Office for National Statistics

# Update to the Methodology used to Calculate Health Expectancies

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Theme: **Health and Social Care**

## Abstract

### Background

The Office for National Statistics (ONS) will adopt the Integrated Household Survey (IHS), encompassing the Annual Population Survey, as the primary survey data source for the calculation of health expectancies for the UK and constituent countries from 2013. This article reports the likely impact of this change along with an assessment of different models of imputation to counter the loss of general health and limiting persistent illness data for children from the underlying survey source.

### Methods

In the first instance, general health rates reported in the IHS were compared with those reported in the General Lifestyle Survey (GLF) and Continuous Household Survey (CHS)/Health Survey for Northern Ireland (HSNI) over the same period. Assessment was then made of the likely impact of change to the age-band structure of health expectancy (HE) calculations, reflecting the lack of data for children in the IHS. Finally, three methods of imputation of child health data were compared to age-band revised estimates of HE in order to assess which approach gave the greatest continuity with the ONS HE series.

### Results

The prevalence of general health reported in the IHS was on the whole similar to that reported in other survey sources. Estimates of ‘Very good’ and ‘Good’ general health were slightly lower in the IHS compared to the GLF and CHS/HSNI for the UK, GB and England, but slightly higher for males in Scotland and all persons in Northern Ireland. The effect of changing the age categorisation in the calculation of healthy life expectancy was negligible; but led to small increases in disability-free life expectancy. Using the prevalence of health states at age 16-19 as a direct proxy for health states in younger age-bands gave results that were most consistent with ONS’ historic time series of health expectancies.

### Conclusions

Adoption of the IHS will lead to a relatively minor discontinuity in ONS health expectancy series. The impact of small differences in health state reporting of adults in the IHS compared to the GLF/ CHS/ HSNI is likely to be negligible. Changing the underlying age categorisation to improve the accuracy of ONS estimates of health expectancies and imputing the health status of children will have a larger effect but is likely to result in a discontinuity of less than one year at birth.

## Introduction

The Office for National Statistics (ONS) will adopt the Integrated Household Survey (IHS) as the primary survey data source for the calculation of national health expectancies in 2013. The IHS is a composite survey combining questions asked on a number of ONS social surveys to produce a 'core' dataset of variables for high precision analysis at different geographic scales.

In order to inform users of the likely impact of this change, we compare the 2010 prevalence of self-reported general health in the IHS with data from surveys used currently by ONS to calculate health expectancies; ONS' General Lifestyle Survey (GLF), the Continuous Household Survey (CHS) of Northern Ireland (NI) and the Health Survey for Northern Ireland (HSNI).

In addition, as the IHS does not collect data for children (younger than 16) we also consider methods to estimate the general health and limiting persistent illness prevalence of this important population sub-group in order to continue reporting estimates of health expectancies at birth.

## Background

Health expectancies add a quality of life dimension to estimates of life expectancy by dividing predicted lifespan into time spent in given states of health. ONS routinely publishes two types of health expectancies; Healthy life expectancy (HLE), which estimates lifetime spent in 'Very good' or 'Good' health based upon self-perceived general health and Disability-free life expectancy (DFLE), which estimates lifetime free from a limiting persistent illness or disability based upon a self-rated functional assessment of health.

Although designed to reflect different facets of health, estimates of HLE and DFLE have been similar at the national scale since 2005-07, when the survey question designed to capture rates of general health changed to improve comparability across EU-member states.

Health expectancies are used by government and the private sector to inform policy, planning and research in areas such as health improvement monitoring, healthcare planning, population change and pensions.

### What are Health Expectancies?

As life expectancy continues to increase in the UK, it is important to ask what proportion of these additional years of life are being spent in favourable states of health or in poor health and dependency. Health expectancies help us to address this question by adding a dimension of quality of life to estimates of life expectancy. They are estimates of the average number of years a person would live in a given health state if he/she experienced the specified population's particular age-specific mortality and health status for that time period throughout the rest of his/her life.

The figures represent a snapshot of the mortality and health status of the entire specified area population in each time period. They are not, therefore, the number of years that a person will actually expect to live in the area in a given health state. This is because both mortality and health rates are susceptible to change and because of migration into and out of the area.

ONS routinely publishes two types of health expectancy estimates; HLE defined, from 2005-07, as the number of years an individual can expect to spend in 'Very good' or 'Good' general health, and DFLE, defined as the number of years an individual can expect to spend free from a limiting persistent illness or disability.

Quality information about ONS health expectancies is available on the ONS website. (165.5 Kb Pdf)

## Methods

ONS health expectancies have undergone several methodological developments since inception. Most recently, ONS estimates of HLE were adapted in response to the European Union (EU) harmonisation of the survey question relating to general health (Smith and White, 2009 (275.3 Kb Pdf), Smith, Olatunde and White, 2010 (610.7 Kb Pdf)).

In 2013, ONS will adopt the IHS as the primary survey source for the calculation of health expectancies at national scales. This is because the IHS offers a substantially larger dataset for analysis and therefore promises greater accuracy and precision in estimating health expectancies compared to historic survey sources and because the GLF, the principal survey source for health expectancies in Great Britain between 1980 and 2010, ceased collecting data in December 2011.

In this article we compare the reporting of self-perceived general health in the IHS with other survey sources to inform users of the likely impact of the adoption of this survey. As the IHS does not collect data for children (younger than 16 years), we also compare methods to impute the general health and limiting persistent illness status of children in order to continue reporting estimates of health expectancies at birth.

### Comparison of survey data sources

In the first instance, the prevalence of self-reported general health amongst men and women in the UK and constituent countries reported in the IHS 2010 was compared with data from the GLF and HSNI in 2010 and with data from the GLF, CHS and HSNI for the period 2008-10. Comparisons of limiting persistent illness could not be made as the IHS did not capture this information in 2010. Data derived from the IHS are not directly comparable with data derived from the GLF and HSNI due to differences in survey design and weighting. Nevertheless, the GLF/CHS/HSNI estimates provide important benchmarks with which to cross-validate estimates of general health.

