

Countdown for UK Child Survival 2017: mortality progress and targets

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Abstract

Background: The Countdown for UK Child Survival tracks recent UK child mortality trends and makes recommendations for improvement.

Methods: We used data from the WHO World Mortality Database to calculate mortality from 1970 to 2014 for 0-19 year olds in the UK and a comparable group of wealthy countries (the EU15+). We used poisson regression models to assess the significance of apparent differences. We extrapolated model coefficients to estimate future disparities between the UK and the EU15+ to 2030. We proposed goals and intermediate indicators to track UK mortality in keeping with the UN Sustainable Development Goals.

Results: UK infant mortality continues to track in the worst decile of EU15+ mortality with 1-4y mortality in the worst quartile. Annual reductions in total UK mortality have been significantly lower than the EU15+ since 1990 for infant, post neonatal and 1-4 year mortality. If current trends persist, by 2030 UK infant mortality and 1-4 year mortality could be respectively 180% and 145% of EU15+ median mortality. UK NCD mortality amongst 1-4 years and 15-19 years persists in the worst quartile. UK injury mortality continues in the best quartile. A framework of goals and indicators for UK child survival survival and health is presented.

Discussion:

UK mortality amongst under 10's continues to diverge from the EU15+ median, and UK NCD mortality remains persistently poor. We propose a set of goals to improve UK childhood survival by 2030 and a annual Countdown mechanism to monitor progress towards these targets.

Introduction

There is mounting evidence that reductions in child and adolescent mortality in the UK are lagging behind those in other wealthy countries. The Royal College of Paediatrics and Child Health (RCPCH) *State of Child Health 2017* Report identified mortality as one of a number of key areas in which children's health outcomes in the UK perform poorly in comparison to our closest peers.¹

We previously developed a methodology for examining trends in UK child and adolescent mortality in comparison to the median and 10th through 90th centiles of mortality across a group of internationally comparable countries.² This comparator group comprises the 15 Western European members of the European Union before May 2004, together with Norway, Canada and Australia (the EU15+).³ We argued that comparison against this group of both Western European plus large nations sharing an Anglo-Saxon origin was more appropriate than comparisons with single high-performing nations. Using data to 2010, we previously estimated that high UK mortality results in 1000 excess deaths in infants and children and around 280 excess deaths amongst 10-24 year olds from non-communicable diseases (NCD) each year, when compared to the EU15+ median.²

In 2015 we proposed a 'Countdown for UK Child Survival' initiative to track progress in reducing these disparities in mortality trends and make recommendations for improvement.⁴ Our Countdown proposal built on learning from the Millennium Development Goals-associated Countdown for reducing child mortality. In the era of the new Sustainable Development Goals (SDG), our UK Countdown initiative will track and report trends in mortality relative to comparable countries, report trends in intermediate determinants of health and survival, demonstrate progress towards specified mortality reduction goals, and make recommendations for achieving progress in improving child health and survival in the UK.

Here we update information on UK child and adolescent mortality performance compared with the EU15+ to 2014, the most recent year for which there are sufficient data across the EU15+ countries. This paper is the first report of our work on the Countdown for UK Child Survival.

Methods

Mortality

We replicated analyses presented in our previous publication on mortality to 2010². National mortality estimates for the UK and EU15+ for 1970 to latest available were downloaded from the World Health Organisation (WHO) World Mortality Database (WMD)⁵ for 0-19 year olds, and Organization for Economic Cooperation and Development (OECD)⁶ for infants, accessed on 9th December 2016. Data were cleaned and disaggregated by sex and age group for neonatal (0-28 days), post-neonatal (29-365 days), total infant (0-365 days) and 1-4, 5-9, 10-14 and 15-19 age groups. 2014 was the most recent year with data available in the WMD for the majority of EU15+ countries, with 2013 being the most recent UK data. We also downloaded data on the four UK countries separately. Mortality data by cause were examined only for 2001 – 2014 as this is the period when the UK and most EU15+ countries moved to using the ICD10 classification system. Cause-specific mortality was grouped using Global Burden of Disease (GBD) mortality groups into communicable disease, non-communicable disease (NCD), and injury mortality⁷.

We calculated death rates per 1000 live births for infants and per 100,000 population by age for 1-9 year olds, and by age and sex for 10-19 year olds within each EU15+ country. We then calculated the 10th, 25th, 50th (median), 75th and 90th centiles for mortality across the EU15+ using Stata 14 (StataCorp, College Station TX). These centiles were then smoothed to 3-year moving averages using the *ma* smoother in Stata 14. Graphs were prepared showing the relation of UK mortality to EU15+ centiles for 1970-2014 for total mortality, and 2001-2014 for NCD and injury mortality. Communicable disease mortality graphs are not shown as these now constitute a negligible proportion of UK or EU15+ mortality in these age-groups.

