review of NHS Data (1984).

Between 1991 and 1995 in Bristol Royal Infirmary between 30 and 35 more children under 12 months died from open heart surgery than expected.

In 1998, Frank Dobson, Minister of Health under the first Blair Government announced that the government would publish hospitality rates and mortality rates by named surgeon
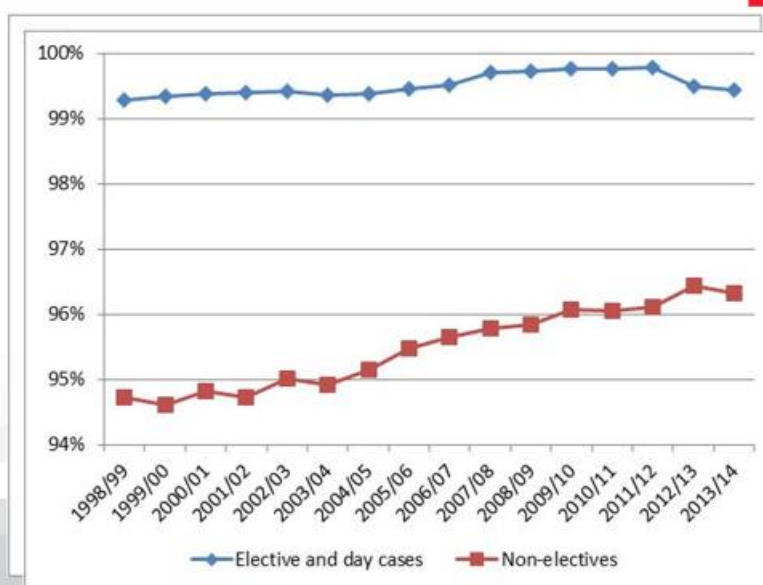
Collecting Outcome Data

Report Cards for cardiac surgery led to

- Fewer deaths but
- Selection of low risk patients (Dranove, 2003)

SCTS produced risk-adjusted mortality for CABG patients treated by 30 surgeons, published from 2001

- Fewer deaths and
- No risk selection (Bridgewater et al., 2007)

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In 2009, England introduced the national Patient-Reported Outcome Measures (PROMs)[https://www.england.nhs.uk/statistics/statistical-work-areas/proms/] programme. Since then all patients having hip replacement, knee replacement or groin hernia repair have been asked to fill in a health questionnaire before they have surgery and once again some months afterwards.

By March 2015 nearly (800,000 patients)[http://content.digital.nhs.uk/catalogue/PUB21189/final-proms-eng-apr14-mar15-fin-report.pdf] had replied. By comparing each patient´s answers, we can find out how much better they felt after surgery.

This information is also valuable for anyone planning to have one of these operations. People thinking about having hip or knee replacement will want to know that they'll feel better, if they´ll be able to walk without problems, get the shopping done and be free of pain. Now they can find out.

Before and After hip-surgery
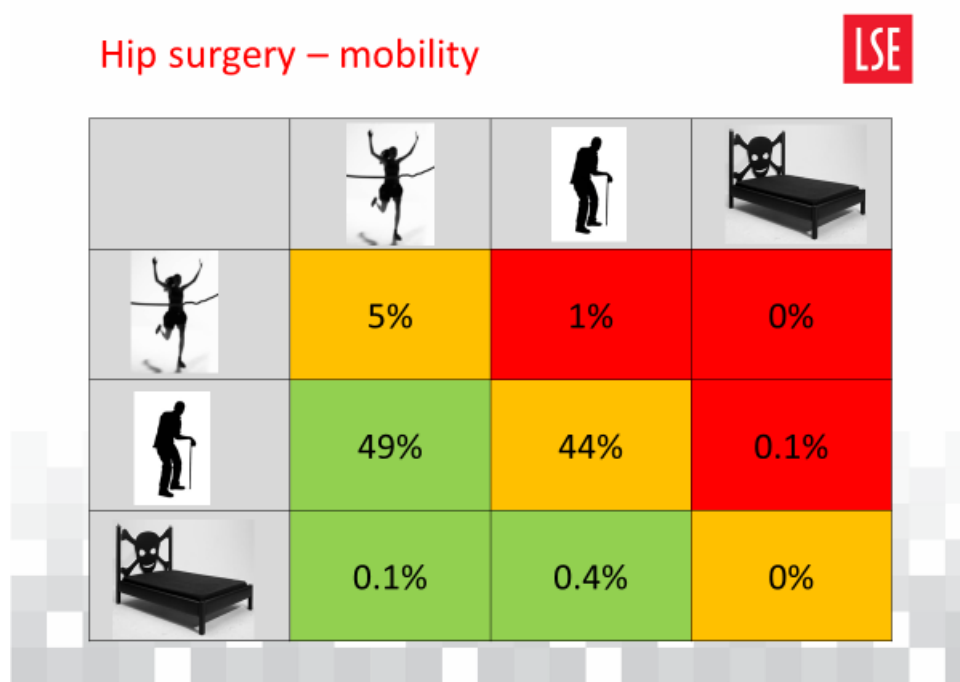
How will I feel after surgery?

At the University of York´s Centre for Health Economics we have developed a (webtool)[http://www.AfterMySurgery.org.uk] based on the answers to the health questionnaires completed by patients. The webtool summarises how different patients felt after surgery, taking

account of how they felt before surgery, how long they'd had health problems, and their age and gender.

Anyone thinking about having surgery can fill in the same simple health questionnaire. The webtool then matches these answers to similar patients who've had surgery before and summarises their experiences, showing how many felt better, worse or no different after surgery. The webtool also shows how many of these patients felt better in terms of walking about; pain; anxiety & depression; ability to wash and dress; and ability to carry out their usual activities.

The webtool is designed to be user-friendly and easily understandable. It only takes a moment to fill in and can be used during doctor visits or by patients and their families at home. It can be accessed from anywhere, so if you (or one of your friends or family members) are thinking of having hip, knee or hernia surgery, you can find out how you are likely to feel afterwards, based on what other people like you have said.

Between April 2009 and March 2016 500k English patients completed the EQ5D before surgery and 3 or 6 months afterwards:

Hip replacement: 185k

Knee replacement: 198k

Groin hernia repair: 115k

Gutacker & Street. (2017) Quality of Life Research

Our webtool ensures that this information can be tailored to the particular characteristics of each person. Until now such specific information has never been available to people thinking about having surgery. Doctors have been able to offer only vague guidance to patients about how people generally feel after surgery. Similarly the (NHS choices website)[http://www.nhs.uk/Conditions/Hip-replacement/Pages/Introduction.aspx] says only that "most people experience a significant reduction in pain and some improvement in their range of movement" following hip replacement. But people want to know what will happen to them, not to "most people".

It is now possible to provide this information because so many past patients have shared their experience of surgery. This means that people in England can now make more informed decisions about whether or not to have an operation.

This figure shows how 100 patients like you felt six months after their operation, compared to how they felt before. These patients are similar

to you in terms of their age, gender and how they felt before having surgery.

Please note that these results only provide an indication of the likely outcome of your surgery.

There may also be a number of other things you may wish to know about, for example how long you will need to be in hospital for or what may happen if you do not have surgery. We recommend that you discuss these results with your GP or consultant.

Most people are likely to go ahead with the operation, the past experience of similar patients providing reassurance that they will feel better afterwards. But some people may decide their prospects of recovery are not worth the risk and decide against having surgery. Allowing people to make this decision themselves is better than denying care to some people simply because Clinical Commissioning Groups have imposed a set of rationing rules on their local populations.

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Florence Nightingale and Statistics: What She Did and What She Did Not Do

Lynn McDonald.

Nightingale, as a social and public health reformer, needed statistics to make her case for change. She had learned how knowledge, meaning hard evidence, well-collected data, could make a difference, actually save lives. The Crimean War had a high death rate, in its hospitals and in the camps, from disease far more than wounds. Yet the rates of disease and death declined radically in the course of the war, to be no higher than for men the same age in an industrial city in England, Manchester.

What Nightingale did was crucial, but she is often credited with what she did not do. So:

What She Did NOT Do

- Nightingale did not collect statistics, not during the Crimean War, or later. Yet two eminent American statisticians made such claims: 'She was able to introduce an orderly plan of recording the principal sickness and mortality data of the military hospital establishments which came within the sphere of her influence' (Kopf, 1916-17), and, 'At Scutari, apart from the important sanitary reforms she instituted, she also systematized the chaotic record-keeping practices, until then even the number of deaths was not known with accuracy' (Cohen, 1984). Indeed, she complained about the discrepancies in the mortality data from three different sources, even that data from the Adjutant-General, who was in charge of burials, reported more burials than the number of deaths in any of them.

- Nor did she (or anyone else) use statistics to get the Sanitary and Supply Commissions sent out, the organizations that made the changes that brought down the rates of disease and death.

- Nor can she be reasonably credited, either by bedside nursing, or walking through the wards at night with a lamp (both of which

she did) with success in bringing down the death rates. Good bedside nursing cannot make up for polluted air, water, overcrowding, poor nutrition, etc., contrary to the contention that 'Nightingale's vigorous use of these facts resulted in a series of reforms, which in turn reduced this terrible rate of mortality' (Kopf, 1916-17).

- Nor did Nightingale ever claim that she and her nursing achieved any of the above, commonly stated in the secondary literature.

- Nor, when the death rates made their great decline, from 60%, did she ever attribute this to the provision of nursing. A French doctor, in a history of nursing, gave a reduction from 60% to 2.2%, thanks to Nightingale's 'ability to transform the hospitals from top to bottom' (Hamilton and Regnault, 1901, 137). An American source made the reduction from 60% to 1%, 'accomplished by her and her devoted band of nurses' (Richards, 2014, 68).

- What Nightingale did state, in her "Introductory" to *Notes on Matters Affecting,* in a footnote, was that 'it is not denied that a large part (10,053 men, or 60 percent per annum, perished in seven months, *from disease alone, upon an average strength of 28,939—this mortality exceeds that of the Great Plague).'*

She specified that this was not from the 'unavoidable or necessary results of war' (14:587). She used similar language in her evidence to the Royal Commission (14:897).

- On her famous polar area charts, she noted the arrival of the Sanitary Commission in March 1855, to show the decline, rather than the start of the nursing, in November 1854, (when death rates increased.