### Survey data

### Integrated Household Survey

The IHS is a composite survey combining questions asked on a number of ONS social surveys to produce a dataset of 'core' variables. In 2010–11, the period under analysis in this article, the

IHS captured information relating to general health from over 341,000 adults (aged 16 and over). Questions relating to limiting persistent illness and/or disability were not included in the 2010-11 'core' survey variables but will be included from 2011-12. For this analysis the IHS included data from the GLF, the Life Opportunities Survey (LOS), the English Housing Survey (EHS), the Living Costs and Food Survey (LCF) and the Annual Population Survey (APS). From 2012, the IHS will include only the LCF and APS, however as the APS accounts for more than 90 % of the total IHS sample in 2010 the loss of the other survey sources beyond this period is unlikely to affect the conclusions of this investigation.

Detailed information relating to the content, design and weighting of the IHS is available on the ONS website. Briefly, the IHS contains around 100 questions, although respondents will not be asked each of these since a proportion are dependant on routeing from answers. Questions cover a number of themes including economic activity, education, health and disability, identity and income. The sampling design of the IHS reflects that of each constituent survey and therefore consists of a range of clustered multi-stage stratified sampling and un-clustered one-stage sampling. IHS data at person level is weighted to enable the production of population estimates and to compensate for differential non-response among different sub groups in the population. The weight for each respondent is a product of the initial address-level design weight, adjustments for multi-household addresses, non-response and attrition (where applicable), a scale factor for pooling surveys and a calibration adjustment.

**General Lifestyle Survey (GLF)**

The GLF is an annual longitudinal survey of private households in England, Wales and Scotland. Around one-third of survey respondents in a given year are new entrants to the survey and the data from these people are used in the calculation of national health expectancies. In 2010, the GLF captured information relating to general health from around 5,300 adults. Three years of GLF survey data are used in the calculation of national estimates of health expectancies and in 2008-10; the most recently reported period, data relating to general health was collected from approximately 16,000 adults. The GLF ceased collecting data in December 2011. Further information regarding the GLF can be found on the ONS website.

**Continuous Household Survey (CHS)**

The CHS is an annual cross-sectional survey of private households in Northern Ireland. Data from the CHS from 2000 to 2009 was used in ONS' calculations of national health expectancies. Further information about the CHS can be found on the Northern Ireland Statistics and Research Agency website.

**Health Survey for Northern Ireland (HSNI)**

Following the recommendation of the Department of Health, Social Services and Public Safety Northern Ireland, (DHSSPSNI) ONS began to use data from the HSNI as the survey source for this country for 2010 onwards. In 2010, the HSNI captured information relating to general health from almost 4,200 adults. Further information about the HSNI can be found on the DHSSPSNI website.

Survey responses in both the CHS and HSNI are weighted by ONS to match the mid-year population estimates of the period in question.

ONS health expectancies for 2008-10 captured data from a combined total of around 11,100 adults in Northern Ireland using the CHS for 2008 and 2009 and the HSNI for 2010.

Survey data were age-standardised for population level comparisons.

**General Health and limiting persistent illness**

**General health: Census and household surveys 2000 to 2007**

Population rates of ‘Good’ general health for the UK and constituent countries for the calculation of HLE between 2000-02 and 2005-07 were captured from the following question;

"Over the last 12 months would you say your health has on the whole been"

Good?

Fairly good?

Not good?

Respondents who answered ‘Good’ and ‘Fairly good’ were combined to give a single population rate of ‘Good’ health for estimates of HLE for the UK and constituent countries between 2000-02 and 2005-07.

**General health: Household Surveys 2005 - ongoing**

In 2005, a new general health question was included in household surveys to meet the requirements of the EU Survey on Income and Living Conditions (EU-SILC).

“How is your health in general; would you say it was…

Very good,

Good,

Fair,

Bad,

or, Very bad?”

This new question ran concurrently with the original on household surveys between 2005 and 2007. For HLE, respondents who answered ‘Very good’ or ‘Good’ were combined to give a single population rate of ‘Good’ health for estimates from 2005-07.

Further information about this change is available (Smith and White, 2009 (275.3 Kb Pdf)).

**Limiting persistent illness: Household Surveys**

The question used to capture limiting persistent illness was consistent across the GLF, CHS and HSNI during 2000 to 2011 and is also asked in the IHS from 2012.

“Do you have any long-standing illness, disability or infirmity – by long-standing I mean anything that has troubled you over a period of time or that is likely to affect you over a period of time?”

Yes/No

If ‘Yes’ the respondent is then asked

“Does this illness or disability (Do any of these illnesses or disabilities) limit your activities in any way?”

Yes/No

Respondents answering ‘Yes’ to both of these questions were considered to have a limiting persistent illness or disability for the calculation of DFLE.

**Census 2001: Limiting persistent illness**

The Census 2001 rates of limiting persistent illness or disability were captured by the following single question.

“Do you have any long-term illness, health problem or disability which limits your daily activities or the work you can do? Include problems which are due to old age”

Yes/No

The subjective nature of these questions means that responses are influenced by the way individuals perceive their health. Self-reports of general health and limiting illness are influenced by an individual's expectations with clear differences observed across socio-demographic factors such as age, sex, socio-economic position and area deprivation. However, despite these differences in expectations, each measure correlates well with health service use and are strong predictors of life expectancy (Weinberger et al., 1986; Idler and Benyamini, 1997; Lee, 2000; DeSalvo et al, 2006; Pietilainen et al., 2011; WHO, 2011; Bopp et al, 2012; Ng et al, 2012).

**Estimating general health and limiting long-standing illness rates for children**

As the IHS does not collect data for children (younger than 16 years), ONS estimates of health expectancies must impute the prevalence of general health and limiting persistent illness for this population in order to calculate health expectancies at birth. There is a precedent; ONS has previously imputed the health status prevalence of children using that reported for young adults at age 16-19. This method was used to calculate ONS health expectancies at birth for the period 1980-82 to 1999-2001 (72.2 Kb Pdf). In addition, Eurostat, the statistical office of the European Union (EU) currently imputes health at ages under fifteen using the assumption that the health prevalence of children (aged 0 to 14) is half of that of young adults (aged 16 to 19, applied to a 15 to 19 age-band for reporting purposes).

Imputation of the health status of children provides an opportunity to improve the accuracy of estimates of health expectancies by accounting for the fact that mortality is somewhat higher in infants (less than one year of age) than in young children (ONS 2012).

Previously ONS estimates of health expectancies grouped young children into a single five-year age-band of birth to four years of age. This improved the robustness of estimates by increasing the available survey sample in each group. In the absence of child survey data, the robustness of estimates is derived from the method of imputation, rather than the size of the available sample and separating out those less than one year of age from other children for imputation purposes allows subsequent health expectancy estimates to take account of the different morbidity and mortality rates of infants.

