



Public Health
England

Protecting and improving the nation's health

Onset of limiting illness and recovery from limiting illness; characteristics of illness dynamics from the Annual Population Survey: Jan. to Dec. 2017

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Our underlying analytical approach

- The total burden of disease in the English population 18-69 may be simplified as the sum total of individual episodes of illness in that population, captured in the APS and grossed up to the national scale; such that each episode has an incidence, a duration, a risk of recurrence, and a degree of burden.
- Further simplified as; **Prevalence = incidence * duration * recurrence**
- We are seeking to characterise and quantify the tasks to be faced in two discrete agendas for public health; prevention (Getting ill less), and recovery (Getting ill better).
 - Reducing **incidence** comprises the 'prevention' agenda
 - Reducing **duration** and **recurrence** together comprise the 'recovery' agenda

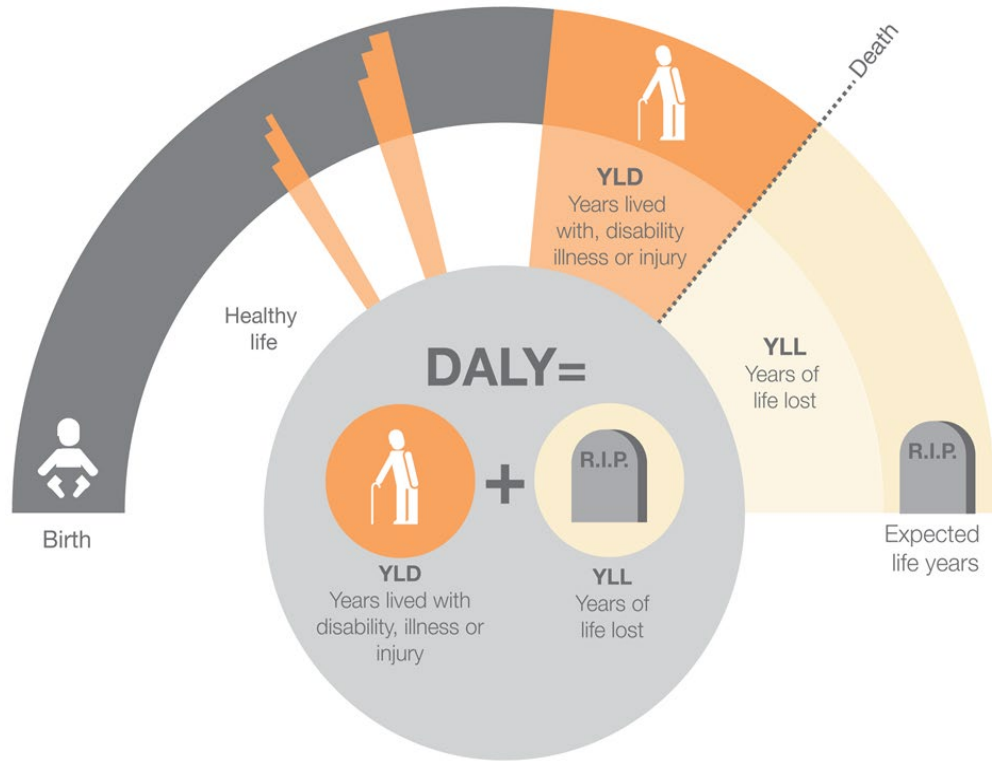
Previous work on this subject

M Bartley, A Sacker, P Clarke. “Employment status, employment conditions, and limiting illness: prospective evidence from the British household panel survey 1991–2001”; 2004, JECH

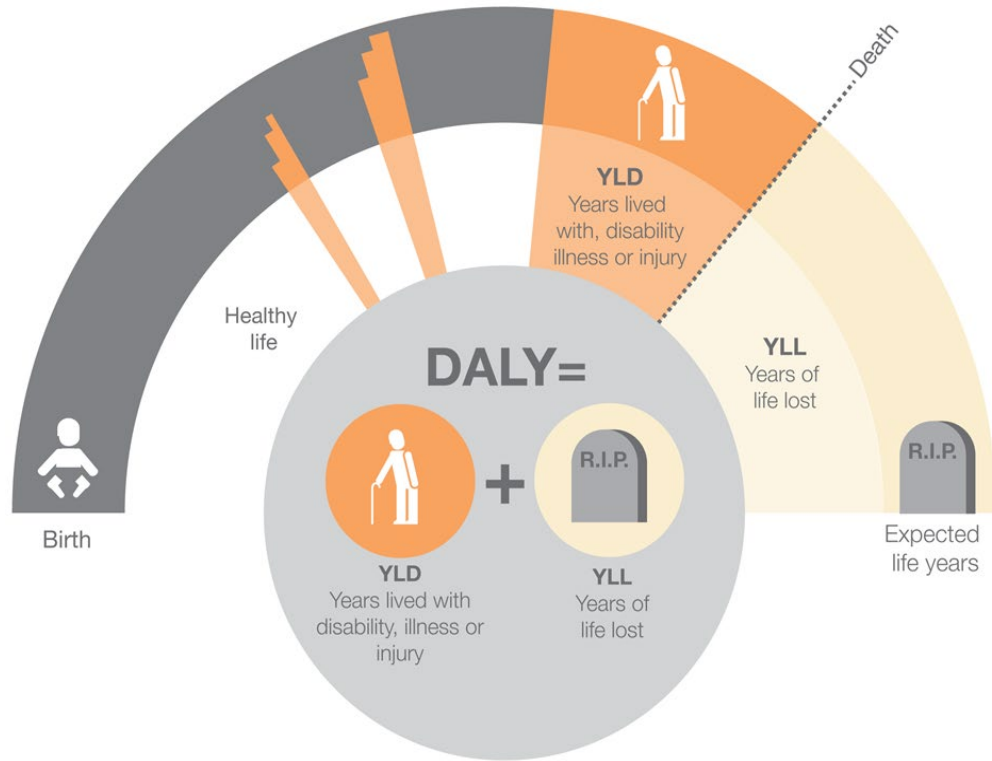
Department for Work & Pensions; Department of Health: “Work, Health and Disability Green Paper Data Pack” Technical Annex; 2016

Melanie K. Jones, Rhys Davies, Stephen Drinkwater. “The Dynamics of Disability and Work in Britain”; 2018, The Manchester School, vol 86:3.