Nor, to examine the false negative claims, did Nightingale's hospital have the *highest* death rates of the Crimean War, as asserted in *Florence Nightingale: Avenging Angel* and often repeated by (careless) authors. Small (1998) gave no numbers of deaths or rates for any hospital in making the claim!! The back dust cover depicts the famous polar area charts (Chart 1), but there is *no* discussion of the data they represent in the text. Further detailed refutations are available (McDonald 2014 and 2016).
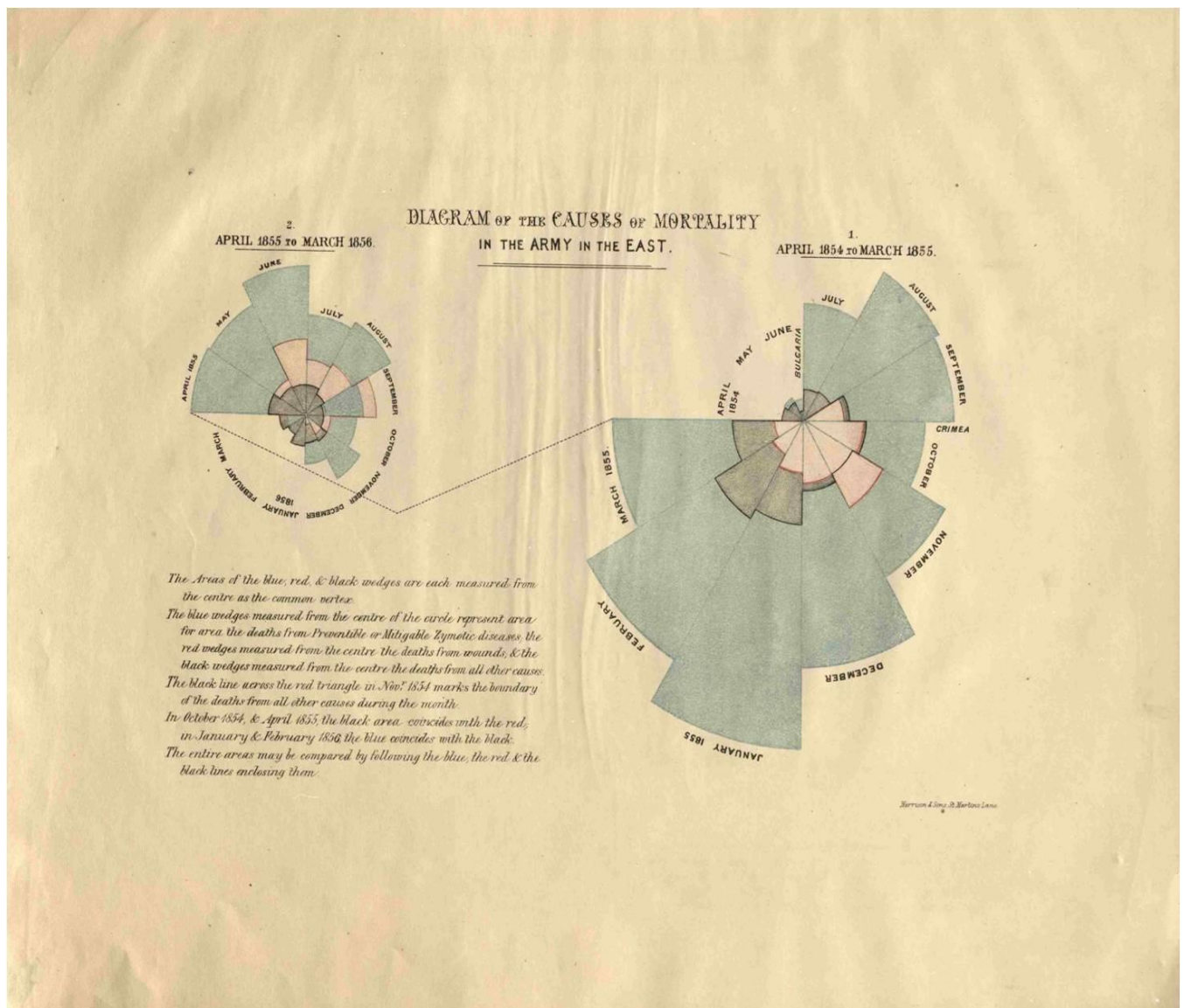
Chart 1 Polar Area Charts

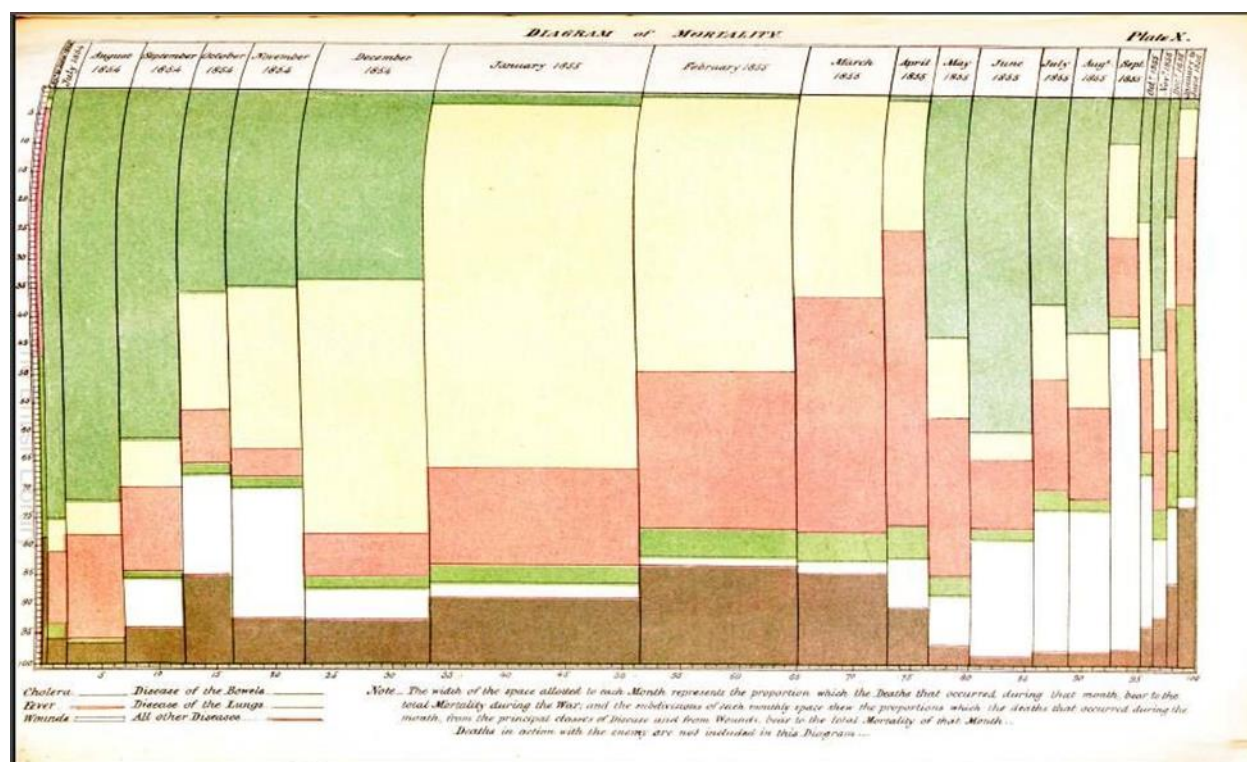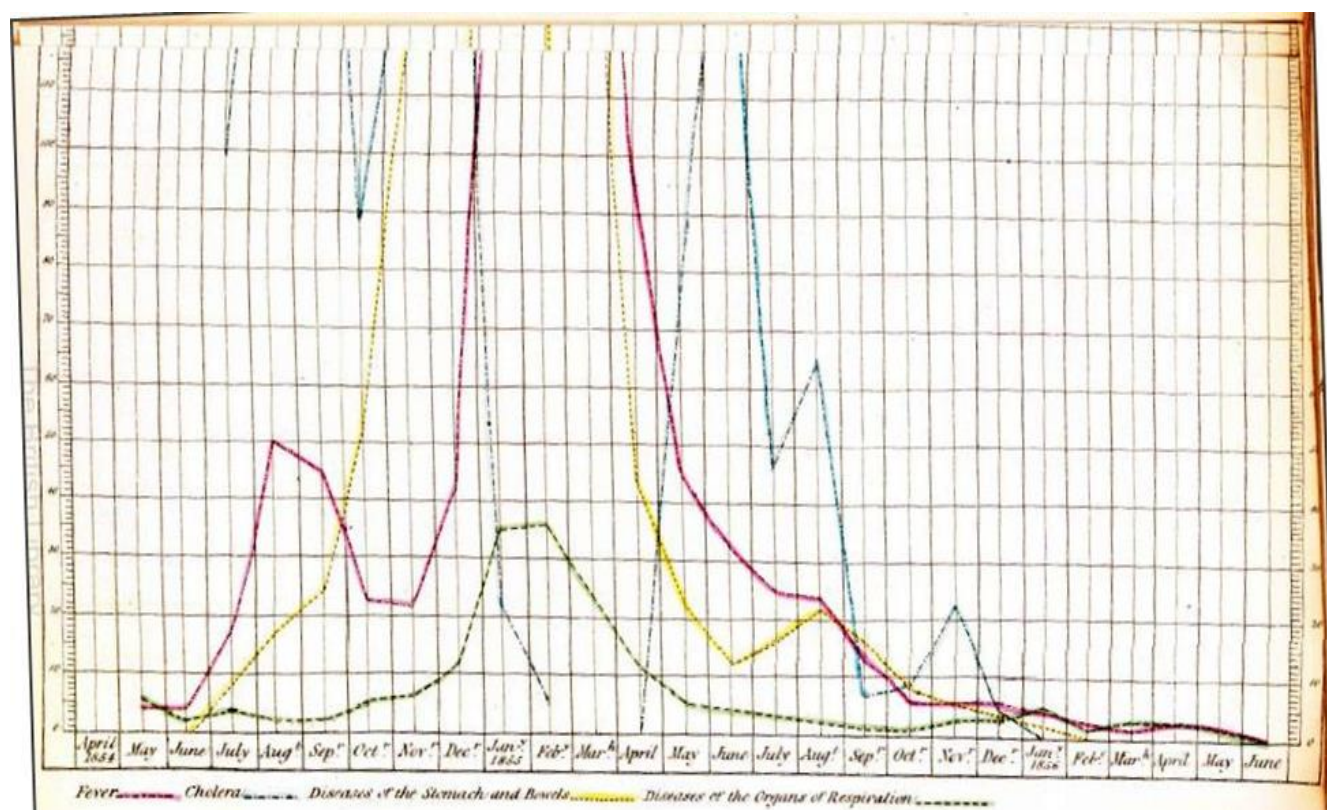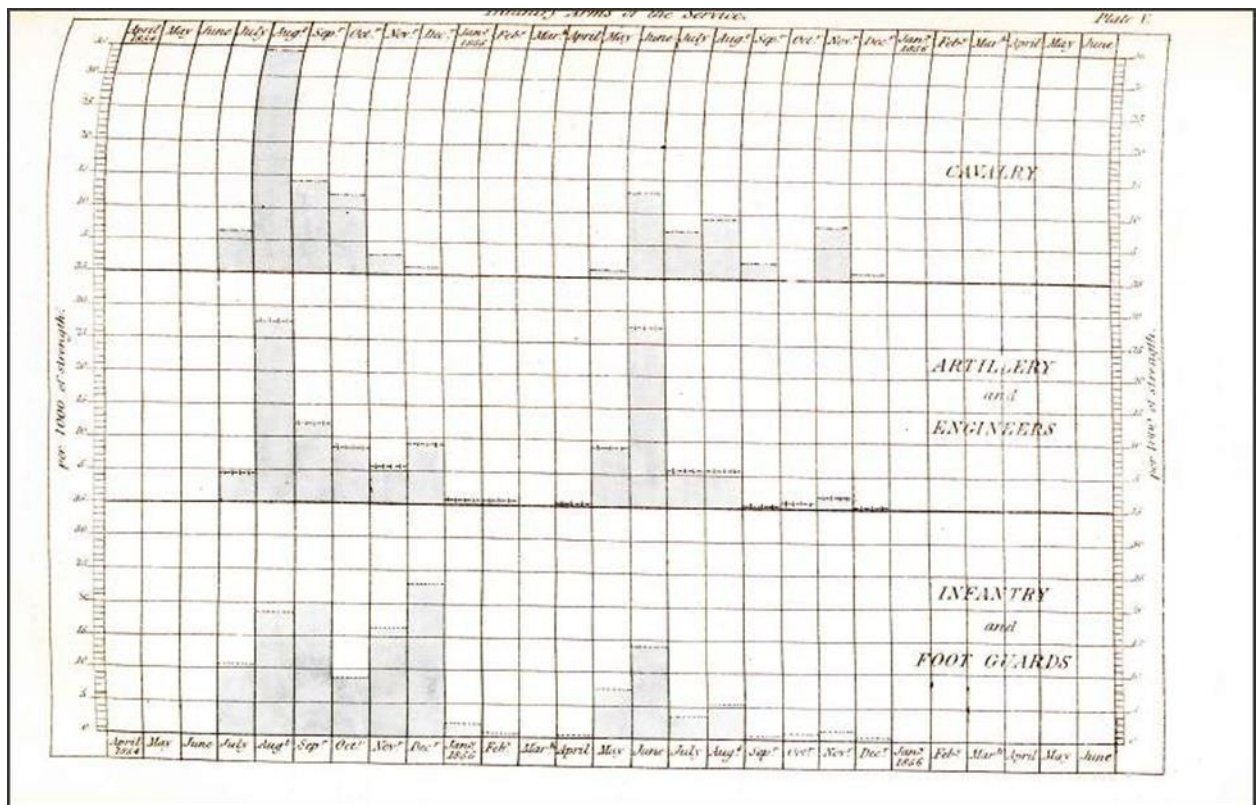## Chart 2 Mortality by Cause over Time