For this reason health expectancies will be calculated using ONS published interim life tables, using the folowing age-band structure.

**Changing age-band widths**

**Health expectancies 2000-02 to 2008-10**

ONS estimates of health expectancies between 2000-02 and 2008-10 were based on a five year age-band widths. For children and young adults there were:

- 0 to 4 years
- 5 to 9 years
- 10 to 14 years
- 15 to 19 years

The IHS does not capture data for children (younger than 16 years). In the absence of a suitable alternative source of data, continuing to calculate health expectancies from birth requires that the health status of children is imputed. The change in band widths give an opportunity to improve the mortality component of health expectancy calculations by taking into account the disparity in mortality rates between children aged more or less than one year (ONS 2012).

**Health expectancies 2009-11 and on**

From 2009-11 ONS will use the following age-band structure for calculating the health expectancies of children and young adults.

- Less than 1 year
- 1 to 5 years
- 6-10 years
- 11 to 15 years
- 16-19 years

This structure does not match exactly the age structure used in the reporting of ONS sub-national life expectancies. This is because additional imputation of health prevalence would be required to create a 15 to 19 years age-band.

The impact of changing the age-band structure on ONS estimates of health expectancies was assessed through comparison with published estimates.

Three different models to impute the prevalence of general health and limiting persistent illness for children (younger than 16) were compared against survey estimates for males and females in the UK and constituent countries.

**Models of imputation**

**Direct proxy**

This approach uses survey data estimates of health state prevalence at age 16-19 as a direct proxy for children. It was used previously by ONS in calculating health expectancies at birth between 1980-82 and 1999-2001. (72.2 Kb Pdf)

**Strengths:** Simple to calculate and has a precedent in ONS estimates of health expectancies prior to 2000-02.

**Weaknesses:** Does not take into account differences in health state prevalence between young adults and children.

**Half prevalence**

This approach halves survey data estimates of health prevalence at age 16-19 and applies the corresponding value to each childhood age-band. This approach is currently used by Eurostat to calculate health expectancies at birth.

**Strengths:** Relatively simple to calculate and provides greater comparability with health expectancies across EU member states.

**Weaknesses:** Assumes a fixed relationship in health between children and young adults.

### Census adjustment

This approach calculates the proportional difference between health states at age 16-19 and childhood age-bands reported for the private household population at census. This difference is then used as an adjustment factor to calculate the health state prevalence of children in subsequent periods.

**Strengths:** Takes account of differences in health state prevalence of young adults and children at census.

**Weaknesses:** Assumes constant relationship in health between young adults and children in intercensal years.

### Standard error calculation

As each model of imputation is derived from the proportion of general health/limiting persistent illness at age 16 to 19, the standard errors for childhood estimates will be calculated from the baseline survey sample for this age-group.

Success will be judged against how closely each model matches published estimates, revised according to change in age band structure.

Due to the substantive difference in general health questions in Census 2001 and survey sources from 2005-07, comparisons of models of imputation in terms of general health and HLE were restricted to the period 2000-02 and 2005-07. For limiting persistent illness and DFLE, comparisons were made for each period between 2000-02 and 2008-10.

## Results

### Comparison of survey sources

**Table 1: Sample size (n) and age standardised prevalence of 'Very good'/'Good' health for men and women aged 16 and above by survey source, period and UK country**

United Kingdom

Numbers, percent

| Country | Sex | IHS[1], 2010 | | GLF[2] / HSNI[3], 2010 | | GLF[2] /CHS[4] / HNSI[3], 2008-10 | |
|---|---|---|---|---|---|---|---|
| | | n | Very Good / Good Health | n | Very Good / Good Health | n | Very Good / Good Health |
| UK | Males | 163,654 | *80.9* | 4,223 | *81.6* [5] | 12,212 | *81.3* [5] |
| | Females | 177,929 | *80.2* | 5,259 | *80.9* [5] | 14,940 | *80.7* [5] |
| GB | Males | 160,244 | *81.0* | 2,485 | *82.6* [5] | 7,577 | *81.8* [5] |
| | Females | 175,131 | *80.3* | 2,814 | *81.7* [5] | 8,442 | *81.2* [5] |
| England | Males | 125,527 | *81.2* | 2,117 | *83.1* [5] | 6,465 | *82.4* [5] |
| | Females | 135,827 | *80.6* | 2,424 | *81.9* [5] | 7,216 | *81.4* [5] |
| Wales | Males | 15,370 | *78.9* | 123 | *80.3* | 395 | *80.9* [5] |
| | Females | 16,755 | *77.5* | 123 | *75.8* | 438 | *77.5* |
| Scotland | Males | 20,267 | *79.8* | 245 | *80.7* | 717 | *77.3* [6] |
| | Females | 22,549 | *79.0* | 267 | *82.5* [5] | 788 | *79.8* [5] |
| Northern Ireland | Males | 2,490 | *79.0* | 1,738 | *73.1* [6] | 4,635 | *75.5* [6] |
| | Females | 2,798 | *77.6* | 2,445 | *74.3* [6] | 6,498 | *75.4* [6] |

**Table source:** Office for National Statistics

**Table notes:**

1. Intergrated Household Survey
2. General Lifestyle Survey
3. Health Survey for Northern Ireland
4. Continuous Household Survey, Northern Ireland
5. Significantly higher than IHS
6. Significantly lower than IHS