Years lived with disability; and years of life lost



Years lived with disability; and years of life lost



Assumptions:

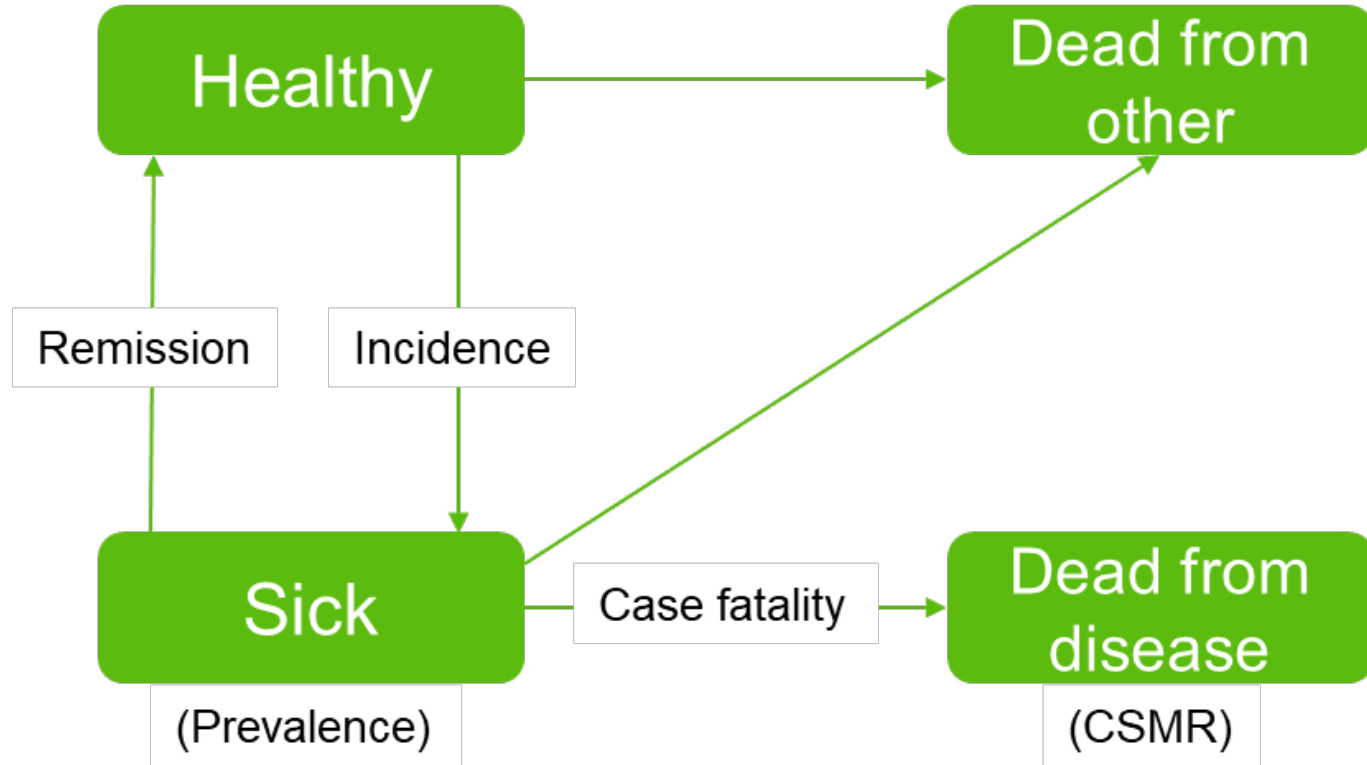
Premature death commonly associated with prior limiting illness

Extended period of limiting illness before premature death

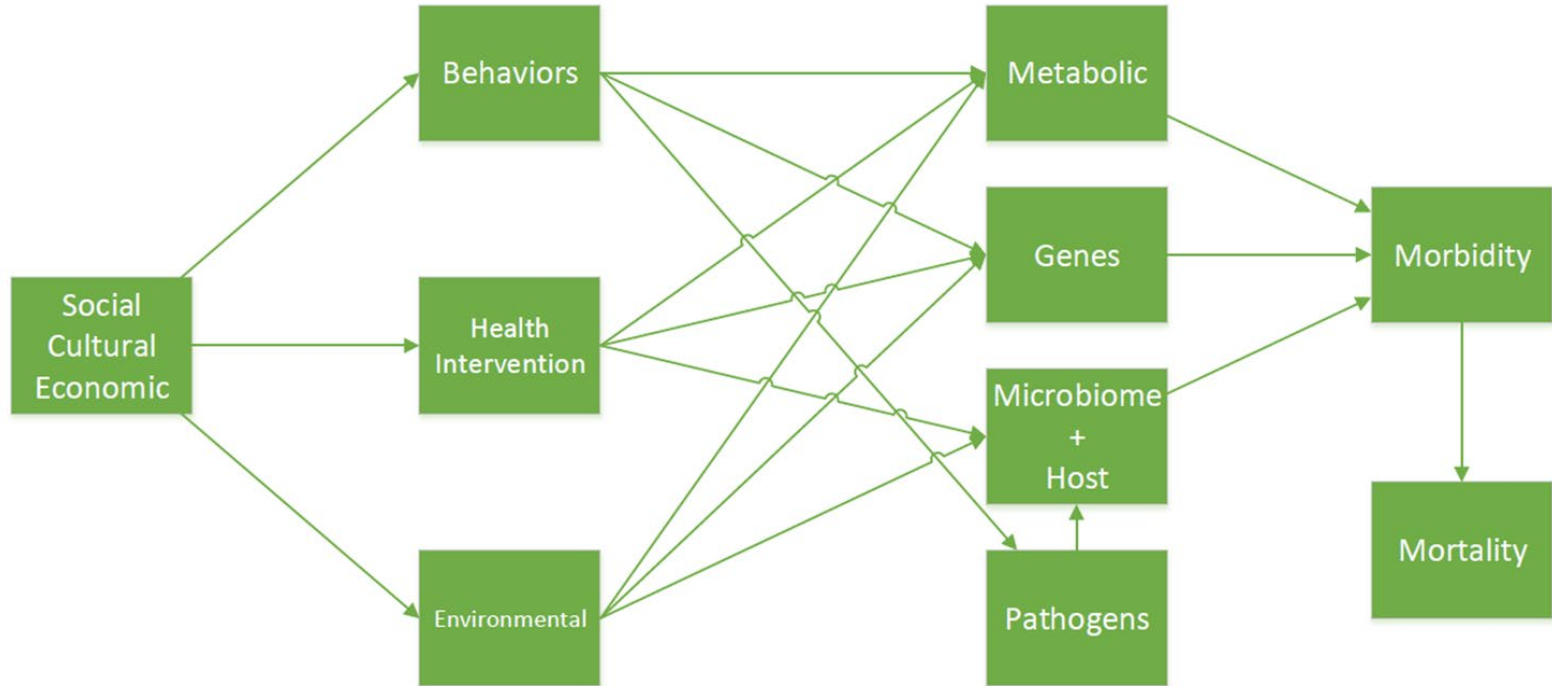
Shorter episodes of onset and recovery from limiting illness in earlier life

Limiting illness episodes demonstrating deteriorating condition over time – up to point of recovery or death