Chart 3 Mortality by Cause over Time

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Chart 4 Mortality by Army Division over Time

What She Did DO

Post-war, Nightingale learned the lessons of the war, by careful data analysis, data collected by the Army Medical Department of the War Office and published, in two volumes, by its director-general, Andrew Smith, as Medical and Surgical History of the British Army, 1858.

Nightingale worked closely with Dr William Farr, superintendent of Statistics at the General Register office, and his staff. Farr was an expert and had published polar area charts before. What each did working together is not known. The result was better work than he had ever done before, but who did the equations? It is not clear how much mathematics Nightingale knew. She is known to have had instruction from a noted mathematician, James Joseph Sylvester (1814-97), but this seems to have taken place from April to mid-May, 1840 (noted in Woodham-smith, 1986, 37, and in the autobiography of a Crimean War colonel, Lefroy, 1895). There is nothing in her own hand describing the lessons or what she learned. Correspondence shows that she sent gifts

(game from her family) to Farr and an employee, Clode, in appreciation. In *A Contribution to the Sanitary History of the British Army,* she specified that certain tables were prepared by Farr and his office, from 'official documents' presented to Parliament (16:338).

Nightingale produced two major analyses post-Crimea:

- Matters affecting the Health, Efficiency and Hospital Administration of the British Army, Founded Chiefly on the Experience of the Late War, 1858, 853 pages, privately printed, a 'confidential report.' her insurance that the truth would come out if she died and nothing was done to make changes; she sent it, stressing its confidentiality, to more than 100 people.

This document has a complicated history. Her analysis had been printed as Notes on the Care and Treatment of Sick and Wounded and the Sanitary Requirements of the Army Generally, 567 pages, in 1857. Then the War Office then released a detailed document, with the names and dates of crucial correspondence, which showed who raised what problem and how long they were ignored. Nightingale added massively to her printed pages, interspersing whole new sections, with Roman numerals, between those already printed.

- Answers to Written Question (1858b), her answers to questions for the Royal Commission, so that she would not experience the indignity of speaking in public and being cross-examined). 89 questions, and some addenda, some short and succinct, some with tables (a total of 16).

Both documents are forward looking, to application, and both use comparative data with civilian populations and hospitals.

Nightingale looked to system change. There is some blame of individuals for failure to act, but by far the worst problems were failures in system, notably a failure in responsibility. One department would be in charge of ordering supplies, another for packing and sending them, and yet another for landing them. Supplies did not get where they were desperately needed, but everybody could blame somebody else, and did.

- She also produced a short report, 16 pages, with charts, giving highlights from the lengthier material, A Contribution to the Sanitary History of the British Army, 1859.

The official report

The Army Medical Department put out a two-volume official report, also in 1858. It, too, featured charts, but none of them like Nightingale's. One useful chart shows deaths by type of disease for such major categories as fever and bowel diseases, as well as wounds. It shows declines over time, but with no explanation as why (Nightingale's flagged the work of the Sanitary Commission). The official report included numerous charts of deaths by branch of the army (all rather similar) and enormous charts of meteorological conditions: temperature, barometric pressure, humidity.
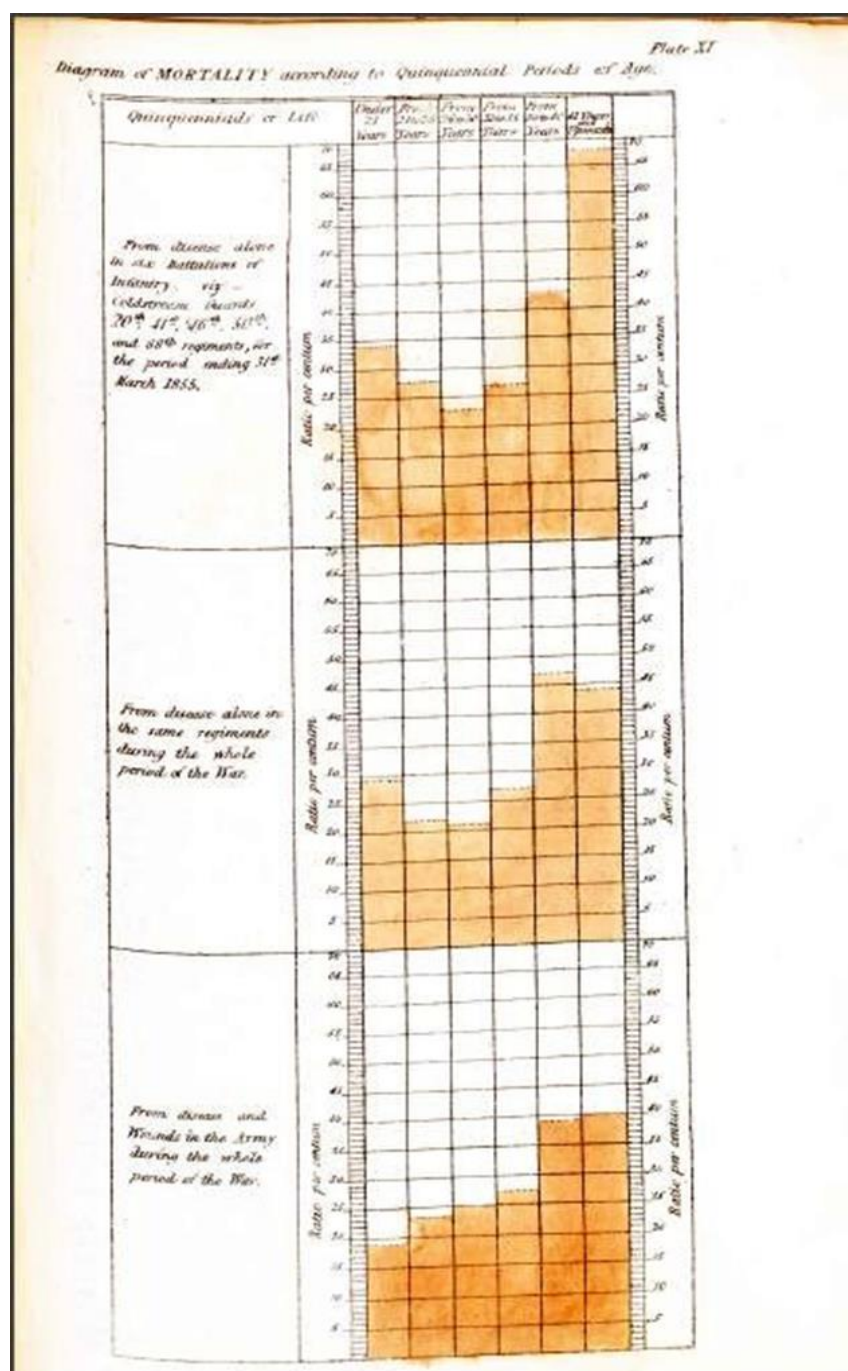
 Chart 5 Mortality by Age Group

Causal knowledge

Nightingale and colleagues learned the cause-effect lessons of the high death rates of the Crimean War. It happened that only the British government instituted changes in running their camps and hospitals, by sending out *civilian* commissions, the Sanitary Commission, consisting of Dr John Sutherland, a pioneer public health expert, and Robert Rawlinson, a civil engineer; and the Supply Commission, consisting of Sir John McNeill, a doctor and old hand with the East India

Company, and Colonel Alexander Tulloch, an early military statistician. The former commission cleaned up the hospitals (sewers, drains, cemeteries, water supply), the latter the camps (housing, clothing, nutrition). Death rates declined radically.

The French Army made no such changes. Their death rates were lower in the first year of the war (the instigators, they were better prepared for it), but higher in the second year, although there was no actual fighting! In effect, there was a controlled experiment: the same war, same climate, same distance from home, yet radically different outcomes (Chart 6).

