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Making a Difference:

Investing in Sustainable Health
and Well-being for the People of Wales

Supporting Evidence

2016



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High level expert group

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Glossary

Abdominal Aortic Aneurysm (AAA)

A swelling (aneurysm) of the aorta – the main blood vessel that leads away from the heart, down through the abdomen to the rest of the body. Large aneurysms are rare, but can be very serious, which is why screening is offered to the population most at risk.

Adverse Childhood Experiences (ACEs)

ACEs are stressful experiences occurring during childhood that directly hurt a child (e.g. maltreatment) or affect them through the environment in which they live (e.g. growing up in a house with domestic violence). ACEs can continue to harm the health of individuals throughout their life.

Air Quality Management Areas (AQMAs)

According to the UK Department for Environment, Food and Rural Affairs, a Local Authority must declare any locations within its boundaries where the air quality objectives are not likely to be achieved as an Air Quality Management Area (AQMA). The area may encompass just one or two streets, or it could be much bigger. The Local Authority is subsequently required to put together a plan to improve air quality in that area - a Local Air Quality Action Plan.

Best buys

The World Health Organization (WHO) (2014) defines a 'best buy' as an intervention which is not only highly cost-effective but one which is also feasible and appropriate to implement within the constraints of low- and middle-income countries' health systems. **Good buys** are other interventions that may cost more or generate less health gain but still provide good value for money.

Body mass index (BMI)

Is a measure of whether someone is considered to be a healthy weight for their height; It is calculated by dividing weight in kilograms by the square of height in metres. It is therefore expressed as kg/m².

Confidence interval/uncertainty interval

In health research, a single study will investigate a representative sample of a population and therefore the results of that study give an estimate of the whole population value of whatever is being investigated. Usually the results of that study are expressed as a 'point estimate' for example, the 'mean', and a 'confidence interval'. The point estimate is the result for that study sample and the confidence interval gives us a range of values within which we can have a chosen level of confidence (usually, 95% or 99%) the population value lies. In other words, the confidence interval gives us an indication of the (im)precision with which the study sample estimates the population value; the wider the interval, the less precise the estimate.

Cost-effective

A 'highly cost-effective intervention' is one that, on average, provides an extra year of healthy life (equivalent to averting one DALY (see below)) for less than the average annual income per person. For example, in Eastern Europe, any

intervention that produces a healthy year of life for less than US\$ 9972 (the average Gross Domestic Product (GDP – see below) per capita) is deemed to be highly cost-effective; an intervention that does so for less than three times GDP per capita is still considered reasonable value for money or 'quite cost-effective' and one which does so for more than three times GDP is considered 'less cost-effective'.

Cost-saving

The World Health Organization (2015) defines cost-saving prevention interventions as effective approaches that generate additional health (and other) benefits at a cost that society is willing to pay; these will be cost-saving if the additional benefits are generated at a lower cost than usual practice.

Crime Survey for England and Wales (CSEW)

The CSEW, formerly known as the British Crime Survey (BCS), is a face-to-face survey asking people who are resident in households in England and Wales about their experiences of a range of crimes in the past year. The survey interviews both adults and children and is conducted on a continuous basis with around 35,000 adults and 3,000 children aged 10 to 15 years old interviewed each year.

Disability Adjusted Life Year (DALY)

One DALY can be thought of as one lost year of "healthy" life due to ill health or injury and is used as a measure of the impact of a disease, health condition or injury in terms of healthy life years lost.

Gross Domestic Product (GDP) is a monetary measure of the market value of all final goods and services produced in a period (quarterly or yearly). Nominal GDP estimates are commonly used to determine the economic performance of a whole country or region, and to make international comparisons.

Health behaviour in school-aged children (HBSC) survey

This survey is carried out in several European regions and countries at four-yearly intervals with an interim report every two years. It analyses key trends in health outcomes, behaviours, and the social context of school-aged children on a national level.

Lower Layer Super Output Areas (LSOAs)

These are part of a geographic hierarchy designed to improve the reporting of small area statistics in England and Wales. They are built from groups of contiguous Output Areas and have been automatically generated to be as consistent in population size as possible, and typically contain from four to six Output Areas.

Minimum Unit Price (MUP)

This is a pricing policy which sets baseline price for alcohol, below which it cannot be sold. The more alcohol a drink contains, the stronger it is and therefore the more expensive it will be. This type of policy aims to reduce alcohol consumption and related harm by increasing the price of alcohol beverages that have high alcohol content but are currently very cheap.

National Crime Recording Standard (NCRs)

This is a UK standard for recording crime in accordance with the Law. It aims to be victim focussed and to maintain consistency of recording across all forces. It is based on applying legal definitions of crime to victim's reports.

National Institute for Health and Care Excellence (NICE)

NICE provide national guidance and advice to improve health and social care.

Needle and Syringe Exchange Programmes (NSP)

These are a type of harm reduction initiative that provides clean needles and syringes to people who inject drugs. It aims to reduce the risks of transmission of certain diseases like HIV/AIDS or hepatitis.

Overweight and obesity

For Caucasian adults a BMI of:

18.5 – 24.9 kg/m² is classed as a healthy weight

25.0 – 29.9 is classed as overweight

30.0 – 39.9 is classed as obese

Over 40 is very (morbidly) obese.

For children and adolescents BMI varies with age and sex, for this reason growth reference charts are used to classify their weight status. More information and the reference charts can be found on the National Obesity Observatory (England) website:

http://www.noo.org.uk/NOO_about_obesity/measurement/children.

Quality Adjusted Life Year (QALY)

The QALY is a generic measure of disease burden, including both the quality and the quantity of life lived. It is used in economic evaluation to assess the value for money of health interventions. One QALY is equal to 1 year of life in perfect health. QALYs are calculated by estimating the years of life remaining for an individual person following a particular treatment or intervention and weighting each year with a quality of life score (on a zero to 1 scale). This is often measured in terms of the person's ability to perform the activities of daily life, freedom from pain and mental disturbance. NICE uses a cost per QALY of £20,000 to £30,000 to determine the 'threshold,' over which treatments/interventions are less likely to be recommended for use in the NHS.

Return on Investment (ROI)

The World Health Organization (2014) defines prevention interventions that are giving a ROI as cost-effective approaches where the financial benefits to health and other sectors outweigh the initial investment.

Stigma

Stigma may take the form of bullying, teasing, harsh comments, discrimination or prejudice based on a person's characteristics or beliefs.

Steroid and Image Enhancing Drug (SIED)

Refers to any substances (licit or illicit) which may be taken by an individual to enhance their performance or their physical appearance.

Introduction

About this report

This report offers research evidence and expert opinion in support of preventing ill health and reducing inequalities to achieve a sustainable economy, thriving society and optimum health and well-being for the present and future generations in Wales.

Public Health Wales has developed the report as part of its mission to protect, improve and promote the health and well-being of the people in Wales and reduce health inequalities. The report also reflects Public Health Wales' responsibility to inform, support and advocate for wider health policy and cross-sector approaches and interventions offering benefits to the people, health system, society and the economy.

The report has been informed by:

- Research evidence
- Professional guidance and expertise in public health and policy, social studies, equity and economics
- Welsh priorities for health and well-being
- Current Welsh policy and health context.

The report consists of **three parts published separately:**

1. Making a Difference: Investing in Sustainable Health and Well-being for the People of Wales – **Executive Summary**;
2. Making a Difference: Investing in Sustainable Health and Well-being for the People of Wales – **Supporting Evidence (this document)**;
3. Series of **8 infographics** focusing on key health challenges for Wales and suggested evidence-based solutions.

Two main sources of evidence were sought to support the case for investing in public health: research evidence and Welsh health statistics. For each priority area, the report presents relevant data on the Welsh population and a brief summary of the research evidence findings contained within purposively selected sources. The methodology for locating and using sources of research evidence is described on page 12.

This is not an exhaustive literature review but presents selected research evidence, data and contextual information available at the time of report development.

Rationale

The context

Current globalisation and demographic trends, the rising human and financial costs of illness and inequalities in health, and the ever more limited economic and natural resources threaten sustainability and the health and well-being of the people living and working in Wales. We face **new challenges** – a growing and ageing population living in ill health with multiple chronic conditions, scarce natural resources, economic austerity and tighter public budgets, new epidemics and global security threats. We are still struggling to fight poverty and inequalities which have an impact on lifelong prospects for a healthy, happy and productive life for too many people in Wales.

A policy of '**austerity**' means ever more limited public resources, fluctuating with economic, political and social crises. Choices about public finance will have a direct impact on public health thus there is a case for health impact assessment, especially of policies and programmes outside of the health sector. It is anticipated that post-2015, public expenditure cuts across the UK may reduce public expenditure as a proportion of gross domestic product (GDP) to the levels of the 1930s (Johnson, 2014; Taylor-Gooby, 2015). At the same time, the **health consequences of social spending cuts fall disproportionately on the poorest** people, communities and regions (Beatty and Fothergill, 2016). Further health impacts, more difficult to isolate epidemiologically but probably at least as significant, are associated with the **stresses of chronic insecurity and powerlessness** (Marmot and Sapolsky, 2014; Whitehead et al., 2016).

Another public health challenge is the so-called "**lifestyle drift**", i.e. the tendency for policy initiatives on tackling health inequalities to start off with a broad recognition of the need to take action on the wider social determinants of health (upstream), but which, in the course of their implementation, drift downstream to focus largely on individual lifestyle factors (Hunter et al., 2009). Decision-makers and policy-makers need to consider this phenomenon and **balance their approach to upstream with downstream policies and interventions**.

A change in the status quo is urgently needed with new, more effective and efficient solutions informed by evidence and expertise to address the challenges of the current climate of austerity and to achieve future health and economic gains for Wales.

Wales is in a unique position to make a difference. A favourable legislative and policy context present key opportunities to work differently – across sectors and with communities and to address the increasing health, social and economic challenges in a more effective and sustainable

way. Sustainable solutions can be enabled by the unique ***Well-being of Future Generations (Wales) Act 2015*** and other legislation, such as the *Social Services and Well-being (Wales) Act 2016*, the *Active Travel (Wales) Act 2013*. The Welsh principles of Sustainable Development and Prudent Healthcare and the Systems Working approach are also key to facilitate, enable and implement positive change.