We used poisson regression models for change in mortality between 1995 and 2014 by age group to identify differences in mortality slope for the UK and the EU15+, as described in our previous report². We used 1995 as the start of the models to identify recent rather than historical changes in mortality slopes, as our previous data had shown a plateau in UK infant and young child mortality from the mid 1990s. Where there were significant differences in mortality slopes between the UK and the EU15+, we extrapolated mortality using model coefficients out to 2030.

Goal and indicator setting

In keeping with the SDG aims, we suggest specific mortality reduction goals for the UK, with additional targets for intermediate indicators that relate to key risk factors for mortality. In proposing UK mortality goals, we attempted to balance ambition with pragmatism. For example, while the SDG global target 3.2 is to end preventable deaths of newborns and children under 5 years old, in the UK our target is to reduce overall mortality among infants, children, and adolescents to reach the best decile among the EU15+ countries, and to end preventable deaths entirely.

For intermediate goals, we built upon work by UNICEF identifying child-focused SDGs relevant to high-income countries.^{8,9} Indicators are based around the global SDGs, reflecting the most common causes of death and important determinants of health for infants, children, and adolescents, based upon previously identified major causes and risk factors for infant, child, and adolescent mortality¹⁰. We selected intermediate indicators based on the following criteria, adapted from UNICEF's work:

- a. Child-specific: Explicitly relating to children rather than society as a whole
- b. Relevant to the UK as a high-income country
- c. Important: they should reflect high burden and important problems with clear relation to mortality amongst children or adolescents, in alignment with the SDGs
- e. Available: valid measures, routinely or regularly collected
- f. Policy relevant: attainable through national or local policy, and achievable
- g. Communicable: amenable to advocacy, clearly and easily understood by policy makers, professionals, and the public

Ethics: No ethical approval required for these secondary analyses of national level mortality statistics.

Results

Total infant, neonatal and post-neonatal mortality for the UK compared with the centiles of EU15+ mortality from 1970 to 2014 are shown in Figure 1. UK mortality continues to track in the worst EU15+ decile (i.e. >90th centile) across each infant mortality category, with no apparent change in the relatively flat trajectory of UK mortality since the mid 1990s. Multilevel poisson regression models for change in infant mortality for the UK compared with the EU15+ mean (see Appendix Table A1), show that the UK has a significantly lower annual mortality reduction since 1990 (2.3% annual reduction for UK infant mortality compared with 3.4% for EU15+ mean; 2.8% for UK post-neonatal compared with 3.8%).

Figure 2 shows 1-4 year total mortality for the UK and EU15+ from 1970 to 2014, and shows the UK falling from the median (50th centile) to the 75% centile since 2000, with no improvement since 2008. Table A1 shows that annual reduction since 1990 in UK 1-4 year mortality (2.8%) is significantly lower than the EU15+ mean(3.7%). Similar trends in 1-4 year mortality are seen across all four UK countries (Appendix Figure A4).

Figure 3 shows UK + infant and 1-4 year mortality as a multiple of EU15+ median mortality from from 1995 to 2013 and then estimated multiples through to 2030 extrapolated using the coefficients generated from the poisson regression models for each age. UK infant mortality increased from 110% to 135% of annual EU15+ median mortality between 1995 and 2013, whilst UK 1-4 year mortality changed from lower (88%) than the EU15+ median to 111% by 2013. Estimates from our models suggest that if current average differences in the declines in EU and UK mortality persist, that by 2030 UK infant mortality could be 180% and 1-4 year mortality 145% of respective EU15+ medians.

Trends in UK and EU15+ mortality for 5-9 year olds and for 10-14 and 15-19 year olds by sex are shown in the Appendix (Figures A1 to A3), with multilevel poisson regression models for change in mortality since 1995 shown in Appendix Table A1 & 2. UK mortality in each of these age-groups has largely tracked along the EU15+ median since 2001. However, models suggest that the UK mortality decline amongst 5-9 year olds and for 10-14 year females is significantly poorer than that for the EU15+.

Non-communicable disease (NCD) mortality for the UK and EU15+ for 1-4 years olds and 15-19 year males is shown in Figure 4, with other age-groups and sexes shown in Appendix (Figures A5-A7). Amongst 1-4 and 15-19 year olds of both sexes UK NCD mortality has largely been in the worst quartile (>75th centile) since 2001, although closer to the 50th centile in 5 to 14 year olds.