Chart 6 British and French Army Death Rates by Winter

Source: Chenu, Mortalité comparée dans les armées française et anglaise, Rapport au Conseil 131..
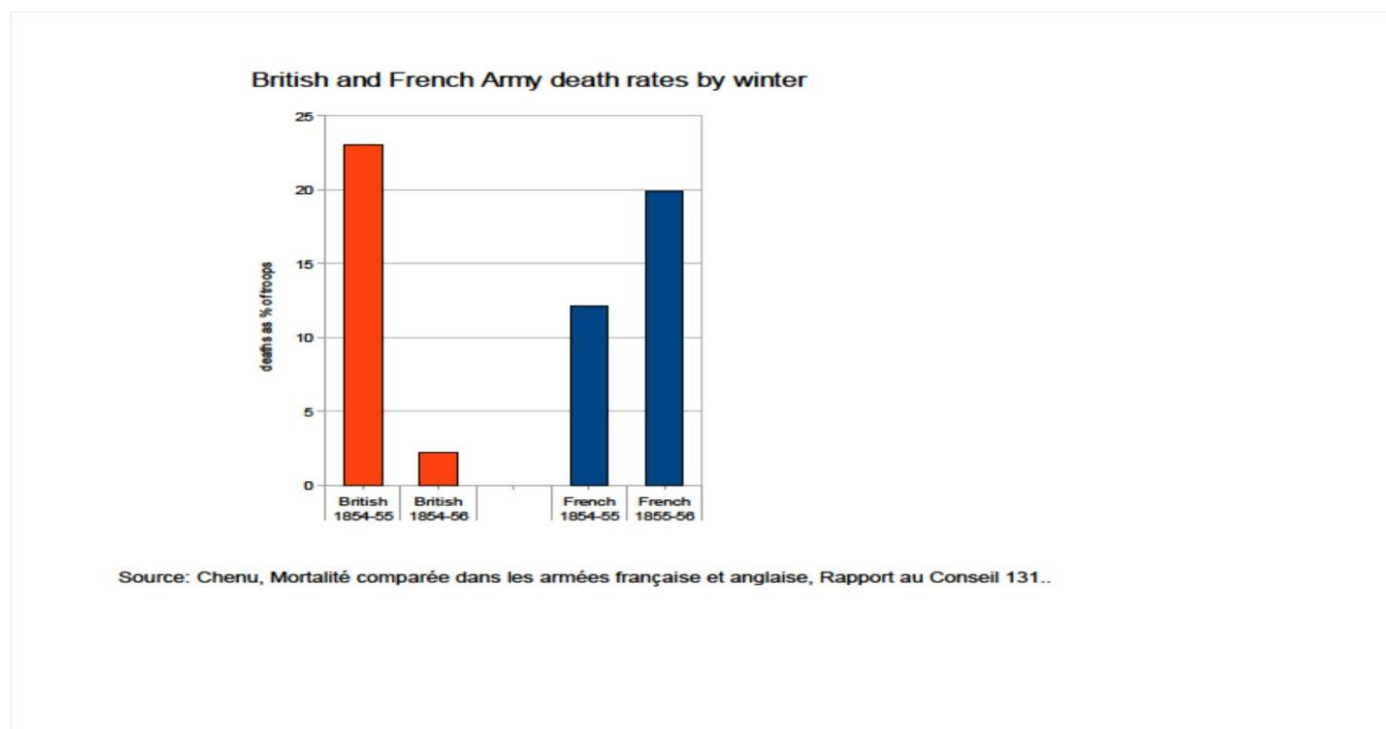
This is very evident to us now, but, since the French were late in publishing their official results (Chenu, 1865), no comparisons appear either in Nightingale's writing or in the Royal Commission Report. There was anecdotal evidence of the high number of French deaths, but no hard data at the time. We are indebted to Chenu for making the comparison showing British superiority in a second, shorter, report (1870). Le Fort (1868), a Crimean War doctor who later published on maternity death rates, gave credit to Nightingale and 'civil doctors' sent out by the British government, without any specific mention of either of the commissions sent.

Nightingale's statistical tribute to Sidney Herbert

Nightingale's tribute to her friend and great collaborator, appropriately, signaled his achievements, as seen by reduced death rates in the British Army post-Crimea. These occurred thanks to his applying the lessons learned from the war. She described Herbert as the first war minister who set himself the task of saving lives, that he took the trouble to learn the necessary material to do so. He himself chaired the four sub-commissions established after the tabling of the Royal Commission report to implement its major recommendations. Her short paper features three horizontal bar charts, the first giving baseline data: mortality rates of the relevant general, English, male population. Then comes the chart with rates for 1837-46, labelled 'This is how Lord Herbert found the army,' followed by data for 1859-61: 'This is how Lord Herbert left the army.' The great diminution of death rates is clear (Chart 7).

Chart 7 Death Rates Before, During and After the Crimean War
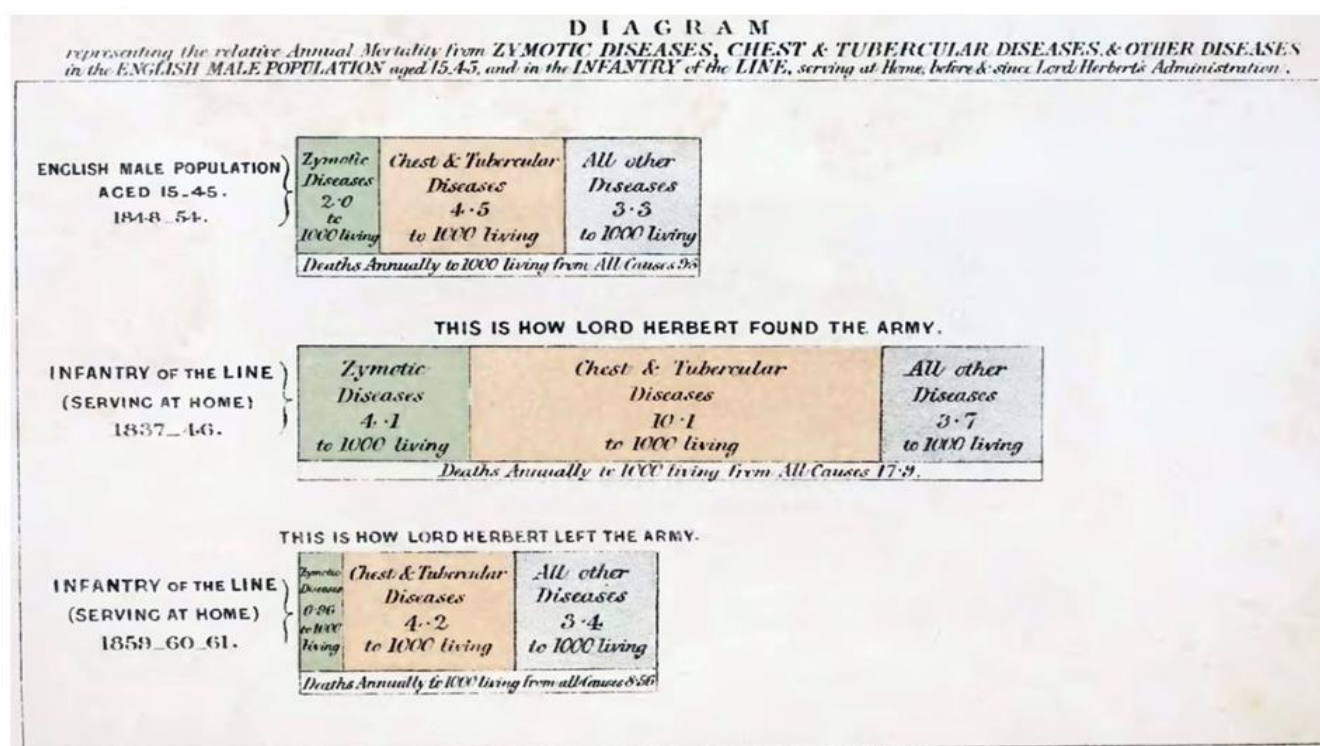
Nightingale made a similar point years later on the death of Dr Sutherland, that the value of his recommendations would be best understood 'by a comparison of the vital statistics of the Army before the Crimean War and those of the present date' (Times 1891).

Native Colonial Schools and Hospitals

One of Nightingale's earliest research projects post-Crimea was on mortality and illness in 'colonial schools and hospitals,' meaning for Indigenous people, in the Australian colonies, Ceylon (Sri Lanka), southern Africa and (pre-Confederation) Canada. Although the data were shoddy, there were enough to show that the rates of death and disease were twice what they should be. Further, 'By far the greater part of the mortality is the direct result of mitigable or preventable disease.' In the report on deaths in hospital, she concluded, with recognition of the poor quality of the data, 'the mortality statistics of these hospitals show a very high death rate upon the numbers treated' (Sanitary Statistics of Native Colonial Schools and Hospitals*).*

She carried on the research to produce papers on the disappearance of Indigenous people both for Australia and New Zealand **(**Note on the New Zealand Depopulation Question). She succeeded in getting Australian public opinion interested – newspapers gave her papers good coverage – but this did not lead to any action.

The physical and sexual abuse of Indigenous children in residential and day schools in Canada, with their loss of language and culture, has become a great issue in recent years. Nightingale's work was not on those aspects of abuse, but simply disease and death**.** She was the first person to make public the high rates of disease and death in residential and day schools in Canada. Incidentally, today's Canadians blame the Canadian government for the abuses, although the rates Nightingale reported date from the 1850s, for schools established in the 1830s, or decades before Canada became a country, in 1867.

Unfortunately, Nightingale was unsuccessful in getting the Colonial Office to continue to collect data, let alone make the necessary improvements. She turned her attention to India, where she was able to have more (albeit limited) impact.

Statistics on India

India was a major concern of Nightingale's for some 40 years. Again, statistics were needed to save lives. The Royal Commission on the Sanitary State of the Army in India, established in 1859, reported in 1863, was aimed at the health of the British Army there. However, it was argued that an army station could not be healthy if its surrounding area was not, hence there had to be a holistic approach.

Nightingale devised the questions sent to the army stations for the Royal Commission and analysed the returned data as Observations by Miss Nightingale on the Evidence contained in Stational Returns¸ 1863. That year also she began to publish short articles on India, with titles like 'How People May Live and Not Die in India' (9:183-94) and 'Life or Death in India,'1873 (9:710-23). 'The People of India,' 1878, sounds nicer, but it opens with: 'We do not care for the people of India....Do we even care enough to know about their daily lives of lingering death from causes which we could so well remove? We have taken their lands,' after which she compared famine deaths with war deaths (9:778-810). A lengthy paper given to the East India Association in 1883 was entitled 'The Dumb Shall Speak and the Deaf Shall Hear, or The Ryot [peasant], the Zemindar [landlord] and the Government' (10:549-98).

Nightingale in fact did little on nursing in India, as more basic challenges kept emerging: dire poverty and famine.

The British government had inquiries conducted after famines, but did nothing about the base causes, the extreme poverty of Indian peasants, such that they had no margin when floods or drought occurred. Famines existed long before British rule in India, but British rule made them worse: higher numbers of deaths, fully documented in Late Victorian Holocausts: El Nino Famines and the Making of the Third World (Davis 2001).

Post-famine, Nightingale held, deaths had to be counted properly, to include deaths from disease as well as hunger itself—malnutrition makes people more vulnerable to disease. The British government, for obvious reasons, preferred to minimize the numbers.

Nightingale's estimate of famine deaths in 1876-1877 was 5 to 6 million, which was dismissed as 'a shriek.' The English representative on the Famine Commission made it 4 million, while the India Office had said 1¼ million. Gladstone's letter of reply to her on the matter acknowledged that her 'shriek' was 'a better expression of the truth than any other utterance' (letter 26 January 1879, cited in Cook 2:292).

In 1869, the Bengal Social Science Association made her an honorary member. Statistics, obviously, reflect the values and priorities of those collecting them. She clearly wanted input on policy matters from Indian nationals themselves, although decisions then were made overwhelmingly in London by British officials.

Nightingale worked closely with Surgeon-Major Evatt to obtain better data on the ordinary workings of health care in India. He sent her what he collected, pre-publication, and she commented, complimenting him when he made improvements, then called for more. She, for example, complained to him when, having told her he would provide 'particulars of the *actual condition* of the nursing' of European soldiers in India, he gave:

> "no *facts*, as to the patients--what they want and *don't* have—what you have observed as to actual neglects, and the sufferings, slow recoveries, or *no* recoveries, and death caused by such total absence of nursing" (letter 8 February 1881, in 10:173-4).