Global Burden of Disease; compartmental model



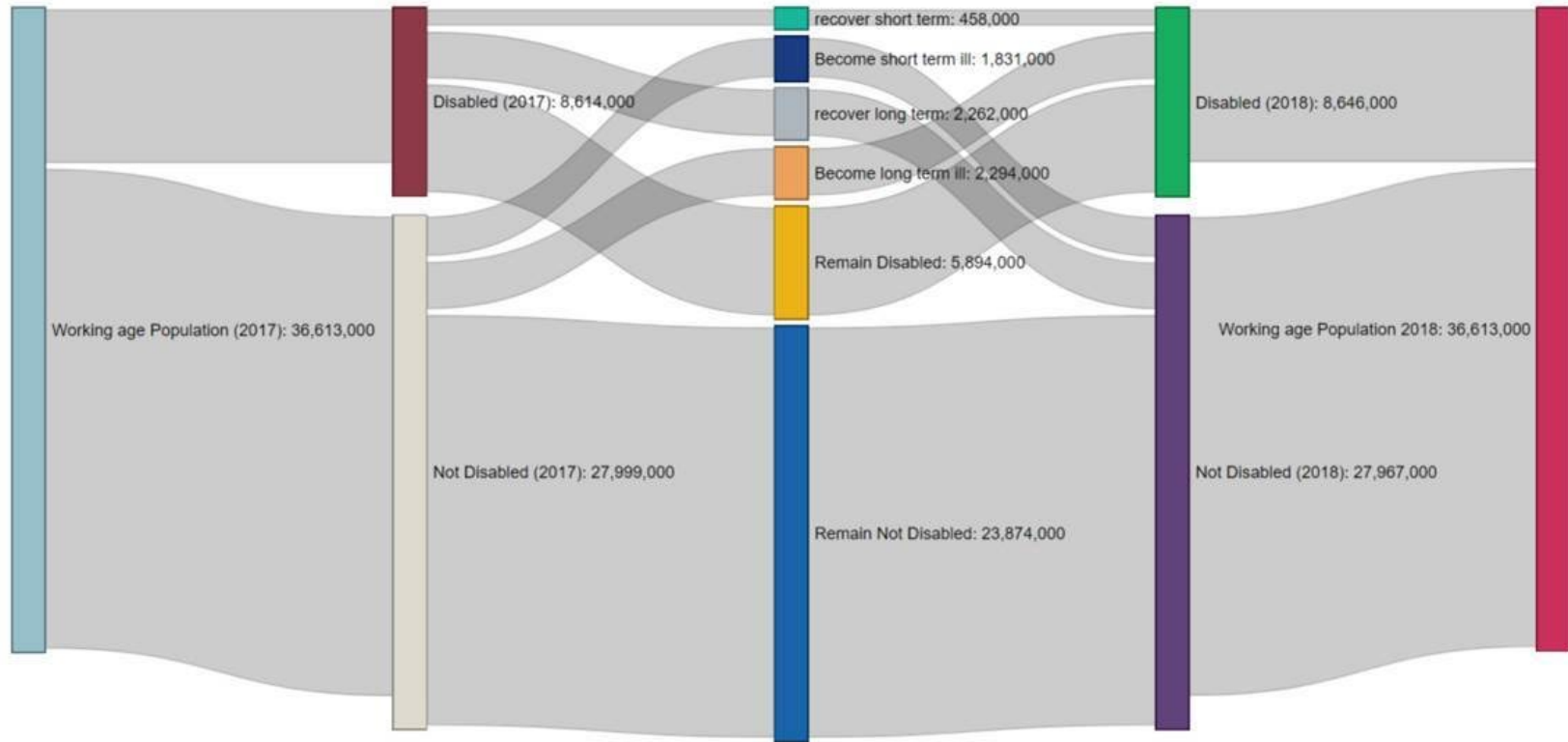
Global Burden of Disease; causal web



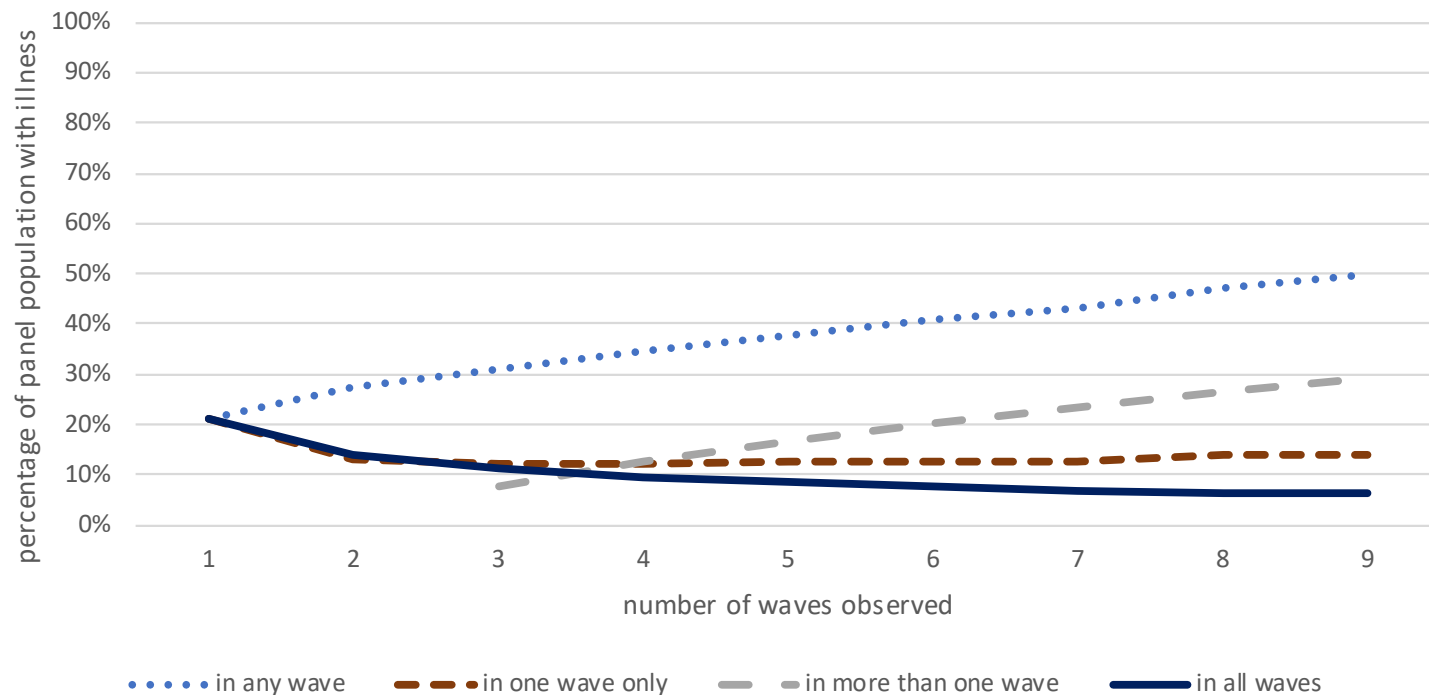
Presuppositions of dynamics of onset and recovery from chronic limiting illness

- **Presupposition of Sequence**; that the determinants of chronic illness can be distinguished into 'upstream' and 'downstream' characteristics; and that 'upstream' factors are more amenable to public health, and vary more widely; while 'downstream' factors are more likely amenable to treatment access and delivery, and vary less.
- **Presupposition of Symmetry**; that the dynamics and characteristics by which persons recover from chronic limiting illness will typically reverse those by which they became ill – hence returning them to 'the way they were'.
- **Presupposition of Causation**; that the 'wider determinants of health' may act with causal effect on the differential likelihood of onset of chronic illness; but are not likely to act separately with causal effect to promote or accelerate recovery from chronic illness.