The five Sustainable Development Principles, agreed with the Welsh population are: prevention, long-term view, integration, collaboration and involvement. They are in part complemented by the four Prudent Healthcare principles: 'do no harm', 'coproduction', 'reduce inappropriate variation' and 'care for those with the greatest health need first'. A key enabler for all health interventions is 'systems working' to improve the public's health, i.e. taking a whole systems approach which aligns public policies, financial flows and accountability with local public, private and third sector delivery and shared assets and outcomes. **A collaborative approach with an emphasis on prevention and public health will help address the current and future health, social and economic challenges in Wales.**

Achieving sustainable health and well-being for the people in Wales is everybody's business. It requires dialogue, shared responsibility and agreement on harnessing action and investment. All relevant stakeholders should be involved: decision-makers and policy-makers in national and local government, senior leaders across all public services including those with public health responsibilities, planners and managers, professionals whose role has an impact on people's health and well-being and, most importantly, local communities, third sector and private organisations.

The supporting evidence

There is a substantial body of research evidence showing that **the economic, social and natural environment in which we grow up, live and work is a major determinant of our health and well-being and that of our children** – directly and through the ways in which we are living.

Prevention - removing the causes of poor health and inequalities (rather than addressing the consequences) - offers good value for money. Preventative policies and interventions save lives and money and improve peoples' mental, physical and social well-being. They show both short and long-term benefits far beyond the health system - across communities, society and the economy.

A recent systematic review (Mason et al., 2016) suggests that **both local public health interventions and nationwide programmes are cost-saving and offer substantial returns on investment (ROI)**. The

overall median ROI was estimated at £14.3 for every £1 spent, ranging from a median ROI of £27.2 to £1 for nationwide public health interventions to a median of £4.1 to £1 for local public health interventions.

Based on the available evidence, Welsh public health priorities and context, and expert guidance and advice, this report identifies **three priority areas for preventive action** with a focus on **ten key public health issues**:

A. Building resilience across the life course and settings

1. Ensuring a good start in life for all
2. Promoting mental well-being and preventing mental ill health
3. Preventing violence and abuse

B. Addressing harmful behaviours and protecting health

4. Reducing the prevalence of smoking
5. Reducing the prevalence of alcohol and substance misuse
6. Promoting physical activity
7. Promoting a healthy diet and preventing obesity
8. Protection from disease and early identification

C. Addressing wider economic, social and environmental determinants of health

9. Reducing economic and social inequalities and mitigating austerity
10. Ensuring safe and health promoting natural and built environments

These areas are interrelated and interdependent, sharing common determinants and solutions.

Methodology

Research evidence

In order to identify research evidence which supports the public health approach advocated in this report, a series of topic focussed literature searches were undertaken. These followed the standard methodology used within the Public Health Wales Observatory Evidence Service (<http://howis.wales.nhs.uk/sitesplus/922/page/64577>) to identify existing relevant documents. Those which met the following criteria were selected for inclusion:

- Published within the last 10 years
- High level sources (i.e. systematic reviews, evidence synthesis combined with modelling, or guidance)
- From reliable (in that they use transparent robust¹ methodology) and/or recognised (e.g. expert body) sources
- Included a description of the economic and health benefits to individuals and governments of a public health approach AND/OR
- An estimate of the costs of failing to address current public health challenges AND/OR
- A summary of the evidence for the cost-effectiveness of public health and prevention approaches AND/OR
- A summary of which preventive interventions show evidence for early returns on investment, and which provide longer-term gains.

For development of the infographics part of this report, data have been drawn from the primary sources cited by the selected high-level reports, for illustrative purposes, or from primary sources identified by topic experts within Public Health Wales where there were gaps in the data provided by the selected high-level reports.

Statistics for the Welsh population

Data were provided by the Public Health Observatory and arise from available data sources rather than new research. Where unavailable, figures for Wales have been estimated from the latest United Kingdom (UK)/England/other data on an unadjusted per capita basis – such extrapolations are denoted with * in this document.

¹ Follows core systematic review principles: comprehensive and stated search strategy, selection of sources based on objective criteria, assessment of risk of bias of primary sources and/or is a methodology developed by an expert body e.g. NICE.

Supporting Evidence

Building resilience across the life course and settings

1. Ensuring a good start in life for all

Key messages:

- The mother's health before, during, and after pregnancy, as well as the home and wider environment in which children grow up have a major impact on their physical, social, emotional and cognitive development.
- Poor early year development has an impact on an individual's health throughout the life course. It also impacts educational attainment, employment or income and on society as a whole.
- Living in poverty and deprivation increases the risk of death and poor health, especially obesity.
- There is a strong economic case for investing in early years programmes - especially those that target the first 1000 days (from conception to the second birthday).
- Early child development interventions should go beyond child survival and physical development to encompass social, emotional and cognitive development.
- Both universal and targeted follow up interventions later on in a child's and teenager's life are important in order to maintain the gain in early years.

1.1 Early years experience: health, social and economic dimensions

Children's chances in life are strongly influenced by their experience during the early years (Commission on Social Determinants of Health, 2008). Physical, social, emotional and cognitive development in the early years not only impacts on health outcomes throughout the life course, but also on other domains such as educational attainment, employment or income (Marmot et al., 2010). In 2008, it was estimated that over 200 million children globally were not achieving their full developmental potential (Grantham-McGregor et al., 2008). In England, in 2012, over

37% of children beginning school were not considered “school ready”, a measure of a child’s physical and social skills development when starting school (GMCA AGMA, 2012). The comparable figure for Wales would be over 13,000 children per year at a disadvantage from the start, regarding their potential education attainment and future life trajectory*.

In Wales, children living in deprived areas have higher rates of obesity and lower immunisation rates than those living in least deprived areas (Welsh Government, 2014). The effects of this are multi-generational, immediate and long term, with influence on the future generation and their entire life prospects. For example, children who grow up in disadvantaged households are more likely to become poor adults themselves – thus, perpetuating the same vicious circle (Field, 2010).

These inequalities begin even before birth as maternal health and the socio-economic situation of the mother have a direct impact on child and adult health, influencing a child’s body and brain development and the likelihood of developing certain diseases later in life (Johnson, Jones and Paranjothy, 2014).

Key statistics for Wales:

- In Wales in 2011, over 2400 live births were recorded as low birth weight (LBW) babies (born weighing less than 2500g) (6.8% of all live births) (Johnson, Jones and Paranjothy, 2014).
- In Wales in 2013, neonatal and infant mortality rates were higher in the most deprived areas. The latest figures show infant mortality rate per 1,000 births for the most deprived fifth to be almost 50% higher than the least deprived fifth (Welsh Government, 2014).
- Data collected in Wales and England between 2005 and 2006 show that one quarter of all deaths under the age of one year could have been avoided if all births had the same level of risk as women with the lowest level of deprivation (Welsh Government, 2014).
- Less than a quarter of babies in the most deprived areas (22.5%) are exclusively breastfed at 10 days after birth compared to those living in the least deprived areas (46.8%) (Public Health Wales Observatory, 2016a).
- There is a strong relationship between levels of obesity and deprivation – 14.7% of children aged 4-5 years old living in the most deprived areas of Wales in 2014/15 were obese, compared to 7.3% in the least deprived areas (Public Health Wales, 2016b).
- In Wales in 2013, the percentage of children up to date with their routine immunisations by 4 years of age ranged from 78% in the most deprived fifth Lower Layer Super Output Areas (LSOAs) to 87% in the least deprived fifth (Public Health Wales, 2013); a serious gap compared to the 95% target defined by Public Health Wales (Public Health Wales, 2016a).

1.2 Impact and costs of adverse early years experiences – to the individual, the health system, wider society and the economy

Young mothers (under 25 years old) living in low-income households and/or in deprived areas have a higher prevalence of babies born with a low-birth weight. This is associated with higher infant mortality, lower life expectancy, higher risk of disability and likelihood of developing diabetes, stroke and heart disease in adulthood, as well as lower educational attainment (Johnson et al., 2014). Ultimately, this will result in costs to the NHS and wider society. For example, babies living in fuel poor homes (cold and damp) are more likely (by 30%) to be admitted to hospital or to attend primary care (Whitehead M. et al., 2014).

Parenting is also a key factor in a child's behavioural development and mental health. Children who live through Adverse Childhood Experiences (ACEs), such as violence, neglect or living with individuals with substance abuse issues, have higher risks of premature ill health and developing health-harming behaviours (Public Health Wales, 2015a).

The impact of such ACEs may include being responsible for nearly a quarter of current adult smoking, over a third of teenage pregnancy and more than half of the violence, heroin/crack use and incarceration reported by study participants. Reflected in population terms, eradicating ACEs could ultimately result in over 125,000 less smokers, or e-cigarette users, across Wales, and over 55,000 fewer people who have ever used heroin or crack cocaine (Public Health Wales, 2015a).

Sub-optimal behavioural development at a young age has a high cost for society later on in life, especially for the criminal justice system. A review of three birth cohort surveys found that over 80% of all criminal activity in Britain is attributed to people who had behavioural problems in childhood or adolescence. This represents a total cost for society of £60 billion per year for England and Wales (Richards and Abbott, 2009).

1.3 Cost-effectiveness and return on investment of a public health approach and interventions

It was estimated that the ROI in human capital for a unit dollar invested at different ages (assuming one dollar is initially invested at each age) would be highest for programmes targeted at the earliest years (0 to 3 years of age), followed by pre-school programmes (4 to 5 years of age) and then followed by interventions in the schooling and post-schooling (job training) ages (Heckman, 2008).

The first 1000 days – from the beginning of the pregnancy until two years of age - offer a key window of opportunity for investment in order to secure a healthy and productive future for children (World Health Organization, 2013). There is a strong economic case for investing in the early years of life, as early years programmes are often less expensive than the services needed to address the physical, mental, behavioural and socio-economic consequences of poor early child development. One estimate suggests that the cost to the UK economy of continuing to address current levels of social problems will amount to almost £4 trillion over a 20 year period. Yet, investing in targeted interventions, universal childcare, and paid parental leave could help address as much as £1.5 trillion worth of the cost of these social problems UK wide (Action for Children, 2009; Marmot et al., 2010). An equivalent estimate for Wales would be a saving of £72 billion*.