The Contagious Diseases Acts

Nightingale fought against this anti-woman legislation, and probably delayed its passage for a couple of years, but the first Contagious Diseases Act was adopted in 1864. It permitted the inspection and compulsory treatment of suspected women prostitutes (never the men), a measure intended to reduce venereal disease in the army and navy. Later acts extended the scope of regulation, until their suspension, then repeal, in the 1880s. Nightingale's role early on was a short paper, Note on the Supposed Protection Afforded against Venereal Disease by Recognizing Prostitution and Putting It under Police Regulation, 1862. For it, she produced data on rates of admission for venereal disease for different stations. She showed that there were lower rates of admission to hospital per 1000 at stations with no police protection (Bermudas, Sierra Leone, St Helena, Mauritius, Jamaica and Ceylon) than those with police protection (Malta Gibraltar and the Ionian islands) (8:431). Of course, data do not always persuade!

Nurse deaths

Nightingale was aware that hospitals were responsible for deaths of patients and staff. Her first table in *Notes on Hospitals* was of hospital death rates (patients) in 106 English hospitals, then various specific groupings. The next two tables were on nurse deaths , for 15 London hospitals, with deaths by age, rates compared with those of the wider female population, tables prepared by Dr Farr ((16:97-98). She wanted nurse deaths tracked, for nurses spent more time in hospitals than

doctors). The data she reported were 'imperfect,' so she created a form to collect better data (16:99).

Mortality in childbirth

Here's a radical idea of Nightingale's: there should be a zero death rate in childbirth (8:253). Giving birth is not a disease, so the only deaths that should occur should be those caused by an unrelated disease. Practically, however, deaths did occur, so that it would be useful to ascertain a 'normal death rate' for lying-in women (birthing mothers). This would then become a standard against which to compare rates in various institutions: lying-in (midwifery) hospitals, regular hospitals, workhouse infirmaries and home births.

Maternity death rates became an issue for Nightingale in1867 when doctors at King's College, London, threatened the closure of the midwifery ward opened in 1862 as a training school for midwifery nurses. There were no deaths in the partial first year, but they began in the next year, and rose. The ward and programme were ended in 1868. She was held up in doing the research by the Franco-Prussian War, 1870-71, and appropriate data were hard to find, so that it finally came out in 1871 as Introductory notes on lying-in institutions.

Nightingale set to collecting comparative data from obstetricians (then a new medical specialty), and from the Liverpool Workhouse Infirmary, from home births, and, thanks to publications, from European hospitals. The result was a thorough (for the time) setting out of a rich diversity of data, with Nightingale's analysis. She was disappointed with the result and looked to a new edition being done, with better data. She hoped that Dr Sutherland would do one, but neither he nor she did.

A key lesson Nightingale learned from the research was that she could see no way of having a midwifery training institution, which required bringing birthing mothers together, without costing some lives. She never set up or assisted in establishing another midwifery ward, much as she was asked to.

The findings included lower death rates at workhouse infirmaries than elsewhere, this despite the poor health status of women giving birth in them (often prostitutes), a reversal of the usual relationship of declining deaths with rising status and income. With the knowledge Semmelweis acquired at the Vienna General Hospital in 1847-48, this can be

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explained, but neither Nightingale nor Farr, nor any of her British contacts, knew of it — this despite the fact that short analyses of his findings were available in English, French and German in 1849 and 1850 (Routh, von Arneth, Simon). Then, in 1861, a German translation appeared of Semmelweis's full (written in Hungarian) book. The findings go against the grain: higher death rates with better training, an obvious point when it is realized that medical doctors did autopsies, midwives did not, except that Paris midwives, who were well trained (two full years) exceptionally, did, and had very high death rates. At Semmelweis's hospital there were two clinics, in effect a controlled experiment, one staffed by medical doctors and medical students, the other by midwives, assignment by time of entry, no choice by patient or doctor. The midwives' clinic had the lower death rates, a well-known fact. Semmelweis made the breakthrough by requiring doctors and medical students to wash their hands in a carbolic solution before entering a birthing ward after an autopsy (and later to wash after seeing any patient, not just after an autopsy).

What She Tried To Do, But Did Not Get Done

The Census

Nightingale understood the importance of population data, especially the Census. In 1860, she made numerous efforts to persuade officials to add two questions to the 1861 Census form: one on housing, the other on sickness. They were related, of course, since she considered that housing was what would later be called a major 'social determinant' of health. In her words: 'the connection between the *health* and the *dwellings* of the population is one of the most important that exists' (letter 10 May 1860, 5:99-100). She called specifically to know how many people live in 'hovels,' and 'in stables, or in flats, or in cellars, or in *back-to back* houses, or in mansions' (letter 11 May 1860, 5:99-101). She was not successful in either quest, although some description of housing did get added late in the century.

Uniform Hospital Statistics

A project of 1859-61, Nightingale sought to reform routine hospital statistics so that, in effect, their success or failure would be noticeable, so that people could compare death rates per admissions by hospital, for different diseases/surgeries. Hospitals then published actual numbers and rates of death (they don't now). For this to work, the different hospitals would have to collect comparable data. She enlisted

the support of the distinguished surgeon, Sir James Paget, at St Bartholomew's Hospital, who succeeded in getting his hospital to revise their forms. She later told him Bart's statistics were the best.

Nightingale made the proposal at the International Statistical Congress, held in London in 1860 (5:83-89). However, this proved to be yet another project that did not produce long-term results, despite initial enthusiastic support at the congress by European delegates.

Nightingale, as well, sent Paget a detailed form to be used as a trial for new hospitals. Hospitals then were difficult to compare, as they differed greatly both in overall building size and dimensions and ward size. This form, which was probably never used, would have been a very useful document, collecting specifics on the nursing (numbers, jobs, and assistants' jobs, coverage of night duties (check on drunkenness?), if separate syphilitic wards (men nurses for?), dispenser in hospitals? pupils? expenses and hospital income, library? museum? chaplain? prayers? services? lending library for patients? spiritual instruction for patients? nurses? what for patients not Church of England? management (treasurer? surgeon? matron?) bandaging, dressings, administration of medicine, mistakes made in administering medicine? training? (5:75-79).

Questionnaire on Poor Law schools

Nightingale drafted a questionnaire in 1874 for Jane Senior, the first woman to be appointed a Poor Law inspector, hence the first woman to hold a British civil service post. The questions included, for each school, number of inmates, yearly admissions, early deaths, and causes of, yearly discharges (to service, friends or other), number of girls for every 5 years of age, number of orphans (father dead, mother or both parents), number of classes, with average attendance, duration, domestic training, number of teachers, and salaries, holidays (if any), examinations (if any), how school and training managed, assessment of girls as to cleanliness, clothing, bedding, general care, and your own summing up of moral state. There were more complicated questions that required discussion with officials: how girls were placed into service and what supervision they got, their situations afterwards, including 'horrid blot!' the number of failures where the girls return to the workhouse (13:641).

Probably nothing came of this project. Jane Senior died soon after and no further women were appointed to such a position for a long time, and no minister approached Nightingale for her assistance.

A Chair or Readership in Social Physics at Oxford University

Nightingale's last endeavour to get statistics used to their fullest, as opposed as collected, was her (unsuccessful) project to get a chair or readership in 'social physics,' the term of Belgian statistician L.A.J. Quetelet, at Oxford. Why there? Because it was the university that trained most Cabinet members, the Army, MPs and senior civil servants, many of whom had a university education and should be using social data for policy decisions. They were not, as she complained to her colleague Benjamin Jowett, master of Balliol College, for 'the enormous amount of statistics at this moment available at their disposal (or in their pigeonholes which means not at their disposal is almost entirely useless.' Why, those persons did not know how to use them. She and her fellow reformers did not seek 'a *neat arithmetical sum;* we want to know *what we are doing* in things which must be tested by results' (letter 3 January 1891, Add Mss 45785 f144, 5:110). This is 'outcomes research,' and still badly lacking *(ED: see previous article by Andy Street).*

The collection of quality of data

Good analysis requires reliable data, a serious challenge Nightingale faced beginning with the Crimean War mortality data: six different data sources, with competing death rates, even more burials than deaths. She learned the importance of obtaining reliable, accurate data. For her, statistics represented real people, in the Crimean War men killed needlessly. As she said in A Contribution to the Sanitary History of the British Army, 'It is impossible to reconcile the discrepancies in these various returns. One thing is quite certain, that hundreds of our brave soldiers perished, in regard to whom neither the when, the where, nor the how will ever be known' (16:344).

Conclusions

There is no doubt that the work done by Nightingale, with her team, saved lives, beyond count. This, however, was done post-Crimea, by careful research and just as careful following of an implementation plan. Nightingale developed a modus operandi that was effective,

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however, not obviously in everything. What she and her team achieved was immense, and even the failures doubtless made it easier for later reforms to be accomplished. You don't win them all, and Nightingale's score, with its blots, is hugely impressive.

As we face so many different issues today, we might reflect on how Nightingale would have approached them. At the top of the list of challenges, there is climate change. She undoubtedly would have seen its importance for the number of lives (species, coastlines) at stake. She understood the connection between irrigation, forest cover and rainfall: 'We go on cutting down wood without replacing it…Tree planting would do much both to bring rainfall and to arrest floods' (Nightingale 1879, 10:293), and 'with tree planting properly carried out, there would be *equalized* rainfall' She noted also, for America, the effect of flooding on crop failure, hunger and famine. She could count and see trends. For her own work, she had to balance, as goals, where the greatest need was (the highest number of deaths), and where she had access (China had a higher population than India, but she had access in India, not China).

How would she deal with estimates on death rates from smoking (8 million plus a year, 7 million direct smokers, 1.2 million from second-hand smoke), with air pollution (mainly fossil fuel burning) at 7 million and rising? (WHO 2019).

On the newly emerged issue of vaping, we might wonder how she would confront the use of a completely made-up estimate, of 95% harm reduction, promoted by Public Health England. Without any data on long-term harm - for vaping is too new – yet it accepted the 95% 'guestimate,' and the claims of cigarette companies that that harm reduction is now their goal (Nutt, et al. 2014).

It does not appear that Nightingale was discouraged by the number of unsuccessful projects she undertook. She continued to take up new issues, or new lines on old issues, and sketch out questionnaires, or 'queries,' to pursue them. People, notably Edwin Chadwick, sent her proposals for research.

Her attitude near retirement reveals her to be no less committed to her reform projects than in her youth. Hospital reformer Sydney Holland (later Viscount Knutsford), who visited her in 1897, recorded her words: 'She warned me against ever being discouraged by the snubs of government officials: 'Keep what you know is right before you, and never

cease trying to get it. Aim high and people will follow you in the end….No, no, no one can be neutral in this life; you are either doing good or bad, and the very fact of not trying to do good is bad in itself' (Holland, 154).

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Capitalism and the Triumph of Quantity over Quality.

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Introduction

An earlier paper in *Radical Statistics,* Scott (2018), discussed the way in which quantification in general and statistics in particular have become key components in the *spectacle* that dominates contemporary capitalist social relations. The most recent example of this spectacle is the way in which numbers are central to both government policy and mass media commentary regarding the coronavirus epidemic. The number of people testing positive, the numbers dying, the R (reproduction) value, to name but three quantities, are pounded into our heads on a daily basis. There is, by comparison, very little public discussion of the qualitative dimensions of the epidemic. How is a corona death defined? What pressures are doctors under when signing death certificates? Are questions that are rarely asked. Similarly, what is the meaning of a positive test result given by a large multi-product/service private company, such as Serco, with little or no track record in this specialist area? The R value is a perfect example of reification, see again the above mentioned paper. How are the weights allocated to the range of variables used by the ten or so organisations publishing R values in the UK? More generally, it is clear that the qualitative focus of the UK government is to use the pandemic to reinforce its socio-economic agenda, i.e. attempting to cut what is left of the welfare state, privatising the National Health Service, promoting the interests of tech companies, pharmaceuticals and certain other businesses. As a result, it is no oversimplification to say those dying from the virus are overwhelmingly elderly and ill working class people, typically in private nursing homes looked after by staff on the minimum wage.