Injury mortality for the UK and EU15+ are shown Appendix Figures A8-A11. The UK continues to perform relatively well on injury mortality, with mortality in or close to the best 25% in each age-group and both sexes.

Goals and indicators

Figure 5 shows mapping of SDG goals (left-hand column) to proposed UK Child Survival Goals (CSG) for A) mortality and B) for intermediate indicators representing determinants of health and risk of mortality. For each UK CSG goal (middle column, Figure 5) we suggest an indicator (right-hand column) for which UK data are available.

Our headline goals are that by 2030, UK infant, child and adolescent mortality rates should be among the best in EU15+ (in the best decile), and that by 2030 the UK should have no more preventable deaths among infants, children, and adolescents. In selecting UK Countdown goals we attempted to balance ambition with pragmatism. For example, while the SDG global target 3.2 is to end preventable deaths of newborns and children under 5 years old, in the UK our suggested target is to reduce overall mortality among infants, children, and adolescents to reach the best decile among the EU15+ countries, and to end preventable deaths entirely.

We propose that UK performance against these indicators should be tracked annually alongside the mortality indicators. We suggest that the impact of inequality in the form of social gradients for each indicator should also be tracked.

Discussion

Our key finding is that the UK position not only continues to be in the worst quartile for infant and younger child mortality, but is worsening relative to trends across comparable high-income countries for each age group under 10 years. Similar trends are seen for each of the four UK countries compared with the EU15+. Whilst our data for the UK are limited to 2013, the Office of National Statistics reported that the infant mortality rate for England and Wales for 2014 showed a small rise to 3.7 per 1000 reported in 2015.¹¹ These data support our finding that UK trends in the younger age-groups appear sadly consistent since the end of the twentieth century, which led us to project findings out to 2030. This projection is alarming as it suggests that the disparities in early childhood mortality between the UK and the EU15+ will continue to widen if current trends continue. By 2030 the UK's infant mortality rate could be 80% higher than the EU15+ median rate with 1-4 year mortality nearly 50% higher, if current disparities persist. The UK excess childhood mortality identified here signifies the scale of preventability and the scope for improvement if the UK could replicate conditions elsewhere.

NCD mortality and injury mortality trends in the UK appear similar to our previous reports, with the UK having high NCD mortality (worst quartile amongst 1-4 and 15-19 year olds) but relatively stable low injury mortality compared with the EU15+. We previously found that neuropsychiatric conditions were the main contributors to the UK excess in NCDs, although the UK appeared to have a slight excess across most NCDs including respiratory, gastrointestinal, endocrine conditions and cancer.

We have suggested a set of UK Child Survival Goals to 2030 including 5 mortality goals and 18 intermediate goals, based upon the international SDG. Our suggested mortality goals are to reach the best mortality decile among the EU15+ countries in each age group across total, NCD and injury mortality. We chose the best decile as this is a pragmatic goal amongst a group of low mortality countries. We propose tracking UK performance on these goals annually, using WHO WMD data.

We also proposed a set of 18 intermediate goals relevant to key determinants and risk factors of mortality in the UK, informed by work by Unicef.⁹ Note that these indicators do not cover the entirety of determinants of health in childhood and are limited to those most directly relevant to infant mortality and mortality from NCDs and injuries. We proposed these indicators to stimulate debate and welcome opinion and challenge. Work is needed to populate and refine these intermediate goals and the suggested indicators.

A discussion of actions needed to reduce UK child and adolescent mortality is beyond the scope of this paper, and has been previously summarised by us in the *Why Children Die* 2014 report¹² by the Royal College of Paediatrics & Child Health (RCPCH) and the National Children's Bureau (NCB). Data presented here suggest that action is becoming more urgent. We believe that tracking UK child survival through the Child Survival Goals and intermediate indicators proposed here will keep a necessary focus on progress and inform iterative policy changes to reduce mortality amongst our children.

Strengths and Limitations

We used authoritative mortality data from the WHO WMD and used a previously published methodology to compare UK trends with those of other wealthy countries. Poisson regression models were run from 1995 to best estimate the slope of mortality decline in the twenty-first century, as there appeared to be potential inflexion points in the early 1990s for UK mortality. Trends in UK infancy mortality are similar across neonatal and post-neonatal mortality, suggesting the observed differences to EU15+ mortality are not due to differing definitions of stillbirth. The goals and indicators we propose are based upon the agreed SDGs and informed by published work by Unicef.⁹

Our data are subject to a number of limitations. Extrapolation of coefficients from the models to estimate mortality out to 2030 merely indicates potential outcomes if current linear trends for both the EU15+ and the UK persist unchanged. The suggested UK Child Survival Goals and indicators are derived by us and need further refinement.