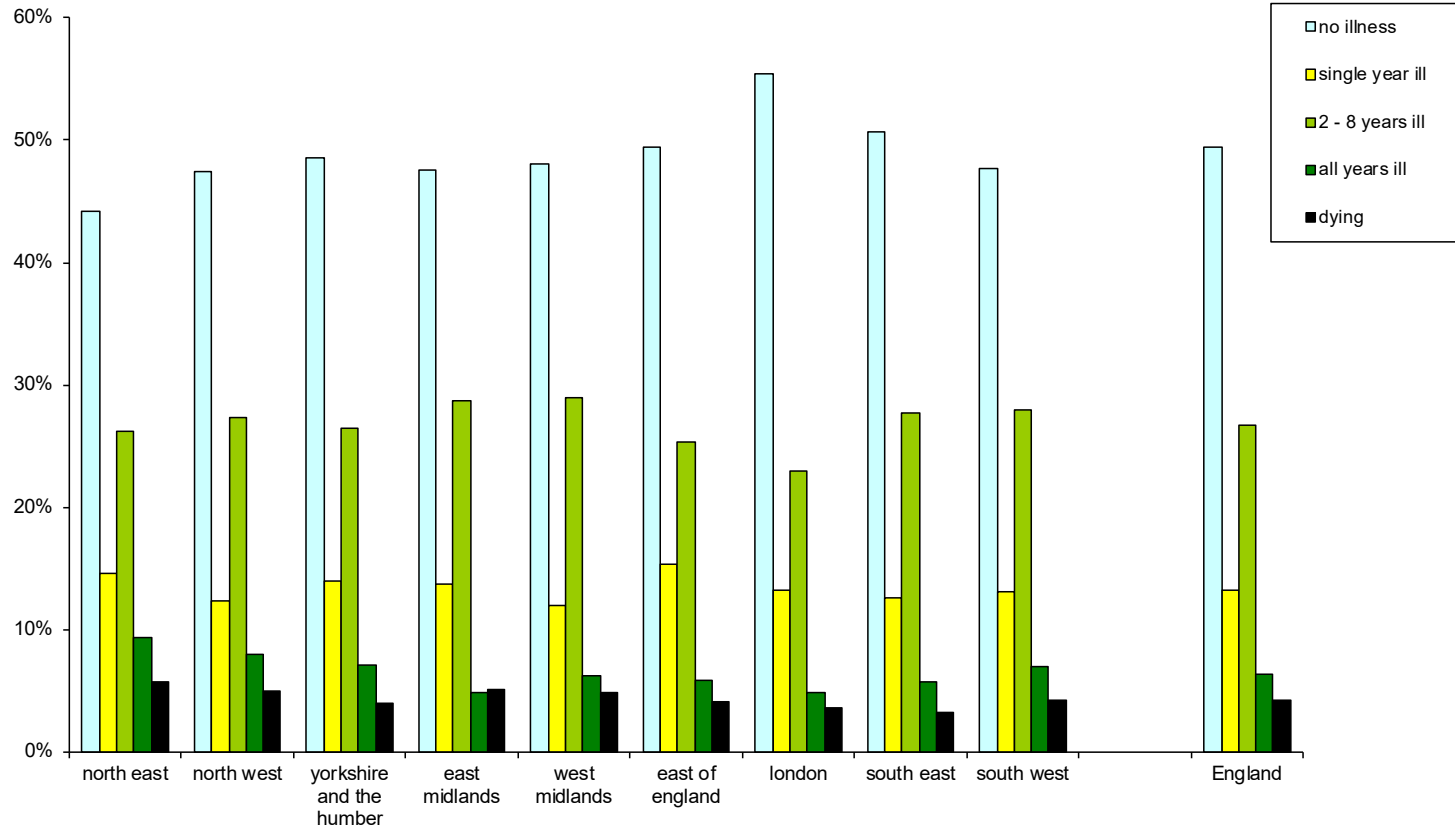
Sankey diagram of 12 month onset and recovery flows: England 18-69, 2017 to 2018; from 'Understanding Society' waves 8 and 9



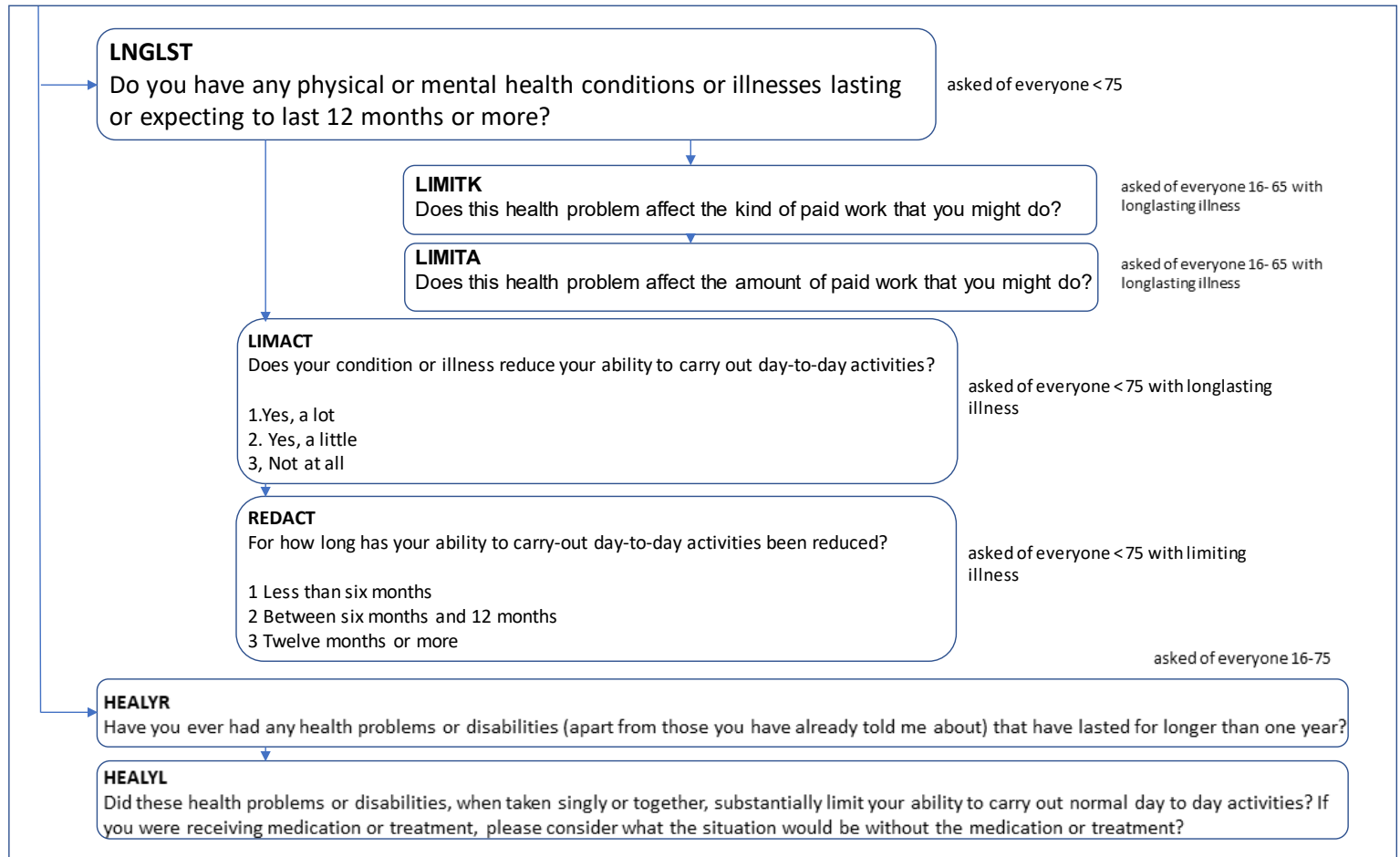
Limiting long-term illness in the 'Understanding Society' panel Nine waves 2010 - 2018; persons aged 16-74