The purpose of this paper is therefore, given the above mentioned state of affairs, to investigate the way in which quality has by and large been vanquished by quantity. To this end, the paper will take a historical perspective in order to demonstrate that the diminishing of quality is not a random development, but rather that each stage in human history is marked by its own relationship between quantity and quality. For the most part, quantification, how many, is reductive: the whole is merely the sum of its parts; whereas quality

refers to identity, what an entity is, which suggests process, the becoming of the natural and social world. Since statistics is the most common form of quantification, i.e. applied mathematics, it is surely important for us to to acquire a deeper understanding of the genesis of the rise of the quantitative and the corresponding decline of the qualitative.

Quantity in prehistory

We can begin in prehistory, see Kelly (2007), when early nomadic hunter-gatherers interacted with each each other and the natural world around them. With a few exceptions, such as tribes in Western Canada which practised slavery, hunter-gatherer societies were classless and egalitarian. Counting would have been rudimentary and democratic, pretty much restricted to male hunting of animals, fish and birds and female gathering of fruit, edible plants and the like. Whilst limited by what items could be carried, it would seem that qualitative cultural activities were central to the lives of hunter-gatherers. Bellos (2011) discusses his time with one surviving Amazonian tribe, the Munduruku: "there was never any need to count...Counting people...is a way of singling people out, which makes them more vulnerable to malign influences" (p15-16). This can be compared to the racist view of Dantzig (2007) who, writing in the 1920s, discusses "the most primitive tribes of Africa and Australia...These savages have not yet reached finger counting" (p14).

As settled agriculture developed, quantification seems to have become more widespread; with farmers measuring field sizes, weighing grain, counting building materials and so on. Similarly, artisans would would count, weigh and measure in order to practice their craft. However, as Graeber (2012) points out, it is important to note that neither barter nor the use of money were a regular feature of village or communal life. Rather, the distribution of goods and services seems to have been predicated upon an egalitarian ethic similar to that of their hunter-gatherer ancestors.

The development of number systems in the ancient world

With the rise of the ancient city states, the relatively democratic and practical approach to quantification changed dramatically. The key feature of the city states which arose around 6,000 years ago was the existence of social class divisions. The ruling elite would systematically dispossess the subordinate classes, employing scribes to record numerical information in order to measure their wealth and power; a proto-accountancy as Brooks (2019) explains. Early evidence of quantification in ancient cities can be found on surviving

clay tablets, found in the Tigris Euphrates basin, along with notches on tallies and other markings used to record "taxes, tithes, census data, dates, land" and so on, writes Levy (2013,p14). Needless to say, members of subordinate classes were excluded from the more abstract forms of quantification. Complex number systems developed as the ruling elites of these city states employed bureaucrats, astronomers, priests, proto-accountants and others to record "weights and measures, squares and cubes...reciprocals...(and) compound interest", Levy (p35). As compared with these developments, the later Imperial Roman number system, including I, II and III, seems rudimentary, with subtraction implicit in the symbols for four and nine, i.e. IV and IX. However, this quantification system appears to have been sufficient to maintain the exploitation that marked the ancient Roman economy. In contrast, judging by the contents of surviving fragments, the ancient Egyptians' number system was highly sophisticated. The intellectual elite developed tables for multiplication and division, anticipated Zeno's paradoxes concerning motion, generated summation series and geometrical progressions, with ever larger denominators and powers. As we shall see, these developments were to be integrated into later capitalist quantification methods, which in turn formed the backdrop to Victorian statistics.

Number as abstract symbol
The creation of number systems by priests, astronomers and other elite groups in the employ of the ruling classes of the ancient city states was underpinned by the belief that numbers contained the secrets of the universe and these should not be made known to the uninitiated. As explained in most histories of mathematics, see for example Parker et al (2019), the political fortunes of the ruling elites in the ancient world waxed and waned, dynasties came and went, and there developed a number of initiate mystery groups. The best known of these being the Pythagoreans, who were strongly influenced by ancient Egyptian and Babylonian mathematics. Rather like today's professional mathematicians and statisticians, these mystery castes sought to monopolise specialist areas of calculation, charging for their services in largely innumerate societies. Their esoteric approach to number was made possible by the process whereby numbers metamorphosed from *adjectives*, such as two books, into abstract *nouns*, denoting simply two. Thus abstract number symbols became reified and, according to these mystics, each number became *qualitatively* different from the others. For example, the number 7 was given great significance in terms of the planets, the diatonic music scale, the days of the week, alchemic experiments and more.

The number 13's Satanic associations, along with other remnants of qualitative notions of number, are today dismissed as superstition and 13 has become just another abstract number; although in some cultures its demonic heritage survives to this day. As a reading of Shesso (2007) suggests, in capitalist society religion and mysticism have for the most part been displaced by secularism, astrology has become astronomy, and alchemy has been transformed into chemistry. Correspondingly, each number symbol has been purged of its mystical significance and become a mere abstract symbol. However, remnants of older number systems remain, such the use of Roman numerals and bases of 60 and 12 in measuring time.

Raju and the history of mathematics
...the Babylonians had numerical and algebraic expertise that went far beyond anything the Greeks ever achieved; Clegg (2017a, p46).

The Greeks Thales and Pythagoras *travelled to Egypt specifically to study mathematics. Presumably there must have been more for them to learn than is revealed in the Ahmes and Moscow papyri*; Levy (2013, p22-3).

Building on the contributions made by Indians over thousands of years to logic, mathematics and probability, Raju (2013) challenges the view that mathematics was invented by the ancient Greeks. As the epigraphs above suggest, some British writers are following Raju's lead, noting that the Greeks confined themselves to geometry and used letters of the alphabet rather than numbers. Written long before paper entered Europe from China, surviving Greek texts are, Raju points out, for the most part, translations from a number of languages, notably Arabic. He notes that contemporary classicists play fast and loose with regard to the progeny of the texts attributed to Plato, Aristotle, Euclid and other Greeks. Similarly, Raju refers to the scant evidence for the existence of Pythagoras and the members of his cult, noting that geometric theory was established long before in ancient Egypt and India. He challenges the classicists' high estimates for the number of free citizens, mostly slave- and land-owners, who would have had the leisure time and resources to write books on geometry.

Crucially, Raju questions the very existence of the key figure in the history of mathematics: Euclid. Speculating on who might be the real author of the *Elements,* he notes that the famed library in Alexandria had copies of mathematical texts from Egypt, Babylonia and elsewhere. Raju points out that this and other ancient libraries were destroyed under orders from the priest caste of the Roman Catholic

church. Having purged itself of liberal tendencies, Catholicism became the official ideology of the Roman empire and its priests encouraged a mob to murder the mathematician Hypatia in the 5th century AD. In what he refers to as the Christianisation of mathematics, Raju traces the later struggle of the priests against Muslim people, who had colonised much of southern Europe bringing with them material wealth and advanced quantitative techniques. As part of this struggle, the priests encouraged landowners and their serfs, in a materially and intellectually backward feudal northern Europe, to volunteer for a series of Crusades to 'liberate' Jerusalem from Muslim control. These military adventures failed, as a result of which the priests accepted material and intellectual reality, adopting some of the more advanced thinking of the Muslims. Military force having failed, the priests sought to bolster Christian doctrine as a means for converting Muslims, Jews and "pagans" by means of rational argument. Central to this endeavour was setting up universities, modelled on Muslim institutions in Spain and elsewhere, in order to train priests in doctrinal apologetics. The *Elements,* attributed to Euclid despite scant evidence, became a key text in training the priests at Paris, Cambridge, Oxford and other universities. This text became a model for proof by means of deductive logic, a method that remains a paradigm amongst mathematicians and statisticians to this day.

However, Raju argues that some of the 'proofs' contained in the *Elements* are not deductive at all, but rather are empirical, i.e. based on evidence gained from practical experience. For example, 'proofs' relating to triangles in the text rely on the areas of squares, knowledge of which had been systematised by ancient Egyptians for purposes of land division and architecture. Even the doyen of the Cambridge deductive proof paradigm, Bertrand Russell, admitted as much in his writings on mathematics. The orthodox approach to deduction as the basis for timeless and universal truth is taken, in large part, from the range of texts attributed to Aristotle. However, Raju doubts the authorship of these texts, demonstrating that alternatives to deductive logic were developed in India, China and elsewhere, as discussed at length in Scott (1999).

Finally in this section, Raju points out that mathematics and logic were highly developed in ancient and mediaeval India; including discussions of infinity, the number zero, square roots, linear and non-linear equations, all of which were vital to the development of statistics. Long before the Italian accountants, Raju argues, Indians used negative numbers to signify debts and percentages to measure

interest rates. Given their invention of a form of calculus and the use of graphs, long before Newton, increasingly historians are claiming that European maths is more or less plagiarised from Indian sources, via Arab traders. Yet, in the European medieval period, users of the abacist culture and Roman numbers, supported by the church, resisted the Indian/Arabic number system, described by one monk as "dangerous Saracen magic" Shesso (p8). Eventually, north European merchants began using the "Saracen" system in secret.

The quantification and domination of nature
In the later medieval period and beyond, the major European powers began a dual process of exploiting nature at home and, by colonial expansion, abroad. Isaac Newton, supported by his secular successors, provided the quantitative underpinning to this dual process. These pioneers of the scientific revolution side stepped the Aristotelian deductive method, with its hard distinction between the true and the false, and adopted an inductive approach to nature in which repeated observation and experimentation became the norm. Gradually, the 'laws' of nature were modelled in the form of mathematical equations which underpinned its domination. Here nature included human beings which, as we have noted above, were racially stereotyped in order to justify the institution of slavery, in which the value of human beings was reduced to quantities of currency. Thus began the colonial, and later industrial revolution, the effects of which are, in the form of climate change, threatening human survival in the early 21st century.

Despite intellectual stagnation in the Muslim world, the Arabic/Indian number system gradually replaced Roman numerals for the accountants, bankers and others facilitating trade, colonial expansion and slavery with the formation of joint stock companies. With the weakening of Papal influence, use of the number zero, or nothing, became a commonplace. The qualitative associations of nothing, such as poverty, death and absence, were discarded as Arabic numbers became the reified quantitative lubricant of the emerging capitalist wage labour system which came to dominate social relations in Europe, North America and elsewhere. Abstract symbols were used to measure the prices and quantities of goods, services and wage workers in the relentless pursuit of profits expressed in purely quantitative terms. For the factory owner, quality was merely a minimum standard of the use-value of a product, as required by the state. As the state supported colonial expansion, developments in warfare methods brought with them the need for data collection and storage; whilst mass production required such

accounting paraphernalia as double entry book-keeping, invoices and ledgers. Commenting on the resulting diminution of quality, Boyle (2000, p7) writes: "the more the words give way to figures, the more counting simplifies things that are not simple". Topical examples of the contradictions between quantity and quality include the cutting down of a tree that is sawn into pieces and sold. This process is both quantifiable and profitable, whereas if the tree remains in the ground, reducing climate change, it is not. Similarly, weed killer may cause cancer but adds quantifiable value to crops and the drugs to cure the resulting health problem add even more.