Conclusions

Trends and projections in infant, child, and adolescent mortality show that the UK is slipping further behind comparable countries. Reaching the suggested UK Child Survival Goals by 2030 will be challenging. Action will be required at all levels of society including the economic, social, and environmental factors that lie beyond the health system, healthcare, and individual level and behavioural determinants. As a Countdown for UK Child Survival, we will annually track and publish progress on mortality and intermediate indicators to provide a mechanism by which decision makers can be held to account for progress.

Funding

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Contributions

RV and IW conceptualised the paper. RV undertook data analysis. IW identified the indicators. JW helped with writing the paper. All authors contributed to the final draft.

What is known about this topic

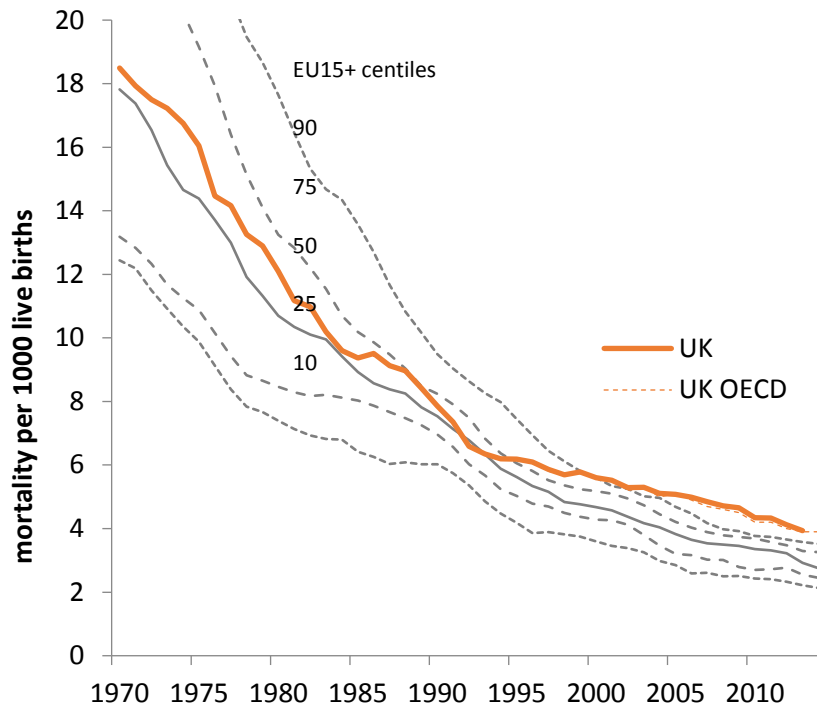
- Progress in reducing child and adolescent mortality in the UK lags behind comparable wealthy countries
- Disparities are particularly evident for infant and young child mortality (<5 years) and non-communicable disease (NCD) mortality

What this study adds

- The UK continues to have lower reductions in mortality for children under 10 years old than comparable wealthy countries.
- We propose a set of UK Child Survival Goals for UK child and adolescent mortality to be in the best decile of EU15+ mortality by 2030. We will monitor progress towards these goals annually through a UK Countdown for Childhood Survival mechanism.

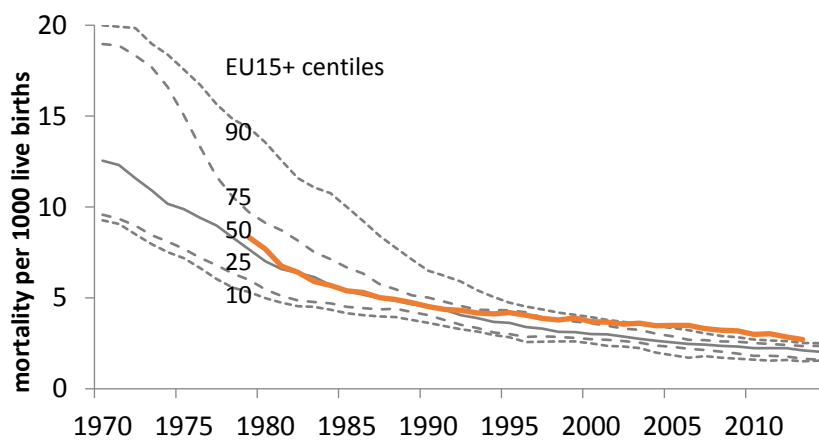
Figure 1. Infant, neonatal and post-neonatal total mortality in the UK and centiles of EU15+ mortality from 1970 to 2014

