BURDEN OF DISEASE IN NORTHERN LINCOLNSHIRE

AND ITS FUTURE IMPACT ON THE LOCAL HEALTH AND SOCIAL CARE ECONOMY

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Acknowledgements

Burden of Disease in Northern Lincolnshire

Contents

Burden of Disease in Northern Lincolnshire

Introduction and Overview of Burden of Disease Project

As with most other parts of the UK, North and North East Lincolnshire's health and social care system will face enormous challenges over the next couple of decades. This is particularly due to an ageing population and forecast growth in long term conditions. This will occur at a time when it appears likely that there will be public finance restrictions which will limit the ability of the NHS and social care to meet this need.

This programme of work was therefore commissioned to examine the burden of disease in North and North East Lincolnshire today and make projections into the future. The primary element of this programme is to identify the current burden of disease in North and North East Lincolnshire in a number of major long term conditions such as cardiovascular disease, cancer, diabetes, respiratory disease, mental illness and musculoskeletal disease and to undertake a modelling exercise based on available data sources to predict the future burden of disease relating to these conditions. The work aimed to look at these diseases as a whole, taking a life course and predictive approach to examine the likely impact on the health and social care system in years to come based on current knowledge and trends.

Based on this intelligence, the aim has then been to identify the interventions which, if delivered efficiently and effectively, could be delivered in such a way that will turn the curve and reduce the burden of disease and therefore the costs to the health and social care system.

The Report will provide a strong foundation for actions such as those laid out in the indicative framework below to address the Goal and Purpose of the Programme.

GOAL: To improve the wellbeing of people in North and North East Lincolnshire focusing on a faster rate of improvement for those at greatest risk of poor health

PURPOSE: To establish an integrated system-wide approach to prevention that supports people to live in a resilient purposeful and independent healthy life

UNIVERSAL	UNIVERSAL	SELECTIVE (TARGETTED)	SELECTIVE (TARGETTED)	INDICATED (SPECIALIST)	INDICATED (SPECIALIST)
Creating a Healthy "Place" that supports and values healthy living, wellbeing, social inclusion and protects people from harm and adverse living conditions	Easily accessible information, tools and advice via a range of sources, making best use of technology that support people's independent pursuit of health & wellbeing	Systematic approach to early identification/recognition of contributory factors including mental health and respond proportionately to individuals and communities stratification of population	Core capability programme approach to confidence building for self-management of conditions by individuals and their significant others	Slow progression and deterioration of LTC and reduce avoidable complications and crisis through proactive management and co-production	Increase co-ordination and integrated case management approach to complex needs to prevent avoidable admissions to hospital and loss of independence
				Incentivise shift to the left	
INPUT	INPUT	INPUT	INPUT	INPUT	INPUT
Spatial planning Active travel Age friendly environments Licensing Healthy Workplaces	Making every contact count Information and brief advice integrated lifestyle services Online access to healthy lifestyle information	Immunisation and screening programmes Maternal and 0-5 services Future in Mind Health-check programme Diabetes prevention programme	Portfolio of self-care tools Direct access to expert advice Volunteering Development programme for managing long term conditions Social prescribing	Proactive management of complex long term conditions Case finding frailty in primary care Out of hours access to support 7 days a week Support and work with carers Use of assistive	Coordination and integrated Case Management Local out of hospital integrated care model End of life/palliative care

Executive Summary

Relevant key defining population characteristics of North and North East Lincolnshire

North Lincolnshire (NL) and North East Lincolnshire (NEL) share many similarities, but also key distinctive differences that are relevant when considering their burden of disease and how best to address it. Clearly important are the following:

- **Demography**: The population age structures are distinctly different, with NL having a substantially greater proportion of elderly, and NEL correspondingly less elderly and a greater proportion of young adults

Population projections by 2035:

- NEL population growth 2.9%; 65yrs. and over increase by 47%

- NL population growth 9.4%; 65yrs. and over increase by 67%; (>85yrs. Increase by 182%)

Increases in the size of these older groups are likely to have a high impact on the demand for health and social care services.

- **Deprivation**: 40% of the NEL neighbourhoods' population fall into the national most deprived quintile 5, while for NL this is less than 20%.

Since the burden of disease will fall disproportionately on the populations in the most deprived neighbourhoods, there are likely to be distinctly different levels and distribution of disease burden in the two districts.

- **Excess mortality**: Both districts have high levels of premature mortality, with NL ranked 244 highest out of 324 Districts and NEL ranked 293. Profile of contributory causes differs somewhat in each:

- NL has a higher proportion of cancers and respiratory disease reflecting its Humberside industrial heritage

- In NEL cardiovascular disease is more predominant, and also has more digestive (liver) disease, particularly in men

- **Inequalities in life expectancy**: both Districts have a high slope index of inequality, both showing over 10.5 years difference in life expectancy across the population:

- For NEL this shows a quite even gradient by deprivation score

- IN NEL the gradient is discontinuous with 2 steps splitting the population into 3 statistically distinct segments

These patterns have important consequences for how service responses will need to be targeted in graduated ways to achieve equitable access and outcomes

Local measures of Burden of Disease

The UK Global Burdon of Disease Study has demonstrated that, while life expectancy has improved and YLL reduced substantially over the last decade there has been:

Burden of Disease in Northern Lincolnshire

- no corresponding reduction in the years of life with illness and disability (YLD).

- no substantial narrowing of the gap in health inequalities

Local analysis has demonstrated some distinctive features of the Burden of Disease (BoD), in particular:

- **Years of Life Lost (YLL):** there are similar patterns in both districts, notably,

  - Across the life course there are distinct patterns of causation:

    ➢ 15 – 34 yrs, deaths due to injury (self-harm; traffic accidents)

    ➢ From age 35 liver disease (alcohol and injecting drug related)

    ➢ From as early as 45 heart disease, cancer and respiratory disease

  - Dramatic differences in profile by deprivation score. In the most deprived quintile:

    ➢ The majority of YLL occur before age 65, while in the least deprived quintile it is the opposite

    ➢ From ages 25 – 65 there are substantial excess YLL due to:

      ▪ Mental health and drug related deaths,

      ▪ Gastrointestinal disease deaths, majority of which are cirrhosis (due to alcohol related harm and infectious hepatitis, much, but not all of which occurs in injecting drug users).

      ▪ Injuries in males (mainly road accidents or self-harm in).

    ➢ A large proportion of cardiac related YLL occur before age 65, while this is only limited to small numbers in the least deprived quintile.

There are major consequences from these findings for the planned pattern and resourcing of health and social care services.

- **Years of Life with Disability (YLD):** A local pattern of YLD drawn from GBoD suggest a similar pattern for NEL and NL, although the size of the burden is substantially greater in the >65 yrs. group on NEL. Key practical factors include:

  - Leading causes of mortality, (cardiovascular; cancer; respiratory; liver disease) only represent a relatively small proportion of disability compared to other major causes.

  - Diabetes is a significant contributor, growing in importance from an early stage.

  - Most conditions increase in proportion to age, except for mental health and drug disorders, which peak in young middle age.

  - Otherwise, bulk of the burden in older age comes from 3 categories:

    ▪ Neurological, because this includes Alzheimer's dementia

    ▪ Musculoskeletal, though mainly 'back and neck' more than arthritis

    ▪ Sensory, loss of sight and hearing, which is very substantial

Burden of Disease in Northern Lincolnshire

- The pattern of mental and drug use disorders is distinctive and varies substantially by age, sex and between the Districts.

- **Reflected use of health services:** comparison of the two districts shows that volume of hospital use is more sensitive to elderly age structure (NL) than greater deprivation profile (NEL).

The most dramatic feature in pattern of use for both, however, relates to variation by deprivation quintile:

- For both districts there is a major difference in use of emergency (non-elective) services by deprivation quintile, with dramatically greater use by the most deprived quintile(s).

- For NL there is little difference by quintile in the volume of use of services, suggesting activity is not reflecting need. For NEL there is some proportionate difference by quintile, suggesting referral and use better reflecting need.

- **Expenditure as a proxy for service:** since there is little data available to analyse primary, ambulatory and social care, programme budgeting was used.

- Hospital expenditure dominates completely.

- Identified primary care expenditure is prominent particularly in cardiovascular and respiratory disease, and for 'endocrine' which is predominantly diabetes.

- Expenditure patterns in primary care do not seem to reflect the major burdens of disease/disability of musculoskeletal disease (back and neck) or of sensory problems (hearing and poor sight).

- Mental health expenditure stands out, but as a composite of complex pathologies, unlike physical health which is separated into a wide range of specialties.

- **Attributable causes:** the dataset of social determinants and risk behaviours driving the burden of disease are briefly examined, noting issues in common, as well as specifics for NL and NEL.

Trends in the Burden of Disease locally

Lessons are drawn from the international analysis, which, on a disease specific basis, examine the factors that will determine burden of disease and expenditure by population. The case is clearly made that even for 2 contrasting major diseases heart disease, (where incidence is falling), and diabetes (where incidence is rising), population growth and ageing will result in increasing numbers and expenditure by 2035.

The local situation for diabetes is modelled, projecting the numbers forward on the basis of increasing incidence due to the growing obesity 'epidemic', population growth, and demography of ageing. This estimates that diabetes patients will increase by:

- 33% in NL

- 46% in NEL

With no control over population growth and ageing, the range of other possibilities for addressing the burden and expenditure are identified.

Burden of Disease in Northern Lincolnshire

Implications: prevention and the Burden of Disease pathway

From a population perspective, there is a pathway of causation whereby intervention at the earliest points ('upstream'; 'to the left') will reduce the consequences ('downstream'; 'to the right').

Working proactively at all possible steps down the burden of disease chain will be critical to enable residents to maintain their independence for as long as comfortably possible, supported where necessary. The intention will be to defer, and compress, the period of time living with (expensive) dependency towards the end of life.

An outline of the pathway follows.

    A. Reducing risk

        a. Social determinants

These have been well described by Marmot (The Marmot Review Team, 2010) as a 'Life-course' of accumulating risks, which can be viewed as a pathway of its own. Reducing risks at any point along the BoD pathway can have its impact as primary prevention as the most extreme version of 'upstream working', but also can influence change at other points in the pathway by influencing 'health seeking behaviour'.

The evidence base shows strongly, however, that interventions that support a healthy start for children during the first 2 – 5 years of life during the development of 'cognitive and executive functions' may have the greatest impact on reducing the cycle of deprivation.

        b. Risk behaviours

GBoD identified the main attributable causes of disease, 5 of the top 10 being behaviour related: dietary risks; tobacco smoke; alcohol and drug use; low physical activity; occupational risks.

Behaviour change is not straightforward to achieve, particularly for people living in complex and challenging environments: in these circumstances risky behaviours are less 'lifestyle choices' and more elements rooted in local cultural norms.

In addition, risk behaviours often cluster together in more deprived communities, multiplying the risks and providing even greater challenges for substantially downgrading risks.

        c. Risk conditions

The remaining 5 of the top 10 attributable risks are in fact measurable abnormalities in physiological/pathological state (e.g. raised blood pressure; raised blood sugar). In general they are not recognised as a problem in individuals without some invasive 'clinical' test. They may become apparent opportunistically during investigation of a patient for another condition, or may be tested for in a systematic case-finding exercise e.g. GP Quality Outcomes Framework (QOF) or the Health Checks programme.

Search strategies need to be systematic and scaled up, and take into account disadvantaged patients who do not have the knowledge, skills and resources to easily take up the offers of testing.

In many cases, confirmation of the problem may be followed with a supported care plan e.g. weight management; dietary control; fitness programme. These will need to be fastidious to achieve

Burden of Disease in Northern Lincolnshire

measurable change and risk reduction. In many cases if the initial care plan is insufficient, medication may be necessary.

B. Reduce disease incidence

Some of the major conditions contributing to the disease burden have an identifiable pre-condition, not the disease itself but part of the pathological pathway which can provide a 'warning' that the disease itself may be developing. If this state can be detected and acted upon effectively, the incidence of the disease itself, with all its downstream consequences, may be averted. Includes:

– Screening (cancers; aortic aneurysm; diabetic eye disease)

– Vaccinating (HPV; hepatitis)

– Case finding (pre-diabetes; cardiac risk; renal disease)

Detecting and managing these pre-conditions on a population-wide basis requires scaled-up and systematic processes, but because they can literally prevent serious disease developing, the processes can be very cost effective and should be pursued to best effect.

C. Managing long-term conditions (LTCs)

Once long term conditions are established there are a number of management goals which will need to be pursued:

• Optimise control and management costs

• Preventing decline in function

• Prevent and manage acute exacerbations

• Prevention of complications

• Managing risk of premature mortality.

There is a good evidence base and plenty of authoritative guidance and protocols for effective management of the main LTCs, and of achieving each of the management goals.

A major determinant of the success or otherwise of each care plan remains the patient capacity and capability to self-manage. This needs to be supported in bespoke ways, both by the practitioners, family and other carers, and by peer 'expert patients'.

Managing these goals from the outset, once the condition is diagnosed, can prevent the sequential increase both in the burden of disease and cost.. (80% of the cost of diabetes services goes on managing the complications.)

D. Managing multi-morbidity

Multi-morbidity, increasing with improving survival, adds management problems e.g.:

• due to mixed signs and symptoms complicating diagnosis;

• interacting/conflicting care plans;

• transitions across healthcare boundaries and specialisms

Burden of Disease in Northern Lincolnshire

Poorer outcomes and higher costs result. Studies show that people with multi-morbidity had higher consultation rates, more (costly) transitions across services, and less continuity of care compared with people without multi-morbidity.

Importantly, people in deprived circumstances have the same prevalence of multi-morbidity as more affluent patients who were 10 – 15 years older (Barnett, 2012)**.** This will have significant consequences for resourcing across health and social care.

E.   Manage frailty

Frailty is a transitional state of vulnerability to accumulated impairments. It affects 20 – 50% of people > 80 years.

- There are five main frailty syndromes ('the pillars of frailty'): falls; immobility; delirium; incontinence; susceptibility to the side effects of medication
- Currently, patients often present in crisis because of these and other problems, without prior warning to urgent or emergency care services and such episodes can precipitate episodic decline.

- Frailty is not a static condition and can be improved. Identifying people living with frailty can help improve outcomes, and should enable prevention plans and contingency arrangements to be put in place.
- Physical frailty and dementia are the main causes of patients entering long-term social home or residential care.

F.   Functional decline

This decline is not inexorable, and can be managed usefully in many cases where resources are deployed effectively and efficiently. The supports may be employed as: Proactive health promotion; Rehabilitation following an acute episode or crisis; Re-ablement.

As all points in the burden of disease 'pathway' described above, there are a range of social determinants that will affect the effectiveness and cost effectiveness of interventions. They include;

- Personal skills, and capacity to self-manage
- Family and carer involvement
- Other social networks; otherwise, loneliness and isolation
- Mental wellbeing
- Physical resources for maintenance and recovery (including financial)

Implications: key components of population level actions
The Report describes five key components of a population based strategy. These elements are critical if percentage change at population level is to be achieved.

1.   Commitment of effort and resource needs to be graded proportionately to complexity of need.

There is a gradient of need right across the population. However, there is a part of that population e.g. in the most deprived national 20% of neighbourhoods, where risk factors combine into a complex whole

Burden of Disease in Northern Lincolnshire

i.e. multiple social risks (income and debt; unemployment; housing issues), clusters of behavioural risks (tobacco and alcohol use; poor diet; inactivity) and early multi-morbidity.

These people will be the most problematic to support to reduce their overall risk. However, they are also the ones suffering the greatest degree of years of life lost, the greatest number of years of life with disability and chronic illness, and make the greatest use of crisis and emergency services.

2. Interventions selected for population level change programmes must meet a tight set of criteria

Programme characteristics will include being:-

- <u>Evidence based</u> – concentrate on interventions where research findings and professional consensus are strongest

- <u>Outcomes orientated</u> – with measurements locally relevant and locally owned

- <u>Systematically applied</u> – not depending on exceptional circumstances and exceptional champions

- <u>Scaled up appropriately</u> – "industrial scale" processes require different thinking to small " bench experiments"

- <u>Appropriately resourced</u> – refocus on core budgets and services rather than short bursts of project funding

- <u>Persistent</u> – continue for the long haul, capitalising on, but not dependant on fads, fashion and policy priorities

Small projects, those based on 'grey' evidence and services that are unsystematic and of patchy and variable quality will not generally result in measurable change at population level

3. To achieve population level change will require multifaceted approaches delivered with system and scale.

The concept of the Population Intervention Triangle is introduced, which brings together the various ways that measurable population level change can be achieved. These are:

- Population level protections: legislation; taxation, licencing; heathy public policy

- Systematic, scaled and sustainable delivery of the evidence base through services

- Systematic engagement with communities to provide supportive networks and environment

- Real connectivity of services into communities; strategic engagement of Third sector

All need to be connected through good leadership, partnership, and vision and strategy that provide measures and milestones towards the desired outcome.

Strategies for risk behaviour change, e.g. on tobacco use, should involve all elements of the Triangle. Services such as smoking cessation will not change prevalence on their own. NICE guidance provides evidence around all points of the triangle.

4. Addressing inequalities in access and outcome.

Burden of Disease in Northern Lincolnshire

It is important to pro-actively address the 'intervention decay' by drawing the 'missing thousands' appropriately into services that can reduce their own burden of disease. A strategic model identifies the components A – D necessary to achieve this:

A. Primary - under recognition of illness by individuals and people around them

B. Secondary – identified as ill but treatment not accessible

C. Inadequacies in quality of in-service provision

D. Insufficient assets for recovery or ongoing self-management

This approach will be most important where levels of deprivation are highest.

5. System, scale and selection of intervention 'best buys'

Introducing the concept of Numbers Needed to Treat (NNTs), an estimate of the number of recipients that will need to be treated to achieve one target success in a given timeframe, can focus attention on the interventions that can be most effective and cost effective in improving outcomes.

The larger the NNT, the greater the span of control necessary to quality control the inputs, and to therefore assure the outputs.

Implications: 'best buys' for reducing the burden of disease

Based on all the considerations in previous sections of this Report, there follow a proposed series of steps amplified to draw in some key implications if there is to be a measurable impact on population level BoD.

1. **Formalise the basis of a consistent, graduated service response to need based on community deprivation score.**

The Report makes clear the very uneven way that the distribution of deprivation and disadvantage is reflected in differential need and burden of disease across the two Districts. Much of this need is unmet at early parts of the BoD pathway, but then reveals itself as disproportionate levels of demand through extensive and expensive complications, multi-morbidity and crisis demands on service, as well as premature mortality.

Addressing the unequal distribution of need pro-actively is not just a morally appropriate matter of addressing social injustice and inequality, but also a pragmatic approach to being able to continue to deliver effective and affordable services.

Such approaches require formal acknowledgement of the way sub-populations are distributed, and then the mapping of what this means for the planning of services to deliver a graduated response. This will require attention to resource distribution, not equal shares, but proportionate to need. There will also need to be tailored means of engagement with different communities, with generic support to their infrastructures where needs are most complex.

2. **Identify and connect effectively with the 'missing thousands'.**

Detailed analysis and mapping shows clear mismatches of need and expressed demand, particularly for inputs addressing the attributable risks and opportunities for prevention of subsequent disease burden.

Burden of Disease in Northern Lincolnshire

Missing potential beneficiaries will be an issue for services, e.g. GPs working across the social spectrum, but is shown to be a particular problem often where need is greatest in the more deprived areas. Reaching out to draw people appropriately into services needs to be systematic and intelligence based.

A model illustrating how partners can contribute additively to addressing the predictable 'intervention decline' is described (The A-B-C-D strategy). Partners will contribute differently for different interventions e.g. GPs being at C for delivering quality service say to deliver CHD management, while working at A and B to identify the problem and navigate to appropriate services e.g. in relation to cold, damp housing.

Proposed HLHF models of out-of-hospital and place–based care arrangements should provide the culture and structures to support strategies to address the intervention decline in key areas of input. This will work if knowledge and information, plans and sought for outcomes are shared and addressed together.

3. **'Sweat the assets' of disease registers to bring best outcomes from a clear evidence base systematically to those who could benefit.**

Disease registers are a critical component of population health systems. Properly used, they will make sure that once a disease is identified and registered, health care is doing all it can to control LTCs by systematically applying the strongly evidence based interventions to all who can benefit, to reduce deterioration and prevent complications.

It should be recognised that those not meeting targets, either as exemptions or treatment failure, may be those with other complex needs. Examples of this areshown for NE and NEL. It is therefore necessary to put the disproportionate effort in to support these people, and incentives and supports should be aligned to encourage this.

However, system efficiency is only half of the story, and engaging the patient in good, supported self-management is also critical to successful outcomes. An evidence review highlights some of the key components.

4. **Sweat the assets of screening, case finding and quality assured action plans to address risk conditions and pre-disease.**

At critical points in the genesis of some diseases it is possible to intervene to prevent the development of the disease itself and its consequences down the burden of disease pathway. Unfortunately, most of these conditions require some form of 'clinical' testing as they are asymptomatic, and must be sought out pro-actively. Success therefore depends on the efficiency and effectiveness of the search.

There is much scope for improving on this in NL and NEL, and examples are shown. In particular it will be cost-effective to improve access and uptake for:

– Health Checks, and opportunistic case finding

– National screening programmes

– Vaccination programmes, including for HPV and hepatitis

Identification of the clinical problem will need to be followed through with fastidious and systematic programme support, and the resources to deliver this effectively need to be available.

Burden of Disease in Northern Lincolnshire

5. Programmes to modify risk behaviours

The main identified risk behaviours are critical ones to address, not just because they are really upstream in the pathway, but also because they each contribute to numbers of the main components of the disease burden. The problem is how to address them with sufficient system and scale. Although the cost per QUALY is very low on an individual basis, the numbers needed to treat (NNT) are very large. This means large numbers of agents will be necessary to support the intervention, and assuring their quality and support brings clear challenges.

Attention is given to important cost effective population based interventions:

- Strategies covering all elements of a Population Intervention Triangle, not just service based inputs, working from NICE guidance and e.g. National Obesity Strategy (forthcoming).

- Capitalise on frontline service contacts with a systematic Making Every Contact Count (MECC) approach, backed with Brief Intervention training and support.

- Provision of 'Tier 2' services, often under provided, to give extra support when 'readiness to change'.

- Target high risk individuals with multiple risks (e.g. smokers on LTC registers) for greatest impact

In the most deprived areas, risks often cluster in individuals. Where this is frequently so, services must be geared up for multi-faceted, rather specialist silo approaches.

6. Addressing the social determinants of the disease burden

On a 'place' basis all partners should work on a holistic and contributory basis to improve personal, family and community resilience. Dividends will be widespread where this is effective, and will have a downstream impact on risk behaviours and the burden of disease.

The local authorities and partners in Northern Lincolnshire are working to address the social determinants of health and wellbeing, including those described in the Marmot Report, to address inequalities across the social 'gradient' and the 'life-course'.

While all components are important, a number are key within health and social care:

- Early years development: this is evidenced to be the most critical and fundamental period of the life course.

- Skills and good work

- Income and debt management

Implementation of support in these areas can be patchy and variable, and some characteristics are identified that will be crucial for integrated and place-based working.

7. Addressing/managing leading causes of Years of Life with Disability (YLD)

Analysis shows that some of the most prevalent causes of the disease burden, particularly in an ageing population, are not necessarily those with the highest profile strategically. Attention is given here to:

Burden of Disease in Northern Lincolnshire

- Sensory loss: material is available to support strategic approaches to sight loss, but much less so for hearing loss. Both are very important contributors to frailty, isolation, lonliness and loss of independence

- Back and neck pain is a huge burden, and overshadows even arthritis as a reported concern, with less systematic management pathways.

Considering the size of these problems largely impinging on out-of-hospital health and social care, it will be important to proactively address strategies for these problems to ensure consistent effective and cost effective programmes with strong preventive interventions and active management.

8. Approach to multi-morbidity

Identification of multi-morbidity type, starting with common pairings, and linkage of information across interfaces provides opportunities for targeted protocols and guidance for intervention and delivery of integrated care.

Clinical information systems should increasingly be able to provide appropriate intelligence for more efficient and effective management.

9. Systematic population-based approaches to frailty and dementia

In relation to dementia, and through substantial improvements in 'pathway' co-ordination there have been measurable improvements in:

- Retained (supported) independence, and deferred entry to residential care

- Reduction in the numbers presenting in crisis to social care, emergency departments and urgent care centres

- Reduction in the number of avoidable hospital admissions/bed days for patients with a dementia diagnosis.

It is recognised that similar advantages could be gained through a formalised recognition of the state of frailty. In addition there is the advantage that, unlike dementia at present, progressive degrees of frailty can be halted and even reversed with pro-active approaches.

10. Predictive modelling

This is an approach using the potential of Big Data to identify predictors of patient risk from very large clinical data sets. Software derived from this can then be used at a local level to derive lists of patients at defined stratified levels of risk, enabling cost beneficial targeting of efforts and resources.

As the approach developed models initially focussed on those at highest risk, but these patients were found to be often in their last year of life, and attempts to reduce risk at this stage tended not to be cost effective. Now the focus tends to be on the next level of risk below, where there is more scope for proactive impact.

In this regard, predictive modelling will be an important intervention to help prioritise patients at high risk and effectively focus particularly where NNT will be smallest for short term impact.

Burden of Disease in Northern Lincolnshire

1. Relevant key defining population characteristics of North and North East Lincolnshire

There are excellent detailed analyses published as Joint Strategic Needs Assessments (JSNAs) for North Lincolnshire and North East Lincolnshire (North East Lincolnshire Strategic Partnership, 2015) (North Lincolnshire CCG and Council, 2015) which will not be duplicated here. The following are key features relevant to the current appraisal.

1.1 Demography

The population 'pyramids' for NL and NEL are shown below.

Figure 1 Population pyramids for Northern Lincolnshire
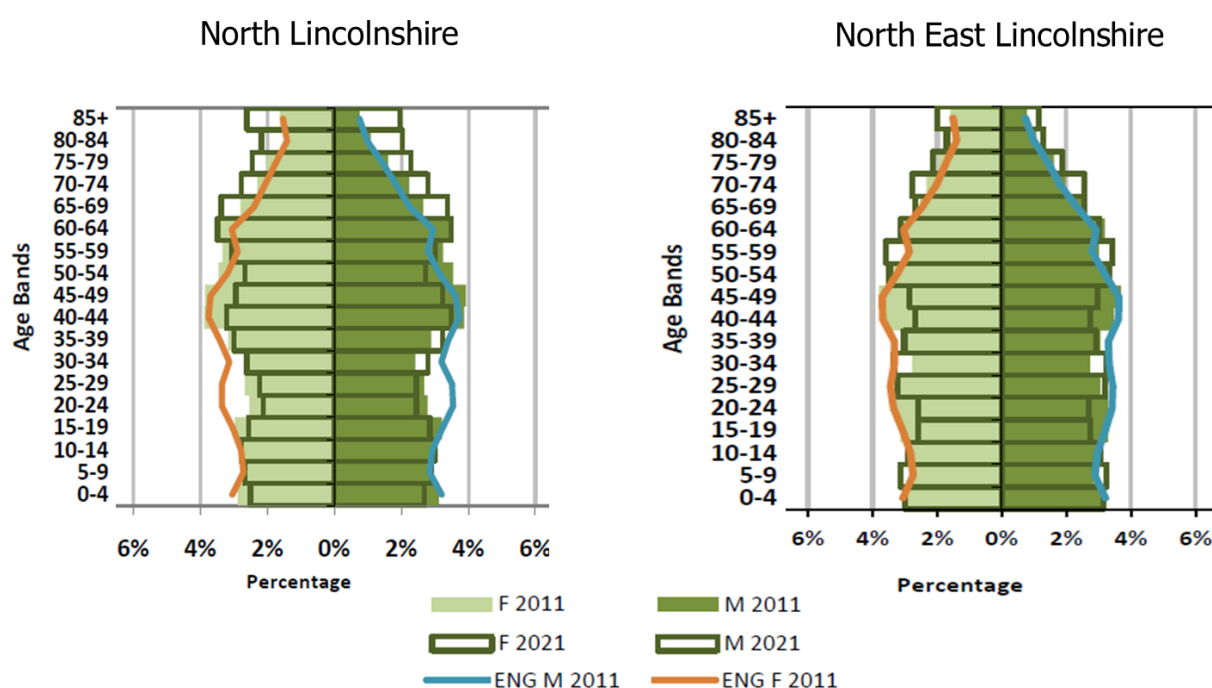
They may look similar to the untutored eye, but show some distinct and important features:

- At the 2011 census NL had less than the England average proportion of young adults age 20 – 39, but above average for 40+.

- NEL in contrast had a very similar profile to the England average, with a greater proportion of young adults.

- Both districts are projected to experience a significant increase in the proportion of over age 60's by the time of the next census and beyond.

The Joint Strategic Needs Assessments (JSNAs) emphasise the nature of the predicted changes:

- Mid-2010 population projections show an estimated population growth of 2.9% in NEL by 2035. By age group, residents aged 65 and over are expected to increase by 46.8%.

Burden of Disease in Northern Lincolnshire

- In NL, the population is projected to expand to an even greater extent, i.e. by 9.4% overall. By far the biggest increase in population is projected to take place in people of pensionable age, 65+, with a projected increase of 67.4% by 2037. The over-85 population is projected to grow significantly with a 182.2% increase over the period.

This age group is most likely to have the greatest accumulated burden of disease as we will demonstrate, so increases in the size of these older groups are likely to have a high impact on the demand for health and social care services.

1.2 Deprivation

NL and NEL have distinctly different profiles of deprivation (Public Health England (PHE), 2014).

Figure 2 Northern Lincolnshire: comparative deprivation profiles (PHE, 2014)
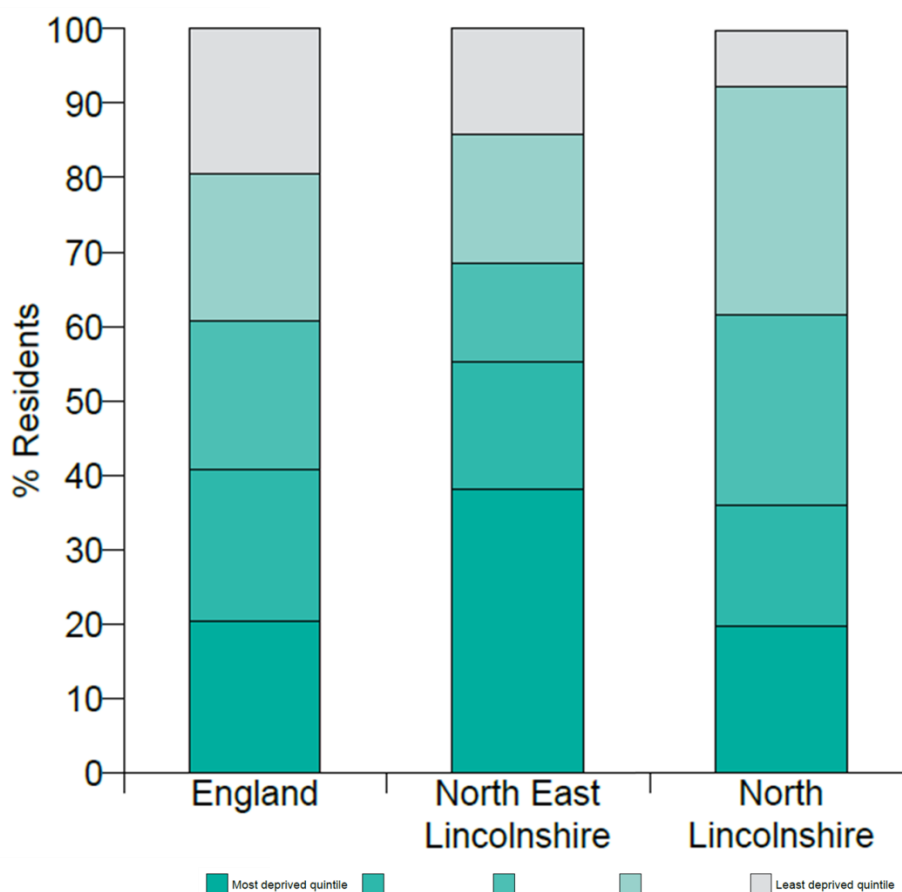

Figure 2 colour codes the England population of neighbourhoods into five 20% segments (quintiles) by deprivation score.

- Compared to England, NL can be seen to have slightly less than average proportions of the most deprived quintiles 4 and 5, and a predominance of quintiles 2 and 3.

Burden of Disease in Northern Lincolnshire

- In contrast nearly 40% of the NEL neighbourhoods' population fall into the national most deprived quintile 5, with proportionally less from the less deprived quintiles.

Since the burden of disease will fall disproportionately on the populations in the most deprived neighbourhoods, there are likely to be distinctly different levels and distribution of disease burden in the two districts.

1.3 Excess mortality

Premature mortality is a strong indicator of health inequalities between and within areas. Figure 3 shows that both NL and NEL have comparatively very high mortality profiles as illustrated by the national mortality rankings (Public Health England (PHE), 2015). As predicted by the deprivation picture, NEL has the worst position of the two, and lies within the 20% highest mortality rates in England.