Persons aged 16-74 observed in all nine waves of 'Understanding Society' Prevalence of years illness and death by region 2010 - 2018



Health questions
in the Annual
Population
Survey 2017



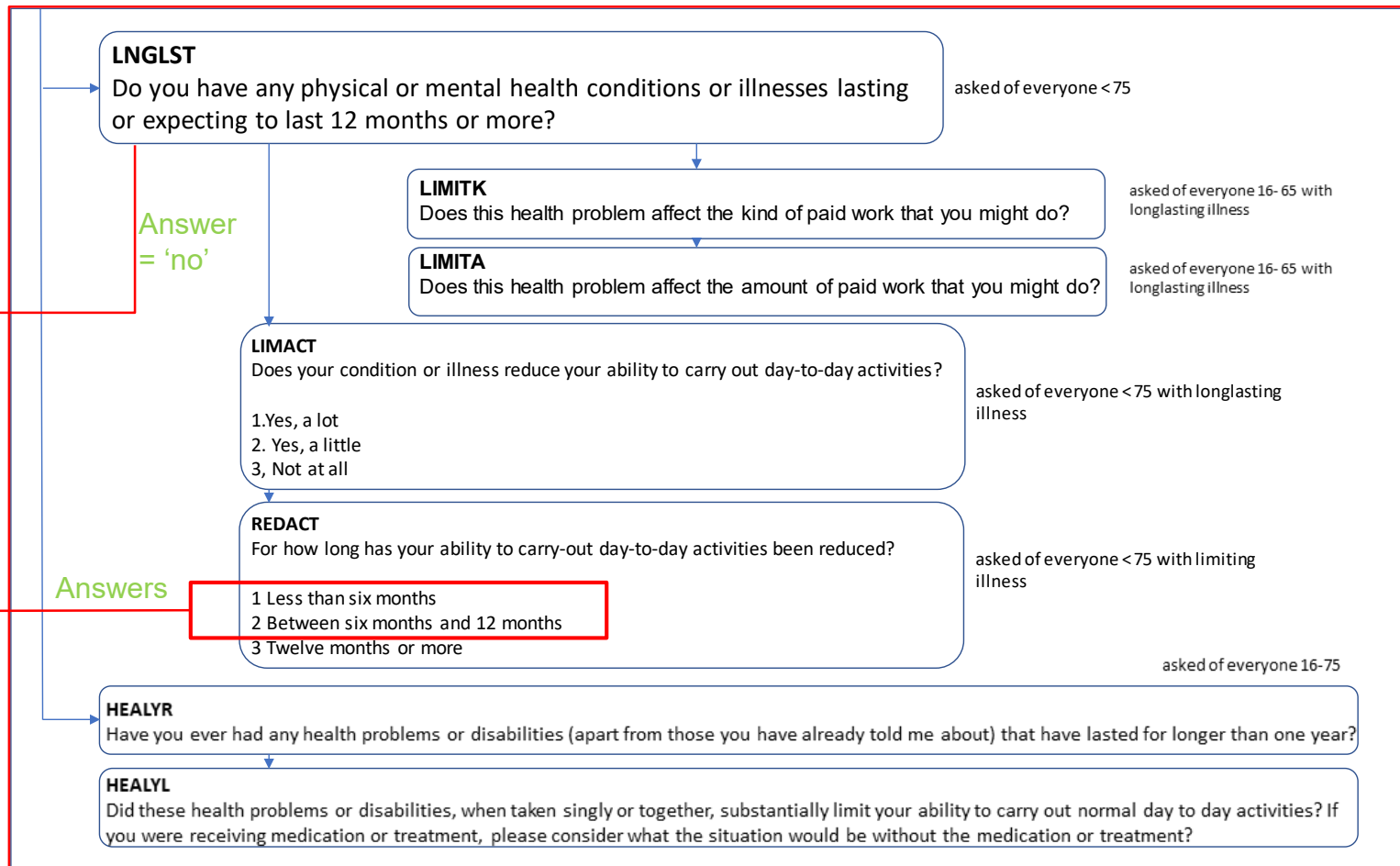
Onset of illness in the Annual Population Survey 2017

Reference population 18-69

Male 38,047
Female 40,654

Population of interest 18-69

Male 1,278
Female 1,795



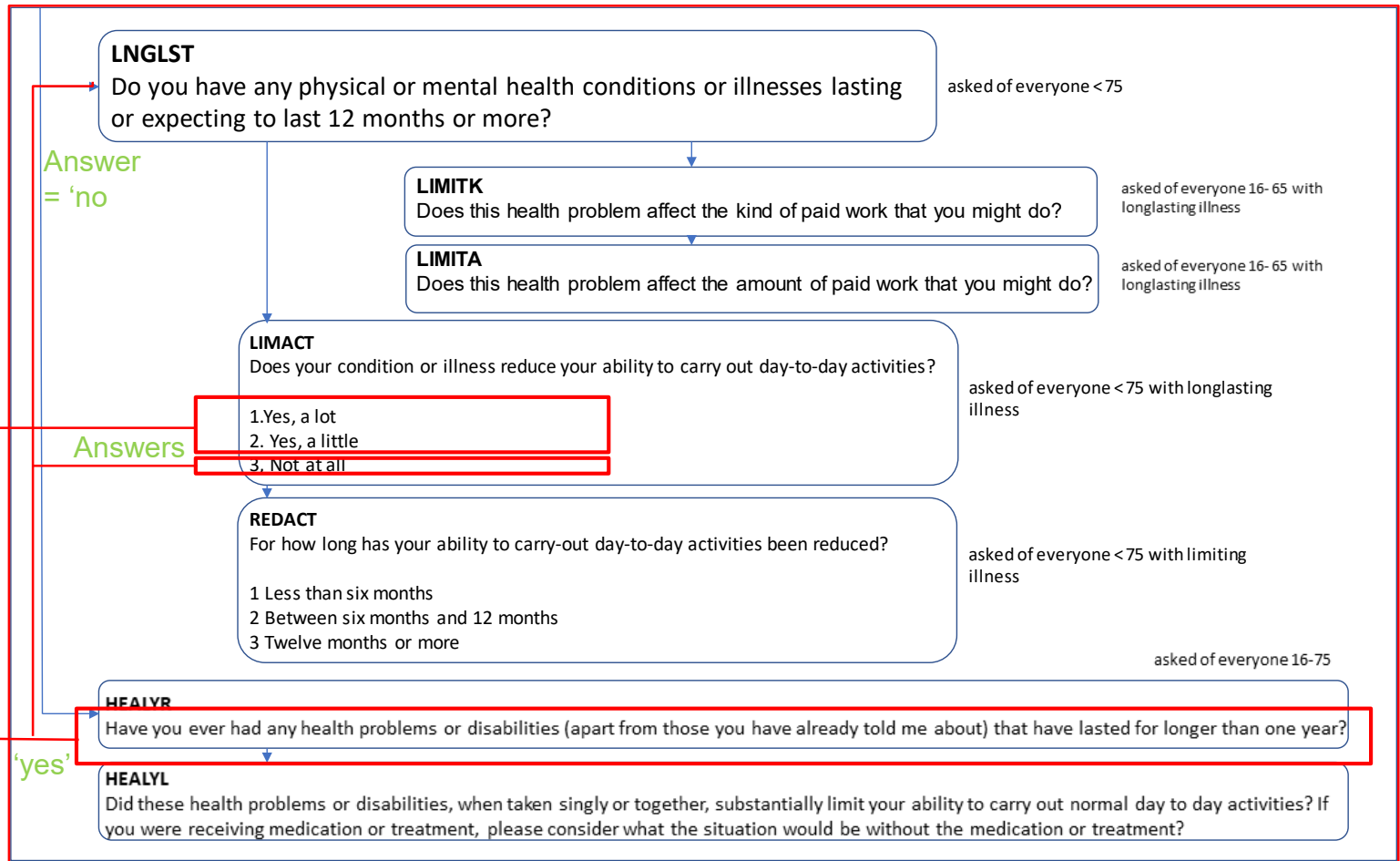
Recovery from illness in the Annual Population Survey 2017

