Explaining inequality in mortality and health across the UK-mind the gap

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Background

Like many other countries, the UK experiences a continuous decline in mortality, even at older ages. At the same time, the country has a long standing and persistent history of mortality and health inequality, both geographically and socio-economically. Here, for the first time we analyse disability free life expectancy (DFLE) changes over time alongside life expectancy (LE) changes at local area level between 1991 and 2001, to determine and understand trends in mortality and health on a UK subnational level.

Research questions and approach

- *Are patterns of inequality the same for LE and DFLE and different ages?*
- *Are patterns of change over time the same for LE and DFLE and different ages?*
- *Which socioeconomic factors explain observed disparities in LE and DFLE?*

To answer these questions we look at the geographical distribution of LE and DFLE (Figure 1, Table 1), classify local areas into an urban to rural gradient (Table 2), classify local areas according to their deprivation (Table 3) and develop a model to explain area variations in LE and DFLE with socioeconomic variables (Table 4).

Life expectancy and disability free life expectancy across space & time

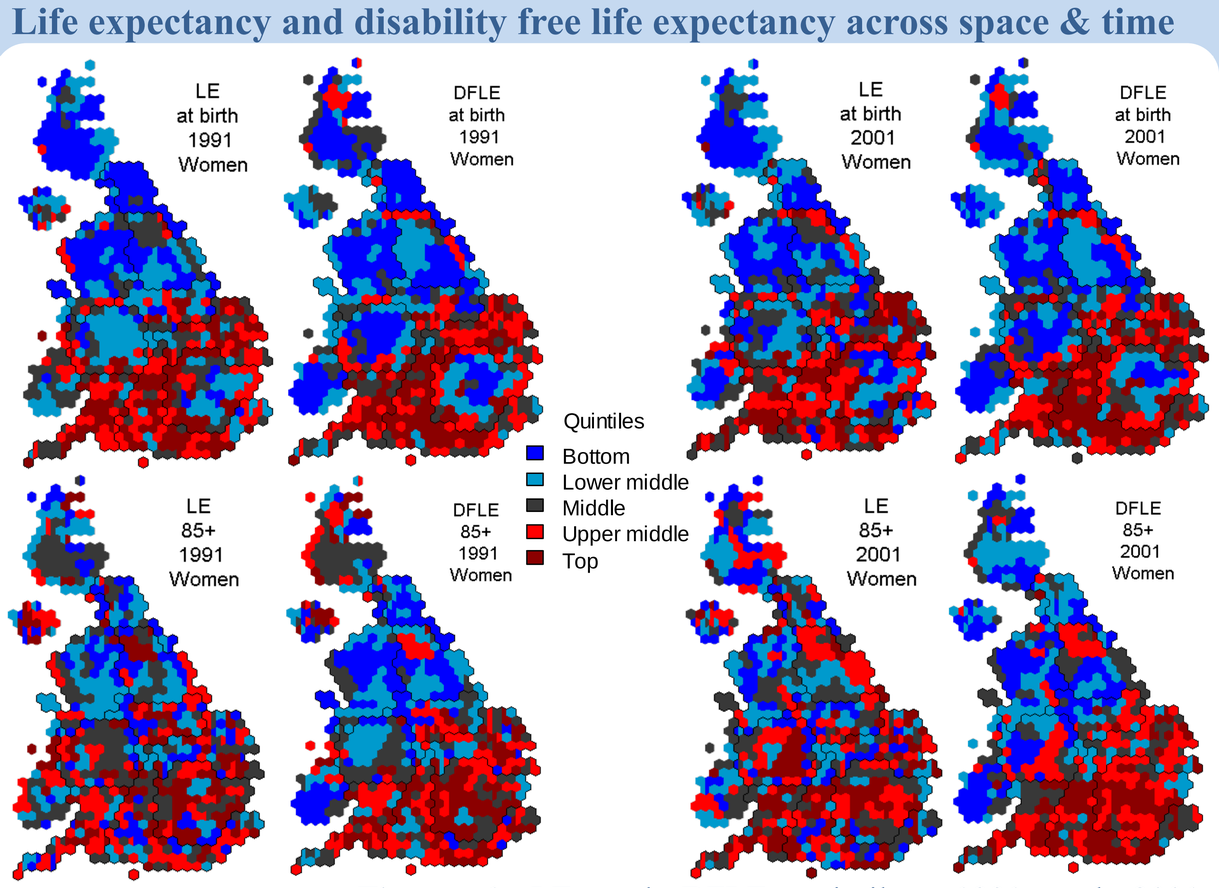

Figure 1 LE and DFLE quintiles, 1991 and 2001, exemplified for women at birth and 85+. UK local areas presented in a population cartogram to highlight the population numbers affected. Each hexagon denotes half a parliamentary constituency.