The profiles of specific disease mortality show that mortality in NL features particularly higher respiratory (lung) and cancer mortality. For NEL heart disease and stroke and also liver disease (possibly related to levels of alcohol related harm) are more prominent. However, injury related death rates are disproportionately low.

Figure 3 Premature Mortality within England (rankings out of 324 local authorities)

	North Lincolnshire	North East Lincolnshire
Overall mortality	244	293
Cancer	250	302
Heart disease and stroke	216	304
Lung disease	275	283
Liver disease	205	279
Injuries	207	113

After PHE Longer Lives tool

More information on 'inequalities' related to specific causes of death can be seen by examining the profile of causes of excess deaths over and above that seen on average nationally.

Figure 4 shows the 'scarf' diagram for NL from the PHE Segmentation Tool (Public Health England (PHE), 2015).

Burden of Disease in Northern Lincolnshire

Figure 4 North Lincolnshire life expectancy gap by cause compared to England
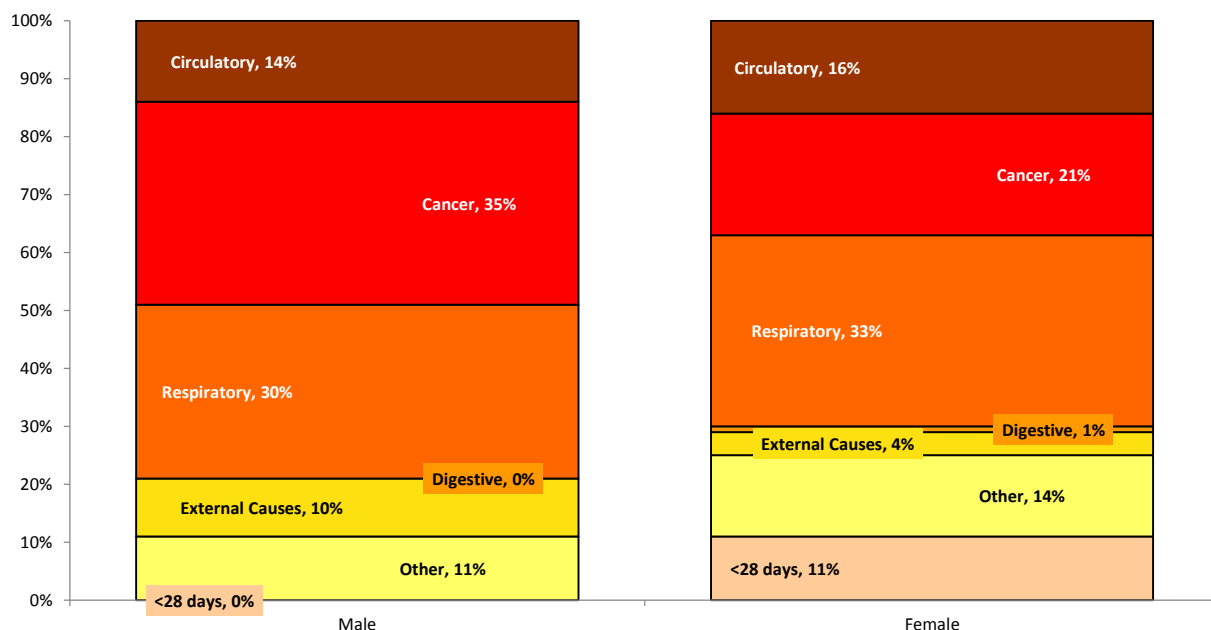
This is a very distinctive pattern, which is seen in areas with a heritage of major heavy industry. It shows a predominance of excess cancer and respiratory deaths particularly in men. This pattern on Humberside is reflected also in local authorities with similar historical backgrounds, e.g. on Tyne and Tees, Glasgow and upper Merseyside.

Figure 5 on the other hand shows the scarf diagram for NEL, which is more conventional in pattern. There is much more of an emphasis on circulatory disease (heart disease and stroke), and a significant component of digestive disease, possibly reflecting problems with (alcohol related) liver disease.

Figure 5 North East Lincolnshire life expectancy gap by cause compared to England

Burden of Disease in Northern Lincolnshire
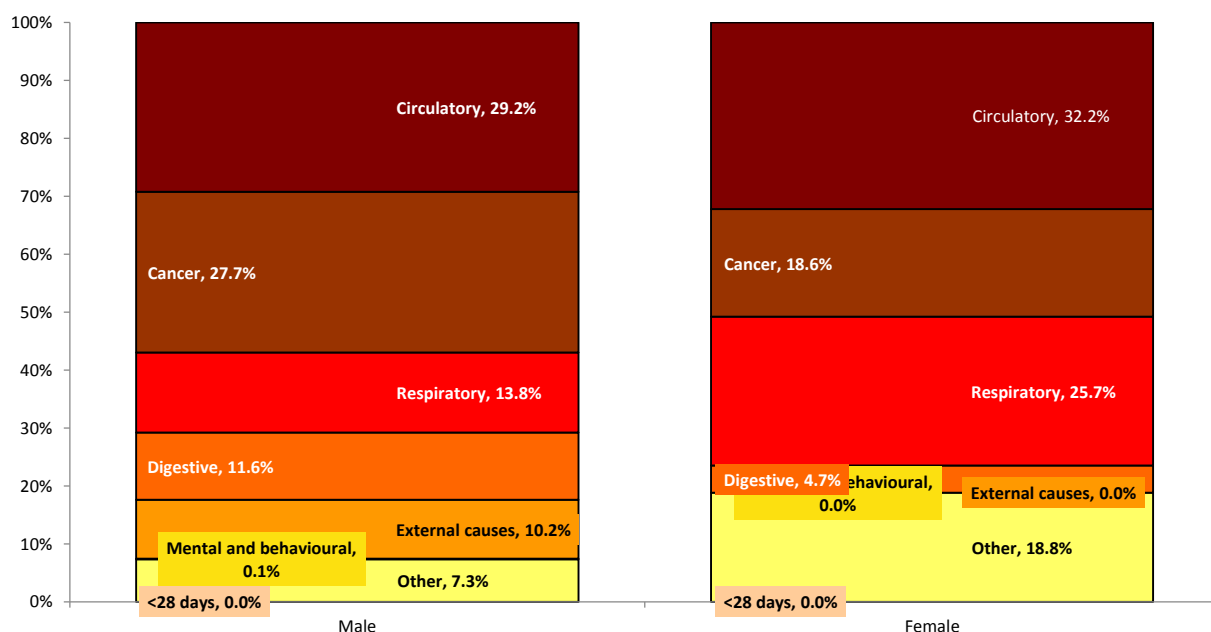
1.4 Health inequalities

A method of analysis called the Slope Index of Inequality is a helpful way of illustrating the measurement of inequalities across neighbourhoods within a local authority. The analysis gathers together neighbourhoods (Lower Super Output Areas –LSOAs) ranked by deprivation score into 10 segments (deciles). It then calculates an average life expectancy for each decile. A straight line can then be drawn showing the best fit across the 10. The slope of this line has then been used as a measure of inequality – the steeper it is, the greater the internal inequality.

However, from a practical point of view, the variation across the deciles can give more information which may be helpful in designing the pattern of intervention to help address the inequalities.

Figure 6 shows the life expectancy slope index for NL. It has a steep slope index of 10.9 years, which means very significant levels of inequality in life expectancy. However, an annotated version of the same graph, shown as Figure 7 gives much more information. The bars across each point on the graph are statistical confidence intervals. In 2 places on the graph the confidence intervals between adjacent points do not overlap. This means that the clusters of neighbourhoods represented by these dots are statistically distinctly different from each other. This is shown by the black 'steps' added to the chart.

On this basis the NL population divides into three distinct segments:

- The least deprived 4 deciles (40%) have similar high life expectance, over 80 years.

- The next 5 deciles (50%) do have a deteriorating slope from 80 years down to 75.

- The final decile (10%) is out on its own with life expectancy below 75 years

It is possible to 'decode' the deciles so as to identify and map the areas represented in each. This can provide the basis of creating differential service and access plans, aiming to improve the 'furthest fastest'.

Figure 7 show the situation for males. That for females shows a very similar picture.

Burden of Disease in Northern Lincolnshire

Figure 6 North Lincolnshire: Slope Index of life expectancy (representing internal health inequalities)
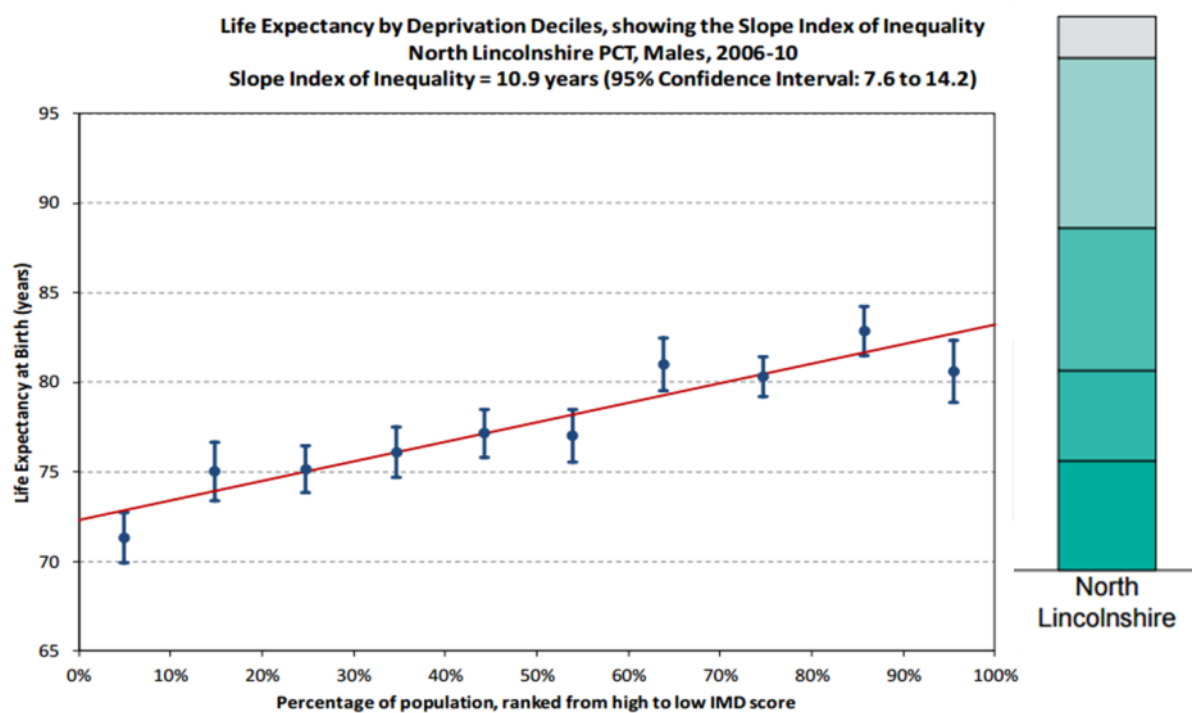
Figure 7 North Lincolnshire: Slope Index of life expectancy (representing internal health inequalities)
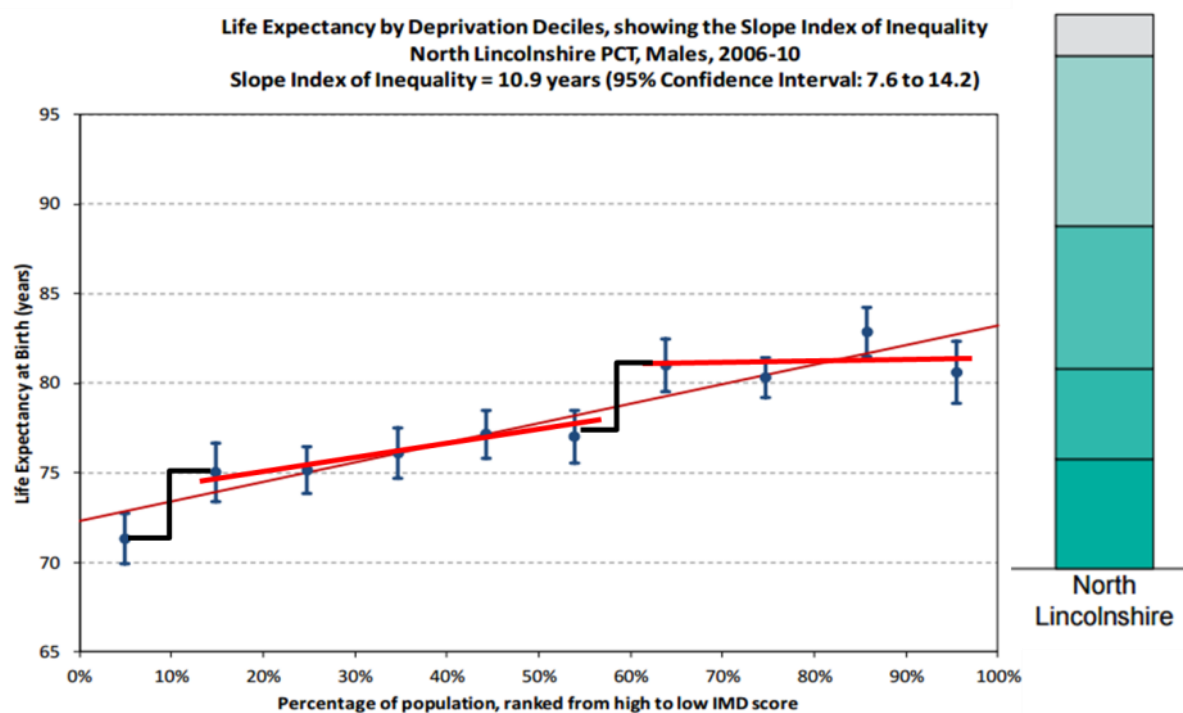
The analysis for NEL, shown as Figure 8 shows again a distinctly different picture.

Burden of Disease in Northern Lincolnshire

The Slope Index is very similar to that of NL at 10.7 years, representing a high level if internal inequality. However, in this case the slope is not 'discontinuous' as with NL. All the confidence intervals between points on the graph overlap, showing that there is a more continuous decline across the deciles.

Again, in contrast to NL, the whole population is in a more disadvantaged position. It can be seen that:

- none of the deciles have an average life expectancy over 80 years

- 3 of the deciles (30%) have a life expectancy less than 75 years.

In the case of NEL therefore, any action plan to address inequalities will need to be proportionate across the whole population, rather than differentially targeted.

Figure 8 North East Lincolnshire: Slope Index of life expectancy (representing internal health inequalities)

Burden of Disease in Northern Lincolnshire
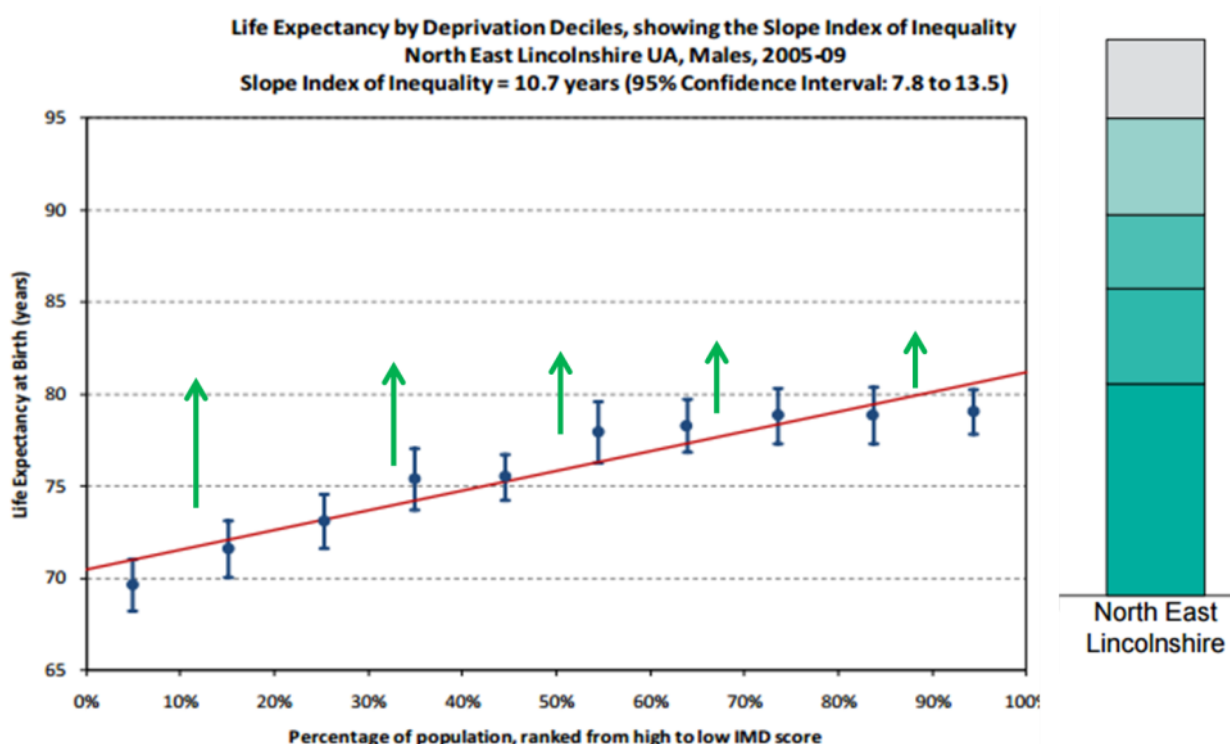
2. Local measures of Burden of Disease

Recent release of the findings of the UK component of the Global Burden of Disease Study (GBoD) emphasised a number of critical conclusions with relevance locally:

- *Health in England is improving although substantial opportunities exist for further reductions in the burden of preventable disease.*

- *The gap in mortality rates between men and women has reduced, but marked health inequalities between the least deprived and most deprived areas remain.*

- *Declines in mortality have not been matched by similar declines in morbidity, resulting in people living longer with diseases.*

- *Health policies must therefore address the causes of ill health as well as those of premature mortality.*

- *Systematic action locally and nationally is needed to reduce risk exposures, support healthy behaviours, alleviate the severity of chronic disabling disorders, and mitigate the effects of socioeconomic deprivation.* (Newton, 2015)

In particular, the issue that declines in mortality have not been matched by similar declines in morbidity mean that while the 'fatal burden of disease' and years of life lost (YLL) are reducing, the years of life with disability (YLD) are increasing.

This has important consequences in terms of pressure on the delivery of health and social care services, particularly in conjunction with rising demographic pressures of a growing and ageing population.

The GBoD study methodology has enabled estimates to be made of population levels of morbidity/disability which should have a direct relevance, enabling better estimates of the need for and potential demand on services. Some of that need is likely currently to be unmet. Such estimates will also provide intelligence to help to better target prevention initiatives.

It will be important, if change is to be achieved at population level, that burden of disease information is interpreted with respect to a number of key parameters, particularly:

- Across the life course

- Taking account of deprivation and its distribution

Figure 9 shows how the profile of mortality in men has been shown to differ by age between the quintiles of poverty in a study population. The relative change occurs progressively across the quintiles, but becomes particularly exaggerated in quintile 5, the poorest.

Figure 10 shows the situation for women. Here there is a distinctive dip across the quintiles in middle age, but again most exaggerated in the poorest quintile. This is thought to be explained by the relatively high rates of breast cancer commonly seen in the wealthiest part of the population.

It will be important to look for evidence of similar experience in Northern Lincolnshire.

Burden of Disease in Northern Lincolnshire

Figure 9 Mortality rate as a percentage of rate for wealthiest quintile (male)
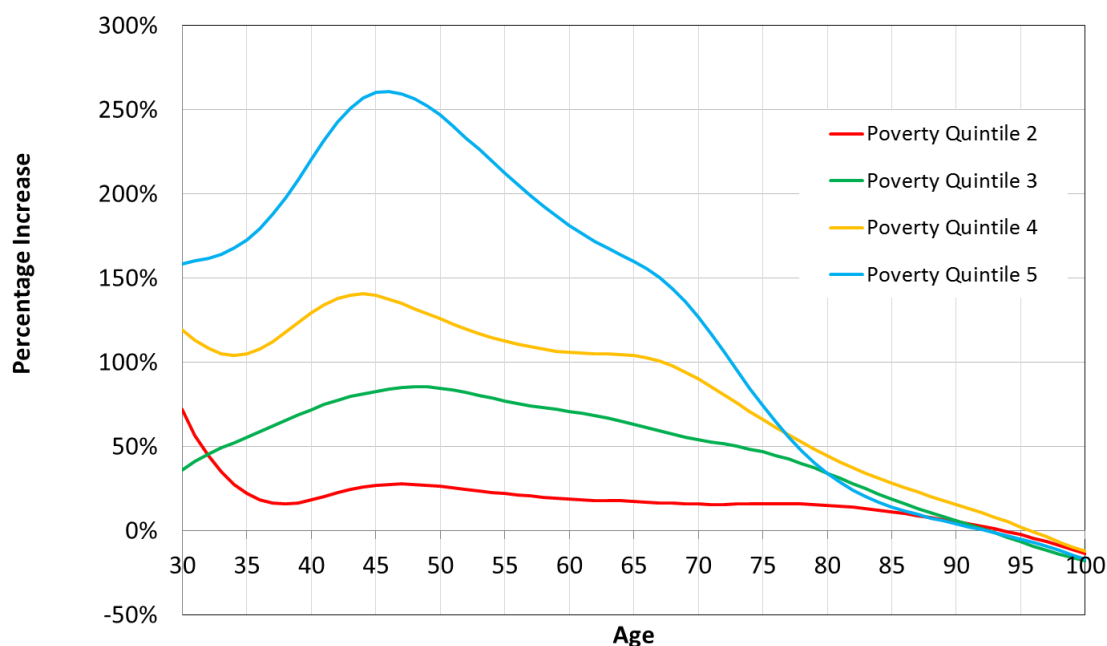
Figure 10 Mortality rate as a percentage of rate for wealthiest quintile (females)
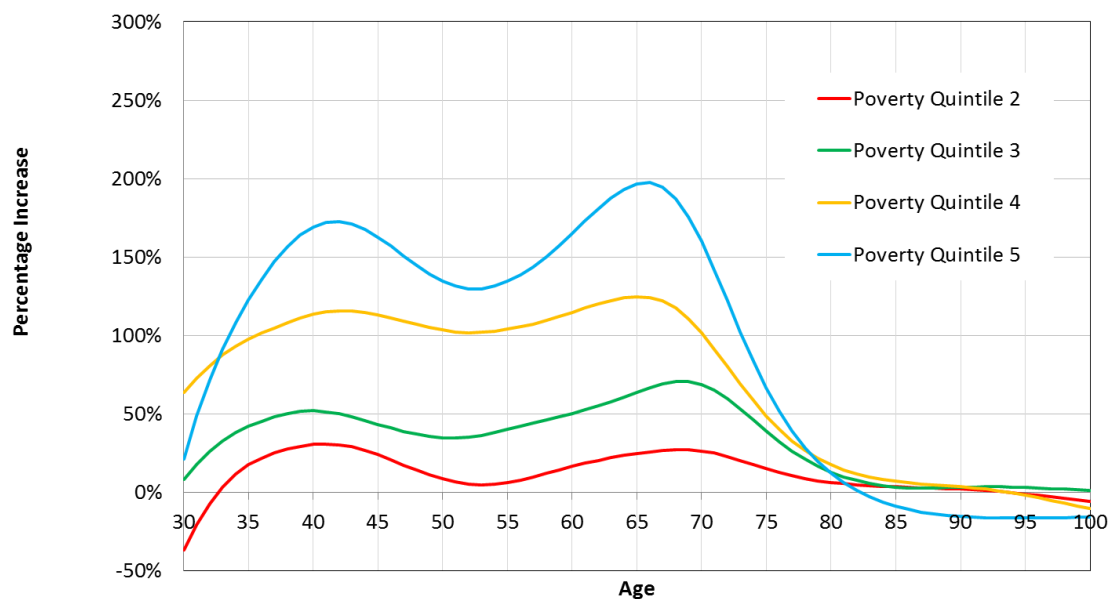
2.1 Fatal burden of disease – Years of life lost (YLL)

Figure 11 confirms the pattern of death by cause, largely confirming the pattern seen of excess deaths in Figure 4. However, this analysis also shows how the number and pattern of deaths is spread across the life course. Key features are:

Burden of Disease in Northern Lincolnshire

- A substantial contribution of deaths due to injury from 15 – 54. Overwhelmingly this is split between self-harm and road traffic accidents

- From age 35 gastrointestinal disease is a notable problem, and this is mainly cirrhosis of the liver caused by alcohol and viral hepatitis (hepatitis B and C)

- From age 45 cancers become the prime cause, in conjunction with cardiovascular disease and a smaller contribution from respiratory disease (a combination of COPD and pneumonia).

Figure 11 Years of Life Lost North Lincolnshire Males

Burden of Disease in Northern Lincolnshire
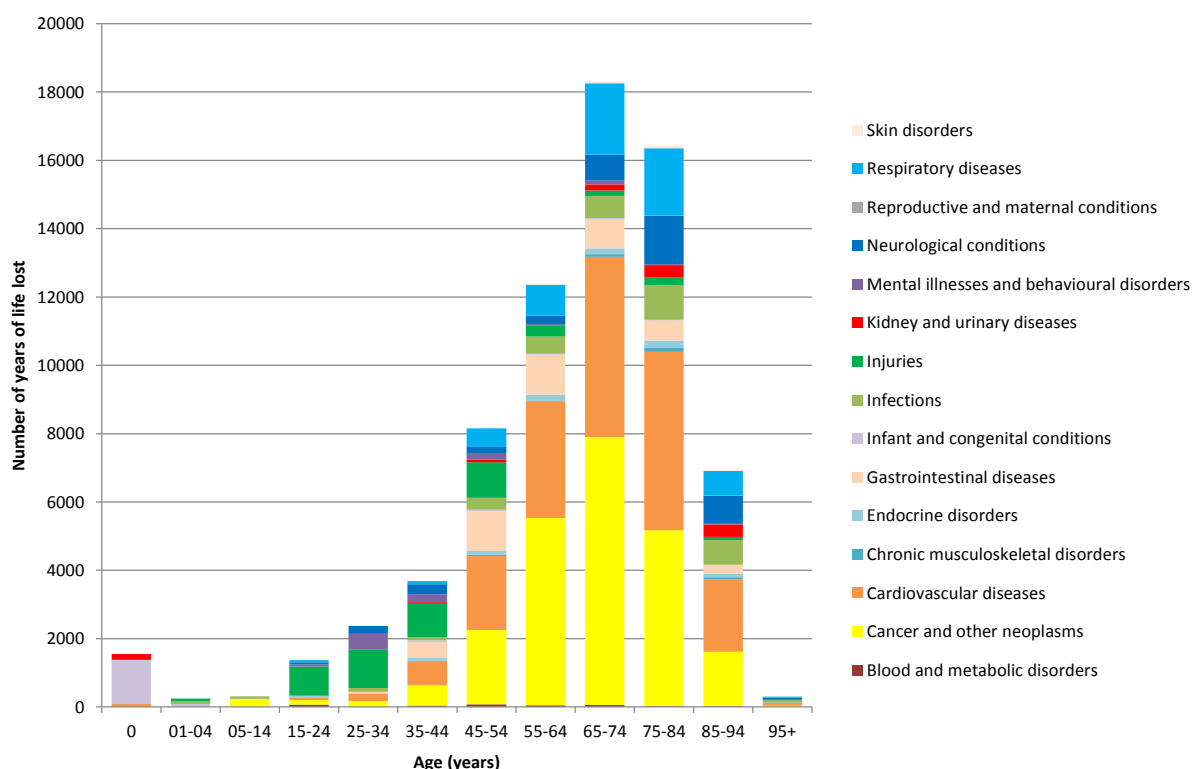
Figure 12 Years of Life Lost North Lincolnshire Males

NORTH LINCOLNSHIRE YEARS OF LIFE LOST:
MALES RESIDENT IN 20% LEAST DEPRIVED LSOAs (2011-2015)

NORTH LINCOLNSHIRE YEARS OF LIFE LOST:
MALES RESIDENT IN 20% MOST DEPRIVED LSOAs (2011-2015)

Legend:
- Skin disorders
- Respiratory diseases
- Reproductive and maternal conditions
- Neurological conditions
- Mental illnesses and behavioural disorders
- Kidney and urinary diseases
- Injuries
- Infections
- Infant and congenital conditions
- Gastrointestinal diseases
- Endocrine disorders
- Chronic musculoskeletal disorders
- Cardiovascular diseases
- Cancer and other neoplasms
- Blood and metabolic disorders

Burden of Disease in Northern Lincolnshire

The analysis behind Figure 12, however, demonstrates well the different distribution both of YLL spread over the life course and cause of death, between the most and least deprived quintiles of population. Some of the main features that emerge by comparison are that in the most deprived quintile:

- The majority of YLL occur before age 65, while in the least deprived quintile it is the opposite

- A substantial element of excess years of life lost under the age of 55 is due to injuries, the bulk of which relate to road accidents or self-harm.

- From ages 25 – 65 there are substantial excess YLL due to mental health and drug related deaths, and from gastrointestinal disease deaths, majority of which are cirrhosis. This splits by causation between alcohol related harm and infectious hepatitis, much, but not all of which occurs in injecting drug users.

- A large proportion of cardiac related YLL occur before age 65, while this is only limited to small numbers in the least deprived quintile.

- The effect of cancer is seen earlier in the life course, but overall there is less of an impact due to this cause over 65 years, possibly due to earlier deaths due to other causes in vulnerable people.

- Respiratory disease (COPD and pneumonia) has a greater impact from middle age, but particularly over age 65. There may be some overlap diagnostically with lung cancer undiagnosed in smokers with chronic cough.

Figure 13 shows the profile of YLL for women in North Lincolnshire.

Figure 13 Years of Life Lost North Lincolnshire Females

Burden of Disease in Northern Lincolnshire
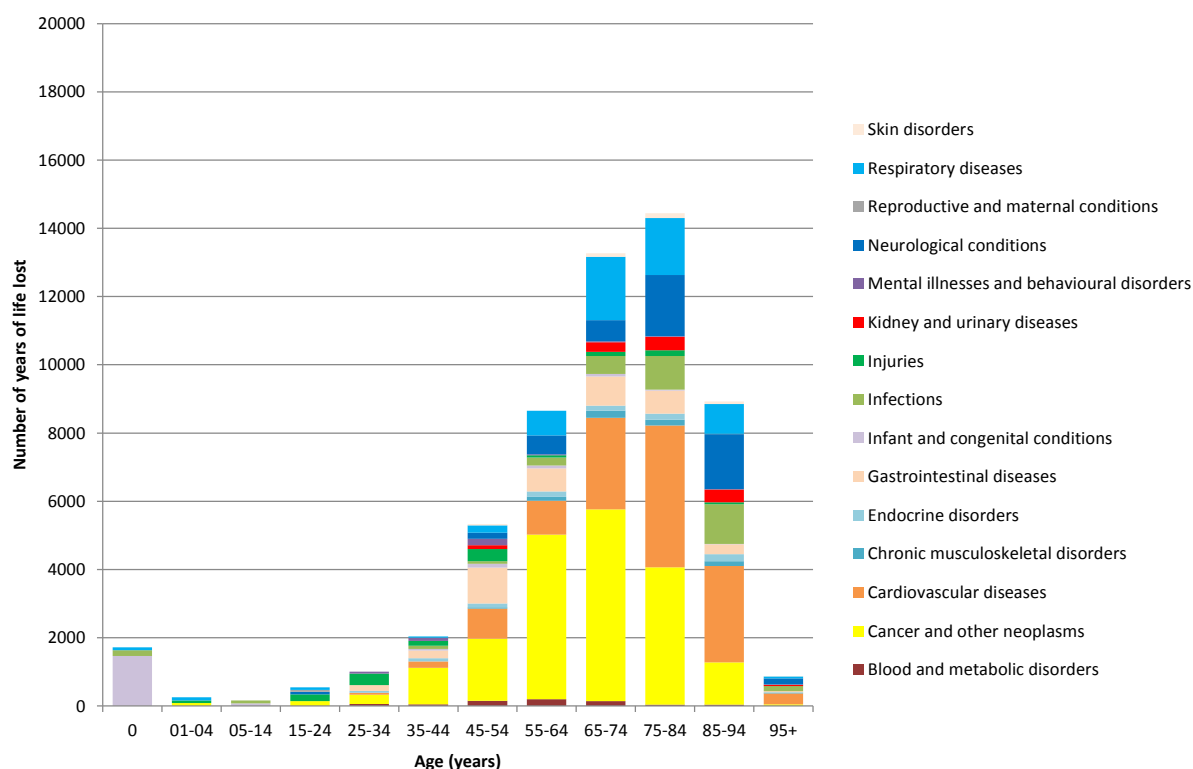
In comparison to the male pattern:

- Cancer, cardiovascular and respiratory deaths also predominate, with some cirrhosis deaths across the life course

- There are less injury related deaths in the earlier years, or at all

- In addition, there are a more significant number of neurological related YLL. There are a variety of causes in this category, but the majority are classed as Alzheimer's dementia

Figure 14 shows how age distribution and cause vary by deprivation quintile.