The gentlemen mathematicians of Cambridge
As the industrial revolution was transforming the world, aided by the various applied mathematical disciplines, the notion of pure mathematics developed in some of Europe's elite universities. Commenting on pure mathematics, Heaton (2015) writes: "until the late eighteenth century, no mathematician would have known what you were talking about" (p41). Central to the development of pure quantification, untainted by any consideration of quality, was Cambridge University, a "finishing school for gentlemen" Agar (2001, p13), which was set up by the Roman Catholic church in the 14th century following a breakaway from Oxford University. A Christian rival to earlier Muslim universities, like hundreds of other church institutions, Cambridge university was intended to propagate Catholic teachings. Across Christian Europe, the Latin quadrivium, consisting of arithmetic, geometry, music and astronomy, became the core of an elite young man's education; women being largely excluded from universities. Following Henry VIII's break with Catholicism, the universities, including Cambridge, became more secular, offering a wider range of degrees. By the 19th century some academics at Cambridge openly declared themselves to be atheists. Cambridge's colleges, particularly Trinity, established a reputation for educating gentlemen in *pure* mathematics. Rouse Ball (1960), a leading academic at Trinity, expressed the prevailing orthodoxy on the origins and methodology of mathematics. Like the overtly racist statistician Francis Galton, Rouse Ball praised Greek mathematics, calling that of the ancient Egyptians, Indians and others "prehistoric". These "early races", he argued, "knew something of numeration and mechanics...were also acquainted with the elements of land surveying". However, he claimed, the mathematics of these "races" were "founded only on the results of observation and experiment" rather than the deductive proofs of Euclid and the other Greek mathematicians. Their results, he added, "were neither deduced from nor did they form part of any science" (p1 and 2).

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Hardy's *Apology*

Whilst pure maths departments are today closing down in universities around the world, with the relevant maths taught in applied departments, Cambridge is one of the elite institutions continuing to offer the subject and features an alumni that includes Russell, Hardy, Wittgenstein and Turing, along with a smattering of scholarship boys and later girls from "low income" families. Russell and Hardy took the view that pure mathematics, as opposed to its applications in engineering, architecture and the like, was an intellectual exercise in deductive logic. Hardy (2019) followed the lead of Rouse Ball, advocating a Platonic approach: "mathematical reality lies outside us...our function is to discover or *observe* it" (p123; emphasis in original). Snow's foreword to Hardy's book is typical of his social class's thinking, describing Hardy, who only merits a footnote in most histories of maths, as having a mind that is "brilliant and concentrated" with "a formidably high I.Q. as soon as, or before, he learned to talk" (p11 and 14). Members of this intellectual elite normally earned only a modest salary by the standards of their class, but were offered board and comfortable lodgings, for life, in an atmosphere of quiet contemplation. This was interrupted only by the occasional lecture or tutorial, so as not to interrupt their discovery of new mathematical proofs. Comparing maths to composing chess problems, according to Hardy, the "function of a mathematician is to do something" and that something is "to prove new theorems"; other aspects of maths, he argued, "is work for second-rate minds" (p61). "Oriental mathematics", Hardy continued, "may be an interesting curiosity, but Greek mathematics is the real thing" (p81). Hardy was committed to what he regarded as the Greek method of proof, frequently citing Euclid and Pythagoras, claiming that it is "clear cut" and "unanimously accepted" (p82). Regarding the application of maths to calculation, he argues that "very little of mathematics is useful practically, and that that (sic) little is comparatively dull...I am interested in mathematics only as a creative art...I have never done anything 'useful'" (p89,115 and 150). In other words, maths should have nothing to do with the real world of qualitative processes. Maths therefore becomes, Raju claims, religious metaphysics or aesthetics.

A more recent academic who ought to have offered an apology is Badiou (2016). A product of the French equivalent of Cambridge, and supporter of Leninism, he argues in much the same way as Hardy that *real* mathematics was born in Greece. An advocate of the Platonist view of mathematical objects as bearers of universal truths waiting to be discovered in some mystical timeless world beyond,

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Badiou writes of "the ultimate beauty of mathematics" (p4). Due to his exposure to Leninism, Badiou accepts the existence of multi-valued logic, but cannot square this with his commitment to the two-valued logic of Greek mathematics. He admits that pure maths is an elite activity involving "only those who are able to understand the most difficult proofs...mathematics, particularly in France, really *is* used as a method of selection of elites via the entrance exams...The vast majority of people, once they've taken a number of relatively easy exams in school, no longer have any real connection with mathematics" (8 and 9, emphasis in original). As a Platonist, Badiou believes mathematics "bypasses the particularity of language" (p34), apparently having its own universal language. Yet, he admits that the specialisations that make up contemporary mathematics mean that often only a "dozen people" around the world are capable of understanding them: "it's the most exclusive of all possible elitisms" (p15). As a result of his timeless approach, for Badiou quantification has no history and no connection with its qualitative socio-economic environment. Therefore he can offer neither an explanation for, nor a solution to, the widely acknowledged parlous state of contemporary mathematical education for those outside of the "elite".

Cambridge's dissidents

A number of Cambridge gentlemen broke away from pure mathematical orthodoxy. The best known of these is Wittgenstein who, like Hardy, compared pure maths to a game, such as chess, but unlike the latter did not accept the Platonic approach. Wittgenstein accepted that maths generated contradictions, but argued this did not mean there had been an *error*, as Russell and Hardy believed. His method, in effect, was to ignore these contradictions and continue as if they did not exist; which was at odds with the proof by contradiction method that remains an axiom in contemporary mathematics. Another dissident, Imre Lakatos, began his pure mathematics career at Cambridge but, after exposure to the orthodox paradigm, moved on both literally and figuratively. His much discussed text, Lakatos (1976), shows his eventual distance from his Cambridge tutors, describing their paradigm of "theorem and proof" as a "Euclidean ritual" a "conjuring act" involving "sleight of hand". "Mathematics", he writes, "is presented as an ever-increasing set of eternal, immutable truths" with an "authoritarian air" (p142).

The Cambridge scholarship boys to the rescue

The calm of the Cambridge gentlemen was shattered when, in the 1930s, Hitler began to invade much of Europe. The British military elite successfully argued that resources should be put into breaking

the codes in which Nazi military communications were formulated. To this end, the government recruited the services of a number of mathematicians, mostly from Cambridge university. Alan Turing is by far the best known of these mathematicians, thanks to the motion picture *The Imitation Game* and a substantial literature claiming that he more or less invented the computer. In these times of social inclusion, as corporately defined, the life of Turing has been used as a smokescreen, to deflect attention away from some important aspects of British code-breaking activities during WWII. Rather than discussing the social class aspects of events at Bletchley Park, the focus of the film and much of the writing about Turing concerns his homosexuality at a time when it was illegal in Britain. Turing came from a modest background relative to, for example, Wittgenstein whose father was one of the richest men in Europe. Turing had to sit an entrance exam/interview at Cambridge, which he failed first time around, whereas Wittgenstein just turned up and, under the wing of Russell, attended lectures and later became a tutor.

Setting the record straight, as Timewatch (2011) documents, an early, perhaps the first, electronic computer was developed by Tommy Flowers, son of a bricklayer who won a scholarship to Cambridge, in order to decode the Nazi Lorenz machine. Another key figure at Bletchley Park was Gordon Welchman, solid middle class and Cambridge educated. As Greenberg (2014) explains, Welchman was written out of history because, whilst working in the United States after the war, he revealed some of the secrets of Bletchley, arguably long after they had any relevance to modern code-breaking. Bill Tutte was the son of a gardener who obtained a scholarship and, although sidelined by his upper class officers, broke the Lorenz code, the latter being a greater achievement than breaking the Enigma machine code.

Pure quantification: the computer and AI

The discussion of the computer in the previous section is important because it is the epitome of quantification, predicated on 0 and 1, so it is in order to reflect on its genesis. 20th century monopoly capitalism, with its corporate giants and large government departments, functioned by means of hierarchies in large part consisting of skilled mathematicians and statisticians making decisions supported by clerical workers performing routine operations. Superseding the adding machine, Agar (2001) argues, computers were designed to operate in precisely this hierarchical environment. Punch-cards, developed for textile machinery, with a hole for *on* and no hole for *off,* were to play a major role in the

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development of the adding machine and later the computer. Agar refers to the use of simultaneous equations, which were time-consuming to solve prior to the advent of the computer. Comparing decimal and binary numbers, Agar points out that the former is more user friendly, or anthropocentric, than the latter; but 0 and 1 lend themselves more readily to rapid calculations. Notwithstanding the contradictions that arise when zero and infinity are used in programs, most mathematicians have continued to insist that deductive reasoning, remains the best approach to computing, AI and robotics. However, the AI specialist Wilks (2019) begs to differ, arguing that despite rapid growth in some areas, other AI areas show little progress using deductive logic. Much of the progress, he explains, has been made by the use of statistical methods rather than programming languages based on formal logic. Referring to the arguments of the mathematician Gödel, who cast major doubt on the process of mathematical proofs, Wilks takes a more qualitative approach. He argues that the most successful AI researchers are tending to use modes of reasoning more akin to lay human thinking, in which we tend to use past experiences and a range of factors in decision making. We must remind ourselves, however, that computing, AI and related technologies are mediated by their corporate capitalist context in terms of cost cutting, job elimination, data gathering, social control and spying: "counting promotes the counter and demotes the counted"; Boyle (2000, p41) quoting Chambers.

Quantification, race and gender

Readers may have noted that the text has made almost no mention, apart from Hypatia, of women. Largely excluded from higher education until the mid 20th century, women began to do work associated with calculation in the growing bureaucracies of large companies and government departments. Yet, as at Bletchley Park, women were by and large doing more routine work overseen by middle class, middle aged, white men. The African American women working at NASA in the 1960s did perform high level calculations, notably Katherine Johnson, but were routinely discriminated against, as depicted in the film *Hidden Figures.* It is to the credit of Su (2020), a former president of the Mathematical Association of America, that he has mentored Christopher Jackson, an African American young man incarcerated for armed robbery, encouraging him to study mathematics in prison. This endeavour is linked to Su's view that mathematics can promote human flourishing, love, justice, truth and more. Alas, this is not what Su's book delivers. Rather, it

offers either only geometry, algebra and calculus with no mention of the qualitative basis of American capitalism. Su could have perhaps encouraged his readers and Christopher Jackson to produce descriptive statistics as one side of an investigation into the qualitative relationships between race, ethnicity, religion and social class, on the one hand, and drug addiction, types and definitions of crime, unemployment, income differentials and more, on the other.

On the widely acknowledged crisis in mathematical education, students could be invited to investigate the claim that the ancient Greeks, as white Europeans, were the source of mathematics, philosophy, democracy and more. Students could be encouraged to investigate the qualitative nature of ancient Athenian society; they could, in terms of quantification, be asked to enquire into estimates of its population size, the numbers of slaves and slave-owners, the number of citizens or women able to vote and related issues. Again, numbers of important archaeological sites remaining in Egypt and Greece could be compared and the implications of this for mathematics could be investigated. Similarly, American students could be asked to investigate how many of their presidents have been women and use this to introduce the number zero and the qualitative meanings of the word nothing. The Indian origins of zero could be investigated along with the reasons why the Catholic church was so hostile to its use. Further investigations could include why, given this hostility, zero was eventually brought into use; young people could investigate what ongoing problems use of the number zero creates for a) mathematicians and b) software coders.