Reference population 18-69

Male 11,244
Female 15,111

Population of interest 18-69

Male 1,443
Female 1,879



Comparison of characteristics for those reporting 'recovery' from illness in APS, compared with those reporting no current or past illness

Percentage of population	aged 18 to 64		aged 65 to 74	
	reporting no illness	reporting recovery	reporting no illness	reporting recovery
Economic status				
in employment	80%	78%	19%	17%
unemployed	3%	4%	0%	1%
full time student	7%	2%	0%	0%
looking after home and family	5%	6%	1%	1%
long term sick or disabled	0%	1%	1%	1%
retired	2%	6%	76%	79%
other inactive	3%	4%	2%	2%
Life Satisfaction scores				
not at all satisfied	0%	0%	0%	0%
1	0%	0%	0%	0%
2	0%	1%	0%	0%
3	1%	1%	1%	0%
4	1%	1%	1%	1%
5	4%	6%	5%	5%
6	6%	8%	4%	4%
7	20%	21%	12%	12%
8	36%	32%	34%	34%
9	17%	15%	20%	20%
completely satisfied	14%	14%	21%	23%

Parsimonious models of illness onset

- Male (Nagelkerke rsq= 0.069) Female (Nagelkerke rsq = 0.050)
- 1st stage: Age, Region of Residence, NS-SEC social status
- 2nd stage male; included stepwise 2nd stage female; included stepwise
 - Working status Housing tenure
 - Smoking status Working status
 - Housing tenure Smoking status
 - Employment sector (public/private) Marital status
 - Country of birth Country of birth
 - Employment sector (public/private)

Parsimonious models of recovery

- Male (Nagelkerke $rsq= 0.126$) Female (Nagelkerke $rsq = 0.092$)
- 1st stage: Age, Region of Residence, NS-SEC social status
- 2nd stage male; included stepwise 2nd stage female; included stepwise
 - Working status
 - Educational attainment
 - Housing tenure
 - Time living at current address
 - Country of birth
- Working status
- Housing tenure
- Time living at current address
- Educational attainment
- Country of birth
- Ethnicity

Fully adjusted models of onset and recovery

- Male: onset (Nagelkere rsq= 0.076); recovery (Nagelkere rsq= 0.128)
- Female: onset (Nagelkerke rsq = 0.053); recovery (Nagelkere rsq= 0.093)

Region of residence

Age

Socio-economic (NS-SEC)

Time living at current address

Country of birth

Smoking status

Working status

Housing tenure

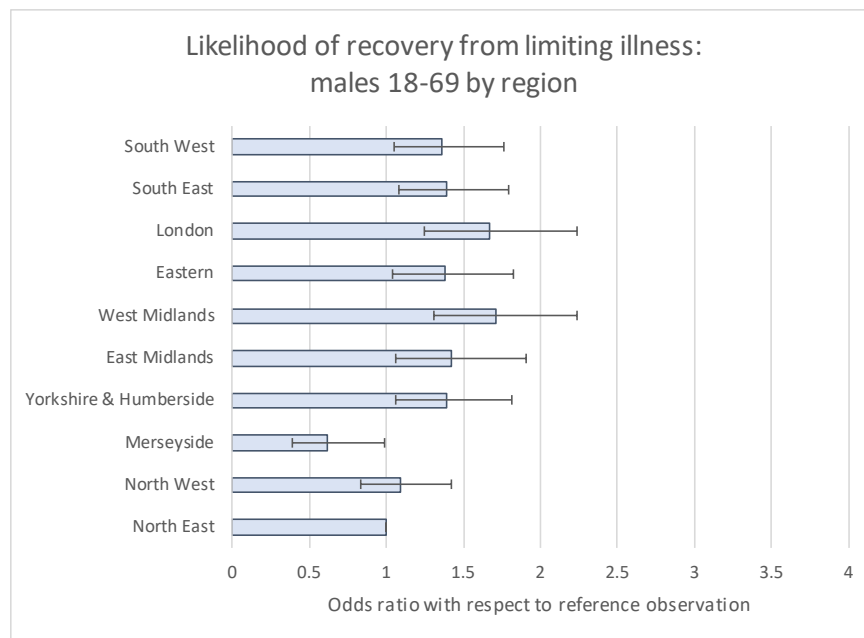
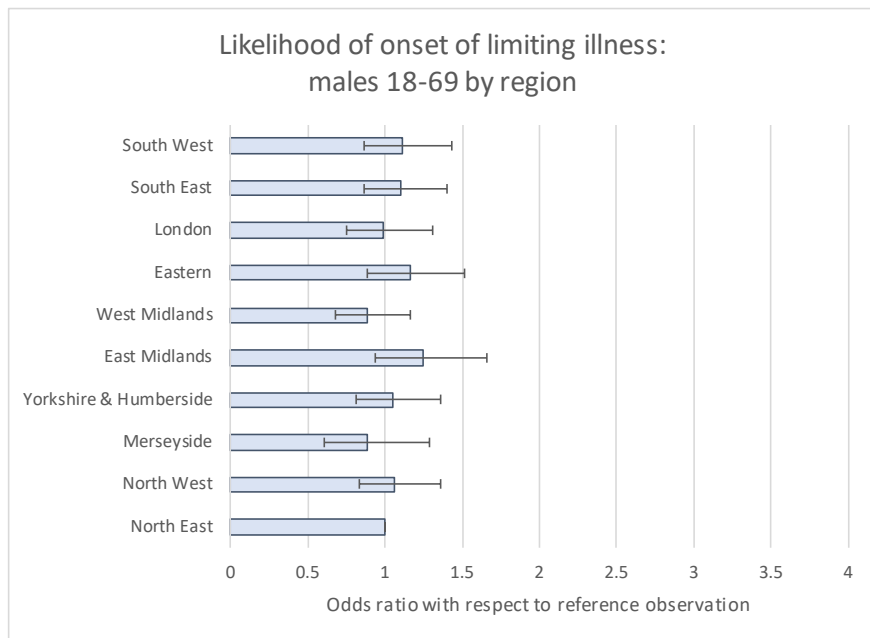
Sector of Employment (public/private)