Burden of Disease in Northern Lincolnshire

Figure 14 Years of Life Lost North Lincolnshire Females

Burden of Disease in Northern Lincolnshire
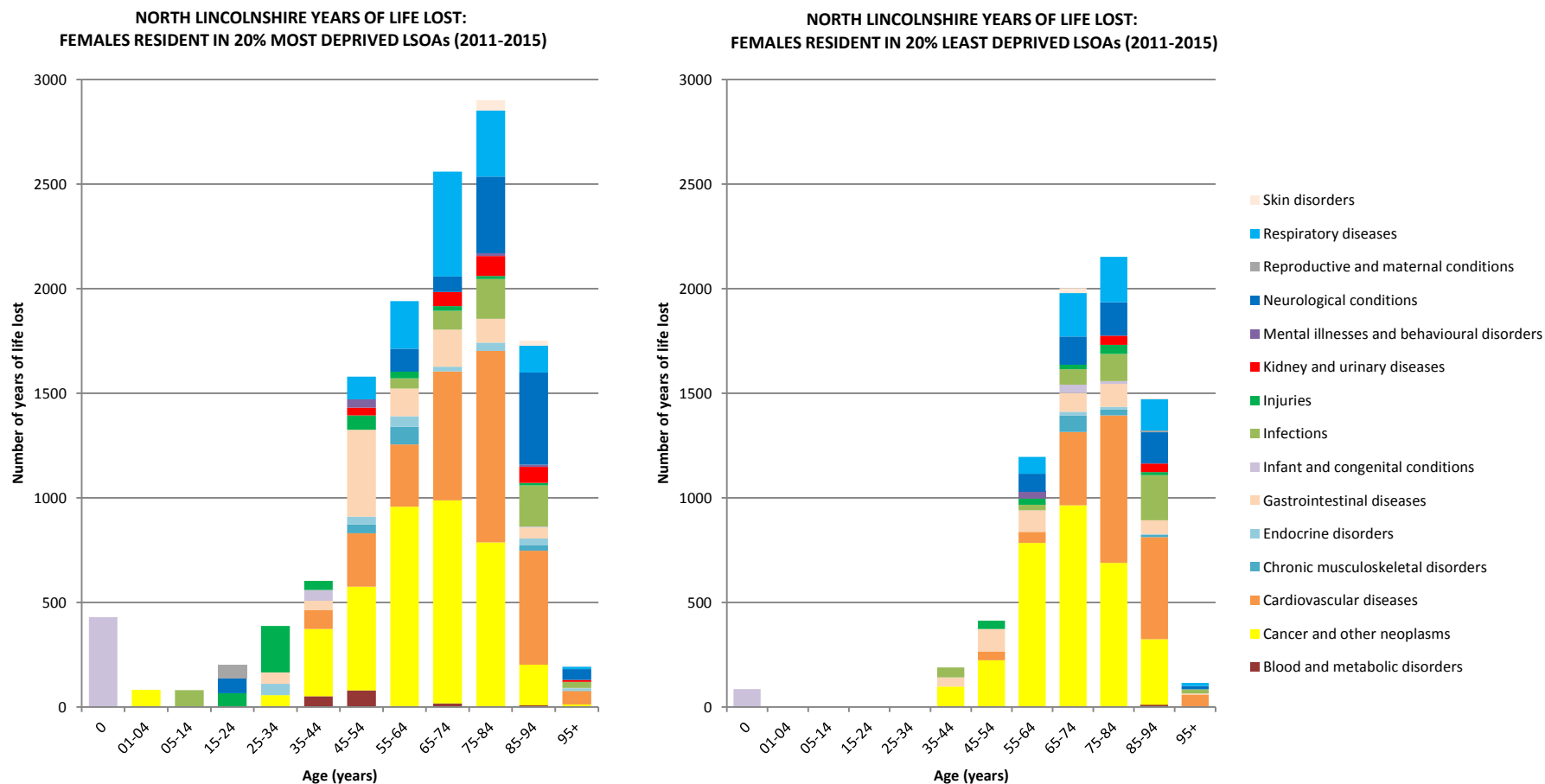
For the female population, as with the male, the most deprived quintile sees a higher proportion of YLL before age 65 than the least deprived. However this is less exaggerated.

Overall the balance of causes is similar in the two quintiles, but scaled up in the most deprived quintile.

Cancer is an exception, being similar in pattern and extent in the two quintiles. This is likely to result from a balancing out, with greater incidence of breast cancer in the least deprived, and greater incidence of lung cancer in the most deprived.

The main difference otherwise is the greater prevalence of gastrointestinal causes, probably cirrhosis.

2.2 Years of Life with Disability (YDD)

Having established the pattern of fatal burden of disease it is important to develop an understanding of the extent to which life years are affected by various forms of disease and disability. Providing estimates of this is not straightforward, or easily measured directly on a local basis, other than examining the use of services (see later) which provides only a partial and patchy picture.

Best proxy is now provided by analysis and extrapolation of data from the UK Global Burden of Disease Survey (UK GBoD). The results of analysis are available down to 'regional' level, and below that to populations aggregated to quintiles of deprivation at local authority level. On this basis, Northern Lincolnshire comes within Yorkshire and Humber Region, and within that, NEL is in Quintile 2 and NL in Quintile 5 (least deprived).

Figure 15 shows the Years of Life with Disability (YLD) by age and by cause for NEL males.

Burden of Disease in Northern Lincolnshire

Figure 15 North East Lincolnshire Males Years of Life with Disability (YLD)
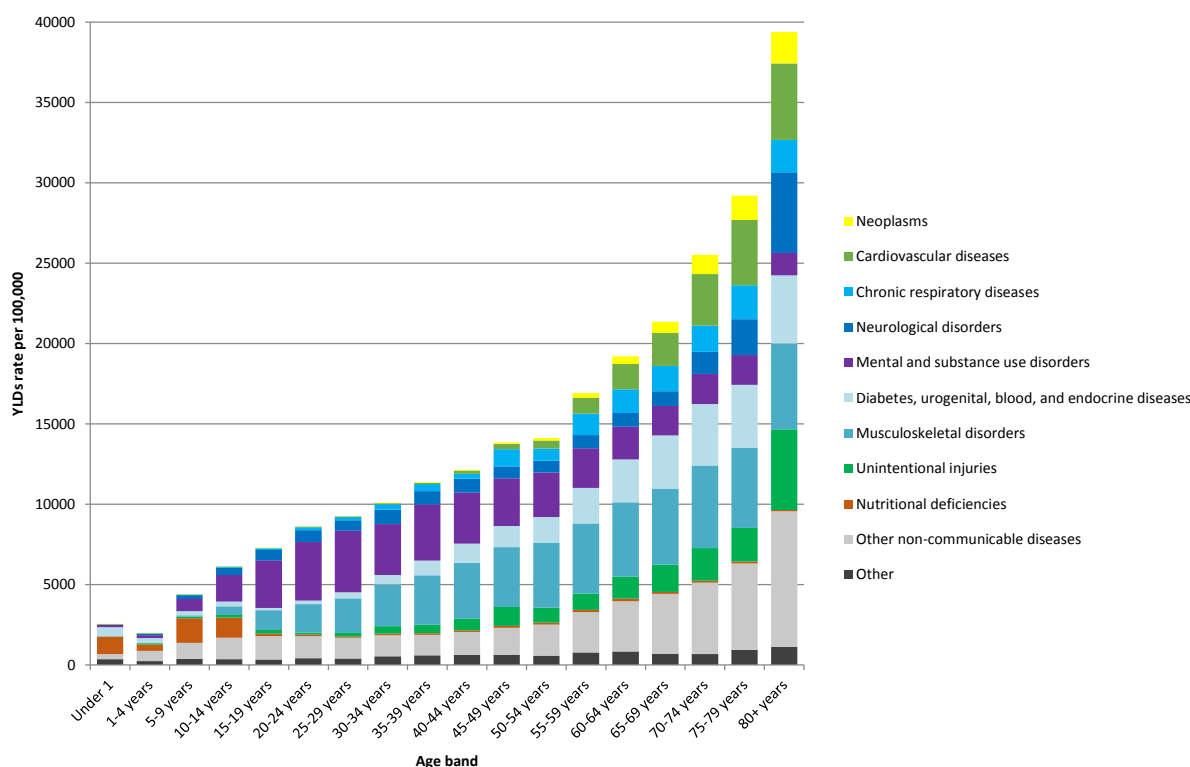
Important key observations for practical purposes include:

- Leading causes of mortality, (cardiovascular; cancer; respiratory) only represent a relatively small proportion of disability compared to other major causes.

- Diabetes is a significant contributor, growing in importance from an early stage.

- Gastrointestinal disease does not feature significantly in relation to disease burden.

- Most conditions increase in proportion to age, except for mental health and drug disorders, which peak in young middle age.

- Unintended injury increases with age, peaking particularly over 80 years. This mainly represents results of falls.

- Otherwise, bulk of the burden in older age comes from 3 categories: neurological; musculoskeletal; other'

Drilling down to the main conditions represented by these last 3 categories, Figure 16 illustrates that:

- Neurological disease is dominated by migraine in middle age, and predominantly by Alzheimer's dementia in later life (categorised here, not as mental health)

- Musculoskeletal is more about back and neck problems than osteoarthritis

- 'Other' is dominated by Sensory problems, mainly hearing and eyesight

Burden of Disease in Northern Lincolnshire

The size of the burden of these conditions, is major, particularly moving into life after 65 and again after 80 years of age. Each will make a significant impact on frailty and functional decline. While dementia is receiving considerable attention and resource as a major disease of ageing, there are as yet few interventions available to reduce its incidence, other than the probable impact of addressing circulatory disease on vascular dementia.

Back and neck problems and sensory disorders have not been a major focus of population health, and so prevention and early management are not being addressed currently with system and scale.

Figure 16 North East Lincolnshire: detailed composition of major BoD categories (male)

Burden of Disease in Northern Lincolnshire
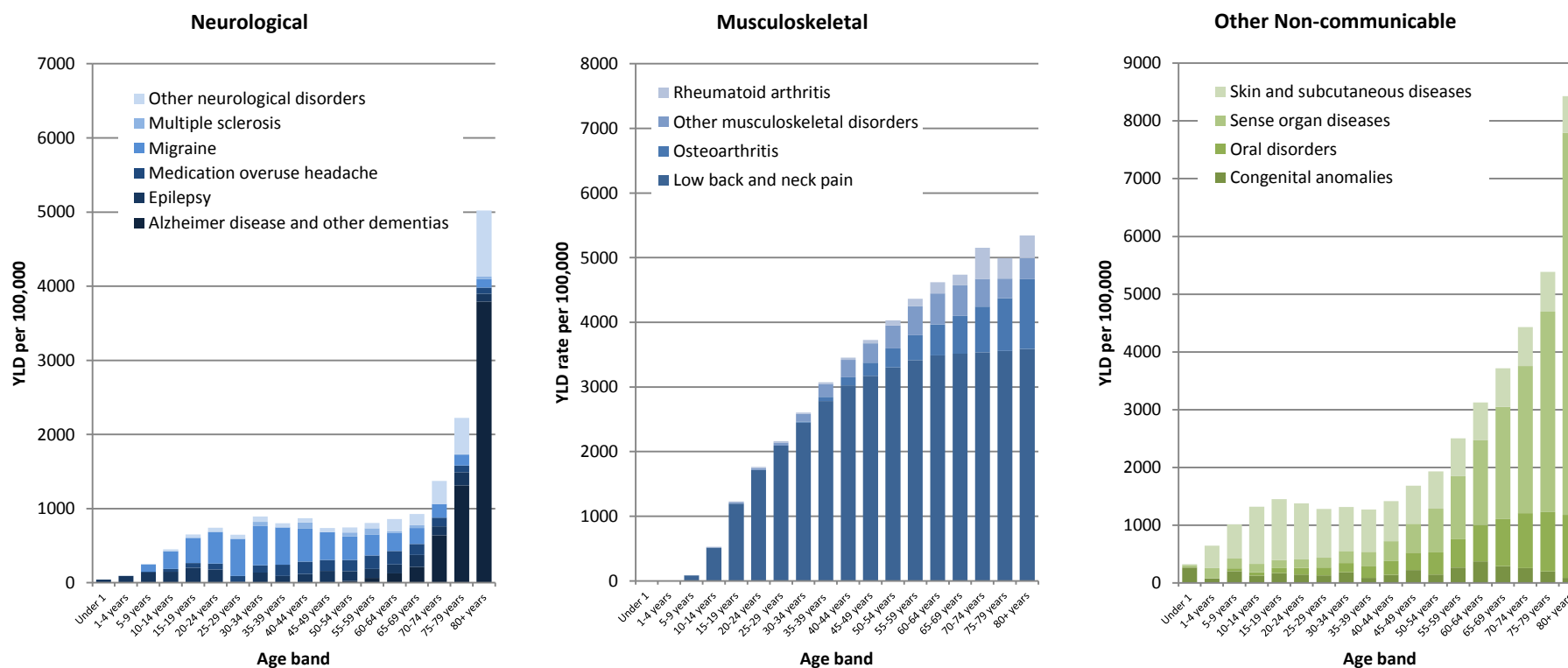
For the female population, the burden of disease as measured by YLD would seem to be less substantial overall than for males, but the overall pattern of disease is quite similar. The impact of migraine in young middle age is however substantially greater. The contribution of musculoskeletal disease (mainly back and neck pain) is proportionately and in absolute terms, greater than for men. Reproductive health issues are excluded from this analysis.

Figure 17 North East Lincolnshire Females Years of Life with Disability (YLD)
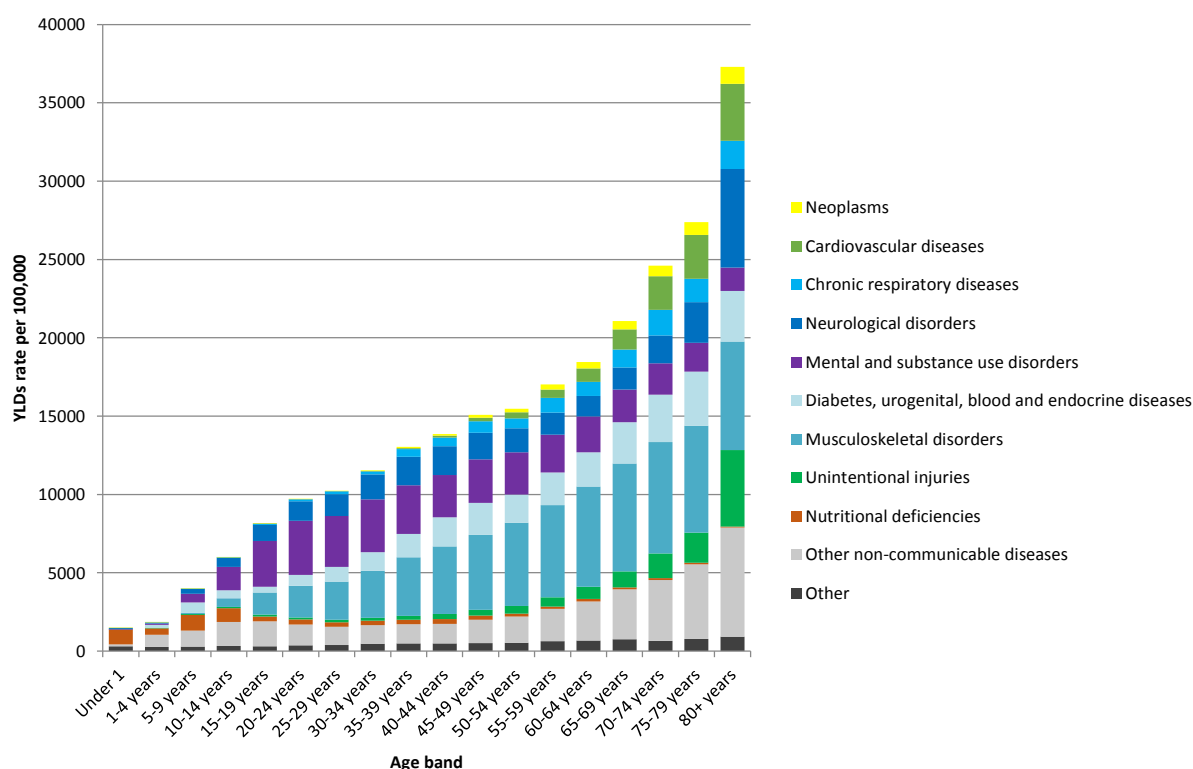
The pattern of YLD in North Lincolnshire is very similar to that of North East Lincolnshire, for males and for females. However the size of the burden is substantially greater in the 65 year age group and above in NEL.

It is worth giving consideration slightly separately to the burden of mental health and drug disorder issues. With a little local variation, there is a substantially similar burden of disease for males and for females across the two Districts. In each case the disease burden rises rapidly from age 15, and peaks steeply in the 25 – 29 year age group. It then falls away gradually into older age.

Across the age range, for both sexes, depression dominates, and stays relatively constant. Anxiety disorders do peak in later middle age, and are less a feature for the male population, though still substantial. Otherwise distinctive features include the following.

For males:

- There is a substantial contribution from 'conduct disorder', from age 5 to 24yrs. more so than for females

- Alcohol use and drug use disorders are substantial contributors from 15 through to the early 50's. Both issues are a greater burden in NEL.

Burden of Disease in Northern Lincolnshire

- Schizophrenia is a substantial issue from 30 through to early 60s in both Districts.

For females:

- In young adulthood, drug and alcohol use problems are less of a problem than for males. However, the problem of eating disorders is substantial in this age group.

Figure 18 North East Lincolnshire: Mental health and drug disorder (YLD)

Males

Females

Legend:
- Other mental and substance use disorders
- Idiopathic intellectual disability
- Eating disorders
- Drug use disorders
- Depressive disorders
- Conduct disorder
- Bipolar disorder
- Autistic spectrum disorders
- Anxiety disorders

Burden of Disease in Northern Lincolnshire
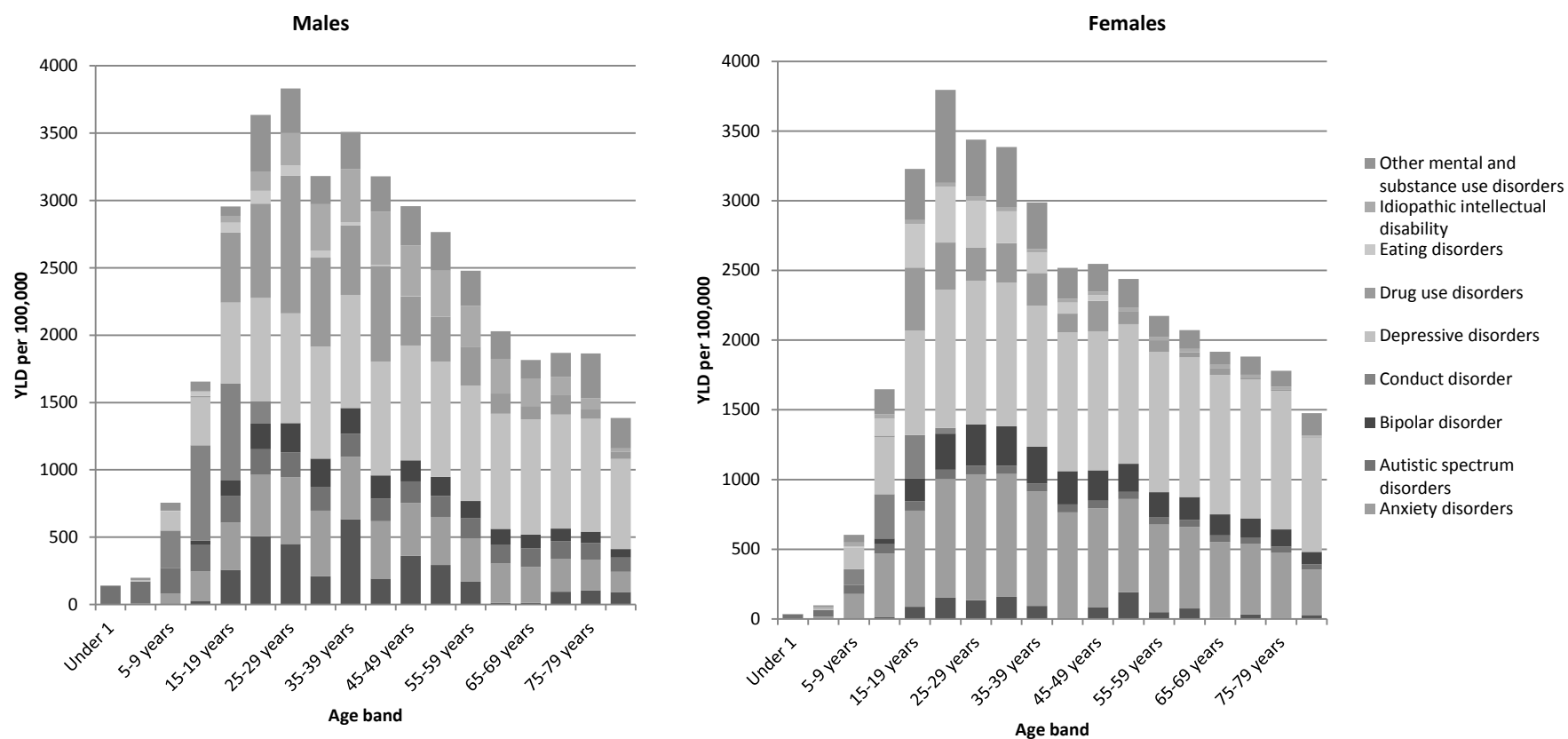
2.3 Impact on the use of hospital services

Planning for disease prevention as well as health and social care services needs to take into account both the fatal and disability burdens of disease. However, data available to asses matched service delivery according to need predominantly comes from the hospital sector.

Figure 19 show the admissions by primary cause of North East and North Lincolnshire. The pattern in both Districts is substantially similar, partly reflecting their use of the same hospital service and therefore the same pattern of provision.

Figure 19 Hospital admissions for Northern Lincolnshire

Burden of Disease in Northern Lincolnshire
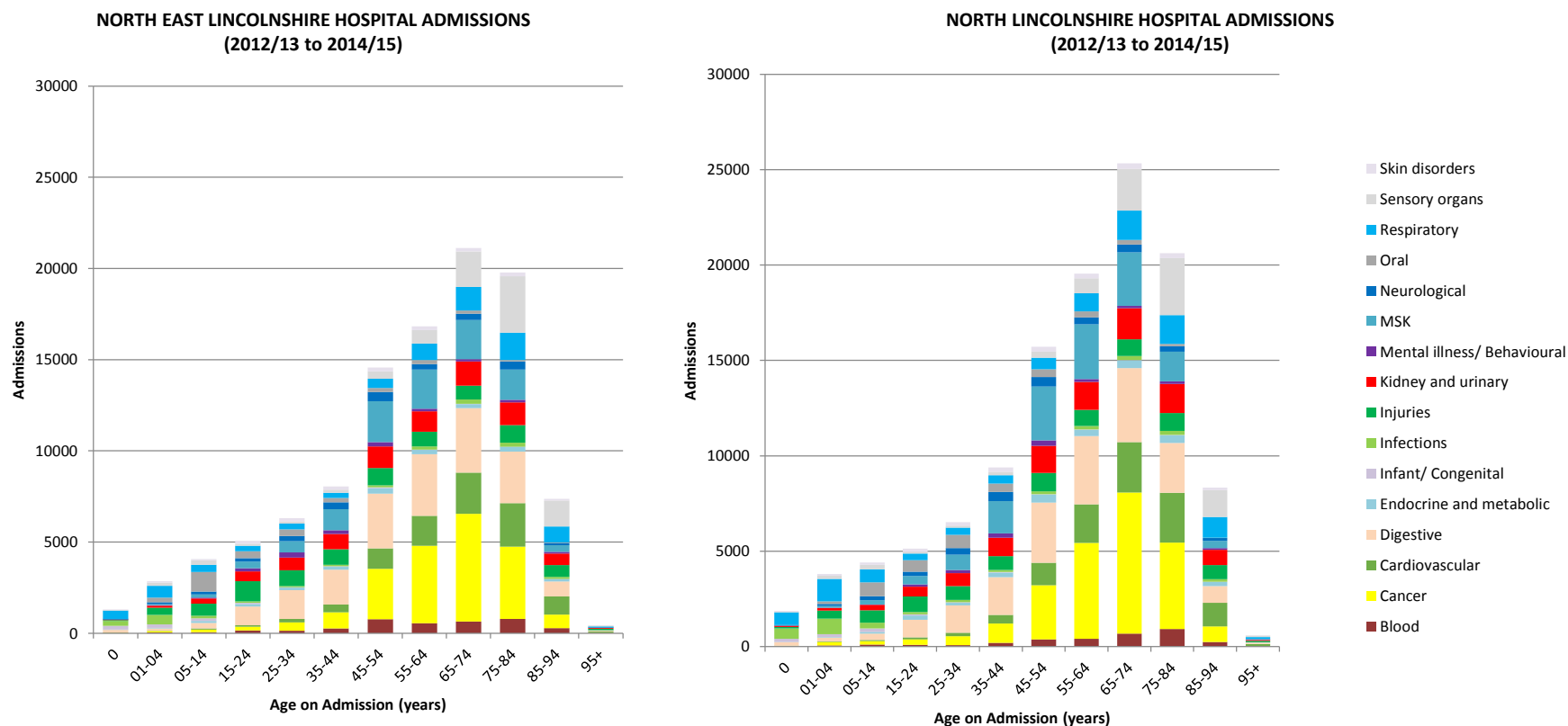
Both Districts have similar population size, but North East Lincolnshire has substantially higher levels of deprivation. It might, therefore, have been expected that the larger number of admissions would come from NEL. However, the reverse is true. It is likely that this reflects the higher proportion of elderly in the NL population.

The case mix does roughly reflect the burden of disease, but mainly to the extent that:

- Main causes of death (cardiac; respiratory) will be reflected in non-elective admissions

- The largest segment, cancer will be reflected in elective and non-elective admissions

- Musculoskeletal, sensory and gastrointestinal admissions, elective and non-elective will largely focus on surgical or possible surgical components of care.

The analysis is of admissions only and not ambulatory care. Mental health admissions largely take place in another Trust and are not included.

An important output of the analysis is to recognise the extent to which there is differential use of the hospital services from across the Districts.

Burden of Disease in Northern Lincolnshire

Figure 20 North Lincolnshire hospital admission rates relative to 20% most affluent LSOAs

Burden of Disease in Northern Lincolnshire
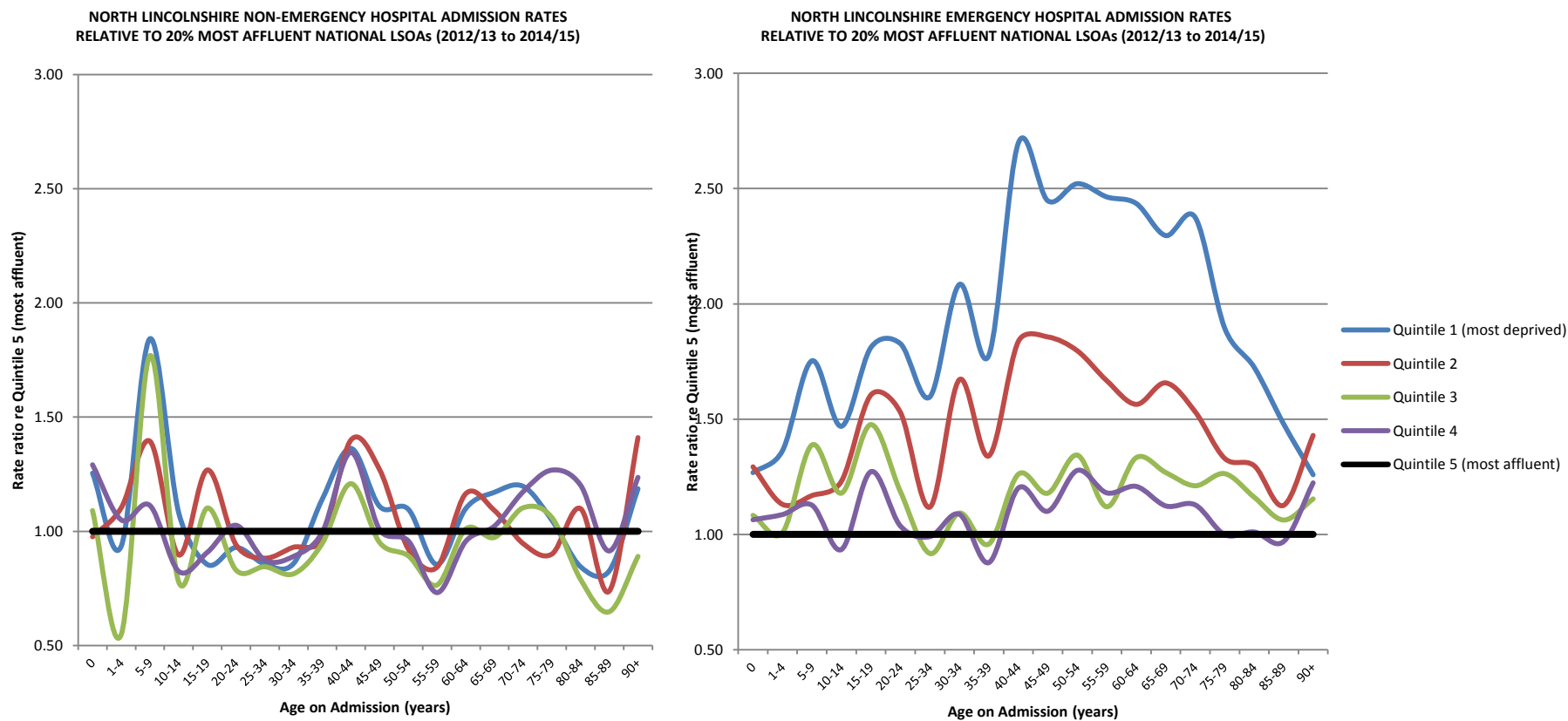
Figure 20 compares the admission rates for each deprivation quintile of NLs population, compared, as a ratio, to that of the least deprived population quintile. The ratio of rates has been separated into elective and emergency admissions. It can be seen that:

- The rate of elective admissions is approximately the same for each quintile. This is surprising, since the burden of disease analysis has shown very different levels of need across the quintiles. Relatively speaking, this suggests that the levels of access and demand may not reflect need appropriately.

- In contrast there is a dramatic difference in the level of emergency admissions, with particularly high use from the most deprived (and second most deprived) quintiles. This is likely to suggest that inappropriate or ineffective use is being made of strategies and services to manage risk and support self-care, resulting in a greater dependency on crisis management.

The pattern of hospital use is significantly different for NEL, as seen in Figure 21 where:

- The more deprived quintiles do show a greater use of elective hospital services than the national least deprived quintile population, particularly for ages 40 - 65. This suggests different culture of referral policy and practice across the two Districts.

- There are also much greater levels of emergency admissions across the age range than the national quintile 5, in this case for the NEL quintiles 1 – 3.

The pattern is different to NL, in that the peak occurs in the age range 40 – 65, but is not sustained to the same level in the older age range, as seen in NL.