The World Health Organization (WHO) Commission on Social Determinants of Health (Commission on Social Determinants of Health, 2008) suggest that early child development (ECD) interventions should go beyond child survival and physical development interventions to include interventions targeting social, emotional and cognitive development. These include (but are not limited to) support to mothers before and after giving birth, breastfeeding and nutrition support, parenting support, access to health services and childcare, and access to early education. ECD programmes should be universal, but include special attention or targeted interventions towards the most vulnerable children such as children with special needs or those living in deprived communities (Commission on Social Determinants of Health, 2008). Certain features of ECD interventions - such as smaller child-to-staff ratios, better trained caregivers/teachers and more intensive and comprehensive programmes that meet the different needs of children - are associated with better outcomes (Marmot et al., 2010).

Most economic evaluations of ECD interventions demonstrate good value for money. A review of ECD programme evaluations carried out between 2004 and 2008 in American and European countries found returns to society for each dollar invested ranged from \$1.26 to \$17.07 (this converts to every £1 invested returns between £1.30 and £16.80²) and suggested there may be wider benefits and returns on investment over time (in the next 15 to 20 years after the intervention) and across the family targeted (with positive impact on younger siblings and in the next generation) as well as higher social, non-monetary benefits (World Health Organization, 2015). For example, for every \$1 (or £0.70) spent on

² Converted for this report using OANDA currency converter (www.oanda.com/currency/converter) accessed 260516.

prenatal care for low-income women, \$3.38 (or £2.30) are saved on infant medical care in the first year of life (Korkodilos and Omonijo, 2015); every £1 invested in parenting programmes to prevent conduct disorder saves £8 over 6 years in avoided cost to the NHS, education and criminal justice (Public Health England and Institute of Health Equity, 2014); the American programme Nurse-Family Partnership, a peri-natal visit programme which has been implemented in the UK, has shown a \$5.06 ROI for every dollar spent (Marmot et al., 2010).

The National Institute for Health and Care Excellence (NICE) (2009) has identified the parenting programme 'Triple P' - Positive Parenting Programme (Allen, 2011; London Economics, 2012), as a cost-effective intervention in reducing conduct disorder; the programme saved an estimated £19.5 million, compared to the £4.6 million it cost.

Marmot et al., (2010) concluded that access to quality early education and care improves children's outcomes, especially among children living in disadvantaged areas or with special education needs. However, although intensive interventions in early years is key, it is recognised that both universal and targeted follow up interventions later in a child's and teenager's life are important in order to maintain the gain in early years (Marmot et al., 2010).

2. Promoting mental well-being and preventing mental ill health

Key messages:

- In the UK, mental ill health accounts for a substantial burden of ill health and disability and, consequently, of the cost to services, and this is set to rise.
- Mental ill health is associated with poorer physical health and increased health-risk behaviours, poor education and higher levels of unemployment.
- Inequality is a key determinant of mental ill health – mental ill health leads to further inequality.
- Early experiences may have long-term consequences for health and social development of children and young people, with associated costs to society and public services.
- Mental ill health has substantial economic impact, including costs due to loss of productivity and being a leading reason for incapacity benefit.
- Investing to increase access to early intervention mental health services could lead to considerable savings for other public services.
- Investment in mental health interventions for children and young people, especially the most vulnerable, is likely to lead to long-term savings by reducing the risk of mental health problems, rates of offending and contact with the criminal justice system and by improving employment prospects.

2.1 Mental health and well-being: health, social and economic dimensions

Mental health is a public health issue. Mental ill health is the largest single contributor to the burden of disease in the UK. No other health condition matches mental ill health in the combined extent of prevalence, persistence and breadth of impact. It is consistently associated with deprivation, low income, unemployment, poor education, poorer physical health and increased health-risk behaviour (Royal College of Psychiatrists, 2010).

People with serious mental ill health are more likely to develop a significant illness, such as diabetes, heart disease, stroke or respiratory disease, before 55 years of age. They have also higher smoking and obesity rates than the general population, e.g. 61% of people with schizophrenia smoke and 33% are obese; 46% of people with bipolar

disorder smoke and 30% are obese (Disability Rights Commission, 2006). People with serious mental ill health die 15-20 years younger than their counterparts in the general population (Bailey S, 2013).

Mental ill health has a human and social cost and also an economic one, with wider costs in England amounting to £105 billion a year (Royal College of Psychiatrists, 2010).

Most mental ill health begins before adulthood and often continues through life. ACEs are traumatic experiences that occur before the age of 18 but are remembered throughout adulthood. These experiences range from verbal, mental and physical abuse, to being exposed to alcoholism, drug use and domestic violence at home. Forty-one percent (41%) of adults in Wales who suffered four or more adverse experiences in childhood are now living with low mental well-being. This compares to 14% of those individuals who experienced no ACEs during their childhood (Public Health Wales, 2016).

Improving mental health early in life will reduce inequalities, improves physical health, reduces health-risk behaviour and increases life expectancy, economic productivity, social functioning and quality of life. The benefits of protecting and promoting mental health are felt across generations and accrue over many years (Royal College of Psychiatrists, 2010). Promotion and prevention is also important in adulthood and older years, with people in later life having specific mental health needs.

Key statistics for Wales:

- Based on the Mental Health Inventory (MHI-5), 74% of adults in Wales are free from a common mental health disorder (Public Health Wales Observatory, 2015).
- In Wales, the proportion of adults who report having a mental health condition has increased from 9% in 2003/4 to 13% in 2015. Breaking these figures down by socio-economic classification of the household reference person, the percentage ranges from 9% among respondents from managerial and professional groups to 24% among those who are long term unemployed or who have never worked. 8% of the people in the least deprived quintile reported having a mental health conditions, against 20% in the most quintile (Welsh Government, 2016a).
- A greater proportion of women (16%) compared to men (10%) self report mental ill health. The highest reported prevalence of mental ill health is in females aged 45-64 years (19%) (Welsh Government, 2016a).
- In Wales the estimated cost of mental ill health to society is £7.2 billion per year (Friedli and Parsonage, 2009).

- In Wales, 10% of the adult population (over 16 years) are receiving treatment for depression, 8% for anxiety and 2% for other mental health conditions (Welsh Government, 2016b).
- According to the Quality and Outcomes Framework (QOF), just under 1% of the Welsh population are on a register of patients with schizophrenia, bipolar affective disorder, other psychoses or are on lithium therapy (Quality and Outcomes Framework, 2015).
- According to a Welsh Government Assembly Report, 37,000 people in Wales were living with dementia in 2011 (Welsh Government Assembly, 2011).

Health Behaviour of School-aged Children (HBSC) Survey 2013-14 (Welsh Government, 2015).

- 18% of children said they had felt nervous more than once a week in the past 6 months.
- 18% of children said they had felt low more than once a week in the past 6 months.
- Among year 11 pupils (aged 15-16 years), 84% boys and 73% girls rated their life satisfaction as 6 or higher on a scale of 1-10.
- Over a third of pupils reported being bullied at school in the past two months.

In Great Britain, 6% of children aged 5-16 years have a conduct disorder - the most common mental health problem in childhood, equating to approximately 23,993 children in Wales*. Conduct disorder persist into adulthood in about 40% of cases (Friedli and Parsonage, 2009).

2.2 Impact and costs of mental ill health - to the individual, the health system, wider society and the economy

In 2004, 22.8% of the total burden of disease in the UK was attributable to mental disorder (including self-inflicted injury), compared with 16.2% for cardiovascular disease and 15.9% for cancer, as measured by Disability Adjusted Life Years (DALYs) (World Health Organization, 2008).

It is predicted that by 2030, neuropsychiatric conditions will account for the greatest overall increase in DALYs in the UK (World Health Organization, 2004). Depression is said to account for 7% of the disease burden in the UK, more than any other health condition (World Health Organization, 2004). In Wales, 9% of adults are receiving treatment for depression and 8% for anxiety (Welsh Government, 2015a). Of particular concern is the prevalence of mental ill health among prisoners. 2005-2006 estimates from the Ministry of Justice show that psychotic disorders may affect as many as 10% of inmates in England and Wales and that 61% of

them are likely to have personality disorders and 36% may be suffering from anxiety and/or depression (Prisons and Probation Ombudsman, 2016).

Mental ill health costs the NHS £10.4 billion (10.8% of the NHS budget) in 2010 (Department of Health, 2010) and it has been estimated that 10.48% of the 2008/9 UK (NHS) budget was spent on mental health services (Department of Health, 2012).

Mental ill health in the UK has been estimated to cost society as a whole, £110 billion per year (McCrone et al., 2008; Friedli and Parsonage, 2009). The overall cost of mental health problems in Wales (2007/08) was estimated at £7.2 billion a year. By way of comparison, the aggregate cost was larger than the total amount of public spending in Wales on health and social care for all health conditions combined, which amounted to £6.1 billion in 2007/08. Spending on mental health is disproportionately low, accounting for 12.2% of public expenditure on all health and social care in Wales (Friedli and Parsonage, 2009).

Children and young people

Early experiences may have long-term consequences for the mental health and social development of children and young people (NICE, 2010b; Public Health Wales, 2016).

The cost of a hospital episode for children and young people admitted for self-harming could be in the region of £200 to £870 per admission (National schedule of NHS reference costs 2008–09 codes HA71B and PA50Z). This excludes the cost of admission to intensive therapy or high dependency units, which may be required in a small number of cases.

The mean cost to society in the UK of mental ill health in childhood and adolescence is estimated to be in the range from £11,030 to £59,130 annually per child (Suhrccke, Pillas & Selai 2008); the total costs of criminal activity related to conduct disorder in England and Wales are estimated to be £22.5 billion each year and a further estimated annual cost of £37.5 billion is attributable to sub-threshold conduct disorder (Sainsbury Centre for Mental Health, 2009). For Wales alone, this would represent an annual cost of £1.2 billion*. Lifetime costs of child conduct disorder in the UK for each 1-year cohort are estimated to amount to £5.2 billion and for sub-threshold conduct disorder they are estimated to amount to £23.6 billion (Friedli & Parsonage, 2009).

Adults

Mental ill health is the leading cause of incapacity benefit payment in the UK; 43% of the 2.6 million people on long-term health-related benefits in 2010 had a mental or behavioural disorder as their primary condition (Department for Work and Pensions, 2010).

2.3 Cost-effectiveness and return on investment of a public health approach and interventions

Children and young people

The number of adults living with low mental well-being in Wales could be reduced by more than a quarter (27%) if no individuals in Wales were exposed to harmful experiences in childhood. In other words, eradicating ACEs in Wales could potentially reduce the number of individuals who report low mental wellbeing by just over 100,000, with an associated reduction in costs (Public Health Wales, 2016).