## Download table

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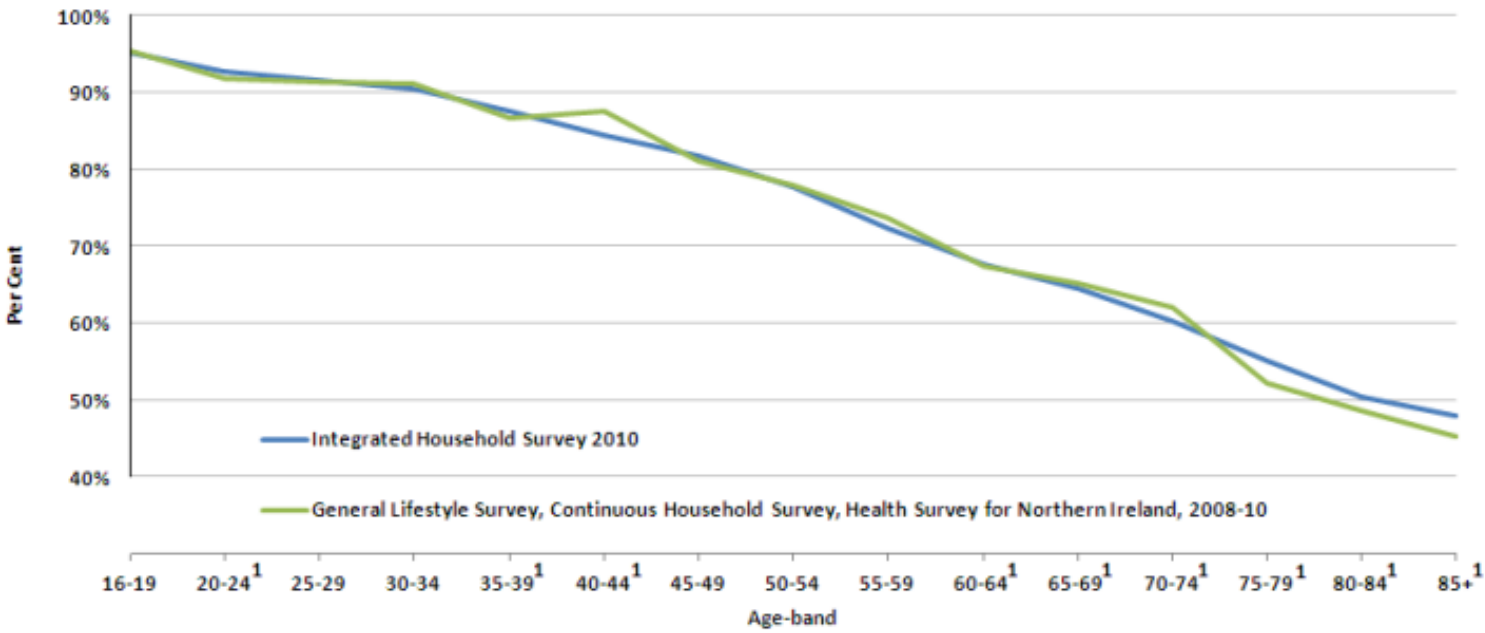
The age-standardised population prevalence of ‘Very good’ and ‘Good’ health for males and females in the UK, GB and England was lower in the IHS in 2010 than in other survey sources in 2010 and 2008-2010, see table 1. Conversely, health was better in the IHS than other survey sources for males in Scotland in 2008-10 and males and females in Northern Ireland in 2008 and 2008-10.
By country, sex and age-band the prevalence of ‘Very good’ and ‘Good’ health was similar across survey sources. Figures 1 and 2, illustrate the close relationship in the prevalence of ‘Very good’ and ‘Good’ health for UK males and females. There were some minor fluctuations revealing small but significant differences between these survey sources. Notably the prevalence of ‘Very good’ and ‘Good’ health in the IHS was lower for men and higher for women at age 40-44 and was higher for men at ages 75 and above compared to the GLF, CHS and HSNI. Similar patterns were evident across all UK countries.

**Figure 1: Prevalence of ‘Very good’ and ‘Good’ health for UK Males by survey source, 2010 and 2008-10**




Source: Integrated Household Survey, General Lifestyle Survey - Office for National Statistics

**Notes:**

1. Significant difference between survey sources

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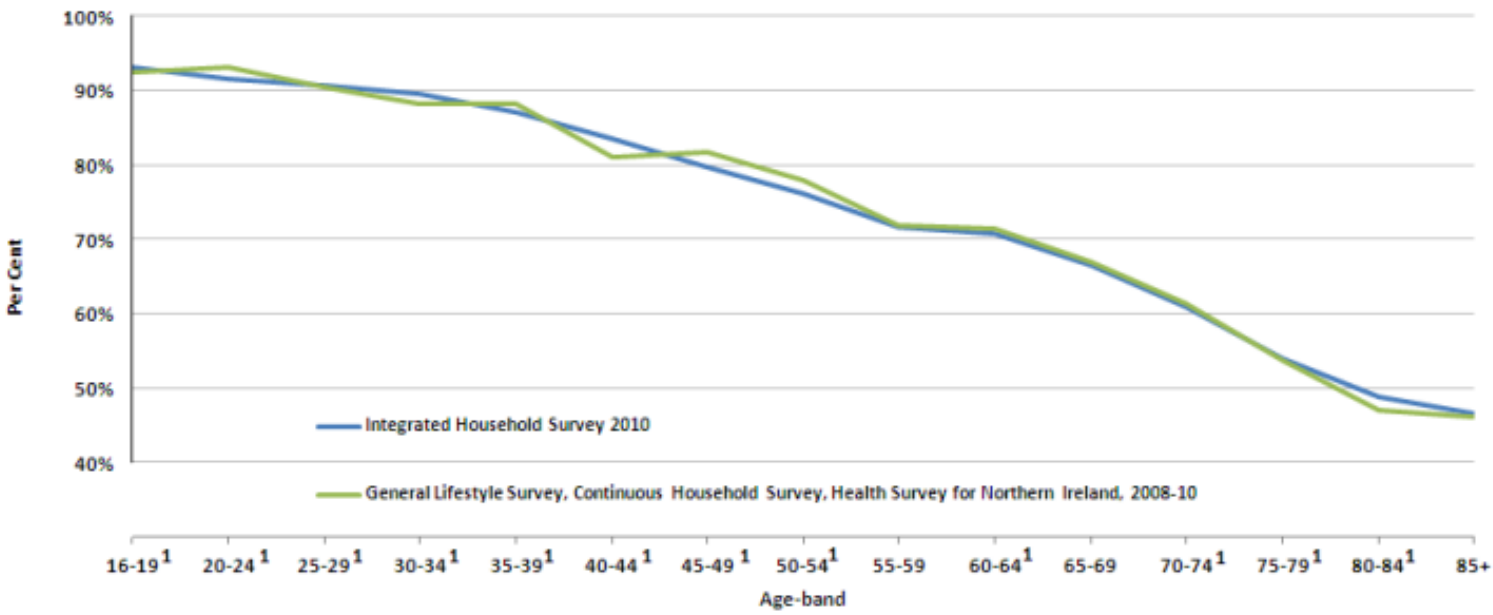
**Figure 2: Prevalence of 'Very good' and 'Good' health for UK Females by survey source, 2010 and 2008-10**