Panel A. Infant mortality in the UK and Eu15+



Note: For comparison, OECD data on UK infant mortality are also plotted as well as mortality derived from the WHO World Mortality Database (UK)

Panel B. Neonatal (0-28day) mortality



Panel C. Post-neonatal (>28day) infant mortality

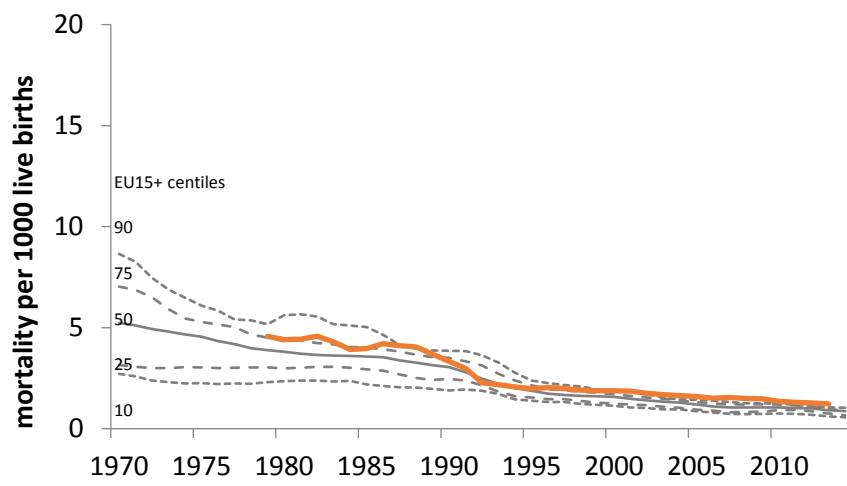


Figure 2. Total mortality amongst 1-4 year olds in the UK and EU15+ from 1970 to 2014