Implementing NICE guidance on *Promoting the quality of life of looked after children and young people* (2010a) is likely to lead to long-term savings from reduced risk of mental health problems, reduced rates of offending or contact with the criminal justice system and increased employment opportunities when the child or young person reaches adulthood and becomes independent. In the short-term, earlier access to mental health services could lead to more immediate savings for local authorities by increasing placement stability and reducing numbers of placement moves.

Early access to mental health interventions is likely to reduce the need for emergency hospital admissions related to self harm or other potentially life-threatening presentations. Whilst savings are not costed, the report points to, for example, the estimated average annual treatment costs for a person with depression are £2210 (McCrone et al., 2008), the estimated average cost incurred per crime is £12,625, the estimated annual cost per man in a local prison is £27,275 and the estimated annual cost per woman in a local prison is £42,477 (ESRC Society Today, 2009 as referenced in NICE 2010b).

It has been estimated that the total cost of looking after a child without any additional support needs, who remained in the same authority foster placement for 20 months, was £35,106. The total cost for a child with emotional and behavioural difficulties was more than six times higher at £215,756 (Department for Education and Skills, 2005).

Based on one example of a common mental health problem - conduct disorder, the total value of prevention in a one-year cohort (33,000 births) in Wales has been estimated to be £247.5 million, with the total value of promoting positive mental health amounting to £1,113.75 million, for a cost of £9.9 million and £20 million respectively. The costs of intervention were estimated to be very low, ranging from £1,350 to £6,000 per child for pre-school parenting programmes (Friedl and Parsonage, 2009).

Public health interventions which have been identified by the WHO as producing a return on investment or cost-saving are listed in Appendix 1.

Adults

It has been estimated that the annual cost of mental ill health to an organisation with 1000 employees is £835,355 and that improving the management of mental health in the workplace, including prevention and early identification of problems, could produce annual savings of £250,607 (Sainsbury Centre for Mental Health, 2009).

Public health interventions which have been identified by the WHO as producing a return on investment or cost-saving are listed in Appendix 1.

3. Preventing violence and abuse

Key messages:

- Violence and abuse are important public health issues.
- Domestic violence impacts on children's mental, emotional and psychological health, their social and educational development and their likelihood of experiencing or becoming a perpetrator of domestic violence and abuse as an adult.
- The public service burden of domestic abuse is considerable, resulting in a high proportion of women attending accident and emergency departments, primary care, family planning, reproductive and sexual health settings are likely to have experienced domestic violence and abuse at some point.
- Violence places a considerable burden on public services.
- Reducing violence and abuse could result in substantial savings on health and social care.

3.1 Violence and abuse: health, social and economic dimensions

Domestic violence and abuse

It has been estimated that around 1.2 million women and 784,000 men aged 16 to 59 in England and Wales experienced domestic abuse³ in 2010/11 (7.4% of women and 4.8% of men). At least 29.9% of women and 17.0% of men in England and Wales have experienced domestic abuse since they were 16 (Smith et al., 2012). This is likely to be an underestimate as domestic violence and abuse are under-reported. Partner abuse is the most prevalent form of domestic abuse. According to the 2010/11 British Crime Survey, around 4% of men and 6% of women said that they had experienced partner abuse in the last year, which was equivalent to around 900,000 female and 600,000 male victims. Female partner abuse victims were also more likely to experience serious sexual assault (8% compared with 1%) than male partner abuse victims (Smith et al., 2012). Lesbian and bisexual women experience domestic violence and abuse at a similar rate to women in general (1 in 4), although a third of this is associated with male perpetrators (Hunt and Fish, 2008). 49% of gay and bisexual men have experienced at least 1 incident of domestic

³ Domestic violence and abuse here is defined as: physical abuse, threats, non-physical abuse, sexual assault or stalking perpetrated by a partner, ex-partner or family member

violence and abuse since the age of 16. This includes domestic violence and abuse within same-sex relationships (Guasp, 2012). The risk of experiencing domestic violence or abuse is increased if someone is:

- female
- aged 16–24 (women) or 16–19 (men) (Smith et al., 2011)
- has a long-term illness or disability – this almost doubles the risk (Smith et al., 2011)
- has a mental health problem (Trevillion et al., 2012)
- is a woman who is separated (Smith et al., 2011) – there is an elevated risk of abuse around the time of separation (Richards, 2004).

The risk is also increased if a woman is pregnant or has recently given birth and there is a strong correlation between postnatal depression and domestic violence and abuse.

Alcohol and drug misuse play a role in domestic violence and abuse but this is poorly understood. Research has found that 21% of people experiencing partner abuse in the past year thought the perpetrator was under the influence of alcohol and 8% under the influence of illicit drugs (Smith et al., 2012).

Domestic violence and abuse between parents is the most frequently reported form of trauma for children (Meltzer et al., 2009). In the UK, 24.8% of those aged 18 to 24 reported that they experienced domestic violence and abuse during their childhood (Radford et al., 2011). It has an impact on their mental, emotional and psychological health and their social and educational development. It also affects their likelihood of experiencing or becoming a perpetrator of domestic violence and abuse as an adult (Stanley, 2011; Holt, 2012). There is a strong association between domestic violence and abuse and other forms of child maltreatment: it was a feature of family life in 63% of the serious case reviews carried out between 2009 and 2011 (Brandon et al., 2012).

Violence

The Crime Survey for England and Wales (CSEW) estimates that there were 1.3 million violent incidents in the year ending 31 March 2015 (Office for National Statistics, 2015a) – 103,000 for Wales alone (Office for National Statistics, 2015b). This showed no significant change compared with the previous year's survey, following a period when the underlying trend was generally downward. The CSEW subcategories of *violence with injury* and *violence without injury* also showed no change with the apparent changes (with injury up 8% and without injury down 8%) not being statistically significant. Around 2 in every 100 adults were a victim of violent crime in the last year, based on the year ending March 2015 survey, compared with around 5 in 100 adults in the 1995 survey.

Victims perceived the offender(s) to be under the influence of alcohol in 53% of violent incidents (Office for National Statistics, 2015c).

Violence against the person offences in England and Wales recorded by the police in the year ending March 2015 showed a 23% increase compared with the previous year (up from 634,623 to 779,027). There was a much larger increase in the category of *violence without injury* (up 30%) than *violence with injury* (up 16%) (Office for National Statistics, 2015a; 2015b).

In England and Wales police recorded crime figures showed an increase of 37% in all sexual offences for the year ending March 2015 compared with the previous year (up from 64,229 to 88,219). This is the highest level recorded, and the largest annual percentage increase, since the introduction of the National Crime Recording Standard (NCRS) in April 2002. Increases in offences against both adults and children have contributed to this rise. Increases were seen in all police forces (Office for National Statistics, 2015b).

The CSEW estimates that there were around 373,000 incidents of violence against children aged 10 to 15 in the year ending March 2015 (Office for National Statistics, 2015a).

Key statistics for Wales:

- It has been estimated that in 2011/12 in Wales, 11% of women and 5% of men have experienced domestic abuse⁴ (Robinson et al., 2012).
- Violence against women, domestic abuse and sexual violence form a significant proportion of violence in Wales. Estimates show sexual violence affects 3.2% of women and 0.7% of men; 3.1% of older people are abused or neglected by carers (Welsh Government, 2014).
- The Welsh Adverse Childhood Experiences Survey⁵ reports that 16% of adults who responded to the survey reported witnessing domestic violence and abuse while they were growing up (Bellis et al., 2015).
- In Wales, 30% of school children have been involved in a physical fight and 10% have had 3 fights in the last 12 months (Welsh Government, 2015).
- The Welsh Adverse Childhood Experiences Survey⁵ reports adults experience of violence under the age of 18 years, 17% experienced

⁴ Defined as partner or family non-physical abuse, threats, force, sexual assault or stalking

⁵ People with higher numbers of adverse childhood experiences (ACEs) are more likely to develop health-harming behaviours including high-risk drinking, smoking, taking drugs, committing violence and being incarcerated. ACEs are stressful experiences occurring in childhood that directly harm a child or affect the environment in which they live e.g. parental separation, domestic violence, mental ill health, alcohol and drug abuse and incarceration.

physical abuse and 10% sexual abuse whilst growing (Bellis et al., 2015).

3.2. Impact and costs of violence and abuse - to the individual, the health system, wider society and the economy

Domestic violence and abuse

The public service burden of domestic abuse is considerable. A high proportion of women attending accident and emergency departments, primary care, family planning, reproductive and sexual health settings are likely to have experienced domestic violence and abuse at some point (Alhabib et al., 2010; Feder et al., 2009). Between 25 and 56% of female psychiatric patients report experiencing domestic violence and abuse in their lifetime (Oram et al., 2013).

Domestic violence and abuse cost the UK an estimated £15.7 billion in 2008 (Walby 2009). This included:

- just over £9.9 billion in 'human and emotional' costs
- more than £3.8 billion for the criminal justice system, civil legal services, healthcare, social services, housing and refuges
- more than £1.9 billion for the economy (based on time off work for injuries).

Population based estimates for Wales suggest an annual cost of domestic violence and abuse of £303.5 million each year across public services in Wales. Human and emotional costs are estimated to be an additional £522.9 million* (Robinson et al., 2012).

The cost of treating someone who is experiencing post traumatic stress disorder as a result of domestic violence and abuse was estimated to be £4,700 (Health and social care costs) per person per month in 2014 (NICE, 2014a).

Violence

Research conducted by Cardiff University (Sivarajasingam et al., 2015) shows a downward trend. Their annual survey, covering a sample of hospital emergency departments and walk-in centres in England and Wales, showed an overall decrease of 10% in serious violence-related attendances in 2014 compared with 2013 (down to 211,514 attendances in 2014). NHS data on assault admissions to hospitals in England show that, for the 12 months to the end of March 2014, there were 31,243 hospital admissions for assault, a reduction of 5% compared with figures for the preceding 12 months. They also found that the number of 11 to 17 year olds being admitted to hospitals for treatment following violence

declined 18%, from 25,108 in 2013 to 20,553 in 2014 (Sivarajasingam et al., 2015).