Source: Integrated Household Survey, General Lifestyle Survey - Office for National Statistics

**Notes:**

1. Significant difference between survey sources

### Download chart

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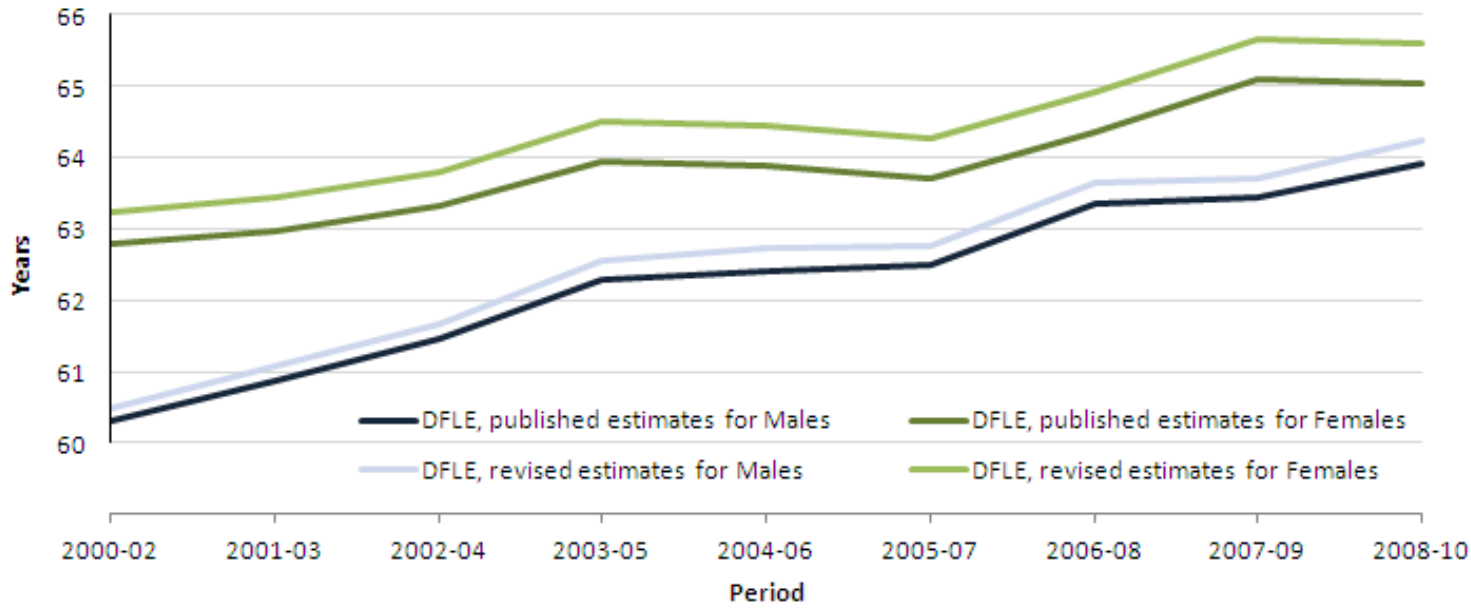
### Impact of change in age-band width

There were no significant differences in HLE between published estimates and those derived from the revised age-band widths in both the 3 point measure, used between 2000-02 and 2005-07, and the 5 point measure, used between 2005-07 and 2008-10. On average, the change produced a difference of between -0.05 and 0.13 of a year for males and females at birth and at age 65 across the UK and constituent countries, data not shown.

For DFLE, differences between estimates were more pronounced. On average, the revised age-band structure led to increases of between 0.02 and 0.72 years at birth and 0.08 and 0.68 years at age 65 for males and females across the UK and constituent countries compared to published estimates using the original age-band structure. For UK females, there were significant differences between the published and revised age-bands for the periods 2000-02 to 2005-07. Figures 3 and 4 show this data for the UK.

**Figure 3: Comparison of DFLE based on original and age-band revised estimates for males and females at birth, 2000-02 to 2008-10; UK**




Source: Office for National Statistics

**Download chart**

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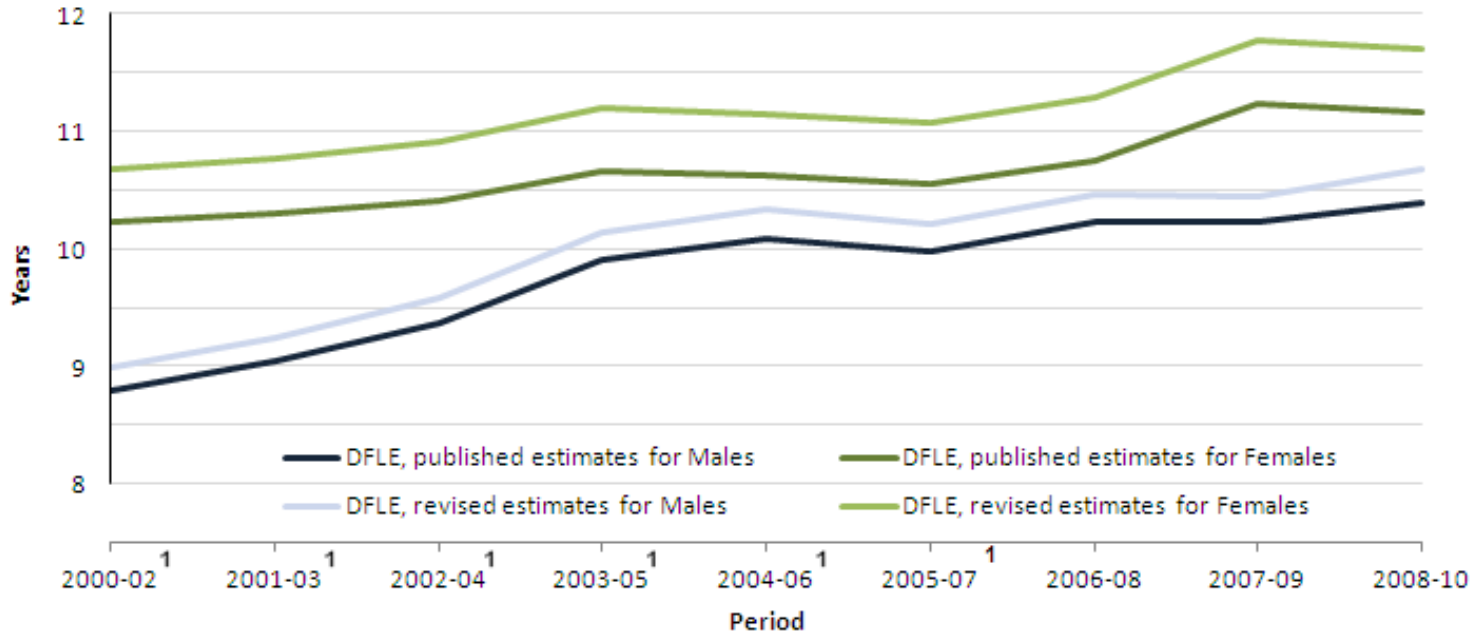
**Figure 4: Comparison of DFLE based on original and age-band revised estimates for males and females at age 65, 2000-02 to 2008-10; UK**