Burden of Disease in Northern Lincolnshire

Figure 21 North East Lincolnshire hospital admission rates relative to 20% most affluent LSOAs

NORTH EAST LINCOLNSHIRE NON-EMERGENCY HOSPITAL ADMISSION RATES
RELATIVE TO 20% MOST AFFLUENT NATIONAL LSOAs (2012/13 to 2014/15)

NORTH EAST LINCOLNSHIRE EMERGENCY HOSPITAL ADMISSION RATES
RELATIVE TO 20% MOST AFFLUENT NATIONAL LSOAs (2012/13 to 2014/15)

Quintile 1 (most deprived)
Quintile 2
Quintile 3
Quintile 4
Quintile 5 (most affluent)

Burden of Disease in Northern Lincolnshire
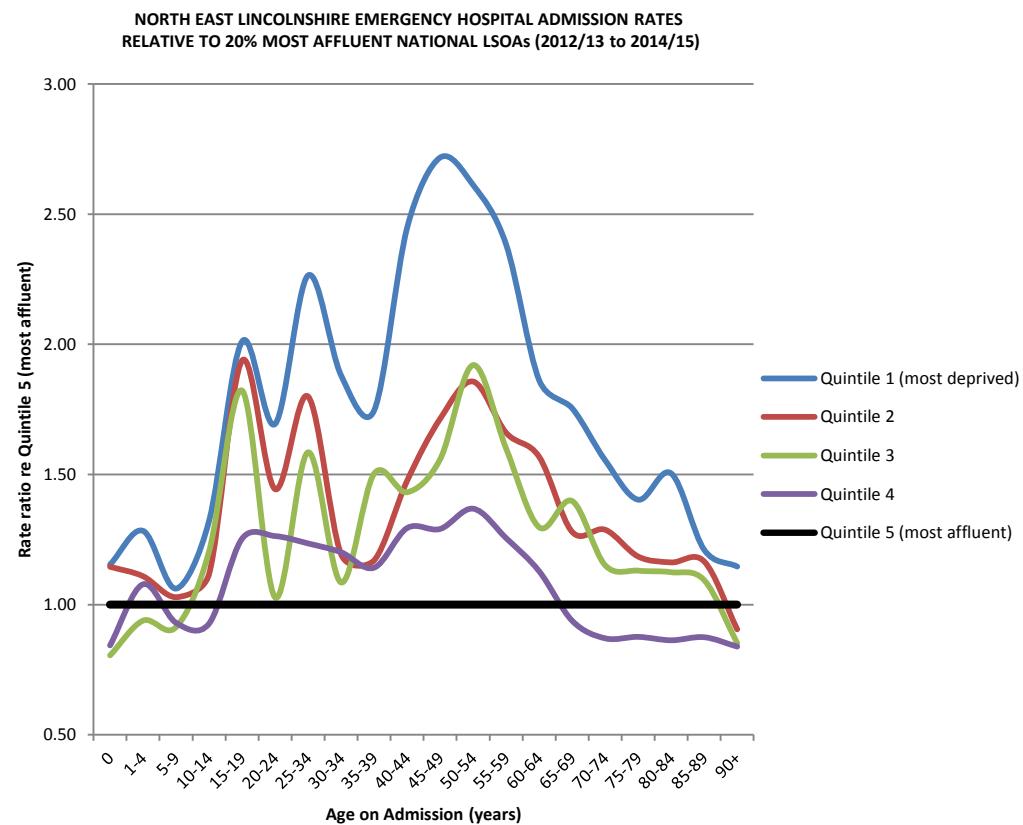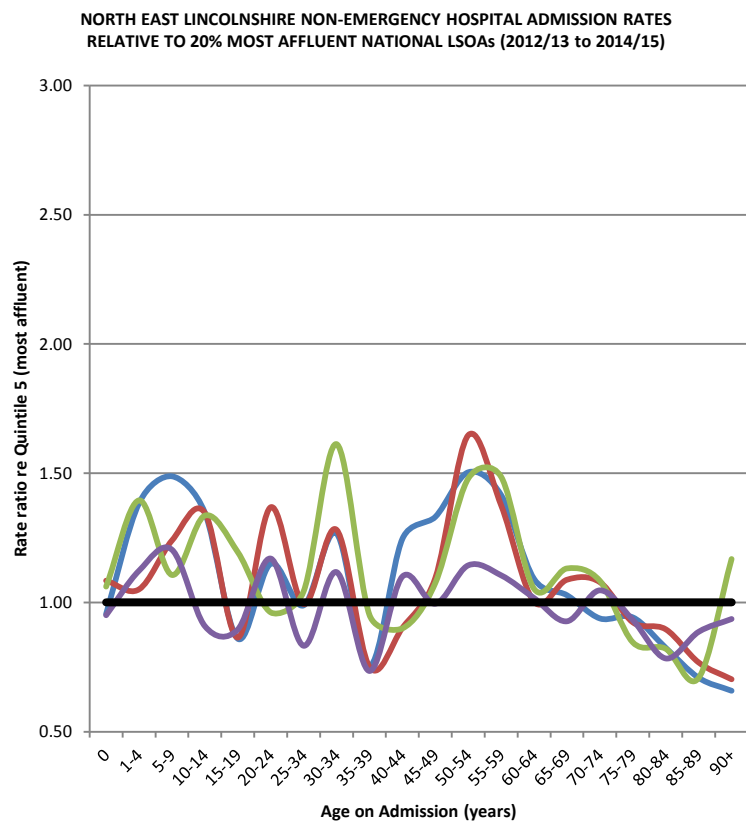
One theory as to why the high emergency admissions rate persists more in NL rather than NEL is that some of the more deprived neighbourhoods in NL are now seeing the development of a number of care and nursing homes, taking advantage of the more affordable property prices. This would change the balance of dependency of the elderly population overall in these areas. This theory will need testing.

2.4 Expenditure as a proxy for use of services

There are no measures of health service use in the primary care and community care sectors comparable to the Hospital Episode Statistics. Figure 22 and Figure 23 are included to give estimates of current spend on the top 10 service demands by sector to provide some proxy, not of workload, but of putative resource commitment. This is not meant to examine relative programme budgeting comparisons.

While mental health expenditure stands out, this reflects the pooling together of a range of complex pathologies (see Figure 18). Corresponding diversity within physical health are separated into a wide range of specialties.

It is seen that otherwise, hospital expenditure dominates completely. Identified primary care expenditure is prominent particularly in cardiovascular and respiratory disease, and for 'endocrine' which is predominantly diabetes. It is of particular interest that expenditure patterns in primary care do not seem to reflect the major burdens of disease/disability of musculoskeletal disease (back and neck) or of sensory problems (hearing and poor sight).

The differential component of the green 'community services' element of the charts reflects the Community Care Plus configuration of service commissioning and provision in NEL.

Figure 22 North Lincolnshire Top 10 Healthcare Costs

Burden of Disease in Northern Lincolnshire
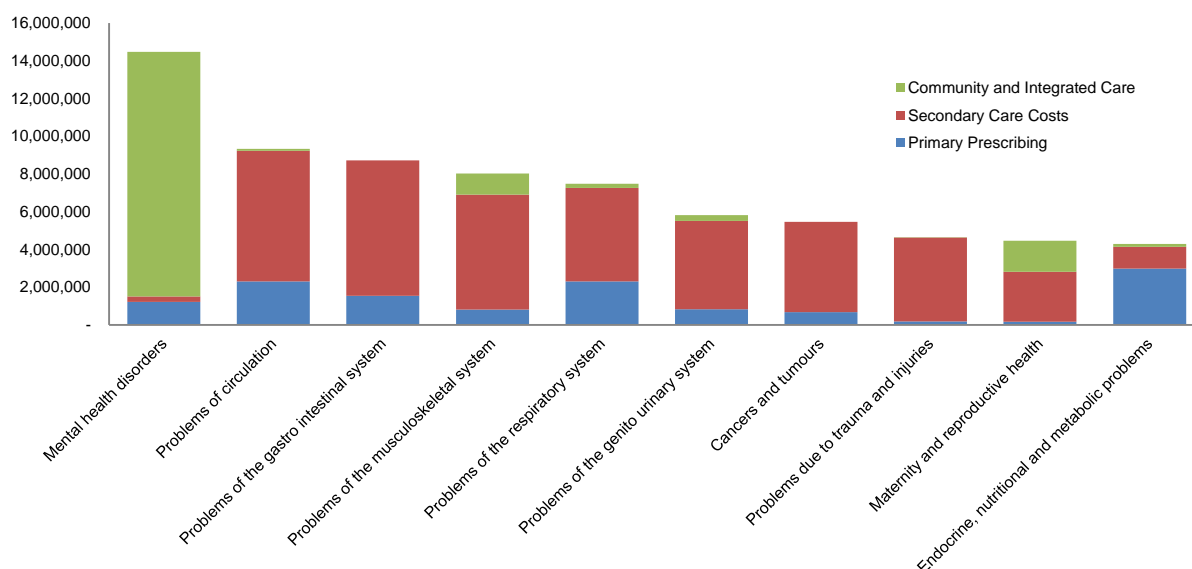
Figure 23 North East Lincolnshire Top 10 Healthcare Costs
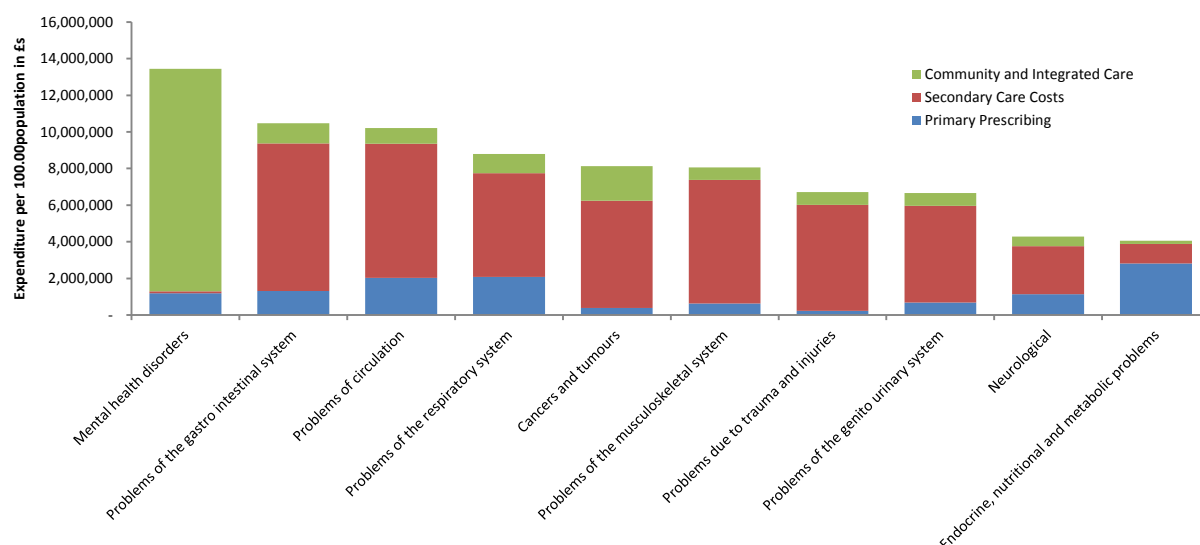
2.5 Attributable causes of burden of disease

A useful schema illustrating the complex range of factors contributing ultimately to the burden of disease is shown as Figure 24.

The social determinants or 'causes of the causes' of inequalities in health (e.g. poverty; discrimination; steep power hierarchy) can affect health directly. These factors, particularly in combination will result in psychosocial risks (e.g. low self-esteem; isolation; loss of purpose in life). These stressing factors can again by themselves result in physical as well as mental (and spiritual) impacts on the body. They also will tend towards behaviours providing short term gratification and escape (e.g. drug and alcohol addiction).

These factors alone and in combination affect the metabolism and psyche, increasing the incidence of the major diseases, particularly cardiovascular disease, cancers, respiratory and liver disease. There are no specific differential diseases of poverty or deprivation. The determinants described result in the diseases common within the whole community. However, these diseases may as a result occur at an earlier stage in the life course (e.g. see Figure 13).

Burden of Disease in Northern Lincolnshire

Figure 24 Major determinants with impact on Wellbeing and Health (after Labonté)
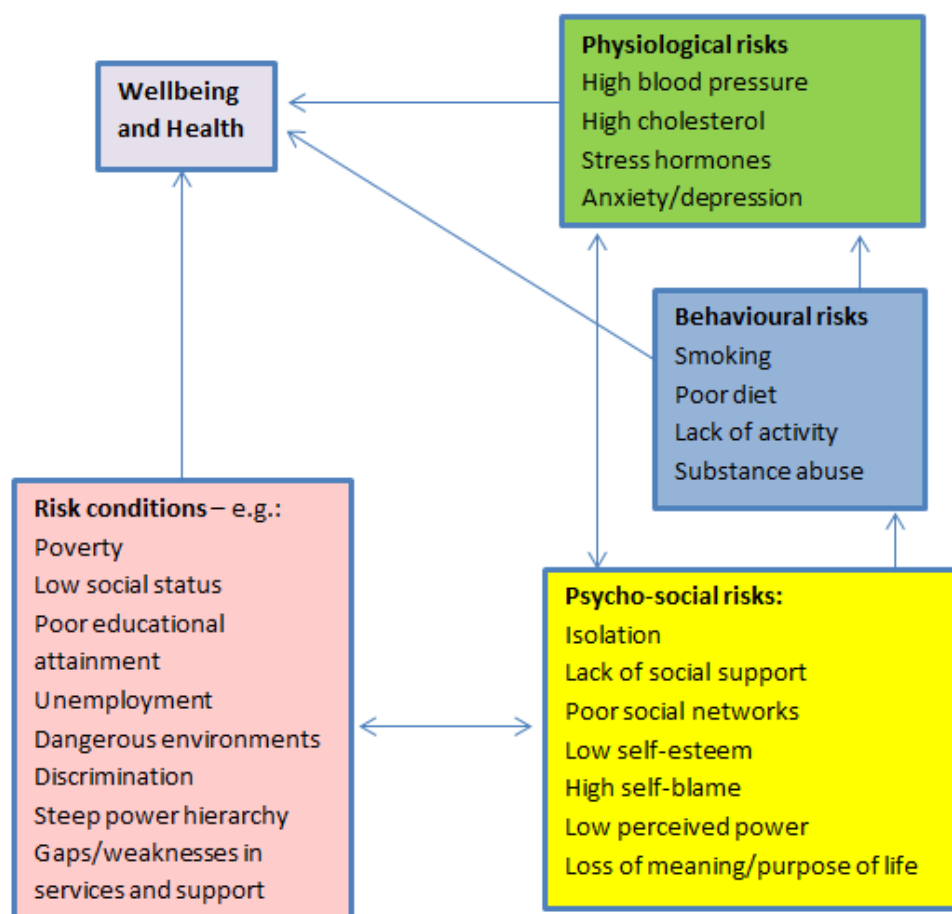
A range of indicators are available routinely which demonstrate how the populations of Northern Lincolnshire compare for some of these factors with regional/national comparators (Figure 25).

Figure 25 Key indicators for social determinants and risk behaviours

Burden of Disease in Northern Lincolnshire
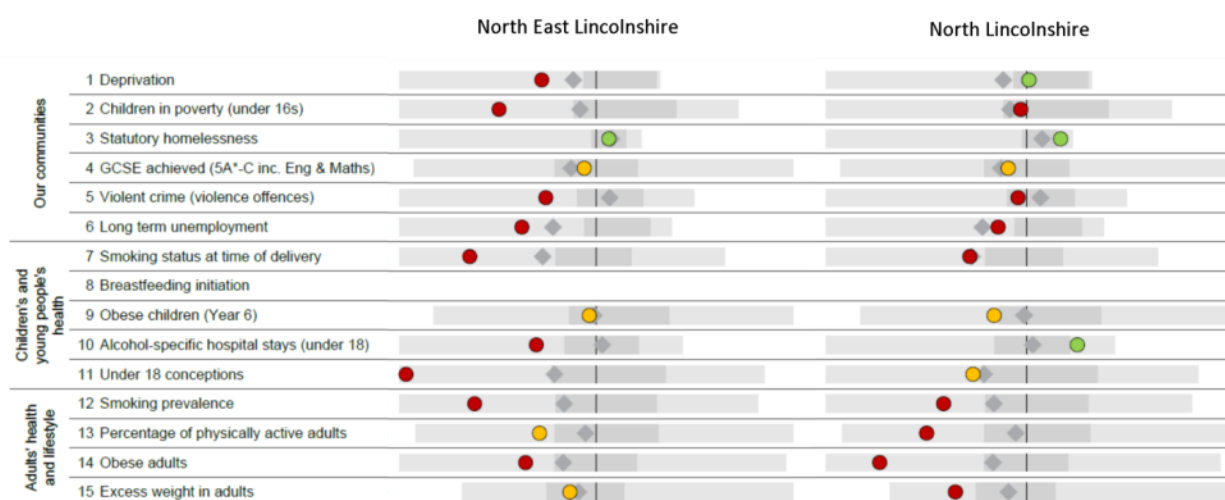
In terms of the social determinants of health, both districts are seen to be 'red rated' (significantly worse than the England average) for the key indicators of children in poverty, violent crime and long term unemployment.

North East Lincolnshire, but not North Lincolnshire, is also red rated for GCSE achievement, with only 52% of children reaching 5 A* - C including English and maths. For another important indicator, not shown here, NEL are amber rated (not significantly different from the England average) for proportion achieving good school readiness (66.8%), an indicator of good early years' development. NL is green rated (70.1%)

The key indicators for children and young people's health risks show both NEL and NL red rated for smoking of mother in pregnancy. Again, NEL but not NL is also red rated for breastfeeding initiation, alcohol specific hospital stays (under 15) and teenage conceptions.

Indicators of behavioural risks in adults show a mixed picture. Both districts are red rated for smoking prevalence, and also for the prevalence of obesity, although NL is more of an outlier in this case. NL is also significantly worse for adults with excess weight, and adults not physically active, for both of which NEL rates amber.

All of these indicators are chosen to reflect the population risk of increased burden of disease. In general, the distribution of higher risk within the Districts is likely to map roughly with the neighbourhood deprivation score. Programmes which successfully target reduction of each of these risks, singly or preferably in clusters, are likely to reduce the burden of disease over time. This data shows that the need and scope for change from programmes to reduce these risks is significant in Northern Lincolnshire. If effective there could be a marked decrease in the overall burden of disease over time.

Burden of Disease in Northern Lincolnshire

3. Trends in the Burden of Disease locally

Projecting the burden of disease forward locally is complex, as for most conditions there are not reliable measures of disease as a baseline. The usual indicator continues to be mortality rates. However, as stated, changes in mortality are not reflected in years lived with disability (YLD), or do not reflect levels of inequality.

Conceptually, a useful case study attempting to project healthcare expenditure forward was carried out in Australia, building on GBoD methods (Vos, 2010). Their analysis focussed on the impact of population increases and ageing on future disease burden and expenditure. It can be seen from Figure 26 that the projected prevalence of heart disease was falling substantially, while that of diabetes was continuing to rise, a situation similar to that reported in the UK.

Figure 26 Australian prevalence estimates for CHD and diabetes
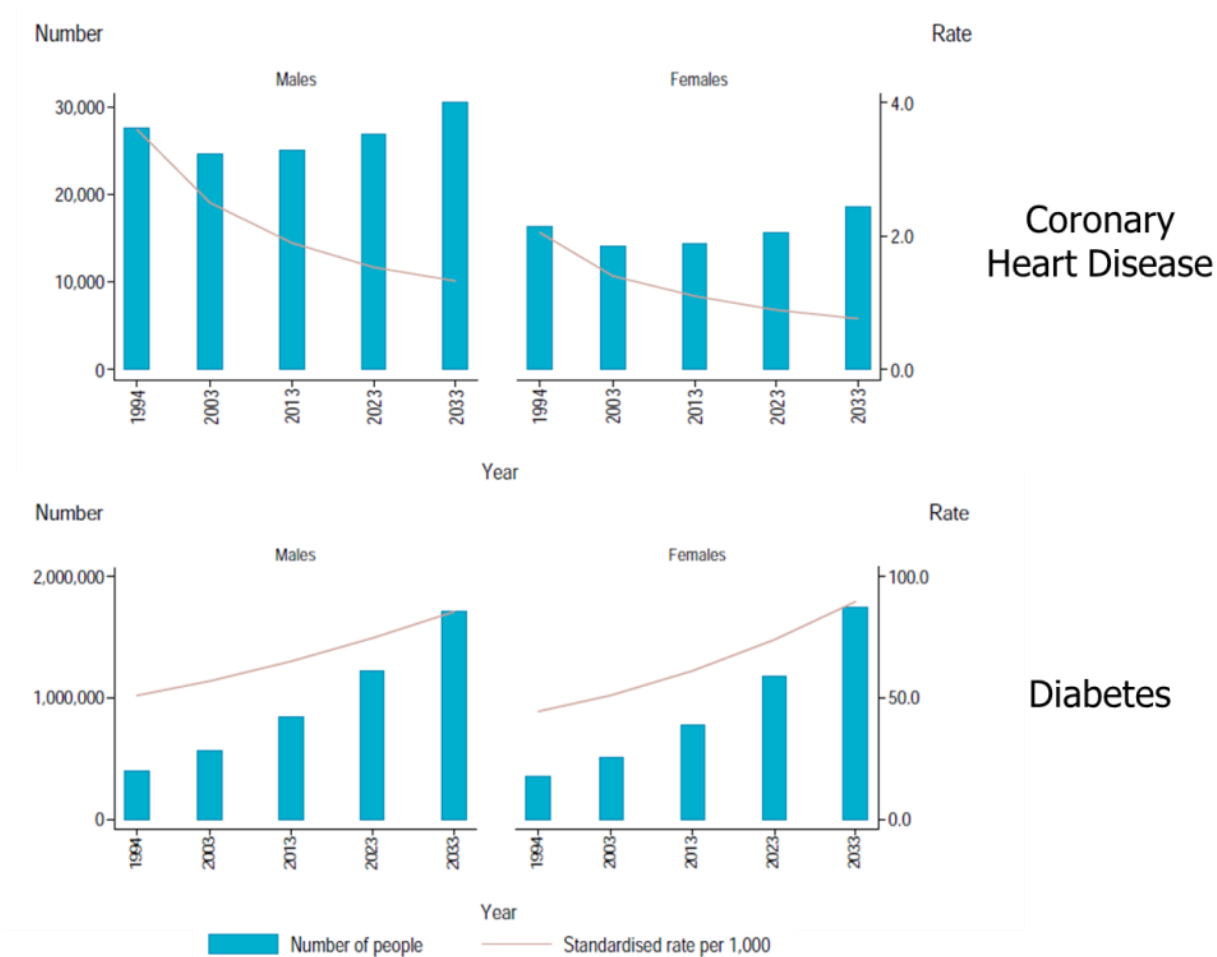
Despite these differences the projections (Figure 27 and Figure 28) show that the burden and costs for both diseases will continue to rise substantially, although sharply more so for diabetes.

Burden of Disease in Northern Lincolnshire

Figure 27 Projection of health care expenditure for cardiovascular disease (Australia)
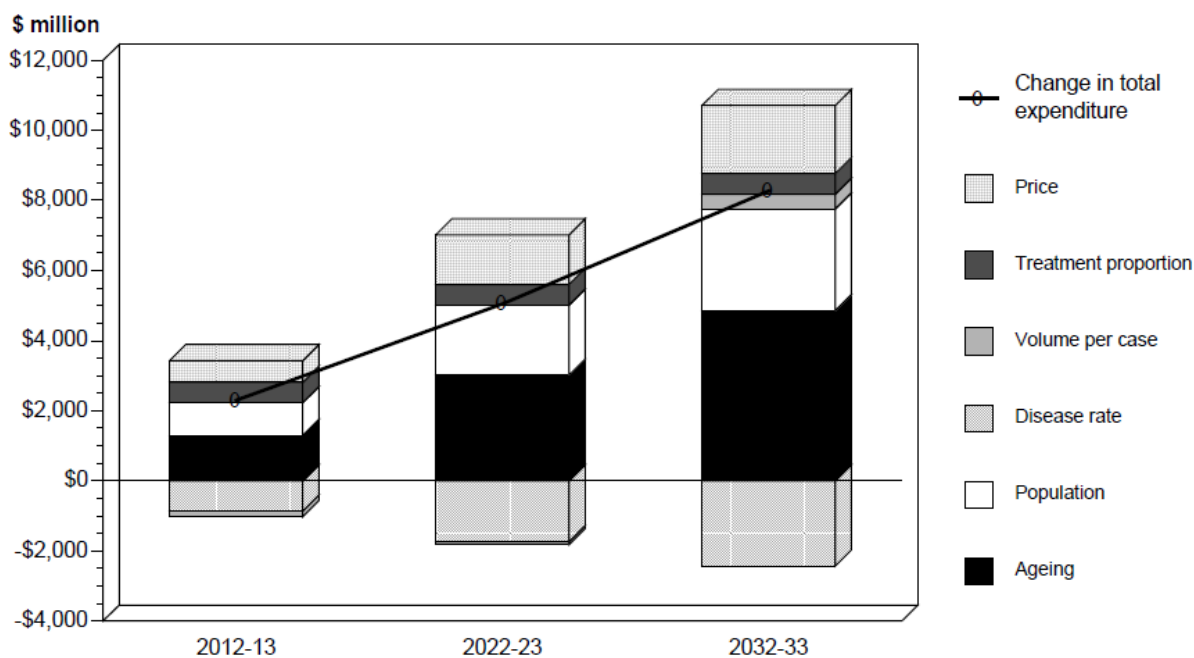
Figure 28 Projection of health care expenditure for diabetes (Australia)

Burden of Disease in Northern Lincolnshire
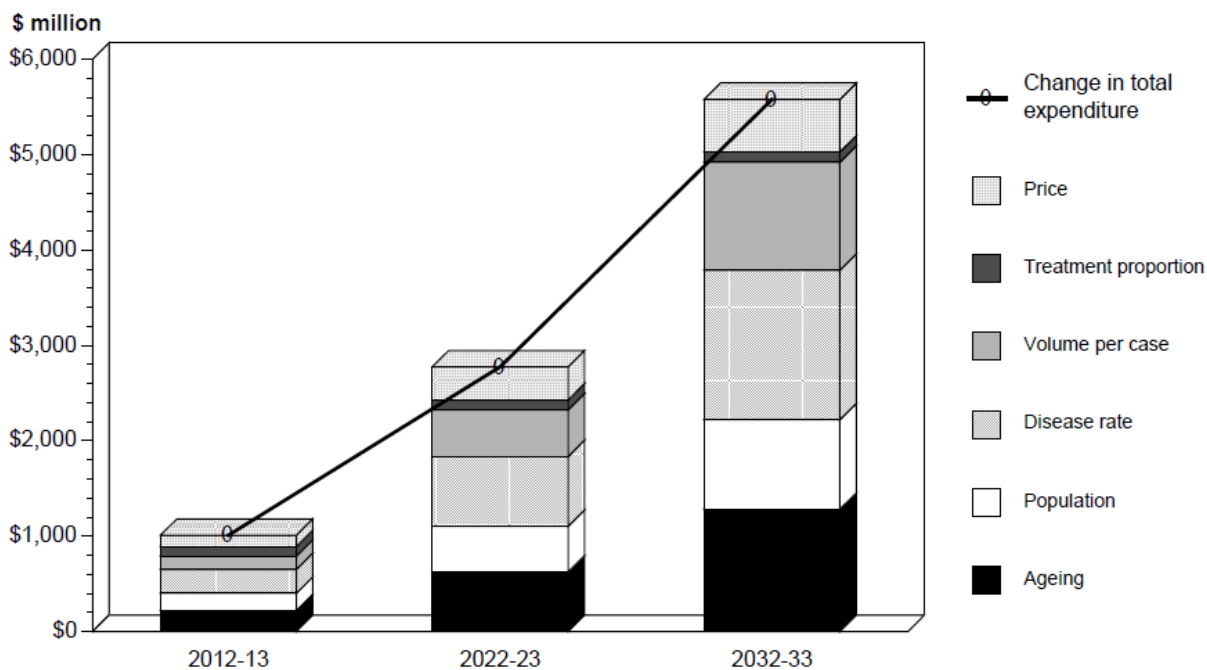
For heart disease, the disease rate falls below the baseline of 0, whereas for diabetes it continues to rise markedly. However, the increases in population growth and ageing drive the numbers in treatment up for both conditions. The other significant factor that they have factored in is 'volume per case' which refers to the average level of treatment input per case, which they estimated to remain fairly constant for CVD, but to increase substantially for diabetes, possibly reflecting management of complications.

It has not been possible to reproduce these same estimates locally during this review, but projections have been attempted for diabetes as an example, it being likely to represent a key burden of disease increase in Northern Lincolnshire as well as Australia.

It is projected that the prevalence of diabetes on an age standardised basis is likely to increase anyway on the basis of the continuing rise in excess weight and obesity, correlated in Figure 29 (Moody, 2016).

Figure 29 Differential prevalence of impaired glucose regulation (IGR) and diabetes with obesity (England)
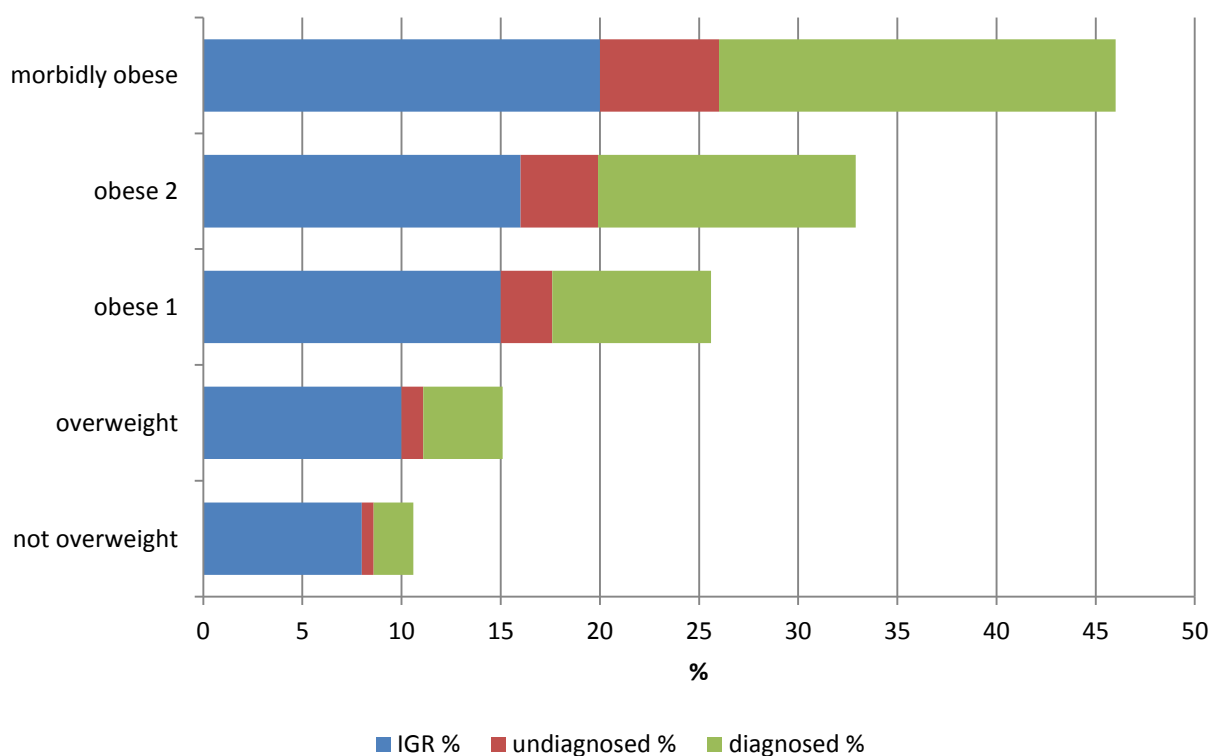
Figure 30, therefore projects the number of cases recently registered in North Lincolnshire forward to 2030, taking into account the forecast population increases and ageing, combined with estimates for continuing rise in obesity.

Burden of Disease in Northern Lincolnshire

Figure 30 North Lincolnshire: projected increase in diabetes numbers due to population growth, ageing and levels of obesity
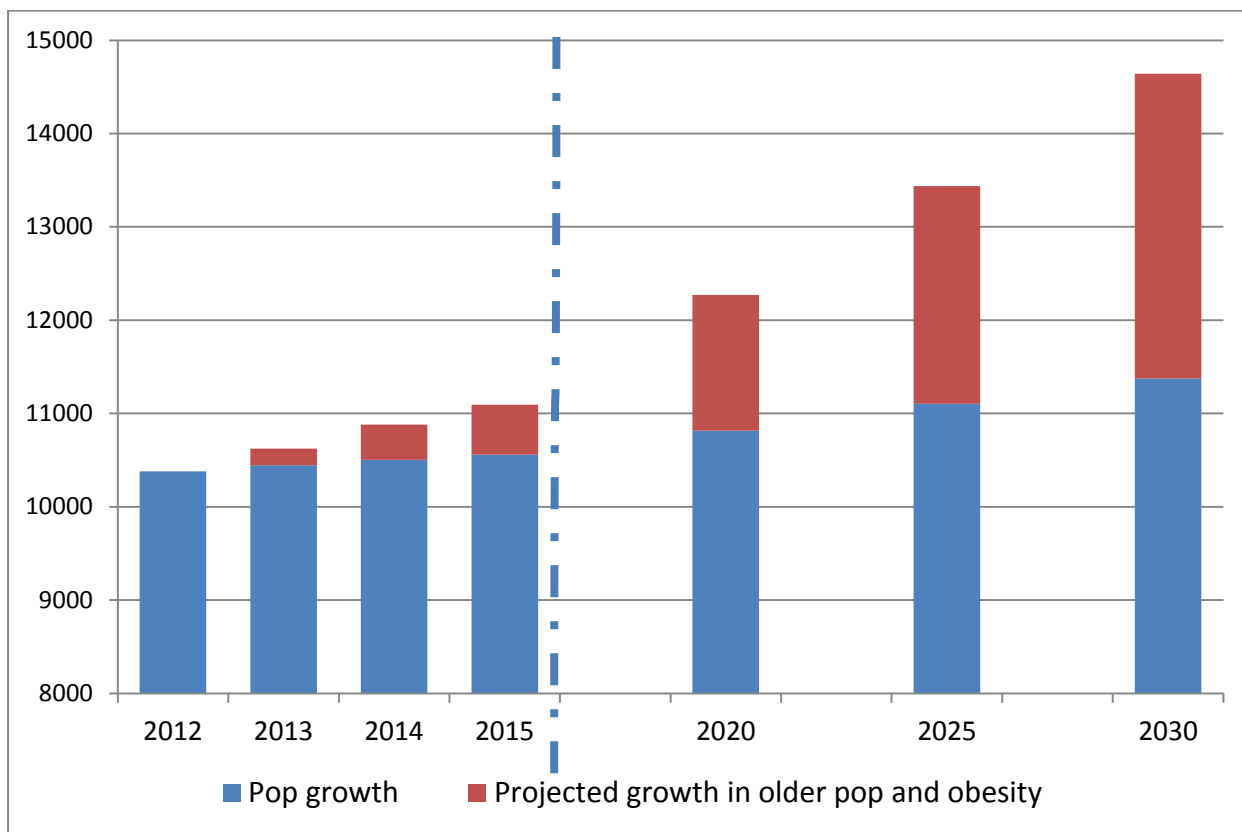
Diabetes rates are also strongly correlated with deprivation scores (Figure 31).