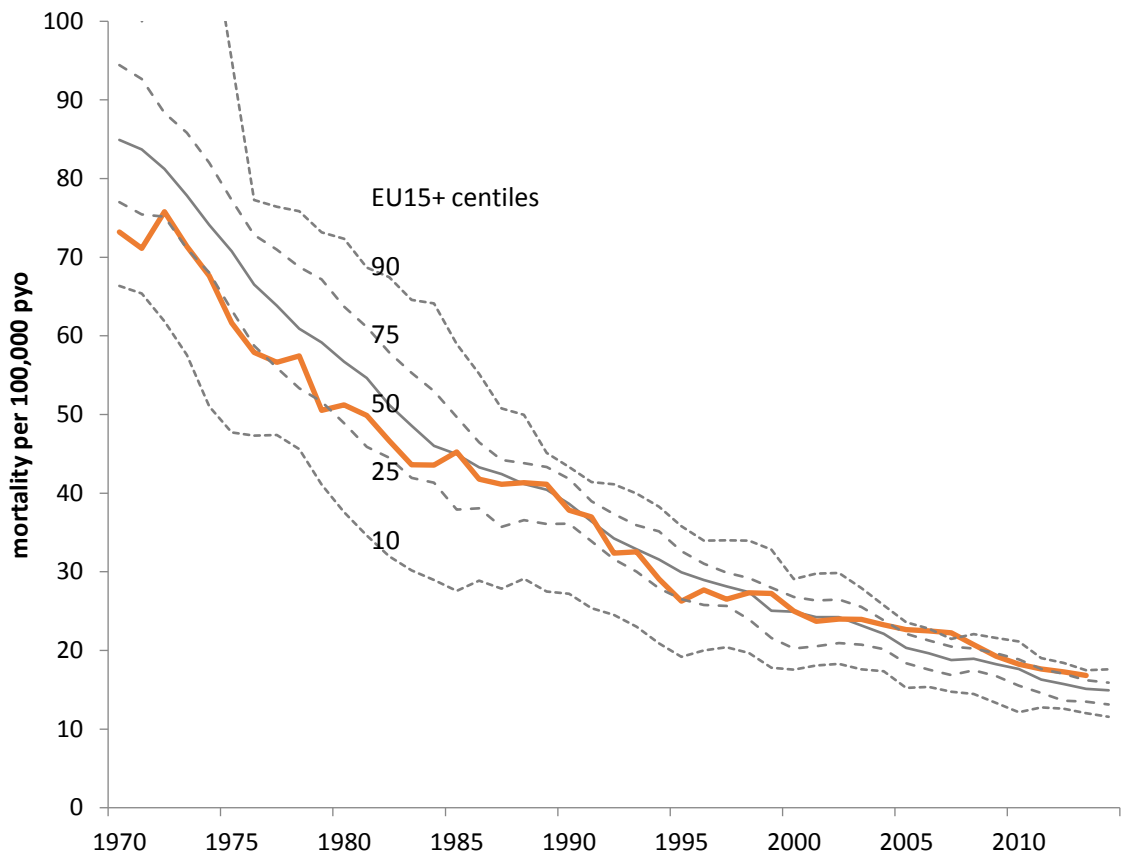
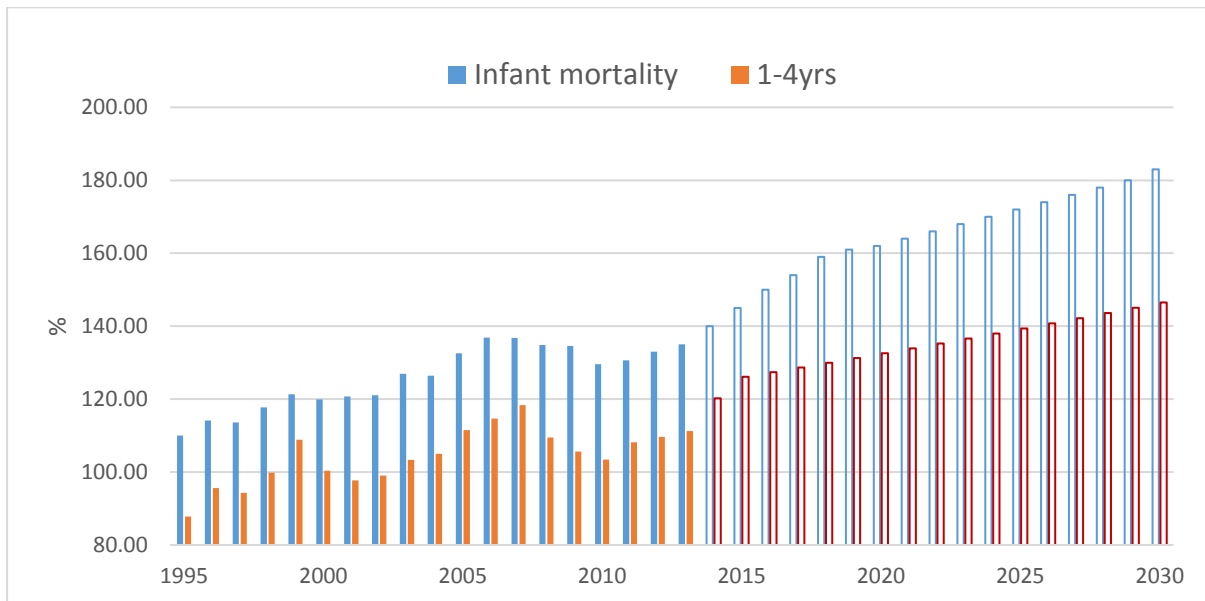


Figure 3. UK mortality shown as a percentage of EU15+ median mortality from 1995 to 2013, with estimates from model coefficients extrapolated to 2030



Note: Actual mortality is shown in solid bars with projected mortality in open bars

Year	Percent difference between UK infant mortality rate and EU15+ median mortality rate	Percent difference between UK 1-4 year old mortality rate and EU15+ median mortality rate
1995	10%↑	18%↓
2000	20%↑	0%→
2005	33%↑	10%↑
2010	30%↑	8%↑
2015*	45%↑	23%↑
2020*	62%↑	30%↑
2025*	75%↑	40%↑
2030*	80%↑	45%↑