Source: Office for National Statistics

**Notes:**

1. Significant difference between estimates for females

### Download chart

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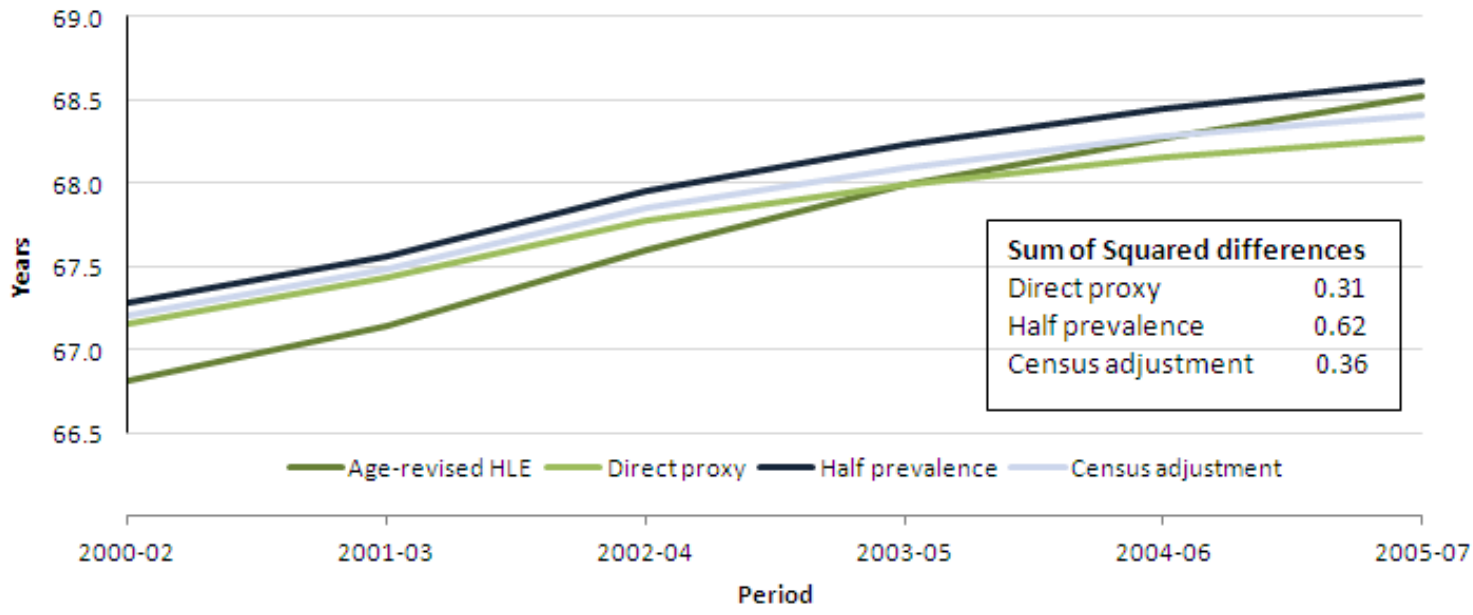
### Comparison of models of imputation

The 'Direct proxy' model of imputation produced estimates of HLE and DFLE that were closer to the age-revised estimates for males and females at birth across the UK and constituent countries on more occasions across the analysed time period than either the 'Half prevalence' or 'Census adjustment' models (see figures 5 to 8). With few exceptions, these differences were not significant. Analysis of the sum of the squared differences for each model by sex revealed that the 'Direct proxy' model was also most closely matched for males. For females the results were mixed, in terms of HLE, the 'Half prevalence' model was the least different over time according to the sum of squared differences, however for DFLE, the 'Census adjustment' model was the most closely matched to age-revised estimates. There were no differences at age 65 since health expectancies are not affected by the health state prevalence of younger age-bands.

**Figure 5: Comparison of the effect of models of imputation on age-revised estimates of HLE[1] for males at birth, 2000-02 to 2005-07; UK**