Figure 31 Differential prevalence of impaired glucose regulation (IGR) and diabetes with deprivation (England)

Burden of Disease in Northern Lincolnshire
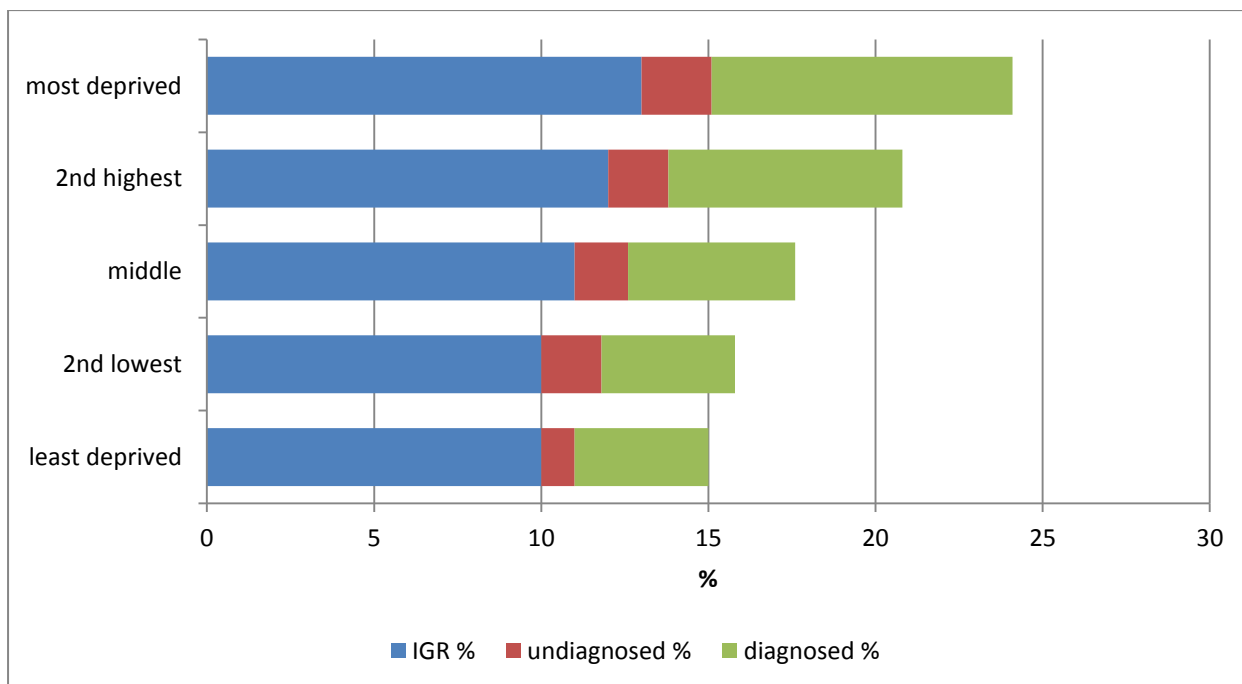
Because of this, although the population of North East Lincolnshire has less of an aged and ageing population, its greater proportion of population rated as more deprived are projected to drive numbers of diabetic patients up to a very similar level to North Lincolnshire (Figure 32).

Figure 32 North East Lincolnshire: projected increase in diabetes numbers due to population growth, ageing and levels of obesity
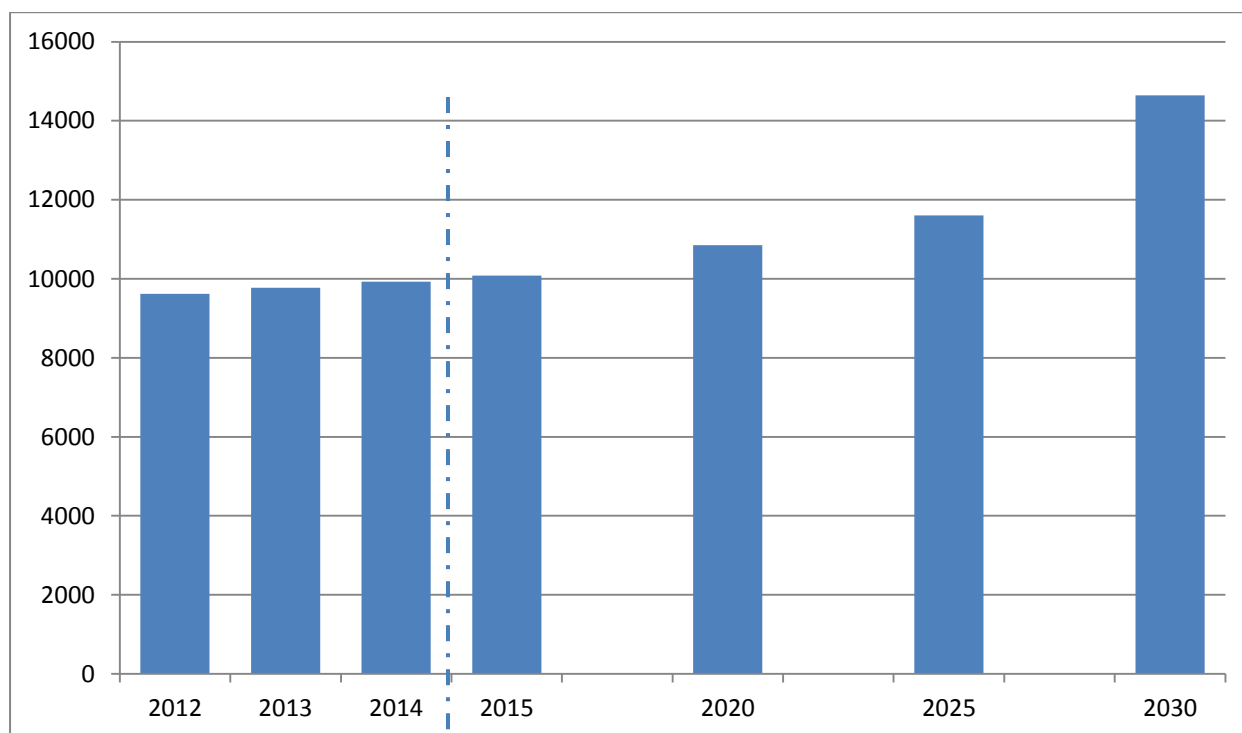
Population growth and ageing are 'given' factors in consideration of the developing burden of disease. It will be important therefore to consider points of intervention where interventions are possible at population level if future considerable burden of disease and cost is to be averted. For diabetes these include (also see Annex):

- Addressing the social determinants of disease such as education, work and skills, poverty etc. which contribute to measured levels of deprivation

- Reducing levels of risk behaviours, particularly diet and levels of physical activity which are contributing to the continued rise in excess weight and obesity

- Target effort and resources for prevention and management in graduated ways to account for inequalities in access to and outcomes from services, as the burden of disease will be proportionate

- Early identification of pre-diabetes (impaired glucose regulation - IGR) e.g. through Health Checks, and effective follow through to prevent onset of full disease

- Effective and cost-effective control and supported self-management of established disease to prevent deterioration

- Efficient and effective screening for early intervention to prevent or reduce impact of complications and the 80% of costs associated

Burden of Disease in Northern Lincolnshire

- For the above, maximise the numbers of patients benefiting from all 9 recommended interventions for best control, and achieving all 3 recommended outcomes

While it has not been possible to profile all the major burden diseases similarly, for each one similar considerations will be relevant. Diabetes is a condition which has a series of indicative symptoms and signs which leads to a large proportion of cases these days being diagnosed eventually, if not early. However, for conditions such as heart disease, cancer and COPD, which might not be so evident, there may be need for more systematic search to identify 'hidden' risk conditions (see later).

Although these conditions themselves can be moderated to an extent, systematic 'upstream' preventive interventions, such as described above, will be preferable to defer the consequences, including complications, multi-morbidity and frailty.

Burden of Disease in Northern Lincolnshire

4. Implications: prevention and the Burden of Disease (BoD) pathway

The potential for a strategic shift in approaches towards prevention and early intervention has been a long-term ambition.

'The following framework is helpful as it has a broad focus. It identifies three categories:

- Primary prevention/promoting wellbeing: this is aimed at people who have no particular social care needs or symptoms of illness - The focus is therefore on maintaining independence, good health and promoting wellbeing. Interventions include combatting ageism, providing universal access to good quality information, supporting safer neighbourhoods, promoting health and active lifestyles, delivering practical services etc.
- Secondary prevention/early intervention: this aims to identify people at risk and to halt or slow down any deterioration, and actively seek to improve their situation. Interventions include screening and case finding to identify individuals at risk of specific health conditions or events (such as strokes, or falls) or those who have existing low level social care needs
- Tertiary prevention: this is aimed at minimising disability or deterioration from established health conditions or complex social care needs - The focus here is on maximising people's functioning and independence through interventions such as rehabilitation/enablement services and joint case management of people with complex needs.

Delivering a strategic shift to prevention and early intervention requires a 'whole system' approach – this is not just about health and social care. It needs to involve the full range of council departments and other stakeholders such as the Pensions Service, Community Safety Partnerships etc.' (Department of Health, 2008)

The priority that needs to be given to prevention and early intervention has most recently been re-stated and embraced as a key element of policy in the NHS England Five Year Forward View. Components of how services may organise to manage and address pressures in their own sector are illustrated in the Northern Lincolnshire HLHF Five Year Vision and Strategy Figure 33 (HLHF, 2015).

Burden of Disease in Northern Lincolnshire

Figure 33 Service Care Funnel – Health and Social Care

Self care and independent living	Home based care	Community based care	Local services	Centralised care
Where intervention is required we aim to deliver care in your own home unless it is better for it to be in a specific care environment.	Most services do not need to be delivered in a hospital setting, so we want to deliver those near your home in your community.	Where services do need to be delivered in a hospital environment, we would expect the majority of these to be in your local hospital.		For some services we know that outcomes are better where they are provided in fewer centres. This could mean more successful treatment or recovery. It may mean you need to travel to another hospital setting, either in North or North East Lincolnshire or to a specialist centre (e.g. Hull or Sheffield).

Running through such approaches is an important core pathway defining how the burden of disease in a community, as well as in an individual, progresses from risk determinants to disease and its progressively disabling consequences. Intervening where possible as early in the pathway as possible has great potential to reduce the impact on individuals and their families and carers, and also of course on health and care services.

Burden of Disease Pathway and potential intervention points

The population burden of disease builds inexorably through a series of stages of increasing severity and consequence. However, before each stage progresses to the next, there is potentially the possibility of intervening to slow or prevent the decline, as captured in Figure 34.

Figure 34 Interventions to impact on Burden of Disease
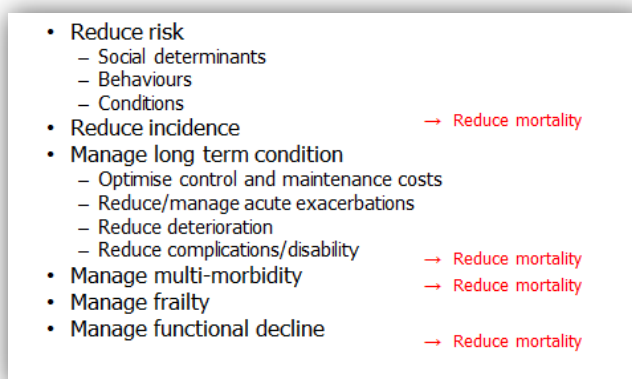
There follows a brief synopsis of the stages in the pathway, to highlight key considerations for development of a prevention strategy.

4.1 Reducing risk

Social determinants

These have been well described by Marmot (The Marmot Review Team, 2010) as a 'Life Course' of accumulating risks, which can be viewed as a pathway of its own (right).

The evidence shows, for example, that support provided to ensure good opportunities for cognitive development and other executive skills in the first 3 – 5 (early) years of life are necessary if the child is to go on to good educational attainment. Educational attainment and skills development are then critical steps towards achieving good employment, etc..

Behaviours

The UK GBoD analysis established which key risk factors contributed to the main causes of the burden of disease. The results of their analysis are shown as Figure 35.

Give every child the best start in life
↓
Educational attainment and lifelong skills development
↓
Fair employment and good work for all
↓
Healthy standard of living for all – income and debt
↓
Healthy and sustainable housing, places and communities

Burden of Disease in Northern Lincolnshire

Figure 35 Disability-adjusted life years (DALYs) attributed to level 2 risk factors in England for both sexes combined
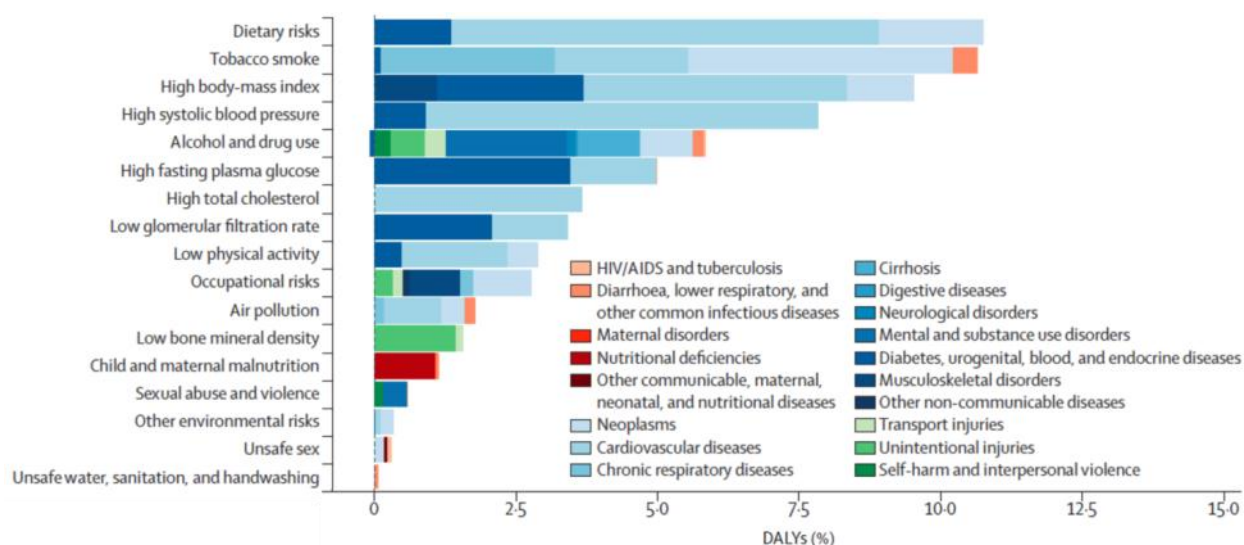
UK Global Burden of Disease Study/ PHE 2013

The risk factors themselves group into two fairly distinct categories, as shown in Figure 36.

Figure 36 Top 10 risks for influencing Burden of Disease

- Risk behaviours
  - Dietary risks
  - Tobacco smoke
  - Alcohol and drug use
  - Low physical activity
  - Occupational risks

- Risk conditions
  - High body mass index
  - High systolic blood pressure
  - High fasting plasma glucose
  - High total cholesterol
  - Low glomerular filtration rate

The first group, risk behaviours, have been recognised for some time as attributable causes of the main contributory conditions making up the fatal and non-fatal disease burden. Their relative impact has varied over time. Nationally the GBoD Survey reported that:

- Dietary causes (e.g. high levels of simple sugars; insufficient fruit and vegetables; over-eating) is now seen to be as important a risk as tobacco.

- Alcohol related harm is now more prevalent than earlier surveys suggested

- Occupational risks are now included in the 'top 10'. This will contribute particularly through components of anxiety and stress, musculoskeletal conditions, particularly back and neck problems, and sensory deficits, particularly impact on hearing and sight.

Programmes to address these risks so as to impact on population level disease will need to be multifaceted, and developed with sufficient system and scale. Behaviour change is not straightforward to achieve, particularly for people living in complex and challenging environments: in these circumstances risky behaviours are less 'lifestyle choices' and more elements rooted in local cultural norms.

In addition, risk behaviours often cluster together in more deprived communities, multiplying the risks and providing even greater challenges for substantially downgrading risks. The chart (Figure 37) shows stark differences in survival of people with 0 – 4 out of four of the main risk behaviours (smoking; excessive use of alcohol; fruit and vegetable consumption; physical exercise) (Buck, 2012). Survival is clearly reduced for each added risk behaviour. From an inequalities point of view analysis showed that:

- Unskilled manual labour is 3 times more likely to have all 4 risk behaviours than professionals

- People with no qualifications are 5 times more likely to have all 4 risk behaviours than those with high level qualifications

Figure 37 The relationship between multiple lifestyle risks and mortality
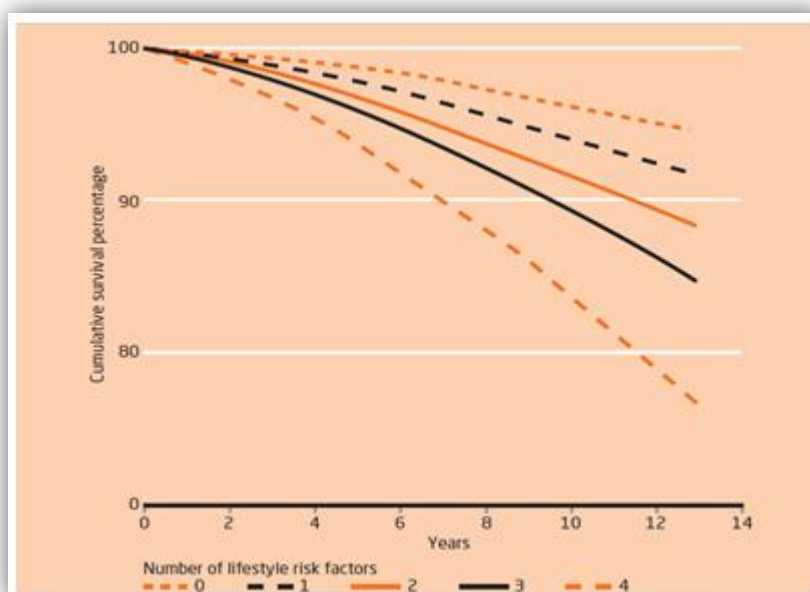
Risk conditions

The remaining 5 risk factors in the top 10 are in fact measurable abnormalities in physiological/pathological state. In general they are not recognised as a problem in individuals without some invasive 'clinical' test. They may become apparent opportunistically during investigation of a patient for another condition, or may be tested for in a systematic case-finding exercise e.g. GP Quality

Burden of Disease in Northern Lincolnshire

Outcomes Framework (QOF) or the Health Checks programme. Key points about this group of conditions include:

- High body mass index (BMI) - excess weight and obesity – is often not acknowledged by patients themselves, or by professionals judging on appearance alone. Proper weight and height measurement may be necessary for its recognition.

- High blood pressure is not always a consequence of excess weight, lack of physical exercise, stress and anxiety etc. A large proportion is labelled 'ideopathic', i.e. with no established cause.

- High cholesterol is not always the result of an imbalanced diet, and so cannot be necessarily predicted.

- High blood sugar can be indicative of a number of (related) disease states which include 'pre-diabetes' as well as diabetes.

Individual abnormal test results need to be confirmed with repeat testing. If confirmed, further diagnostic testing protocols usually need to be followed for the degree of risk to be established, and in some cases for disease state to be confirmed (e.g. glucose tolerance test for diabetes).

Search strategies need to be systematic and scaled up, and take into account disadvantaged patients who do not have the knowledge, skills and resources to easily take up the offers of testing.

In many cases, confirmation of the problem may be followed with a supported care plan e.g. weight management; dietary control; fitness programme. These will need to be fastidious to achieve measurable change and risk reduction. In many cases if the initial care plan is insufficient, medication may be necessary.

4.2 Reduce disease incidence

Some of the major conditions contributing to the disease burden once established have an identifiable pre-condition, not the disease itself but part of the pathological pathway which can provide a 'warning' that the disease itself may be developing. If this state can be detected and acted upon effectively, the incidence of the disease itself, with all its downstream consequences, may be averted.

Detecting and managing these pre-conditions on a population-wide basis requires scaled-up and systematic processes, but because they can literally prevent serious disease developing, the processes can be very cost effective. Examples include the following:

- Screening for and treating 'pre-disease' e.g.:

  – Cancer of the cervix and bowel

  – Aortic aneurysm

- Vaccinating against and treating causative pathogens:

  – Human Papilloma Virus (causative in development of cervical and other cancers)

  – Hepatitis B and C, causative in cirrhosis and other liver disease, including cancer

- Case finding and intensively managing metabolic pre-disease:

Burden of Disease in Northern Lincolnshire

- Pre-diabetes

- Cardiac risk

- Renal disease

As with other population level interventions, success depends on access to and uptake of the test/intervention, and quality assurance work to ensure consistent standards rather than patchiness and variability in service provision.

4.3 Managing long-term conditions (LTCs)

Once long term conditions are established there are a number of management goals which will need to be pursued. For the main contenders, e.g. cardiovascular disease; diabetes; respiratory disease, there is a good evidence base and plenty of authoritative guidance and protocols for effective management. However, effective implementation of such protocols by professionals and practitioners can be patchy. A major component of the success or otherwise of each care plan remains the patient capacity and capability to self-manage. This needs to be supported in bespoke ways, both by the practitioners, family and other carers, and by peer 'expert patients'.

Ambitions for care plans to maximise damage control from the condition can be viewed in the following stages:

- Optimise control and management costs: initial strategies will include gaining control of key symptoms e.g. angina; wheeze, and disease markers e.g. hypertension; raised cholesterol; raised blood sugar. Protocols should be followed that achieve measurable normalisation where possible, with minimal side effects and lowest maintenance cost. Self-management should focus on helping patients to 'take control' of their own condition and wellbeing where possible. Attention should be paid to mental state, particularly depression which is common and will affect health and wellbeing outcomes.

- Preventing decline in function: previously there has been a belief that most long term conditions are irreversible and follow an inexorable declining course (e.g. Type 2 diabetes becoming increasingly medication resistant and eventually requiring insulin). This is now being challenged, and trials of therapy are showing improvement and even reversal of disease processes e.g. through severe weight loss in diabetes; cardiac rehab; pulmonary rehab.

Burden of Disease in Northern Lincolnshire
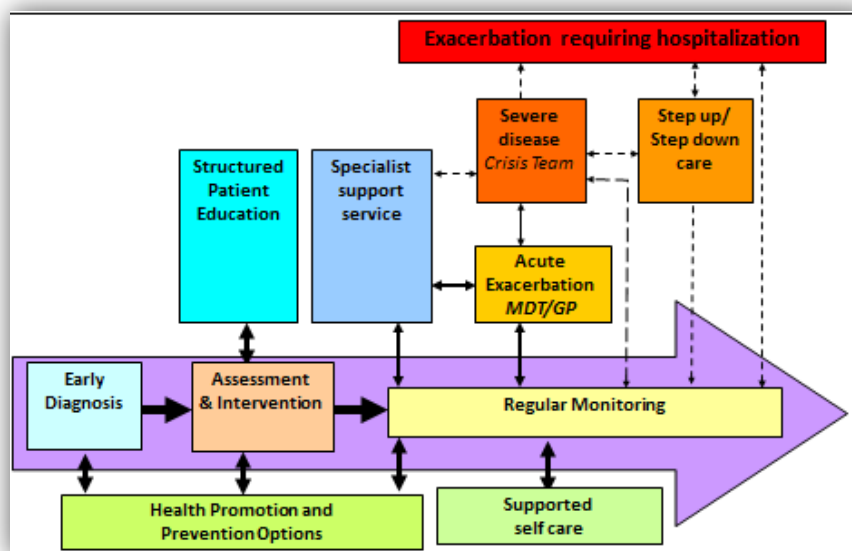
- Prevent and manage acute exacerbations: these are likely to occur on occasion despite maintenance efforts e.g. chest infection in patient with COPD. Figure 38 illustrates possible management process involving integrated clinical care.

- Prevention of complications: this may involve separate programmes for detection and management of common sequelae. In diabetes, for example this includes:

  o Eye screening

  o Foot checks for vascular and neurological deterioration

  o Tests of renal function

  o Management of cardiovascular risk: blood pressure and cholesterol.

Each annual check-up should be overseen by general practice, once the patient has a formal diagnosis, and is included on the disease register. However, this can be imperfect, particularly when other systems run independently e.g. diabetic eye screen; diabetic foot check with podiatry. Audits show that of 8 care process recommended by NICE for diabetes, only 62% of patients had received all 8, and that did not include the eye screen, which was known to be low. The results varied considerably by geography and practice (National Diabetes Information Service, 2013).

4.4 Managing multi-morbidity

With increasing survival comes the potential to aggregate a number of LTCs. These may frequently derive from common risk factors e.g. tobacco use; overweight; alcohol related harm. Patients with multi-morbidity can find management problems e.g.:

- due to mixed signs and symptoms complicating diagnosis;

- interacting/conflicting care plans;

Burden of Disease in Northern Lincolnshire

- transitions across healthcare boundaries and specialisms

Because of these effects the modelling of the impact of interventions on individual conditions can no longer be relied upon. They will be at best indicative.

Little routine data is available in this issue yet, but studies are beginning to describe the extent of the problem. In one study (Salisbury C, (2011)) sixteen per cent of patients had more than one chronic condition included in the Quality and Outcomes Framework, but these people accounted for 32% of all consultations. Using the wider (Johns Hopkins) list of conditions, 58% of people had multi-morbidity and they accounted for 78% of consultations. People with multi-morbidity had higher consultation rates and less continuity of care compared with people without multi-morbidity

Multi-morbidity is strongly related to age and deprivation. Figure 39 shows the accumulation of chronic conditions with age.

A key factor emerging from this appraisal was that people in deprived circumstances have the same prevalence of multi-morbidity as more affluent patients who were 10 – 15 years older (Barnett, 2012). This will have significant consequences for resourcing across health and social care.

Figure 39 Number of chronic disorders by age group (Barnett, K et al 2012)
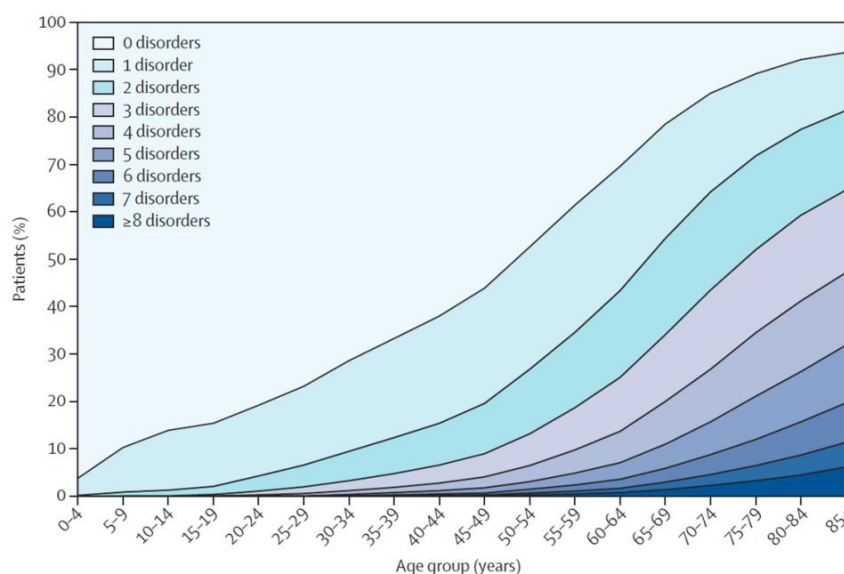
4.5 Manage frailty

- Frailty is a transitional state of vulnerability to accumulated impairments. It affects 20 – 50% of people > 80 years.

- There are five main frailty syndromes ('the pillars of frailty'):

    - falls;

    - immobility;

    - delirium;

    - incontinence;

    - susceptibility to the side effects of medication

Burden of Disease in Northern Lincolnshire

- Currently, patients often present in crisis without prior warning to urgent or emergency care services and such episodes can precipitate episodic decline.

- Frailty is not a static condition and can be improved. Identifying people living with frailty can help improve outcomes, and should enable prevention plans and contingency arrangements to be put in place.

- In relation to the rest of the Burden of Disease pathway, Figure 40 shows the primary diagnosis at the time of admission to a long term care placement with adult care in North Lincolnshire. The dominance of physical frailty and dementia is clear.

4.6 Functional decline

For those with disability, multi-morbidity and accumulated frailty, the critical impact will be the rate and progress of functional decline in the activities of daily living e.g. self-managing shopping; housework; stairs; bathing; preparing meals; personal hygiene. This decline may be gradual or episodic e.g. following a fall or infection.

Again, this decline is not inexorable, and can be managed usefully in many cases where resources are deployed effectively and efficiently. The supports may be employed as:

- Proactive health promotion to include addressing cold, damp housing; nutrition; hydration; mobility, strength and flexibility

- Rehabilitation following an acute episode or crisis (fall; urinary tract or chest infection)

- Re-ablement; providing personal care, help with daily living activities and other practical tasks, re-ablement encourages service users to develop the confidence and skills to carry out these activities themselves and continue to live at home.

Figure 40 Annual new long term admissions to social care by primary diagnosis (North Lincolnshire)
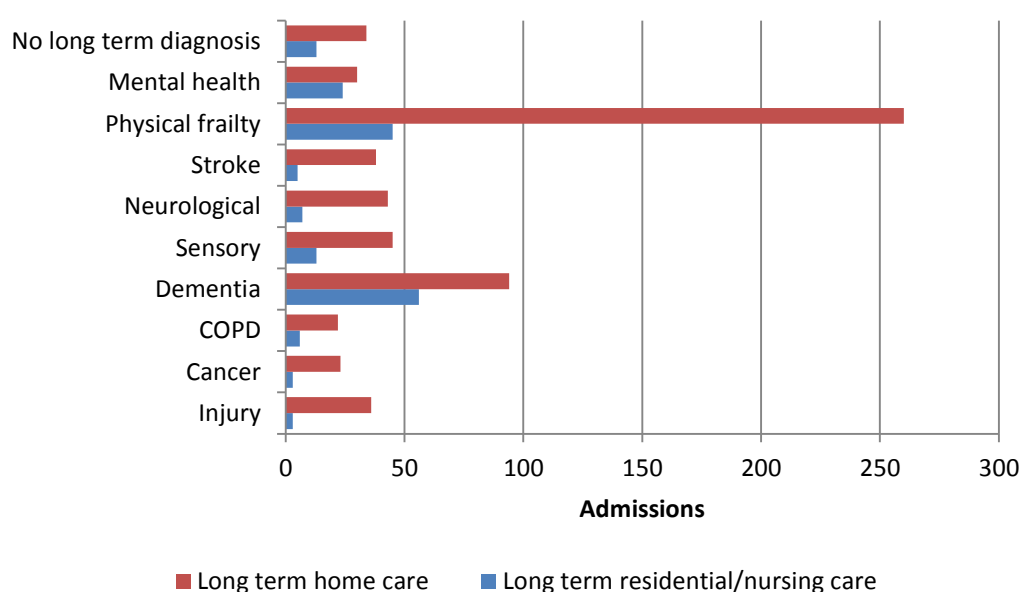
Managing frailty and functional decline effectively and efficiently will be a key concern at the centre of place based approaches and integrated systems for health and social care. In close conjunction with

management of dementia, the ageing demographic will be generating increasing numbers of residents at risk of losing their independence. Working proactively at all possible steps down the burden of disease chain will be critical to enable residents to maintain their independence for as long as comfortably possible, supported where necessary. The intention will be to defer, and compress, the period of time living with (expensive) dependency towards the end of life.

As all points in the burden of disease 'pathway' described above, there are a range of social determinants that will affect the effectiveness and cost effectiveness of interventions, including:

- Personal skills, and capacity to self-manage

- Family and carer involvement

- Other social networks; otherwise, loneliness and isolation

- Mental wellbeing

- Physical resources for maintenance and recovery (including financial)

These determinants apply to individuals across the social spectrum. However, elements of these social determinants will often apply to a greater proportion of individuals living in more deprived sub-populations and neighbourhoods. Care resources are likely to be required to disproportionate levels in such areas to achieve desired outcomes, because of the complexity of need.