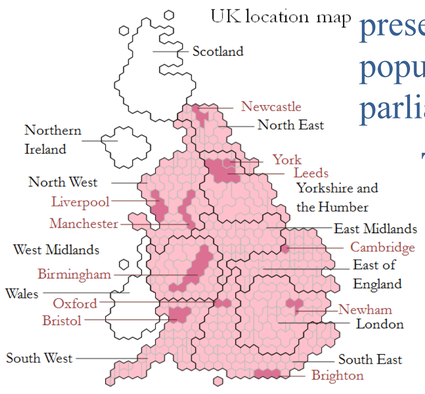

Table 1 Mean LE and DFLE for quintiles shown above

Quintiles	LE_0		LE_{85}		$DFLE_0$		$DFLE_{85}$	
	1991	2001	1991	2001	1991	2001	1991	2001
Top	80.6	82.3	7.2	7.3	66.7	68.0	1.8	1.9
	79.5	81.3	6.5	6.7	65.2	66.1	1.6	1.6
	78.9	80.6	6.2	6.4	63.9	64.3	1.4	1.4
	78.1	79.8	5.9	6.1	62.3	62.4	1.3	1.2
Bottom	77.0	78.5	5.4	5.6	59.5	59.1	1.0	1.0

Life expectancy and disability free life expectancy for women **at birth** show a distinct **north-west south-east divide** in 1991 which still **persists in 2001**. **Similar** patterns were observed **for men and at ages 50 and 65** (data not shown). At **age 85+** a north-west south-east divide is **less apparent.** Some 1991 medium ranked local areas in **Scotland and Northern Ireland declined in rank** by 2001 at birth and 85+. Note that unlike LE_0 and $DFLE_0$, for LE_{85} and LE_{85} **urban areas** are ranked in **upper quintiles**, suggesting living in urban areas might be "good" at an older age. Is this the case? (See table 2). Whereas there is a evident increase in LE both at birth and 85+ over time, the increase in DFLE at birth is marginal or almost non-existing at 85 (see Table 1) – suggesting an expansion of morbidity over time.

City or country life?

Table 2 Local area urban/rural classification, LE and DFLE at birth and 85+ for by gender

Area Classification	LE								DFLE							
	1991				2001				1991				2001			
	M0	F0	M85+	F85+	M0	F0	M85+	F85+	M0	F0	M85+	F85+	M0	F0	M85+	F85+
Major Urban	72.7	78.6	4.93	6.27	75.3	80.2	5.48	6.58	59.6	62.6	1.59	1.46	60.8	63.3	1.68	1.51
Large Urban	73.3	78.8	4.85	6.27	76.0	80.6	5.46	6.49	60.3	63.3	1.56	1.41	61.5	64.0	1.63	1.44
Other Urban	73.3	78.8	4.92	6.32	75.7	80.2	5.28	6.41	60.2	63.0	1.55	1.40	61.1	63.5	1.57	1.37
Significant Rural	74.2	79.2	4.95	6.27	76.9	81.1	5.49	6.44	62.2	64.8	1.61	1.44	63.6	65.7	1.65	1.45
Rural 50	74.1	79.2	4.85	6.30	76.7	80.9	5.30	6.35	61.7	64.5	1.59	1.45	63.0	65.3	1.62	1.41
Rural 80	74.4	79.2	4.93	6.03	77.0	81.3	5.41	6.53	62.4	65.1	1.64	1.45	63.6	66.1	1.67	1.53

The **gap** in DFLE **at birth** (~2.8 years) **between** the **Major Urban** areas and **Most Rural** (Rural 80) areas is higher than the gap seen in LE (0.6-1.7). Both seem very **constant over time**, with a slight increase for women, where Most Rural areas improved more than Major Urban areas . **At 85+,** living in an **urban area** seems not to be a dis**advantage** anymore, LE is not different or slightly higher in urban areas, differences in DFLE are marginal without apparent trend.

Money makes the world go round?

Table 3 Local area deprivation population quintiles, 1991 classification, mean LE and DFLE at birth and 85+ by gender. 1= least deprived, 5= most deprived

Deprivation		LE								DFLE							
		1991				2001				1991				2001			
		M0	F0	M85+	F85+	M0	F0	M85+	F85+	M0	F0	M85+	F85+	M0	F0	M85+	F85+
least	1	75.1	79.9	4.82	6.22	77.9	81.9	5.46	6.37	64.1	66.4	1.65	1.50	65.9	67.8	1.72	1.50
	2	74.6	79.5	4.90	6.20	77.3	81.4	5.45	6.52	63.0	65.6	1.62	1.47	64.5	66.7	1.73	1.55
	3	73.9	79.0	4.94	6.19	76.4	80.8	5.30	6.37	61.4	64.2	1.60	1.42	62.6	65.0	1.62	1.43
	4	73.0	78.4	4.90	6.24	75.3	79.9	5.32	6.37	59.2	62.3	1.54	1.36	59.9	62.5	1.50	1.31
most	5	71.7	77.9	4.93	6.38	74.2	79.6	5.51	6.72	57.3	60.8	1.55	1.45	58.3	61.1	1.62	1.48

LE and DFLE at birth **increased** over time for **each deprivation** quintile, but the increase in areas comprising **the least deprived** ones was **larger** than in the most deprived ones, **increasing the gap** between the least and most deprived areas. For the **oldest old** the picture is **less defined** and in both years LE in the most deprived areas was higher compared to the least deprived areas. Again, the variation in DFLE at birth is more pronounced, than in LE. Note, the least increase in DFLE was in deprivation quintile 4.