It has been estimated that violence costs the economy in England and Wales over £40.1 billion per year (Home Office, 2009) or £2.2 billion per year for Wales alone*. WHO estimates that 1.9 DALYs are lost each year in Europe because of violence (World Health Organization, 2014). It has been estimated that in 2007, violence cost the NHS in the UK 2 billion (World Health Organization, 2014; Home Office, 2009) - £96 million per year for Wales alone*.

Violence also impacts on the health of the community as a whole. Fear of violence in the community can limit the use of public places for physical activity and restrict outside play for children (Department of Health, 2012).

The impact of violence is particularly damaging when children are exposed at an early age, contributing to poor health and well-being prospects across the life course (Department of Health, 2012). Exposure to violence in childhood will impact negatively on:

- School achievement and economic prospects as an adult (including loss of income) (Robinson et al., 2012)
- Behaviour and the use of alcohol and substances as negative coping mechanisms
- Mental health and resilience
- Physical health, with increased use of health services
- Sexual health.

The Burden of Injuries in Wales, 2013 interim report on assaults indicated that in Wales male in-patient admission rates for assaults are six times higher than those of females. In-patient admission rates peak in young adult males (Jones et al., 2013).

In Wales hospital admission rates for 15 to 19 year old males as a consequence of injuries related to assaults dropped considerably between 2009 and 2012. Those in the most deprived areas have admission rates for assaults 3.7 times higher than those in the least deprived areas (Jones et al., 2013).

There is a strong relationship between deprivation and violence, which is likely to be due to a higher prevalence of risk factors such as unemployment, teenage parenting and substance misuse in deprived areas. Inequality is a better predictor of violence than poverty, which may be due to factors such as poor social trust (Department of Health, 2012).

3.3. Cost-effectiveness and return on investment of a public health approach and interventions

Public health interventions identified by the WHO as producing a return on investment or cost saving are included in Appendix 1.

Interventions targeting children and their parents are of particular interest. For example, programmes to support vulnerable first-time mothers (Nurse Family Partnership) save £2 (US\$2.88) for every £0.70 (US\$1) invested and reduce child maltreatment and criminal behaviour (Aos S et al., 2004; Aos S et al., 2006 cited in Department of Health, 2012) while parenting interventions for 5 year old children with conduct disorders saves 8 times more than the intervention cost (Knapp et al., 2011 cited in Department of Health, 2012). Public health interventions which have been identified by the WHO as producing a return on investment or cost-saving are listed in Appendix 1.

Preventing ACEs and improving resilience and protective factors for children could reduce violence perpetration in adults by 60% and violence victimisation in adults by 57% (Bellis et al., 2015).

It is estimated that £16.6 billion is being spent per year across England and Wales on late intervention public services for problems such as mental health problems, unemployment and youth crime, which are preventable in children and young people (Chowdry and Oppenheim, 2015). These costs are spread across services from local authorities, the NHS, schools, welfare, the police to the criminal justice system. Local authorities bear the largest share at £6.5 billion, followed by welfare costs of £3.7 billion and NHS costs of £3 billion. These are only the immediate fiscal costs in a single year and do not capture the longer term impact of these poor outcomes nor the wider social and economic costs (Chowdry and Oppenheim, 2015).

Reducing domestic violence and abuse by implementing NICE guidance (PH50), could save an estimated £4,700 per month per person on healthcare and social care costs associated with treating and supporting someone who is experiencing post-traumatic stress disorder as a result of such violence and abuse (NICE, 2014a). For example, a programme for identification of domestic violence and abuse in GP practices (Identification and Referral to Improve Safety) (Devine A et al., 2010 cited in NICE, 2014a), involved providing practice based training for primary care staff, a prompt to ask about abuse in the medical record system and referrals to appropriate agencies. This intervention cost £0.55 per woman registered with the practice and resulted in a societal cost saving of £37 per year per woman registered at the practice and a saving of £1.07 to the service provider per woman per year.

Estimates from the Welsh adaptation of the Sheffield Alcohol Policy Model suggest that adopting a Minimum Unit Pricing (MUP) policy of 50p per unit of alcohol would be effective in reducing annual crime volume by 4.6% and the costs associated with those harms (Meng et al., 2014).

Finally, adopting a multi-agency approach in the sharing and use of anonymised information on violence-related injuries was used to contribute to violence prevention in Cardiff (Florence et al., 2011). This approach was shown to increase understanding of crime hotspots, victims, offenders and communities at risk and was associated with a reduction in hospital admissions for violence. Based on the programme run in Cardiff between 2003 and 2007, such an approach saves £82 for society for each £1 invested (Florence et al., 2014).

Addressing harmful behaviours and protecting health

4. Reducing the prevalence of smoking

Key messages:

- Smoking is the largest single preventable cause of ill health and death in Wales and a major cause of inequalities in health and life expectancy.
- The proportion of adults and young people smoking in Wales is decreasing, but 1 in 5 adults still smoke.
- The cost of smoking extends beyond healthcare services.
- Tobacco smoking can cause complications in pregnancy, including increased risk of miscarriage, premature birth and low birth weight.
- Second hand smoke is a human carcinogen and no risk free level of exposure has been identified - it can have both immediate and long-term health consequences.
- Childhood exposure to tobacco smoke is of concern, putting them at increased risk of lower respiratory infections and sudden infant death.
- The health of babies born into lower income households is disproportionately affected by second hand smoke. Growing up in an environment where smoking is the norm means they are more likely to start smoking in adolescence.
- Helping smokers to quit could reduce healthcare costs.
- Interventions to preventing uptake of smoking can provide a return on investment. The WHO recommends a comprehensive approach including protecting people from tobacco smoke, warning people of the health risks associated with smoking, supporting smokers to quit, along with advertising bans and taxation to reduce smoking prevalence in the population.

4.1. Smoking: health, social and economic dimensions

Smoking causes a range of diseases including cancer, cardiovascular disease and respiratory diseases. It is associated with many other debilitating conditions such as age-related macular degeneration, gastric ulcers, impotence and osteoporosis. It can cause complications in pregnancy, including increased risk of miscarriage, premature birth and low birth weight. Smoking is also associated with lower survival rates,

delayed wound healing, increased infections, prolonged hospital stays and repeated admissions after surgery (Delgado-Rodriguez et al., 2003; Theadom and Cropley, 2006).

Smoking is the largest single preventable cause of ill health and death in Wales, causing around 27,700 hospital admissions and 5,450 deaths among adults aged 35 and over every year (Public Health Wales, 2012). 19% of adults (aged 16+) in Wales were current smokers in 2015 and there has been a decline in adult smoking prevalence over the last 10 years (Welsh Government, 2016). The tendency to smoke in Wales is heavily influenced by the socio-economic status of its residents. The Welsh Health Survey 2015 (Welsh Government 2016) shows that smoking prevalence is much higher in areas of Wales associated with high deprivation.

People from routine and manual occupational backgrounds are almost twice as likely to smoke as those from managerial or professional backgrounds (27% versus 13%) (Health and Social Care Information Centre, 2014). Smoking is responsible for at least half of the excess risk of premature death in middle-aged men with manual occupations, compared to those in professional groups (Jha et al., 2006).

Smoking prevalence is particularly high among some groups. This includes: lesbian, gay, bisexual and transgendered people, those with mental health problems, people in prison and those who are homeless. A survey of smoking prevalence among gay and bisexual men found that just over 35% smoked cigarettes, including 48% of those who were HIV-positive (Hickson et al., 2007). There is less UK data available on lesbian women.

Smoking prevalence is particularly high among people with mental health problems and has changed little in this group in the past 20 years (Royal College of Physicians, 2013). Most of the reduction in life expectancy among people with serious mental ill health is attributable to smoking (Royal College of Physicians, 2013). A third (33%) of people with mental health problems (McManus, Meltzer and Campion, 2010) and more than two-thirds (70%) of patients in psychiatric units smoke tobacco (Jochelson and Majrowski, 2006).

According to the 2014 Welsh Health Survey (Welsh Government, 2015a), in which respondents with mental ill health are defined as those who report they are currently being treated for depression, anxiety or 'another mental ill health', the smoking prevalence among mentally ill adults was 33%. This compares with a smoking level of 20% reported amongst the whole of the adult population in Wales.

Smoking experimentation and uptake can begin as early as the primary school years. In 2013/14, 8% of boys and 9% of girls aged 15-16 were

regular smokers (Welsh Government, 2015a). Two thirds of smokers start before the age of 18 (Robinson & Bugler, 2010) and almost 40% start smoking regularly before the age of 16 (ONS, 2013). It is estimated that, each year, at least 23,000 young people in England and Wales start smoking by the age of 15 as a result of exposure to smoking in the home (Royal College of Physicians, 2010). Young smokers are also likely to exhibit higher levels of dependency and a lower chance of quitting (Royal College of Physicians, 2010).

Many teenage girls smoke during pregnancy. According to the Infant Feeding Survey 2010, women aged 20 and younger were 6 times more likely than those aged 35 and over to have smoked throughout pregnancy (35% compared with 6%). Pregnant women from routine and manual occupations are much more likely to smoke and to have done so through pregnancy than those from professional and managerial occupations (20% compared with 4%) (McAndrew et al., 2012). In Wales in 2014-2015, 20% of mothers smoked throughout their pregnancy (Public Health Wales Observatory, 2016). More than half (55%) gave up at some stage before the birth. Although most women who had stopped before or during pregnancy were still not smoking shortly after the birth, nearly a third (31%) were smoking again less than a year later (McAndrew et al., 2012). Because of the stigma attached to smoking in pregnancy there is likely to be a significant under-reporting by pregnant women who smoke.

Nicotine inhaled from smoking tobacco is highly addictive however it is primarily the toxins and carcinogens in tobacco smoke – not the nicotine – that cause illness and death (NICE, 2013a). The effects of smoking are not limited to the smoker but have implications for those around them. Second hand smoke is a human carcinogen and no risk free level of exposure has been identified (US Surgeon General, 2006). Breathing it in can have both immediate and long-term health consequences. In the short term, it can exacerbate respiratory symptoms and trigger asthma attacks. In the longer term, it can increase the risk of smoking-related diseases such as lung cancer (Royal College of Physicians, 2005; Scientific Committee on Tobacco and Health, 2004).

The health of babies born into lower income households is disproportionately affected by second hand smoke. In addition, as they are growing up in an environment where smoking is the norm, they are more likely to start smoking in adolescence (British Medical Association, 2007; Royal College of Physicians, 2010).