Educational attainment

Marital Status

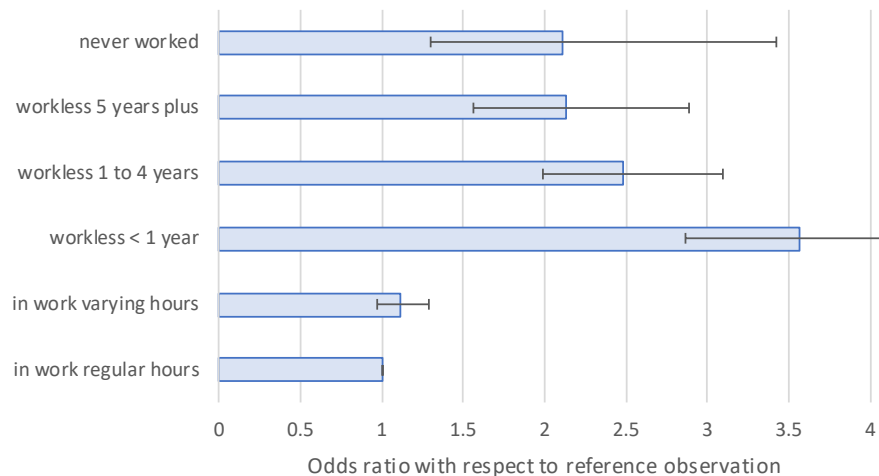
Ethnicity

Odds ratios for Region of residence; male fully adjusted models of onset and recovery; England 2017 ages 18 – 69.

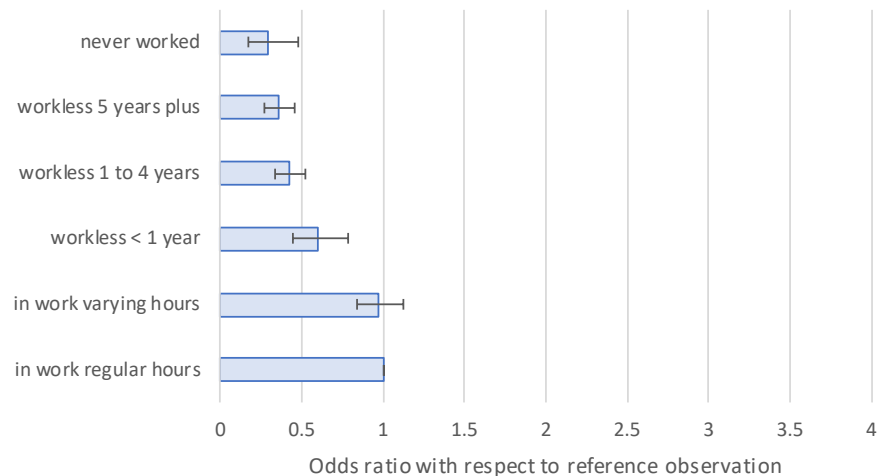


Odds ratios for Working Status; male fully adjusted models of onset and recovery; England 2017 ages 18 – 69.

Likelihood of onset of limiting illness:
males 18-69 by working status

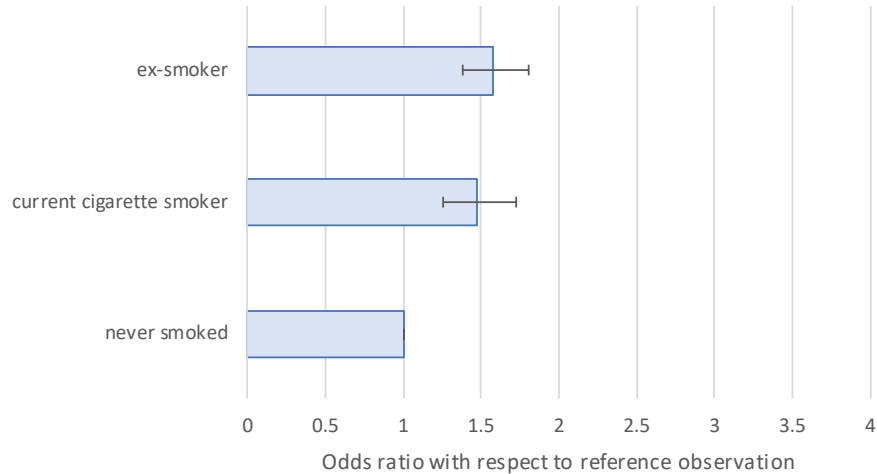


Likelihood of recovery from limiting illness:
males 18-69 by working status

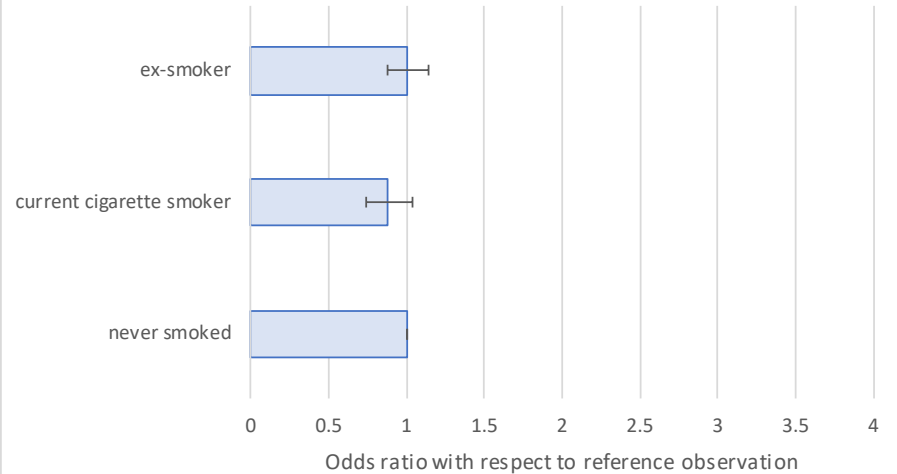


Odds ratios for Smoking Status; male fully adjusted models of onset and recovery; England 2017 ages 18 – 69.