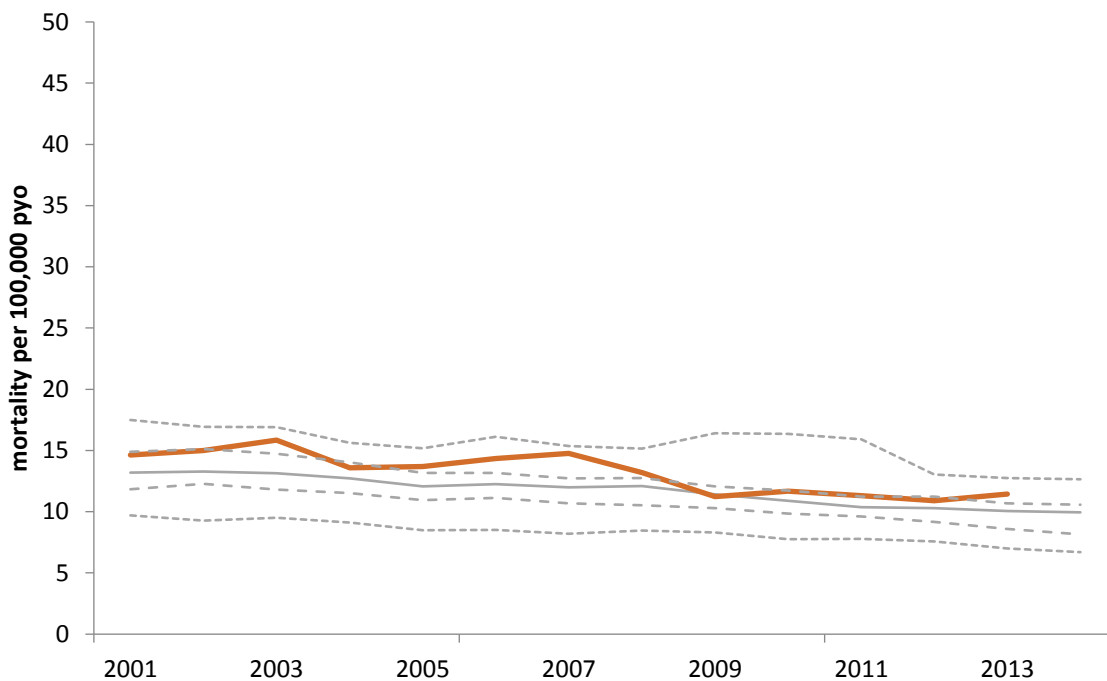
* Projected trends

UK mortality rates greater than EU median are indicated in red with an ↑,

UK rates equal to or less than EU median are indicated in black with an ↓ or →.

Figure 4. NCD mortality amongst 1-4 year olds and 15-19 year old males in the UK and EU15+ from 2001 to 2014

Panel A. 1-4 years



Panel B. 15-19 year old males

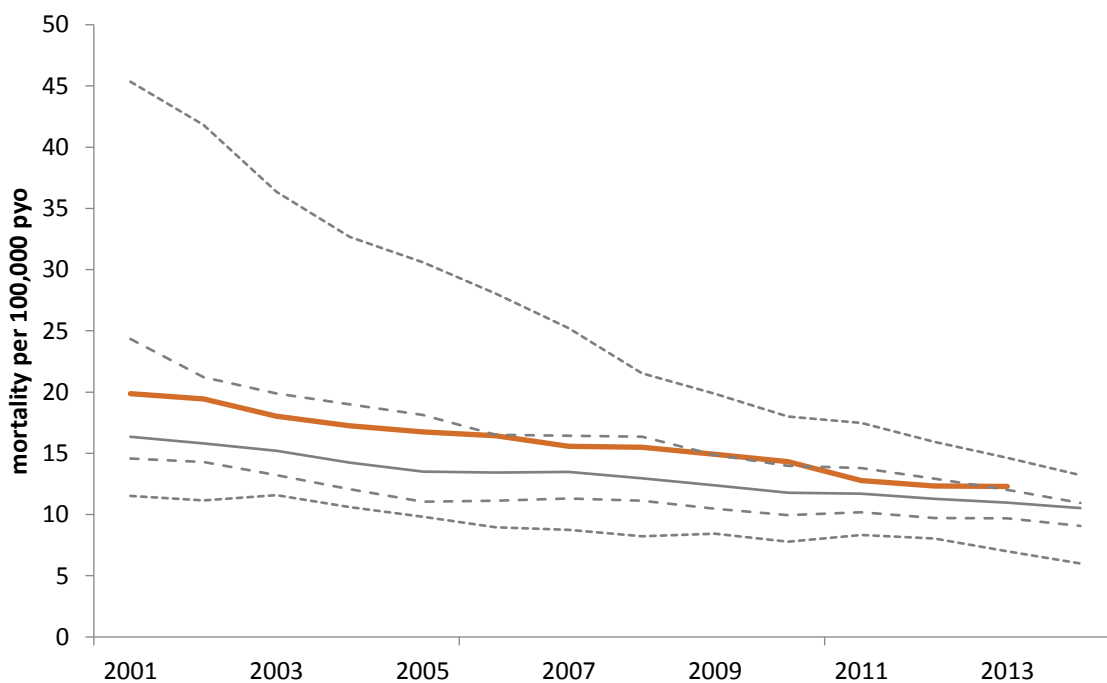


Figure 5. Proposed UK Child Survival Goals and Indicators, based upon Global Sustainable Development Goals (SDGs)