Exposure to second hand smoke in the home affects an estimated 5 million children under the age of 16 (British Medical Association, 2007). A UK report on children estimated that passive smoking caused 22,600 new cases of wheeze and asthma, 121,400 new cases of middle ear infection and 40 cases of sudden infant death each year. Second hand smoke at home result in twice higher risk of sudden infant death and 50% higher

risk of lower respiratory infections and asthma in children. These consequences were strongly associated with maternal smoking (Royal College of Physicians, 2010).

In 2014, 30% of all non-smoking adults aged 16+ in Wales reported being regularly exposed to 'second-hand' or 'passive' smoke (ASH Wales Cymru, 2015). Children in particular are frequently exposed to passive smoke at home. In 2010, 571 hospital admissions in children aged 0-14 years old were due to second hand smoke (Public Health Wales Observatory, 2012). The Childhood Exposure to Environmental Tobacco Smoke (CHETS) Wales 2 study found 22% of the children aged 10/11 in their cohort reported at least one parent figure who smoked in the home in 2014 (Welsh Government, 2014). It has been estimated that domestic exposure to second-hand smoke in the UK causes around 2,700 deaths in people aged 20-63 and a further 8,000 deaths a year among people aged 65 years and older (Jamrozik K, 2005).

Stopping smoking can greatly reduce the risk of smoking-related cancers, compared to continuing to smoke (International Agency for Research on Cancer, 2004 and 2012). In Wales in 2015, 68% of adult smokers reported that they would like to give up smoking, while 41% of adult smokers had tried to give up in the last year (Welsh Government, 2016).

Most people attempt to stop without help, but only around 4% of those who stop without using behavioural or pharmacological therapy are successful for a year or longer (Hughes et al., 2004). This compares with about 15% at 1 year of those who stop with support from NHS stop smoking services (Ferguson et al., 2005).

Recent studies show that people with mental health problems are just as likely to want to stop smoking as the general population – and are able to stop when offered evidence-based support. However, support is not always available (Jochelson & Majrowski 2006; Siru et al., 2009).

Key statistics for Wales:

Welsh Health Survey 2015 (Welsh Government, 2016)

- 19% of adults (aged 16+) in Wales were current smokers in 2015.
- Men and women aged 16-44 have the highest prevalence of smoking at 25% and 22% respectively. The 65+ age group has the lowest prevalence at 10%.
- There has been a decrease in the percentage of adults smoking since 2004/05 (28%) to 2015 (19%). Smoking has decreased among women from 26% in 2004/05 to 18% in 2015 and from 29% to 21% among men.
- Persons in the most deprived quintile are more likely to smoke (29%), compared to the least deprived quintile (11%).

- Persons who have never worked or are long term unemployed have the highest smoking prevalence (43%), whilst those in managerial or professional occupations have the lowest prevalence of 11%.
- In 2015 16% of non-smokers reported that they were exposed to second hand smoke indoors (which includes their own home and other people's homes, whilst travelling by car, and other places).
- 68% of smokers would like to give up smoking, and 41% had tried giving up in the past year.

Health Behaviour in School-aged Children (HBSC) survey 2013/14 (Welsh Government, 2015b)

- Smoking prevalence increases with age. 4% of children aged 11 to 16 reported smoking at least once a week. This rises to 9% for children aged 15-16 (Year 11).
- Rates of smoking amongst children aged 11 to 16 years have declined from 11% smoking at least one a week in 2002; to 3% in 2013/14.
- 13% of children aged 11-16 say someone was smoking the last time they were in a car. This rises to nearly a quarter (23%) for those in the lowest family affluence group.
- 12% of 11-16 year olds have tried an e-cigarette, rising to a fifth (22%) of 15-16 year olds (Year 11). Overall, 2% of the 11-16 years old reported regularly smoking an e-cigarette.

PHW Observatory Tobacco and Health in Wales Report 2012 (Public Health Wales Observatory, 2012)

- Smoking caused 18% of all deaths in people aged 35 and over in Wales in 2010.
- Smoking is about two and a half times more common in the most deprived compared to the least deprived areas. Although smoking attributable mortality is falling across all deprivation fifths, it is falling faster in the least deprived fifth than the most deprived.
- Around 5% of all hospital admissions for people aged 35 and over are caused by smoking.
- In 2010 tobacco was 33% less affordable than in 1980.

Comparison between England and Wales

- In 2014 in Wales 20% of adults (aged 16+) were current smokers, compared to 18% of adults (aged 18+) in England (Welsh Government, 2015a; Office for National Statistics, 2015).
- In 2014 in Wales 22% of men and 19% of women are current smokers. In 2014 in England 20% of men and 16% of women smoke (Office for National Statistics, 2015).
- For the period 2007-09 the rate of deaths from smoking in persons aged 35 and over was higher in Wales (235 per 100,000) than in England (216 per 100,000) (Public Health Wales Observatory, 2012).

4.2. Impact and costs of tobacco - to the individual, the health system, wider society and the economy

The estimated total cost to UK society of smoking was £13.7 billion in 2010. This included £2.7 billion in cost to the NHS but also the loss in productivity from smoking breaks (£2.9 billion) and increased absenteeism (£2.5 billion) (NICE, 2013b; Policy Exchange, 2010).

The costs of smoking to the NHS in Wales were estimated to be £386 million in 2007/08 - equivalent to £129 per head and 7% of total healthcare expenditure in Wales. Smoking accounted overall for an estimated 22% of adult hospital admission costs, 6% of outpatient costs, 13% of GP consultation costs, 12% of practice nurse consultation costs and 14% of prescription costs (Phillips and Bloodworth, 2009).

A later analysis estimated the total cost of smoking to the NHS in Wales in 2012 to be £302 million per year (Grant, 2013). Based on the 20% prevalence of smoking among adults in Wales, this represents a cost of £583 per adult smoker*. The differences in the two sets of figures are likely to be due, to an unknown degree, to the different methodology used to calculate them.

The overall cost to the Welsh economy in 2012 has been estimated to be £790.66 million a year (Grant, 2013). Based on a 2014 Welsh population of 3,092,036 this equates to £256 per person (£1,526 per adult smoker) in Wales; using a smoking prevalence rate of 20% (see above), it can be estimated that there are 518,274 current smokers aged 16+ in Wales and thus each adult smoker costs the economy and NHS in Wales £1,526 and £583 a year, respectively*.

As well as the health impacts, smoking has direct economic repercussions on smokers. In 2014, a 20-a-day smoker of a premium cigarette brand will have spent about £2,900 a year on cigarettes (Health and Social Care Information Centre, 2014). Smoking has the potential to widen the economic disparity that exists within Wales as the cost of smoking has a bigger impact on poorer households given they spend a disproportionately large share of disposable income on cigarettes compared to more affluent smokers. In 2013-14 in Wales, 116 fires in homes were caused by smoking materials (Welsh Government, 2015a). The estimated cost to the Welsh economy of fires in the home was £38 million in 2012 (Grant, 2013).

4.3. Cost-effectiveness and return on investment of a public health approach and interventions

The Explanatory Memorandum for the Public Health (Wales) Bill (Welsh Government, 2015c) states: "It is estimated that, on average, preventing

the uptake of smoking results in an average one year life gain per individual. This life gain is valued at £60,000 per person.”

Compared with smokers, a person aged 25 years who reduces their smoking levels will live for an additional 2 years and will save the NHS £882. A smoker aged 25 years who quits will live an additional 3.79 years, and will save the NHS £1,592. A smoking intervention that achieves 1 additional ‘reducer’ aged 50 will save the NHS approximately £767 over the person’s lifetime. An intervention that leads to 1 quitter will save the NHS £1,412 over the same period (NICE, 2013b). It has been estimated that if 100,000 smokers quit, this could potentially save the NHS £159 million because of reductions in admissions for smoking-related illnesses and the associated medication costs (NICE, 2013b).

Treating smoking-related illnesses in people with mental health problems has been estimated to cost the NHS £720 million a year in primary and secondary care. Given that smoking can reduce their effect, smoking increases psychotropic drug costs in the UK by up to £40 million (Royal College of Physicians, 2013). This equates to approximately £72,000 per 100,000 population. There is a potential saving from a reduction in the prescribing of psychotropic drugs (NICE, 2013b).

It has been estimated, using a NICE costing template (NICE, 2010), that £443,064 could be saved in a year in Wales if uptake of stop smoking services for pregnant women increased to 25% (Jones et al., 2012).

The WHO consider that a combination of protecting people from tobacco, warning about the dangers of tobacco, enforcing bans on tobacco advertising, raising taxes on tobacco and offering counselling to smokers could avert 20 to 30 million DALYs in Europe – which is estimated to be greater than 50% of the total tobacco burden (World Health Organization, 2014).

5. Reducing the prevalence of alcohol and substance misuse

Key messages:

- Alcohol remains a major threat to public health, and is a major cause of death and illness, in Wales. Alcohol consumption is associated with many chronic health problems including mental ill health, liver, neurological, gastrointestinal and cardiovascular conditions and several types of cancer. It is also linked to accidents, injuries and poisoning and social problems such as crime, assault and domestic violence.
- Drinking during pregnancy can have an adverse effect on the developing foetus leading to lower birth weight and slow growth, learning and behavioural difficulties and facial abnormalities.
- Alcohol impacts on wider public services and society and has a significant impact on the economy.
- Policy level interventions are likely to be highly cost-effective with 'best buys' including minimum unit price (MUP) of 50 pence/unit of alcohol; limiting availability (outlet density, hours and days of sale) and better control of advertising.
- Alcohol hurts the poorest the most with alcohol-related mortality in the most deprived areas much higher than in the least deprived.
- Substance misuse is associated with significant health risks including anxiety, memory or cognitive loss, accidental injury, hepatitis, HIV infection, coma and death and may also lead to an increased risk of sexually transmitted infections.
- Drug related deaths are decreasing in Wales.

5.1. Alcohol and substance misuse: health, social and economic dimensions

Alcohol misuse is a major preventable public health concern. Over 5% of the global burden of disease and injury is estimated to be attributable to alcohol misuse. Each year alcohol misuse is estimated to contribute to 3.3 million deaths worldwide; on a global level, alcohol represents the fifth leading risk factor for morbidity and mortality (World Health Organization, 2014a).