Likelihood of onset of limiting illness:
males 18-69 by smoking status

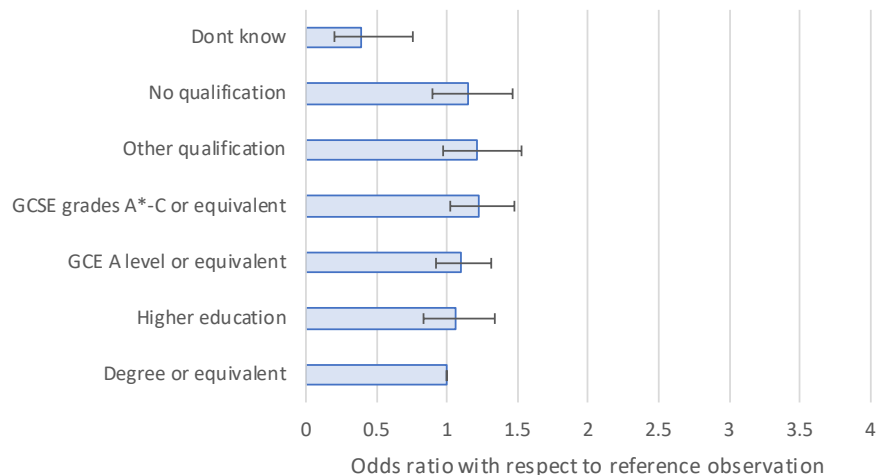


Likelihood of recovery from limiting illness:
males 18-69 by smoking status

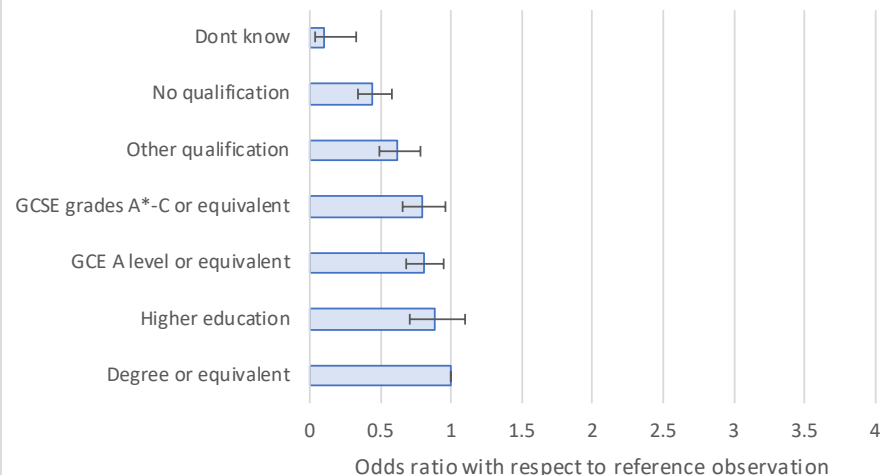


Odds ratios for Educational attainment; male fully adjusted models of onset and recovery; England 2017 ages 18 – 69.

Likelihood of onset of limiting illness:
males 18-69 by highest qualification



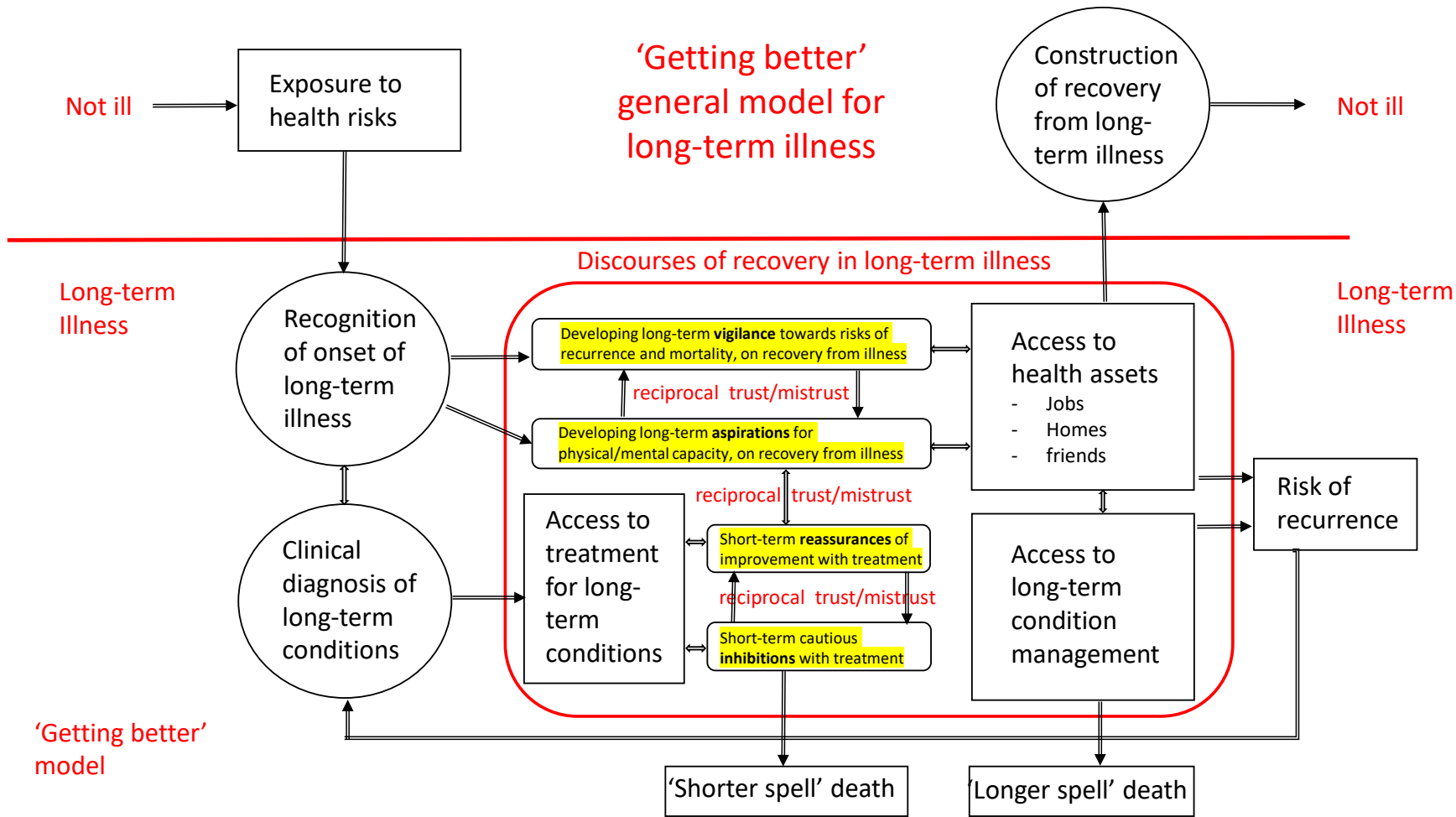
Likelihood of recovery from limiting illness:
males 18-69 by highest qualification



Preliminary conclusions

- From the **Presupposition of Sequence**; we might have expected to find differential risk of illness prevalence (especially at the regional level) to be more strongly associated with differential likelihood of 'onset' than of 'recovery'. **We found the opposite**; systematic variation was more evident 'downstream' than 'upstream'.
- From the **Presupposition of Symmetry**; we might have expected to find that the characteristics and dynamics associated with 'recovery' might have been the obverse of those associated with 'onset'. **We found the opposite**. Our parsimonious models of onset and recovery included different components (e.g. smoking for onset; education for recovery), while those characteristics that were included in both sets of parsimonious models (e.g. working status) did not generally do so symmetrically.
- From the **Presupposition of Causation**; we might have expected to find indications of causal association of the 'wider determinants of health' to be stronger in respect of illness 'onset, than in respect of illness recovery. **Our findings suggest the opposite**; that clinical risk factors (e.g. smoking) were more likely to be associated with differential 'onset, while wider determinants (e.g. education) were more likely to be associated with 'recovery'.

We are now seeking to explore these preliminary findings further, using the 'Understanding Society' longitudinal study



Next steps; and a plea for help

This analysis of the Annual Population Survey has served as a pilot exercise. We intend to take this work further using the 'Understanding Society' longitudinal panel of the UKHLS, applying Cox proportional hazard models; and have extracted a set of 16,068 individuals aged 16-74 in the first wave, for whom we have full reports of illness and recovery over all nine waves.

We would very much like to hear:

- From anyone who has used the APS health questions to explore the dynamics of illness onset and recovery – is there anything seriously problematic in our approach?
- From anyone with recent experience in exploring the dynamics of illness onset and recovery in longitudinal panel data;
- From anyone who would be able to support our current work as 'an extra pair of eyes' especially in respect of applying proportional hazard models to person/year observations, where time series is indicated by annual stage reporting.

We would welcome any feedback; please contact Tom Hennell at Thomas.hennell@phe.gov.uk