Causes for area variation?

Table 4 Socio-economic area characteristics explaining variations in LE and DFLE across local areas, a regression model

Factors	1991								2001							
	LE_0 ♂		LE_0 ♀		$DFLE_0$ ♂		$DFLE_0$ ♀		LE_0 ♂		LE_0 ♀		$DFLE_0$ ♂		$DFLE_0$ ♀	
	b	Beta	b	Beta	b	Beta	b	Beta	b	Beta	b	Beta	b	Beta	b	Beta
Social Class IV and V (%)	-0.13***	-0.36	-0.09***	-0.30	-0.23***	-0.3	-0.18***	-0.3	-0.13***	-0.5	-0.12***	-0.6	-0.34***	-0.6	-0.34***	-0.7
Unemployment Rate (%)	-0.17***	-0.35	-0.15***	-0.41	-0.65***	-0.7	-0.56***	-0.7	-0.22***	-0.3	-0.1	-0.2	-0.64***	-0.4	-0.39***	-0.2
Population Sparsity	-0.01.	-0.12	0.01	0.12	0.01	0.07	0.02	0.13	-0.01**	-0.2	0	0.02	-0.02**	-0.1	-0.01	-0.1
Non-white Population (%)	0.00	-0.01	0.01	0.03	0.06**	0.14	0.03**	0.07	0	-0	-0.01	-0.1	0.05***	0.12	0	0
Constant	77.5		81.7		69.8		71.2		81.7		85		75.7		77.3	
R^2	0.49		0.35		0.72		0.69		0.65		0.5		0.85		0.81	

Bone *et al* (1994) identified area characteristics which explained variation in DFLE across LA in 1991. Here we want to see, whether these variables still have the same importance in the new geography introduced in 2001 and whether they explain variation of LE as well. **Social class composition, unemployment rate, population sparsity and ethnic composition** explain more of **variation in DFLE** across areas than variation in LE, slightly more of the variation in men than in women, and **more** of the variation **in 2001** than in 1991. Social class composition is more important in 2001 than in 1991, when unemployment rate was the most important factor. This change is possibly explained by lower unemployment in 2001 than in 1991.

Main findings and conclusions

At birth, patterns of LE and DFLE – north-west south-east divide, urban to rural as well as deprivation divide- **persist over time**. The **gap** between **urban and rural** areas **stayed** the but at the same time the **gap** between **deprivation** classes **increased**. Here the less deprived areas increased LE and DFLE faster than more deprived areas. The reason behind this could be that public health **interventions** were more **successful for** the already more **affluent** and healthier **population**, as recent studies suggest. As this study investigates area changes, **migration** - e.g. healthier people moving to already "healthier areas" – could also be considered. **Factors** explaining area variation of DFLE in 1991, **social class composition, unemployment rate, population sparsity and ethnic composition**, still do so even more in 2001. However, unemployment was more important in 1991, when the country experienced a recession, than in the booming 2001. Overall, there is a stronger relationship between social class and deprivation and LE and DFLE in 2001 compared to 1991. For the **oldest old** place seems less important. LE in the oldest old shows no strict geographical divide and living in **urban areas** does not **seem** to be a dis**advantage**, possibly because of better **access to healthcare and other services** in urban compared to rural areas. For the oldest old the **deprivation gradient** also **disappears**, which could indicate a **survival selection** effect. **For both ages**, we see **less** favourable **development** in **Scotland** and **Northern Ireland** between 1991 and 2001 and although DFLE increases across the UK, it decreases as a percentage of LE, suggesting that there has been morbidity expansion. However, recent work using a survey time series (1992-2010) of limiting long standing illness rates suggests morbidity compression has been experienced since 2000. **Overall life expectancy and disability free life expectancy increased in most areas between 1991 and 2001. Even though the gap across the UK has probably widened, the general trend is a positive one.**

Acknowledgments - References - Data sources - Contact

The InHALE project (http://research.ncl.ac.uk/InHALE/) is funded by the ESRC (ESRC Research Fund RES-062-23-2970 1 October 2011 - 30 September 2014) DFLE was calculated with the Sullivan method – Sullivan DF (1971) A single index of mortality and morbidity. HSMHA Health Rep 1971;86:347-354. 11, 1991 LLTI data were adjusted according to: Marshall, A. (2009) Developing a methodology for the estimation and projection of limiting long term illness and disability, PhD Thesis, School of Social Sciences, University of Manchester. The urban to rural classification used : http://www.defra.gov.uk/rural/ruralstats/rural-defn/rural-urban-method.pdf , deprivation quintiles used the Townsend deprivation index: Townsend P, Phillimore P, Beattie A. (1988) Health and Deprivation: Inequality and the North Croom Helm: London . Life tables were calculated with ONS vital statistics deaths registration and ONS mid year population estimates, 1991 2001. DFLE was calculated with Census 1991 and 2001 LLTI information, ONS.

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