Alcohol consumption is associated with many chronic health problems including mental ill health, liver, neurological, gastrointestinal and cardiovascular conditions and several types of cancer. It is also linked to

accidents, injuries and poisoning (Rehm et al., 2010). Drinking during pregnancy can also have an adverse effect on the developing foetus. The resulting problems can include lower birth weight and slow growth, learning and behavioural difficulties and facial abnormalities (British Medical Association Board of Science, 2007). Nearly half of all men and over a third of women in Wales are drinking above the recommended guidelines with considerable proportions drinking at levels likely to be harmful or hazardous to health (Welsh Government 2016).

A literature review by Public Health Wales (2015a) examining the health, social and well-being problems associated with alcohol in Wales concluded that increasing levels of alcohol misuse are associated with increased levels of criminal offences, rape and sexual assault, domestic and other violence, driving under the influence of alcohol, anti-social behaviour and unintentional and intentional injury.

In the past 20 years in the UK, the price of alcohol has been rising at around the same rate as for other consumer products but incomes have risen much faster. As a result, between 1980 and 2008 alcohol became 75% more affordable (The Health and Social Care Information Centre, 2009). Since 1987, for example, beer and wine have become 139% and 124% more affordable respectively when bought from an off-license (Booth, Meier and Stockwell, 2008). Overall, 80% of alcohol purchased in the UK is bought by 30% of the population (Booth Meier and Stockwell, 2008). In Britain, the amount of pure alcohol sold per adult rose from 9.53 litres in 1986/87 to a peak of 11.78 litres in 2004/05, before dropping to 10.59 litres in 2010/11 (HM Revenue and Customs, 2012).

Substance misuse is associated with significant health risks including anxiety, memory or cognitive loss, accidental injury, hepatitis, HIV infection, coma and death. It may also lead to an increased risk of sexually transmitted infections (NICE, 2007).

In the UK, it has been estimated that around 4 million people use illicit drugs each year; cannabis is by far the most commonly used, followed by cocaine and ecstasy (Roe and Man, 2006). Opioid misuse occurs on a much smaller scale, but is associated with greater rates of harm than either cocaine or cannabis use.

Although it is difficult to estimate, figures suggest that the prevalence of opiate and crack cocaine injecting is in decline. In 2015 there were an estimated 17,598 opioid users in Wales (Public Health Wales, 2014). The number of opiate-related (heroin or methadone) deaths has decreased over the years. However, over the past decade (2002–2010), they have accounted for around two-thirds of all drug-related deaths in the UK (Davies, English, Stewart et al., 2012). Although drug related deaths are decreasing in Wales, they still account for over 100 deaths each year (Public Health Wales, 2015a).

UK data suggest that the majority of people who use anabolic steroids inject them putting them at risk of bacterial and fungal infections and the transmission of blood-borne viruses. Increasing numbers of new products are being injected (Advisory Council on the Misuse of Drugs, 2010).

In Wales in 2014-15, of those aged 25 to 49 years accessing needle and syringe exchange programmes (NSP), 9,066 (46.2%) described themselves as primarily steroid and image enhancing drug users (SIED). Reported SIED use in Wales declines with age (Public Health Wales, 2015b). Two thirds of all 25-29 year olds report primary SIED use compared with less than one third (28.5 %) of those aged 45 to 49.

Reported primary opioid injecting in Wales in 2014-15 peaked in those aged 35 to 39 years, with 2,133 reported NSP service users, representing 50.1 % of all NSP users in that age band. Primary stimulant use also peaked in this age band, with 534 service users, representing 12.6 % of all those in the 35-39 year age band (Public Health Wales, 2015b).

In Wales in 2014-15, of those aged under 25 years who accessed needle and syringe exchange programmes, 3,542 (81.7%) reported primarily using steroid and image enhancing drugs. 564 (13%) reported primary opioid use (Public Health Wales, 2015b).

Evidence also suggests that among young people, vulnerable groups are more likely to inject drugs. These include:

- Young offenders and those who are homeless or involved in sex work (Cusick, Martin and May, 2003)
- Those excluded from school (Melrose, 2004)
- Young people with parents with drug or alcohol problems (Advisory Council on Misuse of Drugs, 2003)
- Those who are, or have been, in care (Ward, Henderson and Pearson, 2003).

Key statistics for Wales:

Welsh Health Survey 2015 (Welsh Government 2016)

- Generally, there has been a small decline in levels of drinking above guidelines since 2008. 26% of adults report drinking alcohol on average once or twice a week, while 6% of adults report drinking alcohol almost every day.

- 2 in 5 (40%) of adults report drinking above the recommended guidelines⁶ on at least one day in the past week - 45% of men and 34% of women.
- Around a quarter (24%) of adults report binge drinking (30% of men, 19% of women) i.e. more than 8 units for men and 6 units for women on a day in the past week.
- Drinking above guidelines was more common amongst men, and was less common in the oldest age group.
- Around 15% of adults reported that they were non-drinkers, and a further 38% reported that they drank less than once a week.
- Drinking above guidelines decreased as deprivation increased but there was less variation for binge drinking.

Health Behaviour in School-aged Children (HBSC) survey 2013-14) (Welsh Government, 2015b)

- In 11-16 year olds, 17% of boys and 14% of girls report drinking alcohol at least once a week.

Welsh Government data (Public Health Wales, 2015c)

- In 2014 there were 5,120 cases of children in need registered with local authorities due to parental substance misuse, a 3.7% increase from 2013.
- In 2013/14 there were over 350 school exclusions resulting from substance misuse.

Hospital admissions

- Admissions due to alcohol are strongly related to deprivation with rates in the most deprived areas much higher than in the least deprived (Public Health Wales, 2014).
- Alcohol related admissions are more common in 40-59 year olds whereas drug related admissions are more common in 20-39 year olds (Public Health Wales, 2015c).

Mortality

- Alcohol is a major cause of death and illness in Wales with around 1,500 deaths attributable to alcohol each year (1 in 20 of all deaths) (Public Health Wales, 2014).

⁶ This refers to alcohol guidelines 1995 at the time of the survey. New guidelines were published in 2016.

- Mortality due to alcohol is strongly related to deprivation with rates in the most deprived areas much higher than in the least deprived. There are signs that the inequality gap in mortality is widening over time (Public Health Wales, 2014).
- There are around 29 alcohol related deaths every week in Wales (Public Health Wales, 2014).
- In 2014, there were 113 drug misuse deaths in Wales. Drug misuse deaths are approximately twice as high in males than females (Public Health Wales, 2015c).
- Alcohol related deaths are more common in 45-69 year olds whereas drug related deaths are more common in 25-44 year olds (Public Health Wales, 2015c).

Comparison between England and Wales

- A greater proportion of children (aged 11 to 16 years) drink alcohol in Wales than in England, Scotland or the Republic of Ireland (Public Health Wales, 2014).
- In adults, alcohol consumption rates are lower in Wales than Scotland but they are higher than those seen for England (Public Health Wales, 2014).
- Drug related deaths are decreasing in Wales but are increasing in England and Scotland. However, there are still more than 100 drug-related deaths in Wales each year (Public Health Wales, 2015b).

5.2 Impact and costs of alcohol and substance misuse - to the individual, the health system, wider society and the economy

Alcohol

As shown above, alcohol is a major cause of death and illness in Wales with around 1,500 deaths attributable to alcohol each year (1 in 20 of all deaths) and around 29 alcohol related deaths every week (Public Health Wales, 2014). Alcohol-specific deaths for males in 2013 were significantly higher for Wales than England (20.7 per 100,000 compared with 17.8 per 100,000) (ONS, 2015).

Mortality due to alcohol in Wales is strongly related to deprivation with rates in the most deprived areas much higher than in the least deprived (Public Health Wales, 2014). There are signs that the inequality gap in mortality is widening over time.

Alcohol is also linked to a number of social problems. It may be a contributory factor in up to one million assaults and is associated with 125,000 instances of domestic violence in Britain each year (The Health and Social Care Information Centre, 2009), which translates to more than 6,000 cases of domestic violence each year in Wales.

Heavy drinking increases the risk of unemployment, absenteeism, and presenteeism (attending work while sick) (Anderson, Moller and Galea, 2012). Up to 17 million working days in are lost annually in the UK through absences caused by drinking (more than 810,000 for Wales*) – and up to 20 million are lost through loss of employment or reduced employment opportunities (nearly 1 million working days for Wales*) (Prime Minister's Strategy Unit, 2004).

The impact on family members of those with alcohol misuse problems can be profound, leading to feelings of anxiety, worry, depression, helplessness, anger and guilt. It can lead to financial worries and concern about the user's state of physical and mental health, as well as their behaviour. It can also affect the family's social life and make it difficult for family members to communicate (Orford et al., 2005).

Alcohol-related harm was estimated to cost society £21 billion annually in the UK, more than £1 billion for Wales (HM Government, 2012).

A report by Public Health Wales (Public Health Wales, 2015a) examining the health, social and well-being problems associated with alcohol in Wales noted that hospital admissions for alcohol-attributable conditions were increasing over time with 34,077 cases recorded in 2013.

The cost of excess alcohol to the NHS in Wales was estimated to be between £69.9 million and £73.3 million in 2008/09. It was estimated that £1.34 million to £1.41 million was spent each week in Wales treating diseases caused by excess alcohol in 2008/09; between £23.47 and £24.60 for each person in Wales and between 1.27% and 1.33% of total healthcare expenditure (Phillips et al., 2010). The costs of Emergency Department attendances were also calculated as approximately £35.3-£37.5 million in 2008/09 in Wales (Phillips et al., 2010).

Substance misuse

In England and Wales in 2003/04, class A drug use was estimated to cost around £15.4 billion in economic and social terms (Gordon et al., 2006). The costs per year per drug misuser incurred by the health sector, by social care, and due to drug related death and crime are estimated to be between £11,800 and £44,000. The average cost per person injecting drugs over a 6 month period was calculated to be £5,936; comprising £931 in health care costs, £167 in social costs, £693 in addiction services costs, and £4,145 in criminal service costs (Neale et al., 2006). This equates to costs of £11,800 per person injecting drugs user per year.