Source: Office for National Statistics

**Notes:**

1. HLE based upon 3-point general health question

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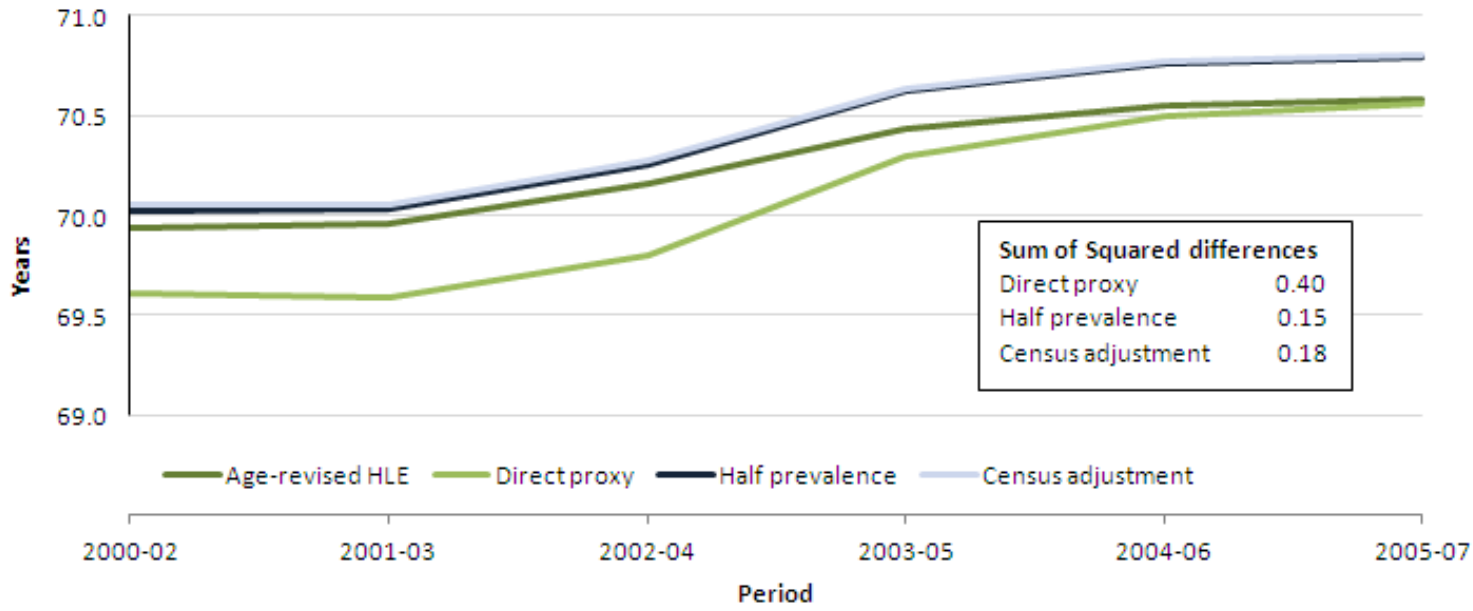
### Figure 6: Comparison of the effect of models of imputation on age-revised estimates of HLE[1] for females at birth, 2000-02 to 2005-07; UK




Source: Office for National Statistics

**Notes:**

1. HLE based upon 3-point general health question

### Download chart

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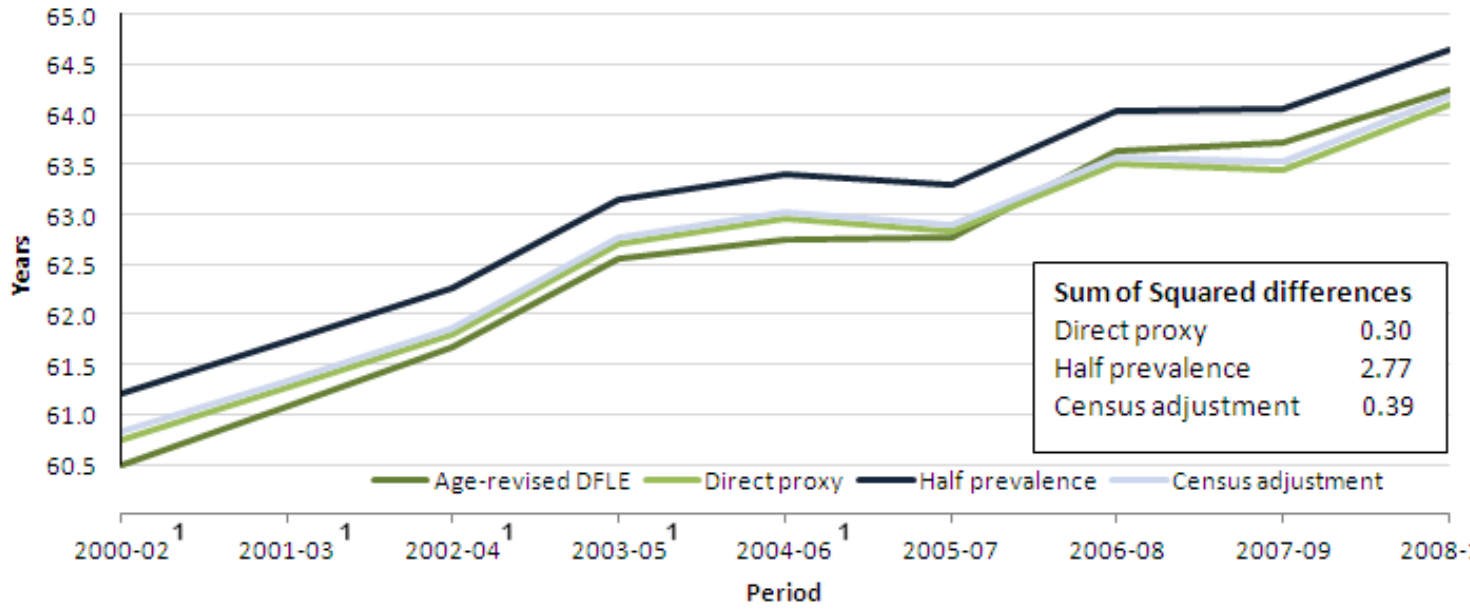
**Figure 7: Comparison of the effect of models of imputation on age-revised estimates of DFLE for males at birth, 2000-02 to 2008-10; UK**