The late Reuben Hersh
...the inner world of human life - can never be mathematized...the inner life of society...falls outside the computer, outside any equation or inequalities; Davis and Hersh (1990, p13 and 14).
Describing the daily life of the billion or so workers who stare at screens and tap keyboards for a living as "slavery", the various texts of self styled *humanist* mathematician Hersh are a breath of fresh air. He is one of the few highly qualified mathematicians who readily acknowledges the socio-economic genesis of his subject. Hersh is highly dubious of the notion of proof, the foundation of pure mathematics, noting that Wiles' 'proof' of Fermat's last theorem is around 150 pages long. He describes proof as a matter of debate amongst members of a specialist group in a particular field of maths. Arguing maths will never be free of contradictions and uncertainties, Hersh shows that addition, along with the other mathematical operations, is no routine procedure that can be successfully applied

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at will. Rather than a universal truth,1+1=2 is a cultural artefact predicated on the need to facilitate the trillions of daily transactions that are the life blood of the capitalist mode of production. He challenges the assumption that an income of £40,000 p.a. is twice one of £20,000 p.a. in terms of a range of qualitative factors. As with all professions, the overuse of symbols is a means of excluding the vast majority of the population, he argues, and is critical of mathematics in the classroom as a paradigm for the promotion of competition, and a lesson for students in the ethics of the wage labour system. With regard to who is the cleverest at maths, the middle class kid wins most of the time, facilitating a life of the mind at an elite university, studying four dimensional figures, to cite Hersh's example, which have no basis in the real world.

A note on arithmetical operations
Schoolchildren around the globe are more or less forced to learn arithmetical operations in order to function in their allotted role in capitalist society. In schools and colleges, arithmetical skills are typically applied to profit and loss calculations, taxes, insurance and a range of related business skills. Along with their times tables, children are taught what came to be known as BODMAS (PEMDAS in America), i.e. in arithmetic first address brackets, then of, next division, multiplication, addition and finally subtraction. Most commentators tend to promote an uncritical and unquestioning approach to this aspect of quantification, ignoring the fact that different calculators and programming languages offer different operational orders with regard to this rule. A more informed approach is offered by Haelle (2013), who acknowledges that: "Math has syntax just as language does - with the same potential for ambiguities". she writes: "It's knowing what operations the author of the problem wants you to do, and in what order". Haelle points out that PEMDAS is "not a rule at all. It's a convention, a customary way of doing things we've developed only recently". Symbols refer to operations that were practical but, like numbers metamorphosing from adjective to noun, now refer to the abstractions of pure mathematics. Whilst most mathematicians take the order of these operations for granted, they have a history and some early examples are provided by Haelle. When the operations are applied in different orders, this will often produce different, rather than 'wrong' answers. Thus the issue of right and wrong answers, argues Haelle, raises the issue of global power in a corporately dominated system predicated on quantification and *standardisation.*

Measurement and variables

Perfect squares, triangles, cubes and the like only exist in the Platonic world of Hardy's pure mathematics, whereas in the real world, as Parker (2019) mentions, over 90% of spreadsheets contain errors. Bearing in mind that when dealing with non-linear variables, i.e. those that rise or fall at increasing rather than constant rates, small arbitrary errors lead to gross errors, as statisticians know well; which draws attention to issues of measurement and accuracy. Measurement is only ever as accurate as the technology being used to facilitate it and is subject to varying degree of arbitrariness; i.e. no person is *exactly* five feet tall or weighs *exactly* ten stones; all *populations*, a key term in statistics, change both quantitatively and qualitatively. As developments in fractal geometry indicate, if, for example, you want to measure a coastline, the smaller or more flexible your measuring device, the more accurate you are likely to be. The statistician Taleb (2007) offers the example of using a ruler to measure a table's dimensions: "The less you trust the ruler's reliability...the more information you are getting about the ruler and the less about the table" (p224). How accurate a measurement needs to be will be determined by practical considerations which will always be mediated by social relations. Symbols can never be *identical* with the real world, particularly with regard to motion; and in this context calculus simply reduces movement to states of rest. Whilst real world phenomena exist irrespective of our units, symbols and models, they can only be known to us via our experiences of them and our subsequent perceptual articulation of them in the form of observation statements expressed in a given language and accompanying culture. The much neglected concept of desire, in its widest sense, is mediated by capitalist social relations, but plays a central role in all of human activity, including quantification.

To the extent that researchers identify a variable and seek to measure it, this process will often involve a *unit* of measurement. Such units are not arbitrary, but rather relate to specific historical circumstances, related to agriculture in medieval times or imperial conquest, to name but two examples. Today these units are mediated by global capitalism in the form of the EU, the UN and other bureaucracies. Students of statistics are routinely coached in the ways of positivism with its distinction between continuous variables, such as height or weight, and discreet variables, such as number of computers or helicopters. Often used as examples in statistics textbooks, weight and height are constantly changing in all beings, animate and inanimate, so measurement of these variables always involves a degree of arbitrariness. As Hegel (1977) indicates, mathematicians are obsessed with obtaining the 'correct' value

rather than acknowledging that all phenomena are part of an ever-developing process. Textbook writers express continuous variables with no acknowledgement that such apparently indifferent quantities have a whole range of qualitative associations. Given their conservative "do well at school and you will get a good job" ideology, statistics teachers frequently use exam grades as raw data. Despite the apparent indifference between equal quantitative subdivisions, certain values are associated with profound qualitative implications, such as the distinction between 39 and 40, or 69 and 70, as is well known to academics. The reduction from quality to quantity is well demonstrated in Likert scales that are typically used in questionnaires giving the respondent the opportunity to, for example, rate their level of job satisfaction on a scale of 1 to 5. Thus, the qualitative richness of human being is reduced to the indifference of number. In the real world of government spending cuts, health care has been subject to the spectacle of quantitative benchmarks and yardsticks as applied to selected variables, which drive management actions with the motto "data driven decision making". Thus quantity, rather than quality, determines the health of nations. Cradle to grave, from exams forced upon children to means-tested benefits for the unemployed and elderly, the measurement of variables has become an alien reified force controlling the lives of wage workers around the world. It is no exaggeration to say that modes of measurement have in large part created the contemporary world, with pound, dollar or other currency symbols dangling in front of those struggling to pay their mortgage, rent, food bills and more.

With regard to pharmaceutical companies, quality is mediated by profitability; thus drugs are designed to suppress symptoms, rather than killing the goose that lays the golden eggs by developing cures. With regard to the behavioural sciences, measuring 'intelligence' by means of I.Q. and other tests, so as to identify "gifted children" or "geniuses", is used to justify unequal treatment of young people. As middle class parents know, by paying private tutors to facilitate practice, test scores can be improved. Resources are typically allocated in terms of league tables, such as those based on exam results, with variable scores aggregated; however, these tables are mediated by social class, manipulation of results and more. To the extent that corporate taxation is deducted from profits, the world's most adept lawyers and accountants are well paid to seek to redefine the ways in which profit is measured. If, for the likes of Amazon, UK tax were to be based on turnover then the same battle of wits over measurement will no doubt ensue and 'creative' accounting, as the art of measurement, will continue to be the basis of a lucrative career.

The reification of time

Before moving to a conclusion, let us turn our attention to the quantification and unitisation of time. Given this quantification, as Einstein pointed out, time varies at every location on our planet. So, in the real world, as opposed to the world portrayed by equations, the longer the time span the more objects become qualitative processes and are less able to be modelled with quantitative constants. Time is an important variable in statistics, but is typically treated in a way that neglects its socio-economic genesis: "Time, once passive, is now aggressive...Time is Money"; Garfield (2016, p4 and 191). To unitise time is to engage in a process that is never far removed from the internal contradictions, such as the fact that low wages create high profits but reduce demand, that mark capitalist social relations. Few statisticians refer to the ways in which clock time is a key component in the multiplicity of ways in which global capitalism imposes its discipline on the lives of wage workers. Again, Garfield (p4, my italics) writes: "We place a clock by our bed but what we really want is to smash it up...We work all hours so that we may eventually work less. We have invented *quality* time to distinguish it from that other time". An 'objective' approach to time, typically used by statisticians, was derived from the movement of the sun and moon which, Muslims and others know, are not synchronised. Poets, philosophers, lovers and others can confirm 'subjective' time is a more elusive concept. As football fans know only too well, "how slow it seems when you're winning and waiting for the final whistle, and how quickly it goes when you're behind"; Garfield (p10). There are a range of competing ways of measuring 'objective' time and, like other units of measurement, historically these were subject to power struggles with regard to how these were imposed. With regard to hours, minutes and seconds, prior to the industrial revolution these had little significance; the working day began when the sun rose and ended when it went down, scant attention was given to the local church clock.

As industrial capitalism rose to dominance, factory owners imposed their discipline on wage workers using the medium of time as measured by the factory clock. Each factory or mill would have its own unique time, which was forced on the workforce, members of which were often not allowed to bring timepieces into the factory. The police and courts were used in the case of repeated absenteeism, extended work breaks, failure to work longer hours, or when there were labour shortages. It was only with the advent of the railways

that it was felt necessary to coordinate differing times; a London-based timetable was introduced across the country in the 1840s. Differing local times would potentially increase the risk of accidents, especially on single track lines; so by 1880 all clocks around the country were legally required to adopt London time. Similar events occurred in other developing capitalist nations, which emphasised the dwindling power of the church vis-à-vis the capitalist class. In France, following events in 1789, the secular Jacobins had changed time by changing the calendar; they wanted to increase productivity in both agriculture and the production of weapons of war. British military power was used to impose clock time throughout its empire so as to measure labour productivity and the coordination of shipping.

The way in which clock time is divided was reinforced by Taylorist time and motion regimes in the workplace, currently imposed by computer technology. Reminding us of slave plantations, these regimes establish a recommended time in which each part of a process should be performed, so as to extract every unit of productivity from a given group of wage workers. Garfield discusses his own experience of working on the production line of a car factory, which is geared to making a car roll off the line every 68 seconds. One manager told Garfield that he "wished people could be more like machines; the problem with staff was that they introduced variability into the process. Absenteeism put a big spanner in the works" (183). Garfield quotes Taylor himself in a classic example of reification: "In the past the man had been first; in the future the system must be first" (p192).

Concluding remarks

In capitalist and state capitalist societies the dominant approach to quantity and quality is at odds with our ability to develop a rationality that really does promote human flourishing. We are perhaps reminded of Hegel's (1977), alas underdeveloped, claim that quantity and quality should be unified as *measure.* Devlin (1997) calls for a "soft mathematics" of the future, one which takes into account motivation and belief. Logical and mathematical rigour, he argues, should give way to alternative modes of reasoning. How his "soft mathematics", or a soft statistics, of the future will look remains an open question. However, in my view, only when the destructive social relations of capitalism are transformed into a world of authentic democracy, with the abolition of money and wage labour, can the relationship between quantity and quality be humanised.

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