UK Child Survival Goals & Indicators

SDG Goals	Goals	Indicators
A. Mortality Goals		
SDG3.2 By 2030 to end preventable deaths of newborns and children under 5 years of age	<p>1. By 2030, UK infant, child, and adolescent mortality rates to be among the best in EU15+ (in the best decile)</p> <p>2. By 2030 to have no more preventable deaths among infants, children, and adolescents.</p>	<p>UK and EU all-cause mortality rates for infant, neonatal, post-neonatal, 1-4 years, 5-9 years, 10-14 years, 15-19 years.</p> <p>Deaths due to potentially modifiable factors</p>
SDG 3.4 By 2030 to reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and wellbeing	<p>3. By 2030, child and adolescent NCD mortality to be among the best in the EU15+ (in the best decile)</p> <p>4. By 2030, adolescent suicide mortality to be among the best in the EU15+ (in the best decile)</p>	<p>UK and EU non-communicable disease mortality rates for 1-4 years, 5-9 years, 10-14 years, 15-19 years.</p> <p>UK and EU suicide mortality rates for 10-14, and 15-19 years.</p>
SDG3.6 By 2020, halve the number of global deaths and injuries from road traffic accidents	<p>5. By 2030, infant, child, adolescent mortality from external causes to be among the best in the EU15+ (in the best decile)</p>	<p>UK and EU injury mortality rates for 1-4 years, 5-9 years, 10-14 years, 15-19 years.</p>
B. Intermediate goals		
SDG1. End poverty in all its forms, everywhere	<p>1. By 2030, reduce by at least half the proportion of children living in poverty.</p>	<p>% children in poverty as measured by households with incomes less than 60% median after taxes and benefits, and adjusting for family size and composition</p>
SDG2. End hunger, food insecurity, improve nutrition, and promote sustainable agriculture	<p>2. Reduce malnutrition in the form of overweight and obesity</p>	<p>Child overweight and obesity rates at school entry, and at 11 years old</p>
SDG3. Ensure healthy lives and promote wellbeing for all at all ages	<p>3. Promote mental health and wellbeing</p> <p>4. Promote breast feeding and reduce inequalities in breastfeeding rates</p> <p>5. Reduce preterm deliveries</p>	<p>Prevalence of mental health disorder</p> <p>% mothers breastfeeding at 6 weeks</p> <p>% neonates delivered preterm</p>
3.5 Strengthen the prevention and treatment of substance abuse	<p>6. Strengthen the prevention and treatment of substance abuse, including tobacco, and the harmful use of alcohol</p>	<p>Smoking, alcohol and drug use amongst adolescents</p>
3.7 Ensure universal access to sexual and reproductive healthcare services	<p>7. Ensure universal access to sexual and reproductive healthcare services</p>	<p>Teenage birth rate: births per 1000 females age 15-19 years</p>

SDG4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	8. Ensure that all children have access to quality early childhood development, care, and pre-primary education so that they are ready for primary education.	Childcare attendance from 3 years to minimum compulsory school age attending centre-based services for at least one hour a week
SDG5. Achieve gender equality and empower all women and girls	9. Eliminate sexual violence	Gender pay gap measured as the difference between men's and women's average hourly earnings as a percentage of men's average hourly earnings.
SDG8. Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all	10. Increase the percentage of young people in education, employment, or training	% 15-19 year olds not in education, employment and training (NEET)
	11. Decrease the percentage of children living in workless households	% children in workless households
SDG10. Reduce inequality	12. Reduce the percentage of children living in deprived households	% children in households with low income and material deprivation
	13. Improve social protection for children through tax and social benefit policy	% children in households with severe low income and material deprivation
	14. Reduce economic inequality	Gini coefficient and 80/20 ratios due to benefits, direct and indirect taxes and services; Palma ratio for 0-17 years (ratio of top 10%/bottom 40%)
SDG11. Make cities and human settlements inclusive, safe, resilient, and sustainable	15. Reduce air pollution including average annual PM2.5 concentrations in urban areas	Average annual PM2.5 concentrations per cubic metre in urban areas, weighted by proportion of child population (0-19 years) living in urban areas
	16. Ensure young people are environmentally aware in order to promote sustainable consumption	Percentage of 15 year old students who are familiar with, or know something about, five or more environmental issues
SDG16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels	17. Reduce everyday violence and bullying against children	% children who had experienced bullying at least twice in the past month
	18. Stop adult violence against children	% children who have experienced severe maltreatment

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