Source: Office for National Statistics

**Notes:**

1. Significant difference between Age-adjusted estimates and 'Half prevalence' model of imputation

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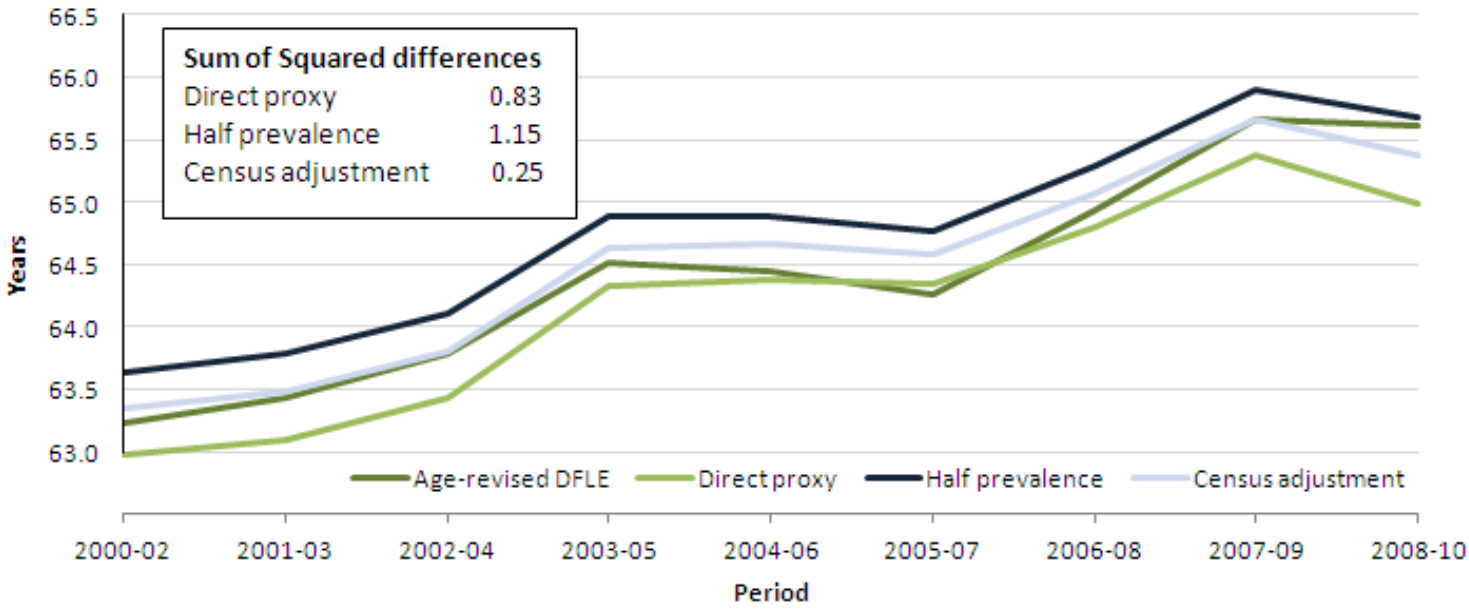
**Figure 8: Comparison of the effect of models of imputation on age-revised estimates of DFLE for females at birth, 2000-02 to 2008-10; UK**




Source: Office for National Statistics

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In general, the half prevalence and census adjustment models of imputation produced higher estimates of HLE and DFLE compared to age-band revised estimates for males and females across the UK and constituent countries; adding on average between 0.1 and 0.6 years and less than 0.1 to 0.3 years respectively. The direct model of imputation produced estimates of HLE and DFLE that were, on the whole, slightly higher for males and slightly lower for females differing by less than 0.1 years to around 0.4 years compared to age-adjusted estimates. Figures for males and females in the UK are shown in figures 5 to 8.

## Discussion

The IHS sample offers scope for more detailed analyses of health expectancies by administrative geography and socio-demographic characteristics and increased accuracy compared to the surveys used by ONS between 1980-82 and 2008-10. This is because the IHS sample for 2010 for the UK and constituent countries (with the exception of NI) was at least ten-fold greater than the combined sample from the GLF/CHS/HSNI for the period 2008-10.

Comparisons of self-reported general health for males and females between survey sources suggest that estimates of HLE will, on the whole, fall slightly across the UK, GB and England upon adoption of the IHS as the primary survey source for ONS health expectancies in 2013. Estimates of HLE for males in Scotland and for males and females in NI are, conversely, likely to increase

slightly as indicated by the comparatively higher prevalence of 'Very good' and 'Good' health for these population groups in the IHS. As the IHS 2010 did not include a question to capture limiting persistent illness we are currently unable to assess the effect on DFLE of the adoption of this survey source. However, given the close relationship between HLE and DFLE since 2005-07, ONS expects the effect to be similar, ie a slight fall in DFLE across the UK, GB and England and a slight increase for males in Scotland and males and females in NI. Analysis of IHS data from 2011 will help to clarify this uncertainty.

The impact upon estimates of health expectancies in changing to the IHS is likely to be modest. For example, a change of one percentage point in health prevalence at birth will result in a change of around 0.01 of a year to the health expectancy at birth. However the degree of change remains unclear, due in part to the compounding effect of health expectancy calculations which mean, for example, that a single percentage point increase in health prevalence across all ages will result in an increase of around 0.8 of a year to health expectancy at birth (author's unpublished observations).

Adoption of the IHS for ONS health expectancies presents the opportunity to improve estimates of health expectancies by taking into account the higher mortality of children less than one year of age (ONS 2012).

Previously ONS estimates of health expectancies grouped the youngest children into a single five-year age band. While the Sullivan method (Jagger 1999) of health expectancy calculation adjusts for this effect somewhat, the data is inevitably skewed by the increased rate of death among the very young. Isolating this group into a single age-band (less than one year of age) allows us to more fully take into account the different mortality experience of this population. The change in age-band structure resulted in negligible change in HLE, with estimates remaining almost the same or increasing by up to 0.1 of a year. For DFLE the change was more apparent with some estimates increasing significantly by up to 0.7 years for females at birth. This difference may be because limiting persistent illness is subjectively more difficult to identify in children less than one year of age compared to older children where the effects of illnesses such as impaired mobility or learning difficulties are more easily diagnosed.

Three models of imputation were assessed against historic data to assess which gave the greatest consistency with the ONS health expectancy series.

Overall, the direct proxy model of imputation produced estimates of health expectancies that most closely matched ONS health expectancy series. This model has a precedent in that it was the approach previously used by ONS for estimates for GB and England for the period 1980-82 to 2000-02 (42.5 Kb Excel sheet). It was particularly accurate for males, but tended to underestimate health expectancies for females at birth. This effect is consistent with the findings of Breakwell C and Bajekal M (2005) (126.5 Kb Pdf) and suggests that the direct proxy model of imputation serves to amplify the poorer self-reported health of females compared to males (ONS, 2012).

The greatest differences in modelled health expectancies compared to the historic series resulted from the half prevalence model of imputation. This approach, currently used by Eurostat, produced estimates of health expectancies that were consistently higher and, for DFLE, significantly different from ONS estimates for males in the UK and GB for the periods 2000-02 to 2004-06.

Interestingly, despite being conceptually more robust, since it is based on the health state prevalence of all individuals in the UK at a given point in time, the census adjustment model of imputation, was not as closely matched with the historic series as the direct proxy model. However, for DFLE at least, subtle differences in the underlying questions used to capture the prevalence of limiting persistent illness between census and other survey sources makes this finding difficult to interpret. For this reason the merits of the census adjustment model will be revisited using more consistent Census 2011 data during 2013 before determining the future methodology for health expectancy derivation at birth for the analysis period 2009-11.

## Background notes

1. Details of the policy governing the release of new data are available by visiting www.statisticsauthority.gov.uk/assessment/code-of-practice/index.html or from the Media Relations Office email: media.relations@ons.gsi.gov.uk

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