Burden of Disease in Northern Lincolnshire

5. Implications: key components of population level actions

Strategically, it will not be possible to select a single set of interventions with which to dramatically reduce the disease burden. Obviously, it is ideal to be able to prevent a disease or group of diseases from occurring at all, and the chances of this can be substantially improved at individual level. Even this is not for certain, however; e.g. a proportion of non-smokers get lung cancer. What can be done strategically is to ensure that by applying certain principles appropriately, most is done to achieve the best possible percentage change at population level. This applies to any point along the pathway. As with Olympic excellence, percentage change in population health can be achieved by 'aggregation of marginal gains'. Small improvements and efficiencies, e.g. of 1% at each stage of the process can result in major outcome 'wins' (Brailsford, 2012), as illustrated in Figure 41.

Figure 41 Aggregation of Marginal Gains

In the beginning, there is basically no difference between making a choice that is 1% better or 1% worse. (In other words, it won't impact you very much today.) But as time goes on, these small improvements or declines compound and you suddenly find a very big gap between people who make slightly better decisions on a daily basis and those who don't.
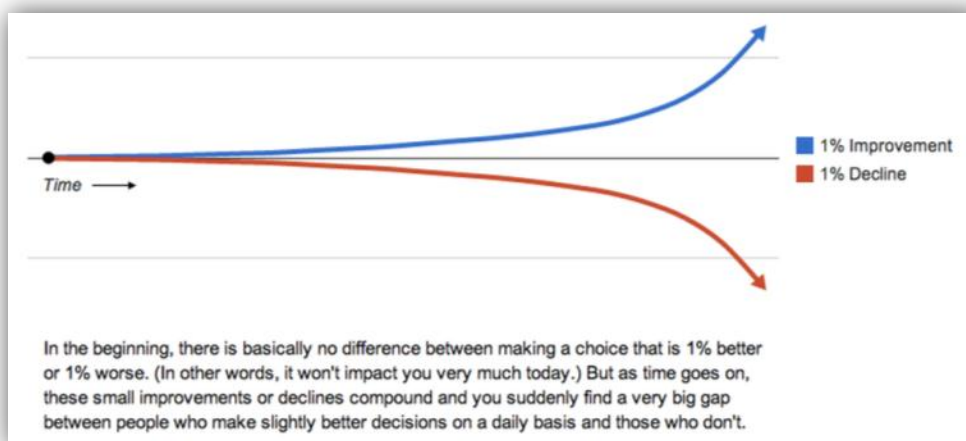
Key principles of delivery to achieve percentage change at population level are outlined below.

5.1 Commitment of effort and resource needs to be graded proportionately to complexity of need.

It is not enough to commit equal shares to different sub-populations. Some individuals, families and communities will seemingly require disproportionate support to achieve the same outcomes as others. This is illustrated in Figure 8. There is a gradient of need right across the population, not just confined to a particularly disadvantaged group. Describing and understanding that gradient should allow a graded level of matched input.

However, there is a part of that population e.g. in the most deprived national 20% of neighbourhoods (Figure 2) where risk factors combine into a complex whole i.e. multiple social risks (income and debt; unemployment; housing issues), clusters of behavioural risks (tobacco and alcohol use; poor diet; inactivity) and early multi-morbidity.

These people will be the most problematic to support to reduce their overall risk. However, they are also the ones suffering the greatest degree of years of life lost (Figure 13), the greatest number of years

Burden of Disease in Northern Lincolnshire

of life with disability and chronic illness, and make the greatest use of crisis and emergency services (Figure 20).

5.2 Interventions selected for population level change programmes must meet a tight set of criteria

Programme characteristics will include being:-

- <u>Evidence based</u> – concentrate on interventions where research findings and professional consensus are strongest

- <u>Outcomes orientated</u> – with measurements locally relevant and locally owned

- <u>Systematically applied</u> – not depending on exceptional circumstances and exceptional champions

- <u>Scaled up appropriately</u> – "industrial scale" processes require different thinking to small " bench experiments"

- <u>Appropriately resourced</u> – refocus on core budgets and services rather than short bursts of project funding

- <u>Persistent</u> – continue for the long haul, capitalising on, but not dependant on fads, fashion and policy priorities

Small projects, those based on 'grey' evidence and services that are unsystematic and of patchy and variable quality will not generally result in measurable change at population level.

5.3 To achieve population level change will require multifaceted approaches delivered with system and scale.

The overlapping mechanisms capable of delivering population level change are illustrated as the Population Intervention Triangle, Figure 42. These components are described in more detail elsewhere (Bentley, 2008), with brief commentary below.

Burden of Disease in Northern Lincolnshire

Figure 42 Producing percentage change at population level

- Population level: civic interventions to help 'make the healthy choices easy choices', e.g. legislation; regulation; taxation; licencing; healthy public policy; campaigns. Stopping smoking in enclosed public places, regulation of sales to minors, licencing of off-licences and fast food outlets should all impact on risky behaviours, although they still need enforcement in some areas e.g. by trading standards and environmental health

- Intervention through services: should be driven with system, scale and sustainability, with governance systems to ensure delivery is of consistent quality producing good equitable service outcomes. Attention should be given to addressing inequalities in access and reaching out to bring effective services appropriately to all who can benefit.

- Intervention through communities: place-based approaches should harness all mechanisms to reach out to help communities strengthen their own leadership and local engagement, build on their own assets (e.g. community based venues, organisations and networks), empower participation and local control in health and related activities. This engagement with communities should not be passive, working just with those that push themselves forward, but should systematically seek to support communities that intelligence suggests are most compromised.

- Strengthening links between services and communities: much work is needed particularly in more deprived neighbourhoods to blur boundaries between service and community infrastructures. Service outreach, delivery in community based venues, harnessing community champions and advocates are all strategies to reduce barriers and gaps to resident access and support. The voluntary, community and faith sector has a large part to play in cross linking systems. Frontline agencies need to work together to provide single points of access and joint pathways for supporting delivery and self-care

Each of the above components can deliver population level change with certain interventions. However, strategies will be particularly strong which are multifaceted, bringing together all the elements of the intervention triangle. For example, smoking prevalence will not be measurably reduced using smoking cessation services alone. Service numbers will never be enough. However, NICE evidence based guidance to local authorities maps well across all the elements of the triangle. This forms a good basis for a comprehensive place-based strategy with responsibilities across the partnership.

5.4 Addressing inequalities in access and outcome.

In all systems aiming to achieve optimal population level outcomes the challenge is to bring effectively delivered, evidence-based intervention to as many people as can benefit. However, analysis tends to show that attempts to achieve this are often far from optimal (Figure 43) (Harrison, 2006).

Figure 43 Disease management provided according to evidence-based protocols e.g. NICE guidance
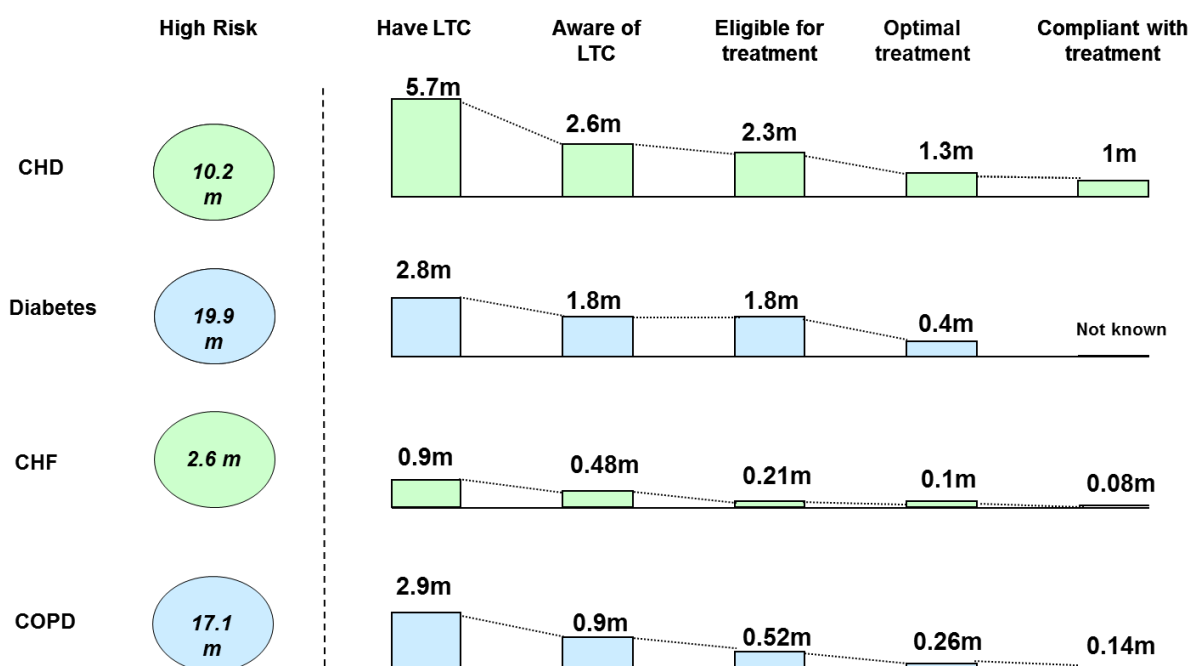
NOTE: Figures are for UK. Taken from Harrison W, Marshall T, Singh D & Tennant R **"The effectiveness of healthcare systems in the UK – scoping study";** Department of Public Health & Epidemiology and HSMC University of Birmingham, July 2006.

The modelling shows that for four of the main long term conditions, coronary heart disease (CHD), diabetes, congestive heart failure (CHF) and chronic obstructive pulmonary disease (COPD) there was a similar pattern of 'implementation decay. For example there were estimated to be nearly 6 million people with CHD, a condition for which there is a very strong evidence base of effective treatment. Only just over half of those were aware of the condition. For nearly all of them there was likely to be effective treatment available, but still just over half were prescribed that treatment. Then only ¾ were compliant with that treatment, making only 1 in 6 of those who could benefit accessing the recommended treatment.

Burden of Disease in Northern Lincolnshire

Any strategy wishing to 'optimise the impact' of evidence based interventions needs to address all these stages of decay (Figure 44).

Figure 44 Components of Unmet Need
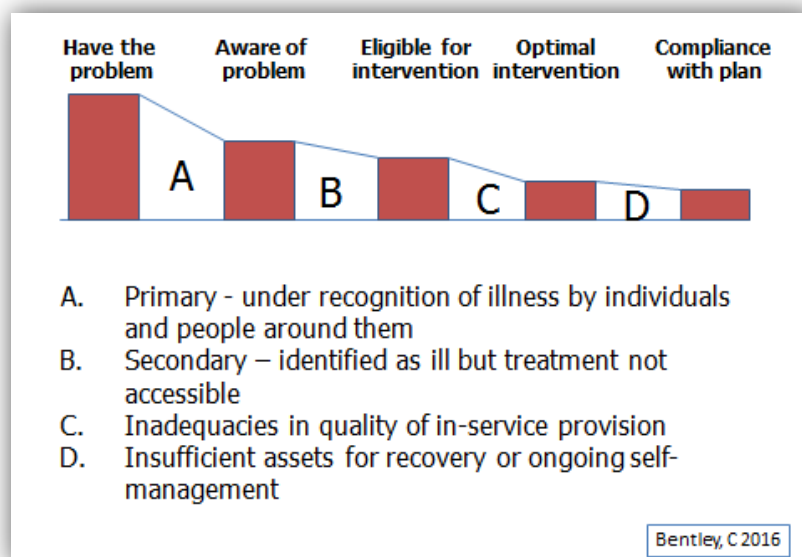
Figure 45 then identifies that the lead provider (general practice in the case of CHD) can only be fully responsible for activities in the red ellipse. Responsibilities for community engagement and education (A), identifying and channelling people into appropriate care (B), and supporting self-management (D) are responsibilities that must largely fall to other (place-based) partners. This will require good leadership, commitment and co-ordination.

Figure 45 Collaboration to address 'implementation decay'

Burden of Disease in Northern Lincolnshire
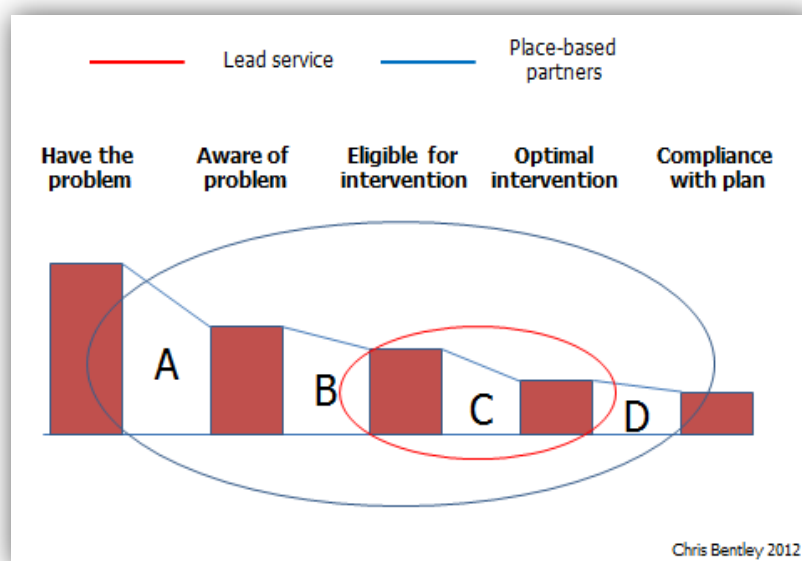
5.5 System, scale and selection of intervention 'best buys'

Interventions that might work well at the level of the individual, or in a small project with special conditions (e.g. extra short-term resources; particularly skilled leadership) may well not expand effectively to deliver on a grander scale. A key consideration revolves around the concept of Numbers Needed to Treat (NNT). This is illustrated as Figure 46.

Figure 46 Numbers Needed to Treat (NNT)
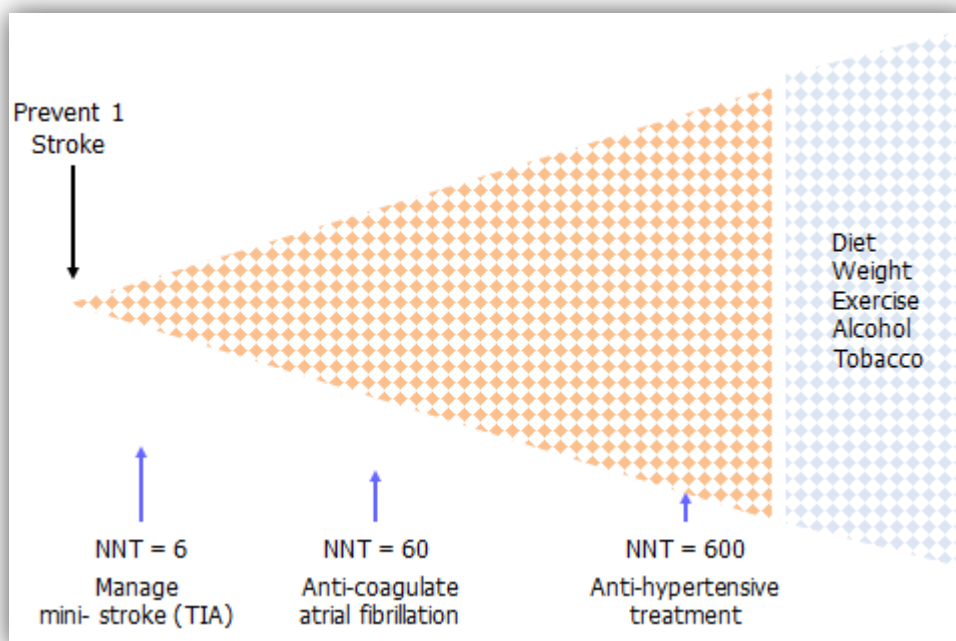
NNT is a figure giving an estimate of the number of recipients that will need to be treated to achieve one target success in a given timeframe. In the example above, the aim is to prevent stroke in people at risk within a 3 year period. For people presenting with a mini-stroke or 'transient ischaemic attack' (which resolves in 24 hours, but gives warning of a possible full stroke to come), prompt clinical action can probably prevent a stroke in about 1 in 6 patients. Detecting patients with a heart rhythm problem AF, and treating with anticoagulant therapy can prevent a stroke for every 60 patients treated. Managing high blood pressure may require 600 patients to be treated to prevent one stroke. Addressing risk management by behaviour change e.g smoking; excessive drinking; poor diet involve interventions with even more substantial NNTs (over 1000) for outcome in the short term.

The challenge for systematic delivery of these interventions is how to assure the quality of the intervention as the NNTs increase, and the number of practitioners necessary expands accordingly. Supervision of 5 staff in a TIA clinic is relatively easy. Governance of smoking cessation support involving dozens of practitioners across a range of agencies will be much more of a challenge.

Figure 47 shows the patchy and variable outcomes achieved, plotted against average prescribing spend by GPs in trying to manage blood sugar control in diabetic patients. Some achieve excellent results at low cost (top-left quadrant), while others poor results at high cost (bottom-right). The scatter of inefficient practice substantially increases the NNT, which in the trials and studies refers to the number needed to treat <u>effectively</u>. The seemingly random scatter can be addressed, helping Practices to achieve better cost effective prescribing and much improved outcomes using guidelines, protocols,

Burden of Disease in Northern Lincolnshire

audits and pharmacist support. This needs to be a specific goal with a tight action plan, however, and implementation requires consensus commitment of opportunity cost.

Figure 47 Diabetes outcomes versus expenditure (DOVE) for Northern Lincolnshire
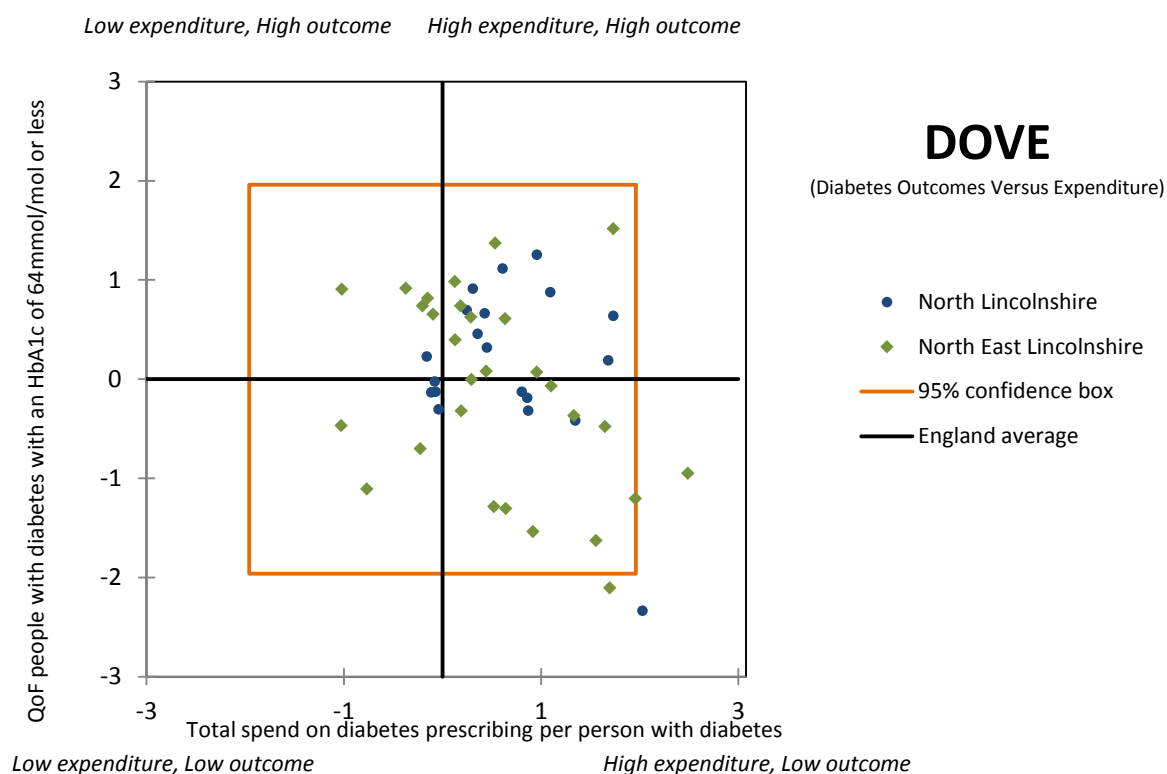
Importantly, most of the target risk behaviours and risk conditions contribute to a number of disease endpoints (Figure 35), so the number needed to treat effectively for any positive endpoint will effectively be smaller. This impacts on the cost benefit, and the cost per Quality Adjusted Life Year (QALY) for successful risk reduction activity in an individual remains very low. The efficiency of delivery principle/problem, however, remains.

Burden of Disease in Northern Lincolnshire

Figure 48 below summarises some of the issues related implementation within the BoD pathway given consideration of the population health intervention principles.

Figure 48 Population levels of intervention in the Burden of Disease Pathway

Step on Pathway	Advantages for intervention	Disadvantages for intervention
Reduce Risk: – **Social determinants** (e.g. 'early start'; income and debt; unemployment)	• Fundamental – 'causes of the causes' • Impact down the whole pathway – e.g. health seeking behaviour • Potential to break the cycle of deprivation	• 'Proportionate universalism' - potentially there are needs right across society • But complex needs in most disadvantaged can be disproportionate • Interventions multifaceted and interdependent • Evidence base patchy
– **Behaviours** (e.g. tobacco; alcohol harm; diet; inactivity)	• Individual risks impact on multiple diseases • Primary – may prevent the disease itself • Otherwise, impacts on the whole pathway	• Behaviour change difficult to deliver effectively to scale • Behaviours often rooted in social conditions which may need to change first • In most disadvantaged, risk behaviours cluster – need multifaceted support
– **Conditions** (e.g. ↑ BP; ↑cholesterol; ↑blood sugar)	• Direct action at the point of risk • Direct measures enable tight control through therapy and/or drugs	• 'Invasive' testing needed – inefficient • Tight systems required for results management and disciplined subsequent action • Testing uptake variable: worse where most disadvantage
Reduce incidence (e.g. cancer screening; vaccination; pre-diabetes management)	• Focus is where risk is greatest and NNT smallest • Direct impact at the point of change • Good evidence base for systematic population level interventions	• Scaled up system needs quality assurance to get cost/benefit • Uptake variable: worse where most disadvantage
Manage Long Term Conditions	• Registers enable scaled systematic intervention with	• Required 'industrial scale' processes often patchy

Burden of Disease in Northern Lincolnshire

Step on Pathway	Advantages for intervention	Disadvantages for intervention
(CVD; COPD; back and neck; clinical depression)	strong evidence base • Systematic monitoring supports good potential control • Upstream control substantially reduces complications; 'salvage costs; premature mortality	• Depends on working with variable patient self-management skills • Support for crucial mental health and socio-economic needs often missing • ↑ Maintenance costs accrue
Manage multi-morbidity (e.g. CHD + COPD; CVD + diabetes + renal disease)	• Recognition of commonly associated diseases can clarify guidelines and protocols • Pathway design could address silo working • Single clinical lead for patient across specialties: better co-ordination; outcome; patient experience	• Silo/sub-specialty working often deep rooted • Complexities of mixed clinical diagnosis; therapeutics; monitoring not yet mainstreamed • Multi morbidity impact 10 – 15 years earlier in most disadvantaged
Manage frailty	• Recognition and recording supports active management: important for co-ordination of integrated care • Potential to reduce stepwise decline (e.g. after falls) • Promotes concept of re-ablement to restore/extend supported independence • Highlights role and importance of carer support	• Large and increasing numbers • With scale comes need for effective systems to co-ordinate and rationalise inputs • Pressure on practitioner and volunteer workforce numbers and skills • Clarity needed on cost-effectiveness of skill-mix • Resource constraints lead to cost ineffective reactive rather than pro-active care plans
Manage functional decline (activities of daily living)	• Practical focus to improve and maintain independence, confidence and wellbeing • Targeted low level inputs to improve skills and provide practical aids can be cost effective	• Need and demand potentially unlimited • Low level needs may fall *below* thresholds for action when funding constrained • Oversight by specialists (OT and physio) may be limited

Burden of Disease in Northern Lincolnshire

6. Implications: 'best buys' for reducing the burden of disease

Based on all the considerations in previous sections of this Report, there follow a proposed series of steps amplified to draw in some key implications if there is to be a measurable impact on population level BoD.

6.1 Formalise the basis of a consistent, graduated service response to need based on community deprivation score.

There are stark differences in health and social care need evident in both Districts related to deprivation score. This is reflected in inequalities in access to and outcome from services across the described pathway. Addressing this is an ethical and legal (Commissioning Strategy/ Equity and Health Inequalities Unit, 2015) imperative, but in addition the situation is having a substantial impact on the effective and efficient use of service resources along the pathway, e.g.:

- Over 50% YLL occur under the age of 64 in the most deprived quintiles, compared to 25% in the least deprived (Figure 12 and Figure 14).

- Pattern of cause of death in under 65's is different in the most deprived quintile with major components of accidental death, alcohol related harm, and cirrhosis partly alcohol related, and part due to infectious hepatitis. However, early onset of cardiovascular disease, cancer and respiratory disease (10 – 15 years earlier on average than least deprived areas), also cause much premature mortality.

- Substantially different use of health services, with less appropriate use of elective services according to need, but greatly increased use of crisis and emergency services (Figure 20 and Figure 21).

Formal agreement around the mapped distribution of deprivation (Figure 49) amongst commissioners and providers, allows systematic planning assumptions to be made about the likely required distribution of resources according to need.

Figure 49 Distribution of population by national quintile (20%) of deprivation

Burden of Disease in Northern Lincolnshire
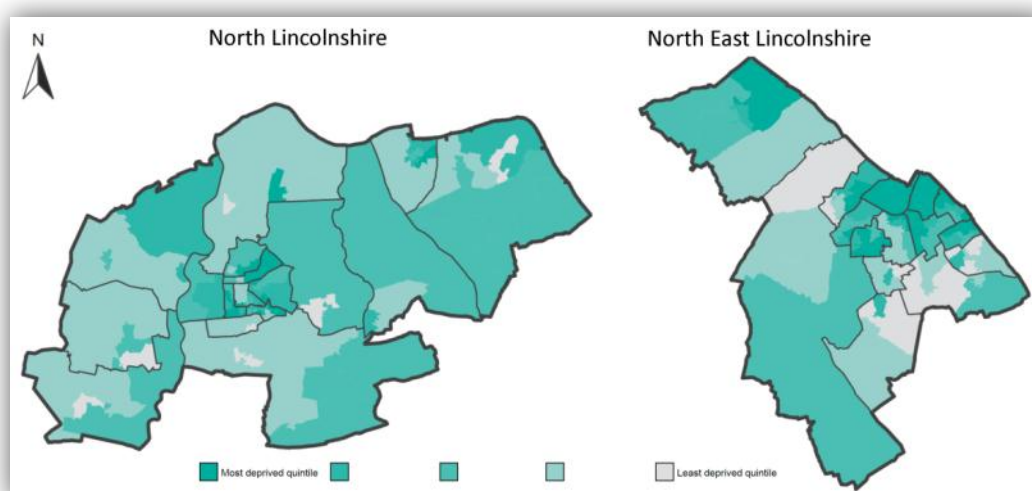
A number of levels of graded response might be planned for on this basis, with a disproportionate input for populations in the most deprived quintile:

- Definition of 'natural communities', with co-ordinated approaches to community engagement. Stocktake of assets including leadership; infrastructures; networks and venues. Co-ordinate and harness inputs from frontline agencies in-place.

- Map general practice support to worst quintile areas, and review support and incentives

- More resource e.g. larger health visiting team for more Healthy Child Programme (HCP) universal plus; larger integrated community teams for elderly frail; more primary care health care assistants to support LTC register work.

- Different configuration of services e.g. multifaceted health promotion to manage clustered risk behaviours; income and debt (e.g. Citizen's Advice - CAB) support linked to services; targeted Local Awareness Early Disease Identification (LAEDI) for lung cancer; focus on Tier 2 alcohol harm reduction services: preferential targeting of Health Checks uptake in 40 – 54 year age group.

- Greater local access: outreach and use of community based venues; enhanced access through community Champions, health trainers, health advocates.

The agreed mapped national quintiles should then be used as the basis of an agreed monitoring scorecard to track progress in relation to service uptake, use and outcomes.

6.2 Identify and connect effectively with the 'missing thousands'.

However good the *service* outcomes are, these will not be reflected as *population level outcomes* unless attention is paid to the way the population uses those services and are supported to do so. Mapping commonly will illustrate a discrepancy between level of need and appropriate use and benefit from services (e.g. Figure 50).

Registering patients with CHD so as to systematically support them in benefitting from strongly evidence based interventions can reduce their chance of a heart attack or stroke by 30 – 40%. However, for well documented reasons people with the greatest levels of need and risk are often unsuccessful at connecting appropriately with services.

Burden of Disease in Northern Lincolnshire

IMD by SOA

☐ Deprived

Qof Prevalence CHD
Average (%)

🟥 5.43
🟧 4.06
🟨 3.7
☐ Less than 3.7

SOA by IMD

☐ Deprived

SMR for CHD under 75

🟥 Over 50% higher
🟧 Up to 50% higher
🟨 Up to 25% higher
☐ National average

Burden of Disease in Northern Lincolnshire
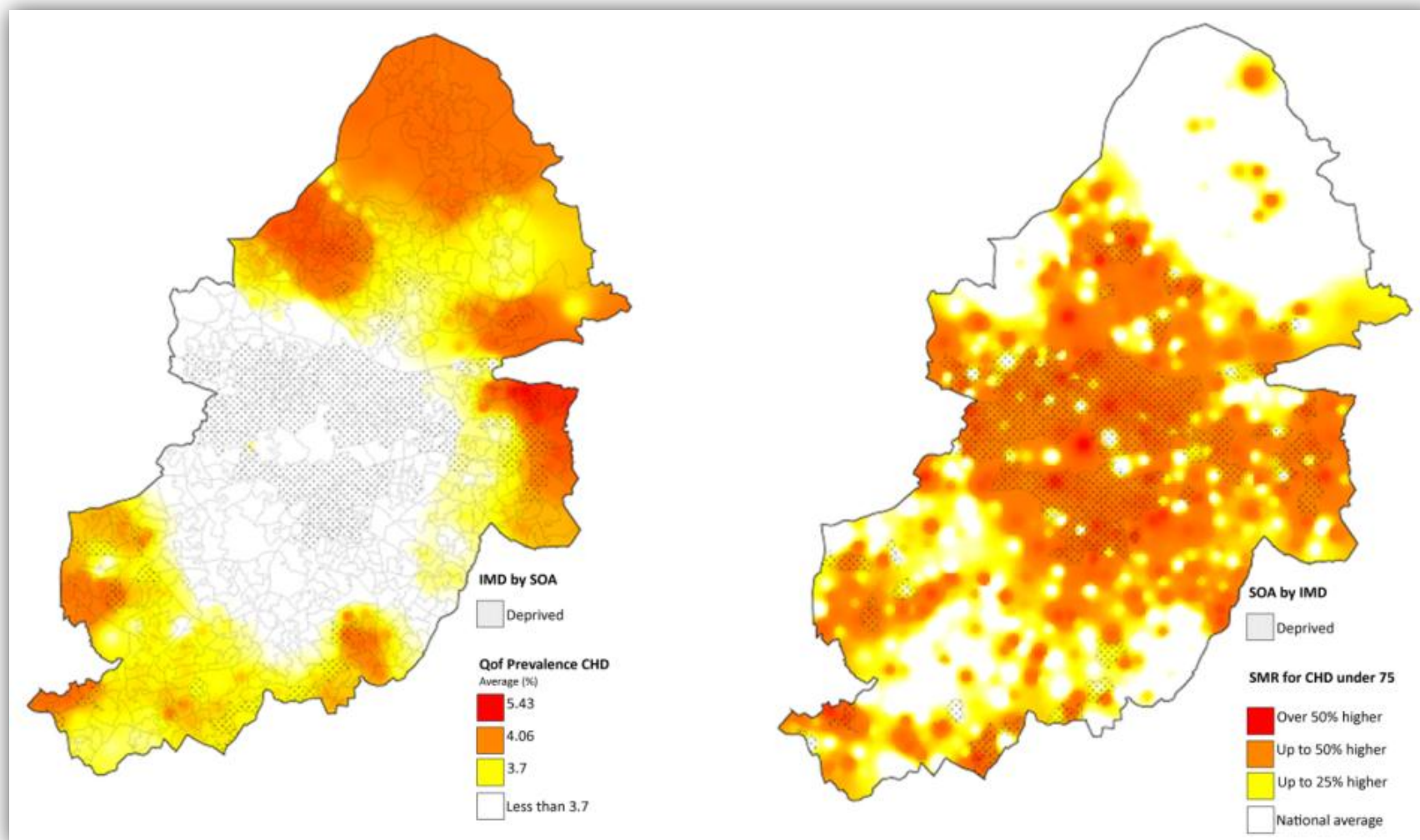
Figure 51 Coronary Heart Disease Standardised Death Rate

NORTH AND NORTH EAST LINCOLNSHIRE
U75 CHD deaths (2011-2015)

National 20% most deprived LSOAs

DSR per 100,000 population

0 - 50
50 - 100
100 - 150
150 - 200
200 - 601

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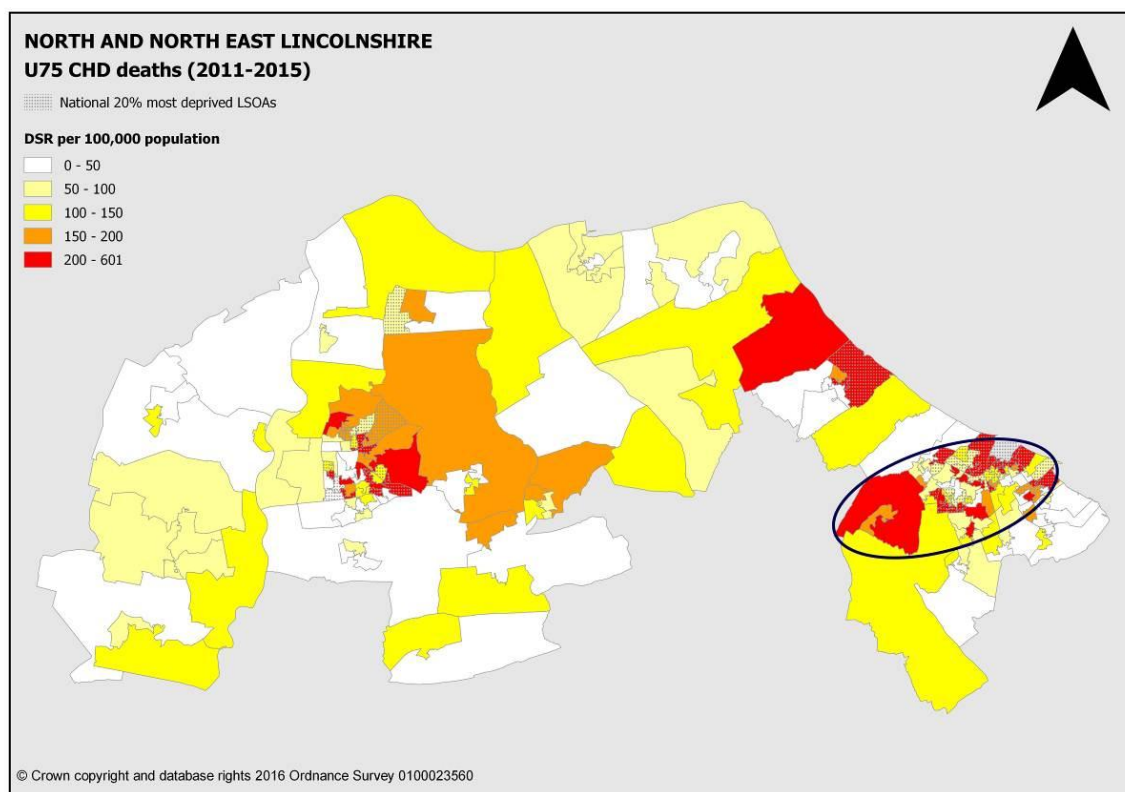
Figure 52 Coronary Heart Disease GP Register Prevalence

NORTH AND NORTH EAST LINCOLNSHIRE
Registered CHD prevalence

National 20% most deprived LSOAs

Average Prevalence (%)

< 3.0
3.00 - 3.9
4.0 - 4.9
>= 5.0

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Burden of Disease in Northern Lincolnshire
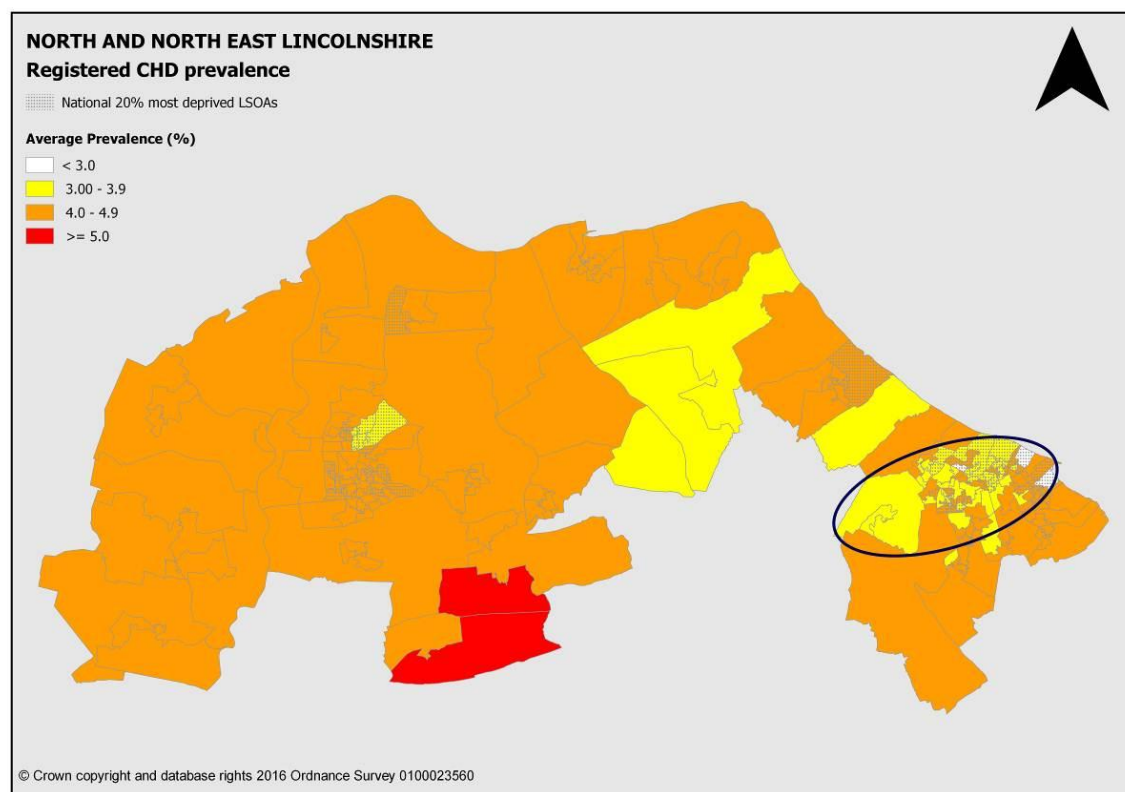
The mapped correlation of prevalence of registration against CHD death rate is less clear cut, and indeed somewhat mixed, in Northern Lincolnshire, partly because of the more distributed population (Figure 51 and Figure 52). However, the blue outlined areas show that for NEL the central area does show correlation between the areas with the highest death rate (red) having relatively low registration rates (yellow). It should be noted that the registration rates are not standardised for age, so a younger population but with earlier onset CHD and premature mortality may be less likely to register 'in time' for effective preventive action.

The points at which this process can break down were examined through Figure 43, Figure 44 (repeated below) and Figure 45. The narrative emphasised that working to address the pathway of 'intervention decline' requires whole system collaboration. Harnessing the wider workforce can be crucial even for medicalised interventions e.g.:

- Knowing the early signs of diabetes or cancer, and where to go for help

- Uptake on Health Checks; screening; vaccinations

- Support to self-manage long term conditions

Proposed HLHF models of out-of-hospital and place–based care arrangements should provide the culture and structures to support strategies to address the intervention decline in key areas of input. This will work if knowledge and information, plans and sought for outcomes are shared and addressed together.

Figure 53 Components of Unmet Need
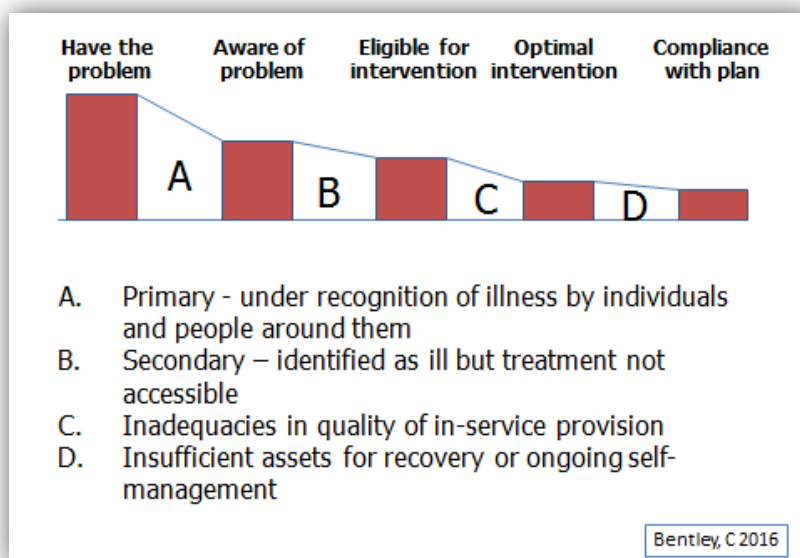
Particularly for mapped communities in the most deprived quintile, from where there can be many barriers to uptake of formal services, there will be added benefit in finding ways to engage with infrastructures supported by the community itself. This is not a straightforward task, but if it is possible to connect effectively, the community itself coming on board to improve their own health and wellbeing can bring with it assets such as leadership, networks and community venues (South, 2015).

Burden of Disease in Northern Lincolnshire

There are many good examples of a developed workforce of Community Champions playing a major role as two-way conduits and effective activists for the wellbeing agenda. Recent initiatives have built on this concept to change and grow the influence of health care locally in what has been called 'asset-based' primary care (altogether better, 2016). Health Champions are recruited and trained to expand the primary care team.

Poor connectivity with appropriate services is not all about people in disadvantaged circumstances. Figure 54 gives examples of characteristics of people for whom special targeted strategies will be necessary.

Figure 54 Seldom seen, seldom heard residents

- **Hard to identify and contact** (e.g. rough sleepers, illegal immigrants)

- **Not available, no time** (e.g. families with young children, people working long hours, carers)

- **Hard for public agencies to communicate with** (e.g. non -English speakers, people with learning disabilities, people unable to read or write, those with hearing difficulties, those who are visually impaired)

- **Resistant to involvement with statutory bodies** (e.g. because they feel threatened), (e.g. tenant in arrears, mother in an abusive relationship)

- **Hard to engage on public bodies' agendas** (e.g. young people on health issues)

- **Taken for granted.** Not hard to reach or engage with, but at risk of under-representation (e.g. white working class men).

6.3 'Sweat the assets' of disease registers to bring best outcomes from a clear evidence base systematically to those who could benefit.

Disease registers are a critical component of population health systems. Properly used, they will make sure that once a disease is identified and registered, health care is doing all it can to control LTCs, to reduce deterioration and prevent complications.

Northern Lincolnshire primary care is doing relatively well in managing some of its conditions. For example, controlling blood pressure in people with CHD (Figure 55).

Burden of Disease in Northern Lincolnshire

Figure 55 % on CHD register hitting BP target 150/90 mmHg or less (2014/15 QoF)
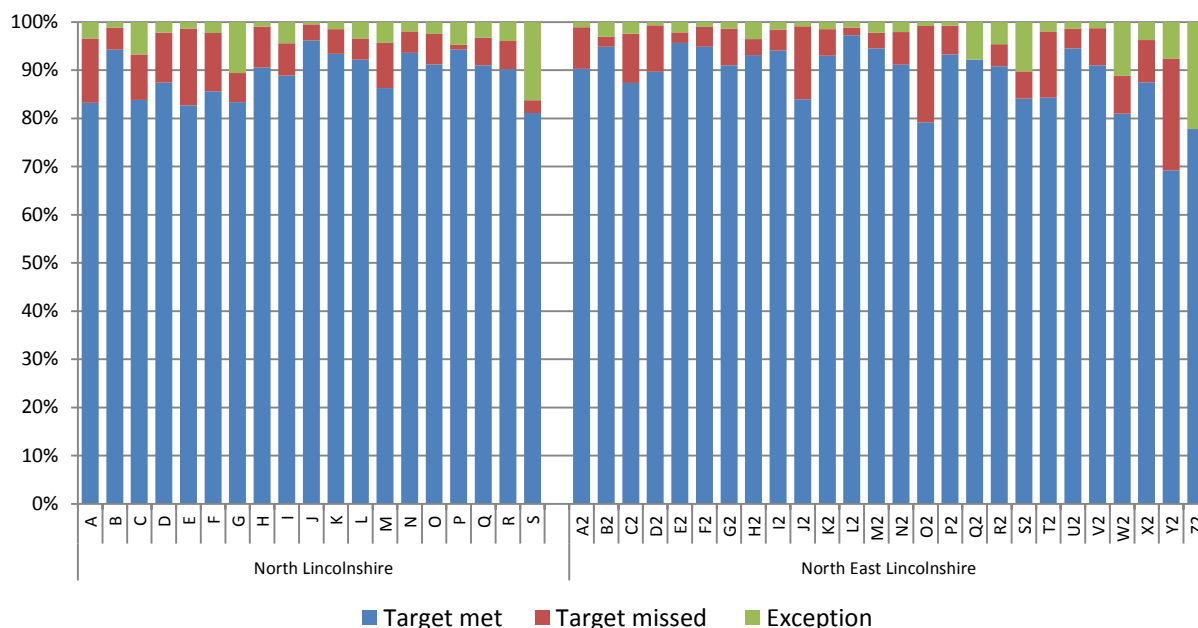
It is seen that in nearly all practices over 80% of patients have their blood pressure well controlled. However, the question should always be asked, who makes up the remaining nearly 20%. The concern is that the remainder include a significant percentage of the most complex cases with the highest risk, and that these may still go on to heart attack and stroke, despite being on the register.

Figure 56 puts that different perspective (Primary Care CVD Leadership Forum, 2016).

Figure 56 % of patients with CHD whose blood pressure reading (measured in the preceding 12 months) is not 150/90 mmHg or less by GP practice

Burden of Disease in Northern Lincolnshire
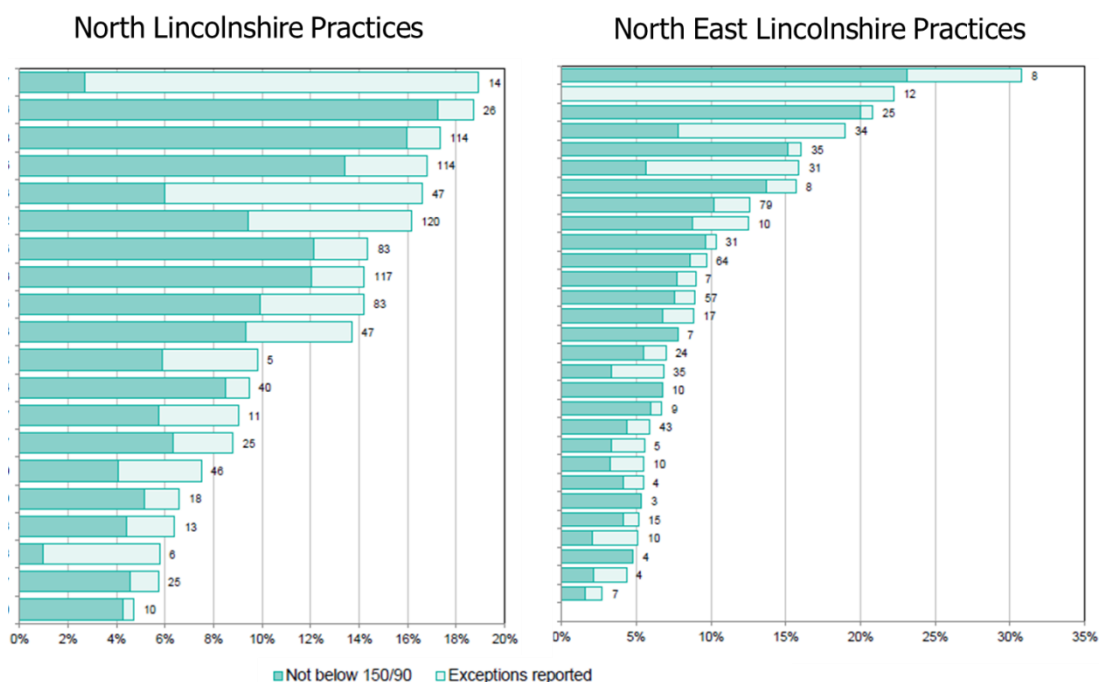
From this perspective, it can be stated that, for example in North Lincolnshire:

- In total, including exceptions, there are 964 people whose BP is not <= 150 / 90

• GP practice range: 4.7% to 18.9%

• If all practices were to achieve as well as the average of the best achieving practices, then an additional 401 people would be treated

The figures are similar but slightly less for North East Lincolnshire.

Diabetes is increasing in prevalence following the obesity epidemic, and contributes to an increasing proportion of the burden of disease and years of life with disability. 80% of the cost of diabetic care is spent on (preventable) complications (amputations; blindness; renal failure; stroke). However, the extent to which full advantage is taken of control measures, by practice, is very variable. For example the National Diabetes Audit (in which just over half of Northern Lincolnshire practices responded) (Primary Care CVD Leadership Forum, 2016):

- % receiving all 8 control measures

    o NL average 60% (36% – 79%)

    o NEL average 67% (36% - 79%)

- % achieving all 3 QOF treatment targets (blood sugar; BP; cholesterol)

    o NL average 40% (range 28% - 55%)

    o NEL average 40% (range 34% - 58%)

The question is not how does this benchmark, but how can such wasted opportunities for prevention be missed? Once the patient is diagnosed, and on the register, the extra resource needed to make it count in preventing deterioration and serious complications can only be cost effective, and hugely beneficial to the patient, family and society.

The register 'tool' is also available to improve control other components of the cardiovascular disease cluster such as hypertension, renal disease (CKD), heart failure; atrial fibrillation. For each good control information is locally available on an ongoing basis, and strategically on a regular basis ((Primary Care CVD Leadership Forum, 2016).

The main mechanisms for improving the impact of registers have been well documented, and include the following: (HINST, 2010)

- The main responsibility lies with the practice itself, to improve the efficiency with which registers are run, and to ensure the clinical protocols for management are clear, and are followed by all trained staff.

- Primary care is under pressure, so it is important that the 'industrial scale' that registers represent is adjusted to with appropriate systems. Skill mix will be critical for cost effectiveness. Health care assistants (HCAs) can manage much of the process if well supervised, with referral chain up to practice nurse and doctor in defined circumstances. Recruitment and training of HCAs could be done on a group/CCG basis, employment bay practice, with possibility of shared sessions by smaller practices. (Goodwin, 2010)

Burden of Disease in Northern Lincolnshire

- Variability in practice performance can be mitigated through local governance and support mechanisms. For example a small specialist CVD support team can produce substantial improvements in consistent delivery.

However, system efficiency is only half of the story, and engaging the patient in good, supported self-management is also critical to successful outcomes. In particular, evidence review shows the importance of the following:

- Care planning: this is an on-going process where an individual's needs are discussed with a professional, joint goals are agreed and these goals are monitored and reviewed on a regular basis. Care planning appointments require that the patient and the professional have enough time to discuss a range of issues which may be impacting on an individual's ability to manage their health. Part or all of this support may be delivered by non-clinical staff. This may include social and psychological issues in addition to those related to physical health. Subjects which may be useful to discuss for those with complex health needs include finances, nutrition, loneliness and warmth (Smith, 2016).

- Self-management: a systematic review of this critical element concluded the following (Centre for Reviews and Dissemination, 2015):

  o Commissioners and providers should consider how they promote a culture of actively supporting self-management

  o Successful self-management interventions are multicomponent and tailored to individuals' needs

  o Key components of self-management support include education, action planning, and practical, psychological and social support

  o Condition-specific self-management support reduces overall hospital use and improves quality of life in the short-term; effects on costs are mixed

  o Work schedules, family commitments, lack of transportation, and the cost of medication and dietary changes are possible barriers to patients engaging with self-management

  o Key considerations for implementation include strong clinical leadership, training and resources, and regular evaluation

6.4 Sweat the assets of screening, case finding and quality assured action plans to address risk conditions and pre-disease.

At critical points in the genesis of some diseases it is possible to intervene to prevent the development of the disease itself and its consequences down the burden of disease pathway. Unfortunately, most of these conditions require some form of 'clinical' testing as they are asymptomatic, and must be sought out pro-actively. Success therefore depends on the efficiency and effectiveness of the search.

Burden of Disease in Northern Lincolnshire

Figure 57 % actual (blue) versus expected (blue + grey) on CHD register including % hitting BP target 150/90 mmHg or less (2014/15 QoF)
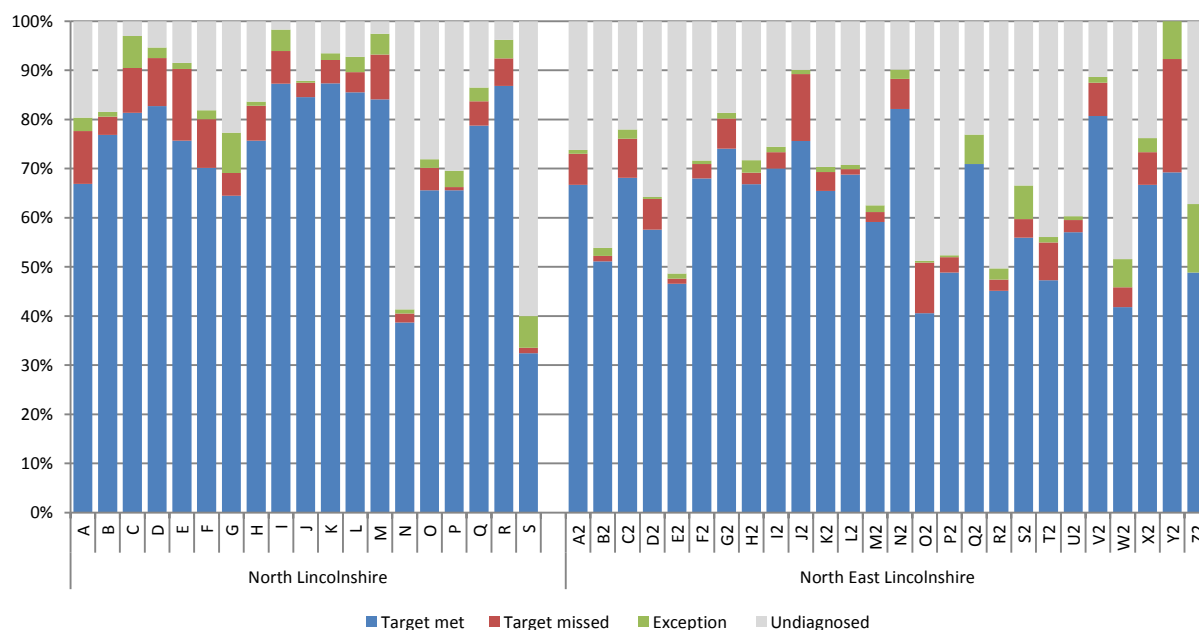
Figure 57 illustrates the potential scope for improved early detection and control in relation to cardiovascular disease. However good the control once a patient is on the register, that effort and expertise is not available to those 'missing' from the register (light blue bar in the Figure). There is a substantial difference seen between NL and NEL Practices on this measure. This is likely to represent the added complexity of identifying a younger patient group in more deprived circumstances.

Search strategies will be a combination of opportunistic testing for specific risk conditions (which can be systematised e.g. by flagging notes; software aided predictive searching) or by specific system of health checks.

The NHS Health Check is a sophisticated check of heart health. Aimed at adults in England aged 40 to 74, it checks vascular or circulatory health and works out your risk of developing some of the most disabling – but preventable – illnesses. Crucially, the NHS Health Check can detect potential problems before they do real damage. The check is designed to detect the risk of developing heart disease, stroke, Type 2 diabetes, kidney disease and some forms of dementia. There is also a simple screen for possible alcohol related harm.

As NHS Health Checks are currently mandated, the scope for improving effectiveness lies in how they are delivered. The evidence suggests that targeting to the neediest populations earliest may be more effective than opportunistic programmes and would also reduce the risk of exacerbating health inequalities. (Christmas, 2016).

The mandated NHS Health Check does not have a strong record of success, and locally within Northern Lincolnshire the systems are far from reaching their potential. There have been a number of changes in approach, but it will be critical to pursue effective change as this provides a vital way in to reducing the burden of disease right down the pathway.

Burden of Disease in Northern Lincolnshire

Figure 58 demonstrates the recent performance of NL, benchmarked against England and the Region (Primary Care CVD Leadership Forum, 2016).

Figure 58 % invited and % taking up Health Check (Yorkshire and Humber)

% of eligible people offered a NHS Health check

NHS Greater Huddersfield...	24.7%
NHS North Kirklees CCG	24.7%
NHS Hull CCG	23.5%
NHS Calderdale CCG	22.8%
NHS Sheffield CCG	20.2%
NHS East Riding Of...	20.0%
NHS Vale Of York CCG	18.1%
NHS Leeds North CCG	16.6%
NHS Leeds West CCG	16.6%
NHS Leeds South And...	16.6%
NHS North East...	15.9%
NHS Harrogate And Rural...	15.5%
NHS Scarborough And...	15.5%
NHS Airedale, Wharfedale...	15.2%
NHS Bassetlaw CCG	15.2%
NHS Bradford Districts CCG	15.0%
NHS Bradford City CCG	15.0%
NHS Barnsley CCG	14.7%
NHS Wakefield CCG	13.8%
NHS Rotherham CCG	12.9%
NHS North Lincolnshire CCG	11.9%
NHS Doncaster CCG	4.5%
England	19.7%

% of eligible people receiving a NHS Health check

NHS Greater Huddersfield...	13.7%
NHS North Kirklees CCG	13.7%
NHS Calderdale CCG	13.3%
NHS Barnsley CCG	12.7%
NHS Leeds North CCG	10.8%
NHS Leeds West CCG	10.8%
NHS Leeds South And...	10.8%
NHS Sheffield CCG	8.2%
NHS Hull CCG	7.7%
NHS Bassetlaw CCG	7.4%
NHS Rotherham CCG	7.0%
NHS Vale Of York CCG	6.8%
NHS North Lincolnshire...	6.7%
NHS Bradford Districts CCG	6.7%
NHS Bradford City CCG	6.7%
NHS Airedale, Wharfedale...	6.6%
NHS North East...	6.4%
NHS Harrogate And Rural...	6.4%
NHS Scarborough And...	6.4%
NHS East Riding Of...	5.0%
NHS Doncaster CCG	4.5%
NHS Wakefield CCG	4.2%
England	9.6%

The chart shows that the invitation rate (for the latest year in a 5 year cycle) is one of the lowest in the region. NEL has a better invitation rate, but a similar uptake rate of only 6.4%. However this benchmarks, it is not doing its fundamental job!

In principle, this process is one that needs to involve the whole system, following the 'intervention decay' model described above. One of the most effective of such schemes, before this became 'mandated' was 'The Big Bolton Plan', which engaged the whole system to great effect, achieving a very high proportion of the population being tested (Blair-Stevens, 2010).

Identification on its own, of course, will not prevent the development of disease. It is important to be just as systematic about care planning and support for the necessary changes to be made by the individual. Reviewed evidence suggests that changes made after ascertainment of risk are generally patchy and variable, which of course will compromise any population level measurable outcome (Christmas, 2016). While structured programmes to achieve moderation of risk through lifestyle and behaviour change (see next section) can be effective, these need to be monitored closely for effect. This might best be achieved systematically using a risk register. Where the required behaviour modification (e.g. substantial weight loss) is not being achieved, there should be defined time to proceed to other forms of risk modification e.g. statins; antihypertensive medication.

A particular national priority initiative is underway which involves the identification of pre-diabetes. People at high risk of developing Type 2 diabetes can be identified through the NHS Health Check and

Burden of Disease in Northern Lincolnshire

evidence shows that the disease could be prevented in 30-60% through appropriate behaviour change support (NICE, 2015). Generally, more intensive programmes (more contact, lasting longer) achieved better results. This will be a critically important initiative to address with system and scale in Northern Lincolnshire, as elsewhere, as:

- The incidence of Type 2 diabetes is increasing year on year in association with the obesity epidemic

- Diabetes is a major and most rapidly increasing contributor to fatal (YLL) and disability related (YLD) burden of disease.

- Prevention of progression to disease will prevent downstream cost and effort of its LTC control programme, and ultimately the high 'salvage costs' of managing severe complications.

Screening programmes. Most of the main national adult screening programmes are aimed at detecting and mitigating pre-disease states before they progress to full often catastrophic disease (cervical cancer; bowel cancer; aortic aneurysm; diabetic retinopathy). All these programmes have been judged to be effective and cost effective at population level. Responsibility for running the screening programmes is mandated to NHS England, and this is quality assured through PHE. The NHS is commissioned to complete diagnostic procedures and treatments, along agreed pathways.

There are significant inequalities in access and uptake to screening, particularly for bowel cancer. Responsibilities for action on inequalities in uptake lie with NHS England. While local public health does not have responsibility specifically for screening uptake, responsibility for population health generally requires oversight and action where inequalities are not being addressed. The impact of such inequalities is demonstrated in Figure 59.

While there are some problems with data access to monitor this issue, this important element of the prevention of downstream burden of disease needs to be vigorously pursued.

Figure 59 Impact of screening on cancer survival (PHE)

Burden of Disease in Northern Lincolnshire
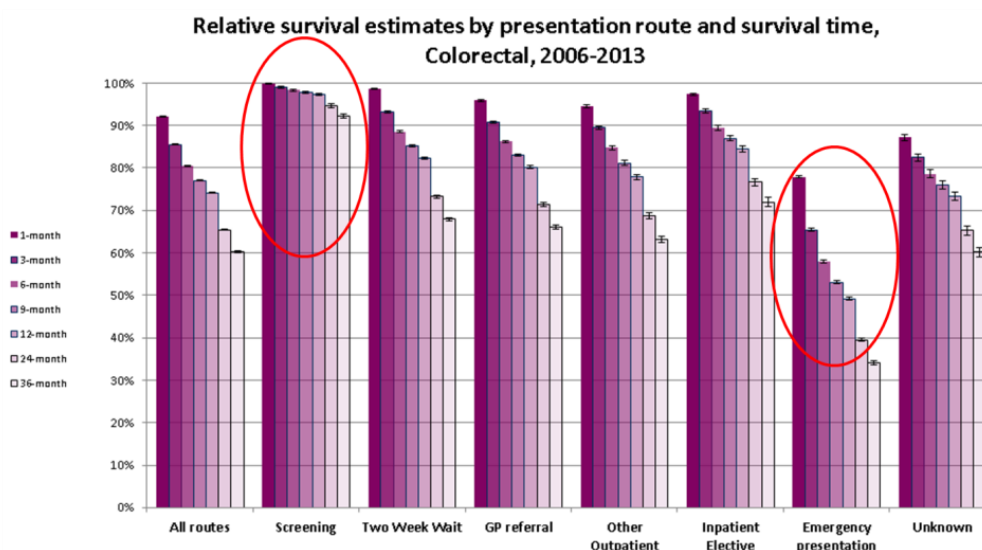
Vaccination and treatment. Nationally approved vaccination programmes are clearly effective and cost effective, and should be pursued to get maximum uptake.

Human Papilloma Virus vaccine is dramatically effective in ultimately preventing a large proportion of cervical and other epithelial cancers. Currently only available systematically for young women, uptakes are high in Northern Lincolnshire (NEL – 91.5%; NL – 85%). These are good results. However, reviews show that the missing 10 – 15 % are frequently young women regarded as 'making poor life decisions', and regarded as having high degree of risk across a number of key areas. There is no herd immunity 'when you live outside the herd'. It is probably worth giving frontline staff (school nurses; vaccination teams) the capacity and empowerment to follow up completion of courses in these 'missing' young women.

Hepatitis C is a significant contributor to components of liver disease, including cirrhosis and cancer, and a notable element of premature death particularly in young disadvantaged residents. 90% of infections are attributed to infecting drug use.

This is a difficult programme to implement at population level, but NICE has produced the following guidance (NICE, 2012):

- Identifying a hepatitis lead with the knowledge and skills to promote testing and treatment. Consideration given to training peer mentors and health champions to promote this work.

- Ensure there is a local pathway to specialist care for infected people; including the possibility of providing treatment in the community combined with opiate substitution therapy.

- Offering and promoting testing to all service users, with annual screening for those who test negative for Hep C infection, but remain high risk

- Ensure staff have the knowledge and skills to promote testing and treatment, and are trained and competent to undertake pre- and post–test discussions and dried blood spot testing for those with venous access.

6.5 Programmes to modify risk behaviours

The main identified risk behaviours are critical ones to address, not just because they are really upstream in the pathway, but also because they each contribute to numbers of the main components of the disease burden. The problem is how to address them with sufficient system and scale. Although the cost per QUALY is very low on an individual basis, the numbers needed to treat (NNT) are very large (Figure 46). This means large numbers of agents will be necessary to support the intervention, and assuring their quality and support brings clear challenges.

There are no 'magic bullets' here, so Northern Lincolnshire needs a comprehensive strategy for each of the main risk 'behaviours':

- Dietary risks

- Low physical activity

- Tobacco smoke

- Alcohol and drug use

- Occupational risks

Burden of Disease in Northern Lincolnshire

For the first two of these, it is likely that most effective and cost effective interventions will have been brought together in the national obesity strategy, due to be launched soon. Otherwise, a number of key principles for population level action will be as follows:

- Strategies need to cover interventions at all points of the population intervention triangle (Figure 60). It is advisable to focus on clear cut; evidence based interventions only, and focus on implementing these effectively with system and scale. A good starting point is the NICE guidance to Local Authorities e.g. on Tobacco Control, which can be mapped across the intervention triangle to assure a balanced programme (NICE, 2015).

Figure 60 Producing percentage change at population level

- Brief interventions (BI) are short, opportunistic interventions aimed at encouraging healthier lifestyle/ behaviour in an individual. There are numerous published studies on BI for many different behaviours. In general the findings are positive, with BI reported to be both effective and cost effective. NICE specifically recommends use of BI in a number of fields including stop smoking, obesity, physical activity and alcohol and prevention of frailty and dementia. There is good evidence that BI is an effective and cost-effective intervention; and there is good evidence about what works in individual behavioural areas.

As with other health improvement interventions, the evidence generally shows that BI is good at prompting change, but there is less evidence for the long term sustainability of that change – this needs taking into account when planning services.

Delivery of BI with system and scale requires sustainable programmes of training and re-training as well as monitoring impact and feedback to practitioners.

Burden of Disease in Northern Lincolnshire

Making Every Contact Count is an important approach to equipping frontline staff in health and social care organisations to deliver BIs having identified specific risk behaviours in patients /clients during routine service activity. Some programmes have evaluated well, where systematic and sustained programmes have been put in place.

- Tier 2 services: BIs are short interventions lasting 5 -10 minutes. Where it is believed there is readiness to change but more support is needed, referral to Tier 2 services can be effective. NICE advises that for alcohol related harm, this can involve, say, 6 half-hour support sessions even from lower level trained staff.

Tier 2 services are often missing or inadequately provided, falling for commissioning purposes between Tier 1 (primary care) and Tiers 4 and 3 (hospital based and specialist outreach services). Boosted provision of 'Tier 2' services for a range of risk behaviours may be a useful cost effective option for population level impact.

- Targeting high risk individuals. From a population health perspective, services to address individual risk behaviours, e.g. stopping smoking, will not reach sufficient numbers to measurably change population prevalence on its own. They will need to contribute to multifaceted approaches across the population intervention triangle.

The value of such activity on outcomes, however, will be amplified if the activity is focussed on individuals with 'multiplicative' risks. This should substantially reduce the NNT.

Most straightforwardly, such a target population is to be found on the LTC registers in each practice. Programmes to address, for example numbers still smoking on the major disease registers, should be actively monitored, and interventions such as BI, and referrals to 'Tier 2' and specialist services systematically documented.

- The biggest challenge will be where risk behaviours cluster, often in people with most disadvantage (see Figure 37). Where this is the case services will need to have a multifaceted approach, being able to flexibly respond to client's readiness to change to address particular risks at particular times.

6.6 Addressing the social determinants of the disease burden

The local authorities and partners in Northern Lincolnshire are working to address the social determinants of health and wellbeing, including those described in the Marmot Report, to address inequalities across the social 'gradient' and the 'life-course'.

Important priorities for those working to specifically manage the Burden of Disease will be the following:

- Early years development: this is evidenced to be the most critical and fundamental period of the life course. There are a number of key initiatives that focus on the early years, and the core of these is provided across the social gradient as 'universal', with triggers to initiate 'universal plus' extra inputs according to identified need. This principle (with different labels across health, social care and education services) is applied across Children's Services in more or less integrated ways. With significant funding constraints, however, there is a risk that the resources available for any graduated input may fall short, particularly of the 'disproportionate' need in

Burden of Disease in Northern Lincolnshire

the most deprived areas. Key components of response, which should embody integrated approaches, key workers and outreach links, include:

- o Promoting early antenatal booking
- o Smoking cessation in pregnancy
- o Perinatal screening uptake
- o Healthy Child Programme (capacity to fully respond to universal + need)
- o 'Early Help' co-ordinated children's service teams
- o Children's Centres
- o Focussed initiatives (Family Nurse Practitioners; Troubled Families)
- o Good quality early years education and childcare

These initiatives should all be in place across the Districts. However, it is important to carry out audits and monitoring to ensure that:

- o Access is easiest and outreach is focussed on the most disadvantaged natural communities, as mapped (see 6.1 above), including single points of access and key workers
- o Resources are mapped against modelled need, including appropriate and efficient use of skill mix
- o Commissioning and incentives support capacity to respond appropriately to significant identified need
- o The system endeavours to make measures of input, outputs and (intermediate) outcomes available on a community basis to promote effective responses.
- o Good co-ordinated information systems will be critical to ensure the identification of and actions to address barriers and gaps. Children and parents in need should not be allowed to fall through the gaps.

Similar systematic, targeted and often community based approaches to support will apply to other elements of the Marmot objectives e.g.

- • Skills and good work

Programmes for skills development should be accessible within areas of greatest need. Training and skills development is most effective when needs based, and when training itself involves participatory planning.

- • Income and debt

Community based advice and support (e.g. Citizen's Advice; credit unions) can be critical parts of multi-faceted support to self-management, at the core of health and wellbeing. It should be clear in all communities where support is available, and health and social care should provide signposting and advocacy, at least, to support access and outcomes

Burden of Disease in Northern Lincolnshire

On a 'place' basis all partners should work on a holistic and contributory basis to improve personal, family and community resilience. Dividends will be widespread where this is effective, and will have a downstream impact on risk behaviours and the burden of disease.

6.7 Addressing/managing leading causes of Years of Life with Disability (YLD)

The GBoD identifies two major causes of YLD which will have a significant impact on wellbeing, social isolation and loss of independence. They will also have a significant impact on health services, mainly primary care. However, there is little evidence of serious population level attempts to impact on their BoD.

6.7.1 Sensory loss

Mild but progressive sight and hearing loss is a common feature of ageing and may go unnoticed for some time, but can have a serious effect on a person's communication, confidence and independence. The recognition and recording of needs arising from sensory impairment by staff who are alert to the symptoms and signs and aware of the role of the GP in the route to referral can help to ensure early assessment and access to appropriate healthcare services.

The majority of people who are registered as having a sensory impairment are over the age of 65. Given the projected increase in the number of people over the age of 65 in the population, there is likely to be greater demand on services to support the needs of people with sensory impairments.

While there is minimal support for population level approaches to hearing loss, there are important initiatives in progress for sight loss.

Research by the Royal National Institute for Blind People research suggests that 50% of blindness and serious sight loss could be prevented if detected and treated in time. Prevention of sight loss helps people to maintain independence and reduces the need for social care support. Sight loss is heavily influenced by health inequalities, including deprivation and age. Sight loss can increase the risk of depression and falls related injuries such as hip fractures as well as loss of independence and poverty.

Costs and demands on NHS outpatient services are high with ophthalmology services having the third highest attendances of all services from 2011-2012. In 2008, the direct and indirect cost of sight loss was £6.5 Billion and by 2013 these costs were predicted to rise to £7.9 Billion (UK Vision Strategy).

There are 4 measures in the Public Health Outcomes Framework on this issue. The figures show quite distinct level of difference between NL and NEL. For example Figure 61shows a significantly different number of sight loss certifications. Similar differences occur for cases of glaucoma and macula degeneration related sight loss. This seems surprising, considering the more elderly make-up of the NL population.

Eye health, with a focus on ageing and sight loss, is a UK-wide Royal College of General Practitioner (RCGP) clinical priority for April 2013 to March 2016. A GP network on eye health has been set up to help the clinical champion to further develop and deliver the programme, as well as supporting the dissemination of key messages. The programme aims to enable GPs to:
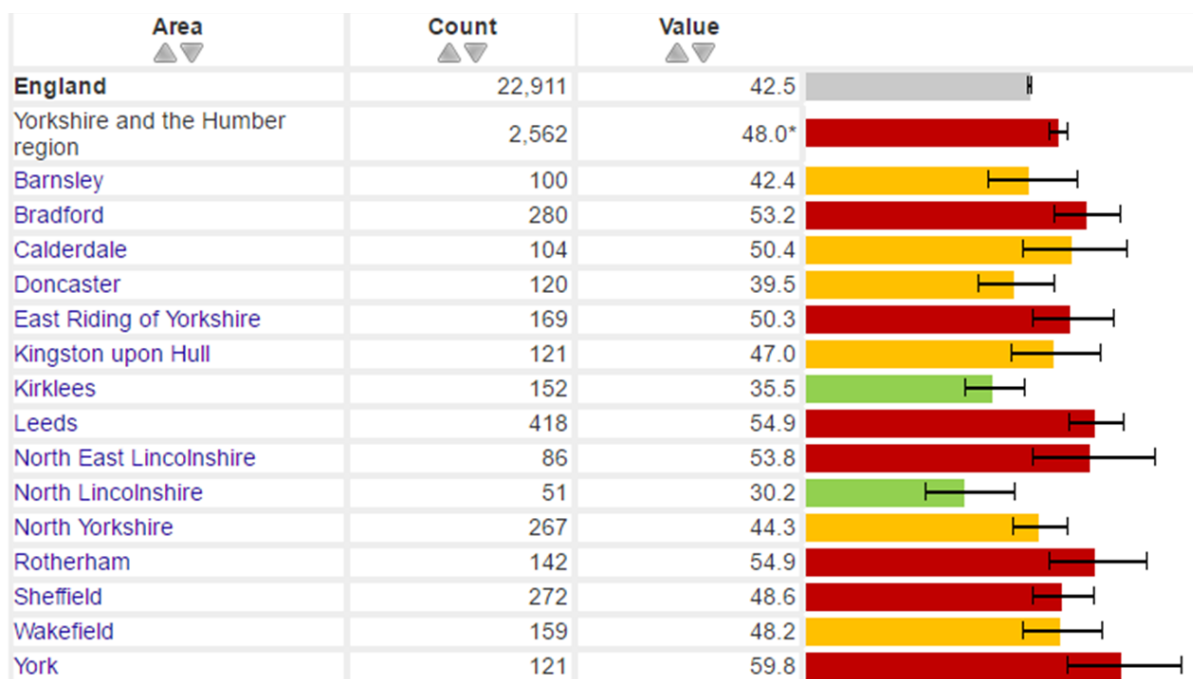
- Prevent avoidable sight loss amongst their older patients and associated conditions such as falls, fractures and depression

Burden of Disease in Northern Lincolnshire

- Refer into eye care services patients with signs of 'correctable' sight loss (e.g. refractive error, cataracts etc) to maintain and improve their quality of life

- Ensure patients with permanent sight loss maintain their independence for longer by helping them to access rehabilitation, low vision and other support services

This programme might provide a basis for a systematic approach in Northern Lincolnshire.

Figure 61 Preventable sight loss - sight loss certifications

Area	Count	Value	
England	22,911	42.5	
Yorkshire and the Humber region	2,562	48.0*	
Barnsley	100	42.4	
Bradford	280	53.2	
Calderdale	104	50.4	
Doncaster	120	39.5	
East Riding of Yorkshire	169	50.3	
Kingston upon Hull	121	47.0	
Kirklees	152	35.5	
Leeds	418	54.9	
North East Lincolnshire	86	53.8	
North Lincolnshire	51	30.2	
North Yorkshire	267	44.3	
Rotherham	142	54.9	
Sheffield	272	48.6	
Wakefield	159	48.2	
York	121	59.8	

Public Health Outcomes Framework 2015

6.7.2 Musculoskeletal conditions (MSK)

While it is no surprise that MSK is a major contributor to YLD (Figure 15) and to hospital admissions (Figure 19), analysis of the conditions contributing to those figures show a very different profile to both. While hospital admissions are dominated by joint replacements and fractures, the YLD is very much dominated by back and neck pain.

The high volume of associated problems should make this a priority condition for identification and systematic early management to prevent the condition becoming a chronic problem.

A large proportion of cases occur in the workplace, and the Health and Safety Executive have reviewed the evidence around the costs and benefits of case management and rehabilitation in this setting (Hu-Tech Associates Ltd, 2006). In the NHS workforce MSK is one of the main causes of sickness absence, and it is important that Occupational Health and Health and Safety develop organisational strategies for prevention and rehabilitation, driven by good intelligence and needs assessment.

Outside the workplace, the incidence and prevalence of back and neck pain should make it a priority for systematic approaches within the out-of-hospital plans for integrated care.

Arthritis Care have produced guidance to emphasise self-management, but this needs to be used in conjunction with NICE guidance and technical reviews.

Burden of Disease in Northern Lincolnshire

6.8 Approach to multi-morbidity.

Studies e.g. (Kadam UT, (2013)) have shown how pairings of LTCs affected A & E attendance and the increased costs of hospital care. For example, transition, defined as at least one episode in each of 3-year time periods, was as follows: patients with hypertension and diabetes had the fewest transitions in the 3-year time period (37% A&E episode and 51% hospital admission), but those with heart failure and renal disease had the most transitions (67% A&E episode and 79% hospital admission).

Specific common multi-morbid pairs are associated with higher healthcare transitions and differential costs. The adjusted costs were significantly higher for all six multi-morbid groups compared with their respective single disease groups.

The overall conclusion is that identification of multi-morbidity type, starting with common pairings, and linkage of information across interfaces provides opportunities for targeted protocols and guidance for intervention and delivery of integrated care.

Clinical information systems should increasingly be able to provide appropriate intelligence for more efficient and effective management.

6.9 Systematic population-based approaches to frailty and dementia

There are currently systematic approaches to the identification, registration and management of dementia. These involve mainstream population level initiatives, driven by 'commissioning' incentives, including Health Checks, QOF and CQuINs. This focus is based on the substantial improvements that can be achieved by the coordination of proactive support for patient and carers on their health and wellbeing. Partly as a result of this, but also through substantial improvements in 'pathway' co-ordination there have been measurable improvements in:

- Retained (supported) independence, and deferred entry to residential care

- Reduction in the numbers presenting in crisis to social care, emergency departments and urgent care centres

- Reduction in the number of avoidable hospital admissions/bed days for patients with a dementia diagnosis.

It is recognised that similar advantages could be gained through a formalised recognition of the state of frailty. In addition there is the advantage that, unlike dementia at present, progressive degrees of frailty can be halted and even reversed with pro-active approaches.

Burden of Disease in Northern Lincolnshire

There are significant overlaps between the two syndromes, which will enable system efficiencies, e.g.:

	Frailty	Dementia
Mild	Evident slowing; need help with higher Activities of Daily Living (ADLs) e.g. finances; transportation; heavy housework; medications. Progressively impairs shopping, walking outside alone, meal preparation.	Includes forgetting details of a recent event, though still remembering the event itself, repeating the same question/story, social withdrawal
Moderate	Need help with all outside activities and keeping house. Inside problems with stairs, bathing and minimal assistance with dressing.	Recent memory very impaired, though remembering past events well. Can do personal care with prompting.
Severe	Completely dependent for personal care whatever cause (physical or cognitive). May seem stable and not at high risk of dying within 6 months.	Cannot do personal care without help

Systematic processes for pro-active management could include:

- Pro-active assessment and identification. A useful tool for use at GP level appears to be the electronic Frailty Index (eFI). (NIHR CLAHRC Yorkshire and Humber, 2015) This works through GP clinical systems, and identifies patients on a mild/moderate/severe basis. The aims of the process are stated to be:

The eFI will help improve care for older people with frailty by:

- Directing better primary care pathways for older people by considering individual frailty rather than chronological age

- Identifying the top 2% most vulnerable patients for targeted care planning to reduce unplanned hospitalisations

- Structuring integrated care around frailty, to ensure that those who may benefit most are identified for integrated services

- Enabling targeted medication reviews for older people with frailty using evidence-based checklists (e.g. STOPP/START criteria)

- Identifying the presence of frailty to guide more appropriate, shared decision making in secondary care, for example in cancer services for older people

- Identifying those with advanced frailty who may be entering the terminal phase of life for advance care planning discussions

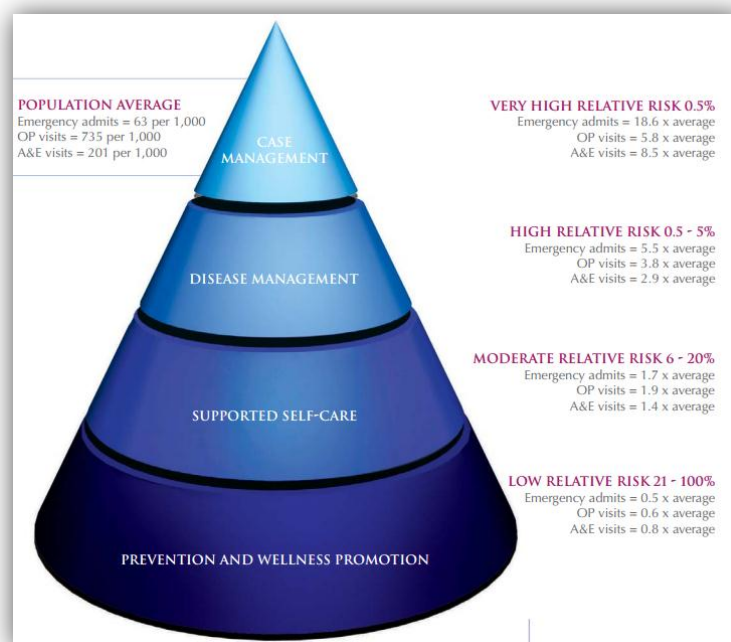Burden of Disease in Northern Lincolnshire

- Proactive care should include graduated integrated inputs to address care and contingency planning. Place – based out-of-hospital arrangements, including the voluntary, community and faith based networks, should work towards key worker designation and attention to generic issues to include nutrition, loneliness and warmth

- Frailty programmes should include prevention and management pathways for the 5 pillars of frailty:

  o Falls

  o Delirium

  o Immobility

  o Incontinence

  o Medication problems

- Key performance indicators and audits should be focussed to monitor the impact of frailty interventions over time.

6.10   Predictive modelling

Predictive modelling is an approach using the potential of Big Data to identify predictors of patient risk from very large clinical data sets. Software derived from this can then be used at a local level to derive lists of patients at defined stratified levels of risk, enabling cost beneficial targeting of efforts and resources. There are now a wide range of commercial models for this approach, and a market place from which to choose from alternative providers.

One of the early versions of this incorporated several systems into a Combined Predictive Model (Health Dialog UK Ltd./ King's Fund, 2006). The Combined Model was reported to offer an increase in predictive power for the highest risk patients, and also to facilitate the identification of a much broader population with emerging risk (Figure 62).

Burden of Disease in Northern Lincolnshire

POPULATION AVERAGE
Emergency admits = 63 per 1,000
OP visits = 735 per 1,000
A&E visits = 201 per 1,000

CASE MANAGEMENT

DISEASE MANAGEMENT

SUPPORTED SELF-CARE

PREVENTION AND WELLNESS PROMOTION

VERY HIGH RELATIVE RISK 0.5%
Emergency admits = 18.6 x average
OP visits = 5.8 x average
A&E visits = 8.5 x average

HIGH RELATIVE RISK 0.5 - 5%
Emergency admits = 5.5 x average
OP visits = 3.8 x average
A&E visits = 2.9 x average

MODERATE RELATIVE RISK 6 - 20%
Emergency admits = 1.7 x average
OP visits = 1.9 x average
A&E visits = 1.4 x average

LOW RELATIVE RISK 21 - 100%
Emergency admits = 0.5 x average
OP visits = 0.6 x average
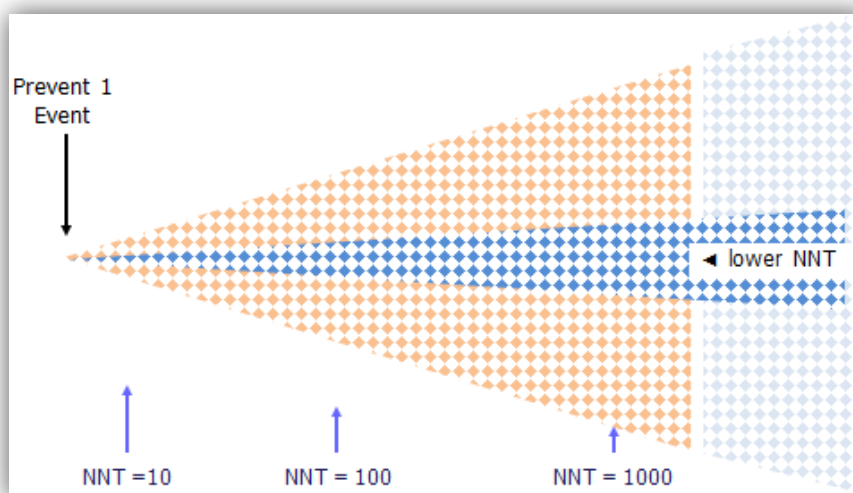A&E visits = 0.8 x average

Experience with such systems subsequently has shown that focus on the very high relative risk patients at local level, those with, for example, high levels of hospital admission, are mainly in the last year of life. In strategic terms, it is likely to include patients with moderate and severe forms of frailty and dementia, and case management approaches on this basis may be most appropriate.

It is probably the next level of risk where focus on prevention of deterioration and development of complications from LTCs is the focus, that substantial interventions can be most effective.

In this regard, predictive modelling will be an important intervention to help prioritise patients at high risk and effectively focus particularly where NNT will be smallest for short term impact (Figure 63).

Figure 63 Numbers Needed to Treat (NNT) predictive models identifying patients with high risk (dark blue)

Prevent 1 Event

◄ lower NNT

NNT =10   NNT = 100   NNT = 1000

Burden of Disease in Northern Lincolnshire

7. Conclusions

This Report focusses on the growing Burden of Disease nationally and within Northern Lincolnshire. It emphasises how the burden, numerically is set to rise substantially, driven particularly by uncontrollable factors of population growth and ageing. Managing this burden is the considerable challenge for strategies such as Healthy Lives, Healthy Futures.

The approach taken is therefore to identify where population level interventions can be used to mitigate some of the growth in substantial ways. This is based on a Burden of Disease 'pathway' which identifies stages in the development of disease and its consequences, and establishes points of intervention, where 'upstream' prevention can avoid or defer 'downstream' problems.

A major factor which determines current and future extent of the burden is identified to be the inequalities arising from socio-economic deprivation. The pattern is different in NEL and NL, but very significant in both. The case is made that working to address the inequalities is not just a case of working against social injustice. There are major consequences for service workload and cost in Districts such as NL and NEL.

Mapping the necessary graduated response to address unmet needs upstream on the pathway so as to impact substantially downstream will be critical. Working on appropriate access and uptake according to need will involve, at least for the most deprived areas, systematically reaching out to engage communities where they are, and connecting to work with assets such as leadership, networks and venues, not as patchy small projects, but to scale. This should be a necessary extension of 'place-based' approaches currently in planning.

Variations in risk and disease are described across the life-course, again varying by deprivation quintile, and this should dictate differences in priority focus, and the differential timing of interventions, based on good intelligence.

The focus for chosen interventions is based on choosing approaches that are capable of making percentage change at population level. Otherwise they may be tokenistic as the burden of disease grows.

Many of the necessary interventions are already in place to a degree, but the implementation and access is patchy and variable. Much greater value and impact can be achieved by tightening management approaches to address system, scale and sustainability.

In particular, the case is made that all partners need to be engaged, as do the communities themselves, if substantial impact is to be made. Using the A-B-C-D strategic approach described, different agents and sectors will play different roles depending on the intervention. It will be important to be clear how the local authority, CCG, primary care, frontline community services and the voluntary, community and faith sector can each play their part, for each of the prioritised interventions.

Burden of Disease in Northern Lincolnshire

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Burden of Disease in Northern Lincolnshire

healthy lives healthy futures

Annex. Diabetes and the Burden of Disease Pathway

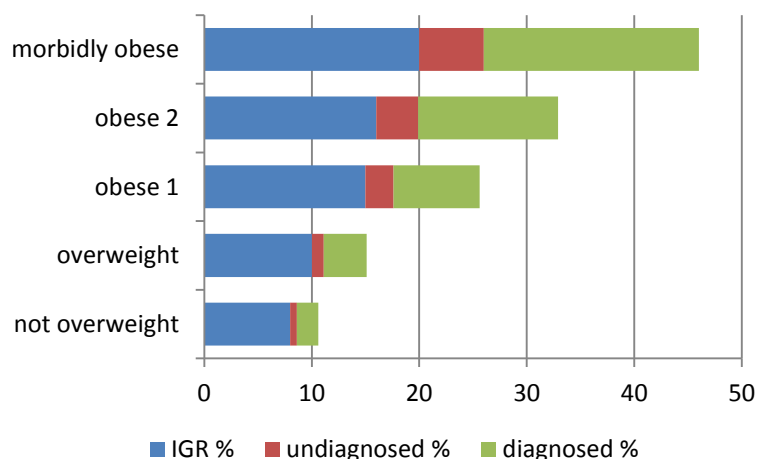### Risk factors: Social Determinants of diabetes (Moody, 2016)
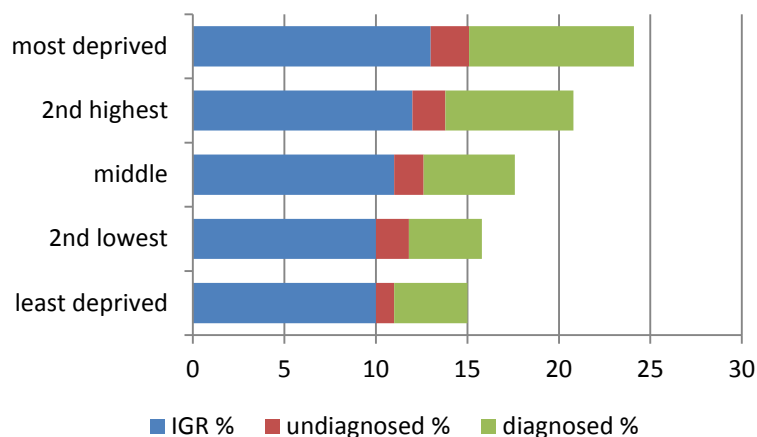
All components, pre-diabetes (IGR) and diabetes correlate strongly with deprivation.

Strategies need to work to address how the population uses services and are supported to do so.

Community engagement approaches needed in most deprived.

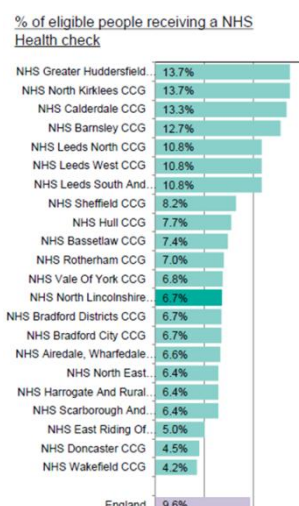### Risk factors: Risk behaviours and diabetes (Moody, 2016)

Obesity is a very strong and proportionate risk factor for diabetes.

Obesity rates are highest in most deprived population.

Obesity strategy must be scaled up and systematic to achieve population level change. Must use all components of the intervention triangle

Prevent progression to full disease

30 -60% of Impaired Glucose Regulation (IGR) does not and/or can be prevented from progressing to diabetes.

Northern Lincolnshire only currently screens only 6 – 7 % of those eligible annually - less in the most deprived.

Are there sufficient resources for intensive face-to-face support of those detected.

Burden of Disease in Northern Lincolnshire

LTC cost effective control in diabetes

DOVE
(Diabetes Outcomes Versus Expenditure)

- North Lincolnshire
- North East Lincolnshire
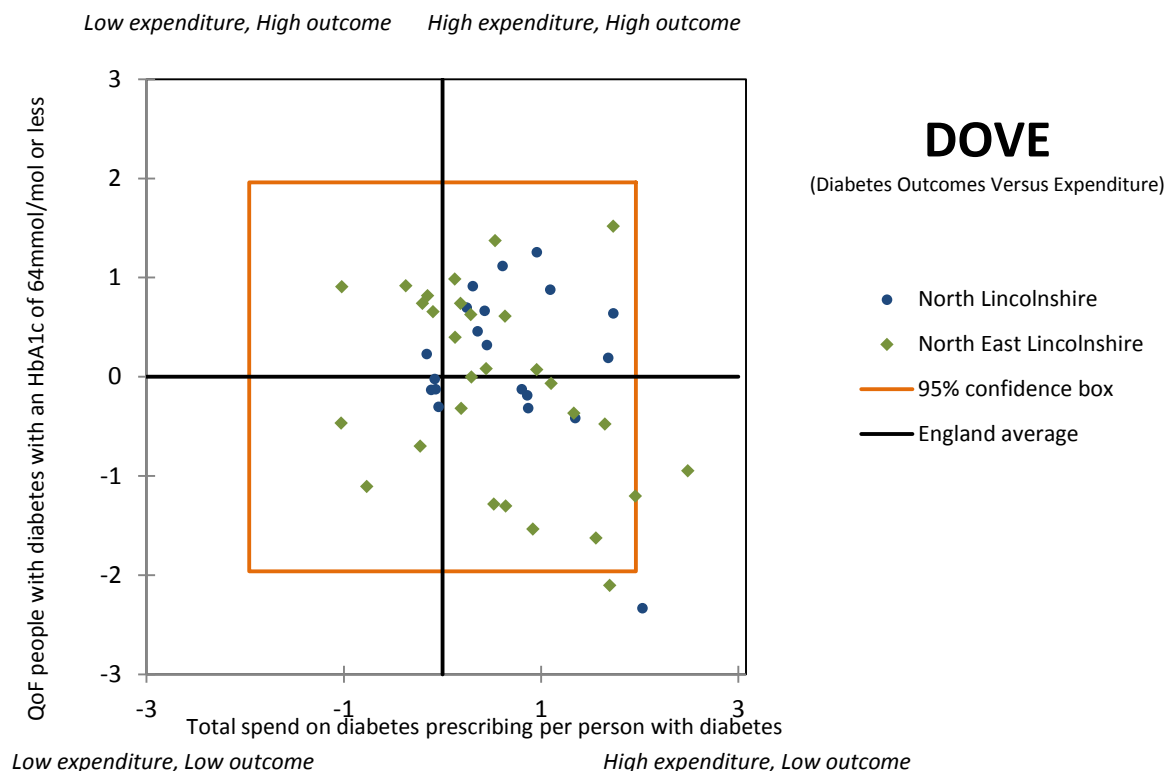- 95% confidence box
- England average

Chart illustrating random scatter of a measure of performance: practices achieving blood sugar control in diabetes (outcome) plotted against average diabetes prescribing cost. Practices need to move from bottom right quadrant (high cost, poor outcome) to top left (lower cost, good outcome). Diabetes control in this PCT (not Northern Lincolnshire) was patchy and variable.

LTC prevention of complications
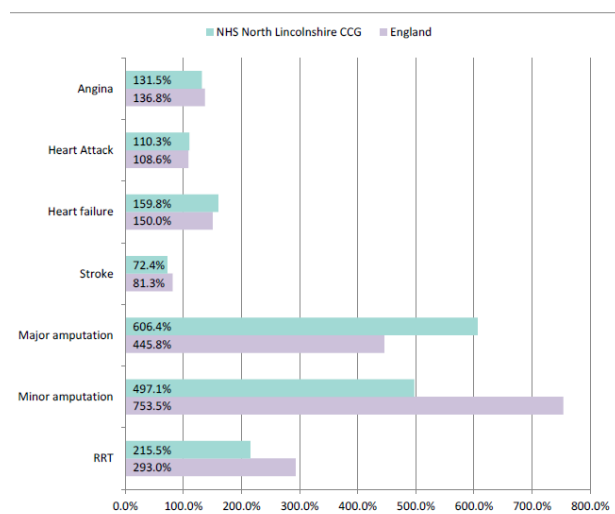
Major complications together lead to multi morbidity . Huge human and health and social care cost.

80% of healthcare costs of diabetes due to complications

Most are preventable by upstream working within the pathway.

Burden of Disease in Northern Lincolnshire

Acronyms

Abbreviation	Full Phrase
BI	Brief intervention
BMI	Body mass index
BP	Blood pressure
CAB	Citizens Advice
CCG	Clinical Commissioning Group
CHD	Coronary heart disease
CHF	Congestive cardiac failure
COPD	Chronic obstructive lung disease
CQuINs	Commissioning for Quality and Innovation payments
eFI	electronic frailty index
GBoD	Global Burden of Disease study
HCP	Healthy Child Programme
HLHF	Healthy Lives, Healthy Futures programme
IGR	Impaired Glucose Regulation
JSNA	Joint Strategic Needs Assessment
LAEDI	Local Awareness Early Disease Identification (cancer)
LSOA	Lower Super Output Area
LTCs	Long Term Conditions
MECC	Making Every Contact Count
MSK	Musculoskeletal
NEL	North East Lincolnshire
NICE	National Institute of (Health and) Clinical Excellence
NL	North Lincolnshire
NNT	Numbers Needed to Treat
PHE	Public Health England
QOF	Quality and Outcomes Framework
quintile	20% segment
RCGP	Royal College of GPs
YLD	Years of Life with Disability
YLL	Years of Life Lost

Burden of Disease in Northern Lincolnshire