5.3 Cost-effectiveness and return on investment of a public health approach and interventions

'Best buys' which can reduce alcohol consumption, harm and costs if fully enforced (WHO, 2014b) include introducing a minimum unit price (MUP) of 50 pence/unit⁷ of alcohol; limiting availability, including outlet density, hours and days of sale; and better control (ban) of advertising. It was estimated that restricting alcohol availability has the potential to be very cost-effective if fully enforced – saving \$550 to \$1,450 (approximately £385-£1,000) for each year in good health restored. Likewise, implementing a comprehensive ban on advertising has the potential to be very cost-effective if fully enforced – saving \$1,000 to \$1,100 (approximately £700-£770) for each year in good health restored (World Health Organization, 2015).

It has been estimated that in Wales the introduction of a minimum unit price (MUP) of 50 pence for alcohol would lead to 53 fewer alcohol related deaths and 1,400 fewer hospital admissions each year (Meng et al., 2014). Modelling suggests that this policy would lead to greater reductions in deaths and hospital admissions per 100,000 drinkers for those in poverty than those not in poverty. Direct costs to healthcare services are estimated to reduce with savings of £131 million over 20 years. Crime is expected to fall with an estimated 3,684 fewer offences per year. Costs of crime are estimated to reduce by £248 million over 20 years. Workplace absence is estimated to fall under with a reduction of 10,000 days absent per year. The total societal value of the harm reductions for health, crime and workplace absence is estimated at £882 million over 20 years. This figure includes reduced direct healthcare costs, savings from reduced crime and policing, savings from reduced workplace absence and a financial valuation of the health benefits measured in terms of Quality-Adjusted Life Years (a QALY being valued at £60,000 in line with Home Office guidelines) (Meng et al., 2014).

The report on alcohol by Public Health Wales (2015a) concluded that policy-level interventions are likely to be highly cost-effective, as are brief interventions. The report summarises international evidence which supports the use of alcohol pricing policies to reduce affordability and cites research commissioned by Welsh Government which indicated that a policy of minimum unit pricing would be effective in reducing alcohol consumption, alcohol related harms (including alcohol related deaths, hospitalisations, crimes and workplace absences) and the costs associated

⁷ One unit of alcohol is equal to 10ml or 8g of pure alcohol. This equals one 25ml single measure of whisky (ABV 40%), or a third of a pint of beer (ABV 5-6%) or half a standard (175ml) glass of red wine (ABV 12%).

with those harms. This review also identified a need for further ROI analysis to be undertaken within Wales.

The King's Fund suggest that motivational interviewing in primary care has a ROI – bringing back £5 to the public sector (in reduced health care, social care and criminal justice costs) for every £1 spent on motivational interviewing and supportive networks for alcohol and drug dependent people (Kings Fund and Local Government Association, 2014).

If needle and syringe programmes are part of an integrated care pathway which leads to a higher proportion of people who inject drugs taking part in opioid substitution therapy, or take part in other drug treatment, then a fall in the number of people who inject drugs is likely (NICE, 2014). It is estimated that the cost of injecting equipment for a person who injects psychoactive drugs is around £200 per year and for a person who injects image- and performance- enhancing drugs is around £6 per year plus dispensing costs. This may avoid the annual cost of treating a person with hepatitis C which is between £22,000 and £41,000; for a person with Human Immunodeficiency virus (HIV) this is between £10,000 and £42,000 depending on stage of disease progression. For example, for each additional 10% of people who inject drugs who use a needle and syringe programme there will be a reduction in the numbers of people being diagnosed with blood-borne viruses such as hepatitis C (NICE, 2014).

6. Promoting physical activity

Key messages:

- Not enough adults or children are physically active enough in Wales to protect their health.
- A sedentary lifestyle is an independent risk factor for some of the main causes of ill health and disability in the UK.
- Increasing how much physical activity someone does can significantly improve their physical and mental well-being, can help prevent and manage many illnesses including coronary heart disease, some cancers, diabetes and reduce the risk of premature death.
- Inactivity can have significant economic costs.
- 'Best buys' to increase physical activity include mass media campaigns, supporting active travel (walking and cycling), brief intervention for physical activity in primary care and promoting physical activity in workplace, schools and communities.

6.1 Physical activity: health, social and economic dimensions

Increasing how much physical activity someone does can significantly improve both their physical and mental well-being and reduce illnesses and disease throughout life. It can also improve life expectancy (NICE, 2014).

Physical activity can help prevent and manage more than 20 conditions and diseases including coronary heart disease, some cancers, diabetes, musculoskeletal disorders, mild to moderate depression and obesity (NICE 2014; Department of Health 2011). Some evidence suggests being sedentary is an independent risk factor for certain diseases such as coronary heart disease and type 2 diabetes; evidence also suggests that even people who achieve the recommended levels of physical activity may still be at risk if they spend too much time being sedentary (Lee et al., 2012).

Key statistics for Wales:

Welsh Health Survey 2015

- In 2015 64% of men and 53% of women reported being physically active for 150 minutes or more a week (Welsh Government, 2016).

- 29% of men and 35% of women reported having no active days (Welsh Government, 2016).
- Over half (52%) of those aged 65 + reported that they were not physically active in the previous week. People classified as NS-SEC 'managerial and professional' did the most physical activity at 64%, whilst those who had never worked or were long term unemployed did the least at 40% (Welsh Government, 2016).
- 40% of adults in the most deprived quintile reported being physically active for less than 30 minutes in the previous week, compared with 23% in the least deprived quintile (Welsh Government, 2016).

Health Behaviour in School-aged Children (HBSC) survey 2013-14

- 20% of boys versus 11% of girls were physically active for 60 minutes every day of the week (Welsh Government, 2015b).
- Physical activity decreases with age (Welsh Government, 2015b).
- The percentage of children being physically active shows a downwards trend of less physical activity (Welsh Government, 2015b).

Welsh Outdoor Recreation Survey 2014

- 93% of people in Wales have made at least one outdoor visit in the last 12 months (Natural Resources Wales, 2015).
- Health reasons were the most commonly cited long term barrier for not visiting the outdoors (Natural Resources Wales, 2015).
- People with any academic qualification were more likely to visit the outdoors than those with no qualifications (Natural Resources Wales, 2015).

Comparison with other UK nations

- In 2011, out of the four home countries, the percentage of adults meeting the physical activity guidelines in Wales (physically active on 5 or more days a week) was lowest for women and second lowest for men (Department of Health, 2011):
 - Wales⁸ - 36% for men and 23% for women
 - England⁸ - 40% for men and 28% for women
 - Northern Ireland⁸ - 33% for men and 28% for women
 - Scotland⁹ - 43% for men and 32% for women

⁸ 30 minutes or more of moderate intensity on at least 5 days a week

There has since been a change in the guidance used to measure physical activity levels in the UK. The new indicator used is “% of adults achieving at least 150 minutes of physical activity per week, in accordance with the UK CMO recommended guidelines”.

- For journeys of 1 to 2 miles to school in Great Britain: 31% primary school children walk vs. 62% of secondary school children either walk or cycle (Department for Transport, 2012)
- In Wales people (adults and children) are less likely to use walking as a mode of transport than in England and Scotland i.e. 21% of trips were on foot in Wales, compared to 23% in England and in Scotland (Welsh Government, 2013).

6.2 Impact and costs of physical inactivity - to the individual, the health system, wider society and the economy

Physical inactivity is the fourth leading risk factor for global mortality (6% of deaths globally) and physical inactivity is estimated to cause 27% of diabetes cases and 30% of ischaemic heart disease cases (World Health Organization, 2010). In the UK, it is estimated that 11% of coronary heart disease cases, 13% of type 2 diabetes cases, 18% of breast cancer cases, 19% of colon cancer cases and 17% of premature mortality are due to physical inactivity (Lee et al., 2012).

It has been estimated that not acting on physical inactivity will lead to the loss of 8.2 million disability adjusted life years (DALYs) in Europe (World Health Organization, 2014). Physical inactivity was estimated to cost €150–300 per inhabitant per year in Europe (Cavill et al., 2006).

In the UK, 2006/7 estimates put the total UK NHS costs of physical inactivity at around £0.9 billion. This is derived from costs incurred from stroke, heart disease, colorectal cancers, breast cancer and type 2 diabetes and it has been estimated the annual cost of physical inactivity to the NHS inflated to 2012/13 costs was £1,067 million (Scarborough et al., 2011). For Wales this would represent a cost of £51 million each year for the NHS*.

As well as healthcare costs, there are also economic implications for the individual in terms of lower productivity, and loss of earnings to the social security system in terms of increased incapacity and sickness benefits, and to employers and the wider economy in terms of lower productivity and sickness. Based on English estimates, the cost of physical inactivity for the Welsh economy would represent £314 million per year from

⁹ 30 minutes or more of moderate intensity on most days of the week

sickness absence and £57 million per year from premature death of people of working age (Ossa and Hutton, 2002 as cited in NICE, 2013). The total economic costs of physical inactivity in the UK for a number of illnesses summarised by the British Heart Foundation (British Heart Foundation National Centre, 2013) ranged from £3.7 billion for stroke to £18.9 billion for coronary heart disease.

6.3 Cost-effectiveness and return on investment of a public health approach and interventions

Public health interventions identified by the WHO as producing a return on investment or cost-saving are included in Appendix 1.

Other examples of 'best buys' include mass media campaigns to promote physical activity which would increase the proportion of the population undertaking physical activity by 2.35% for a cost of less than £1.40 (US\$2) per capita, interventions promoting physical activity in worksites which would increase the proportion of employees physically active by 12% for less than £4.11 (US\$5.5) per capita (Sassi, 2010)¹⁰.

Primary care brief interventions promoting physical activity are estimated to cost between £20 to £440 per year of healthy life gained as a result of the intervention. In comparison, statin treatment to treat high cholesterol costs between £10,000 and £17,000 per year of healthy life gained (Department of Health, 2012).

Based on the WHO's review of evidence (World Health Organization, 2014), increasing cycling and walking in urban areas would save £0.9 billion for the NHS in Wales over 20 years. For example, every £1 spent on cycling provision would save £4 in health costs for the NHS in Wales*.

¹⁰ Costings calculated using an online currency converter (www.xe.com/currencyconverter/) on 5/5/16.

7. Promoting healthy diet and preventing obesity

Key messages:

- More than half of Welsh adults and over a quarter of children are overweight or obese. Overweight and obesity is related to social disadvantage, with higher levels in the most deprived populations.
- Only a minority of adults in Wales eat the recommended levels of fruit and vegetables.
- Being overweight or obese can lead to both chronic and severe medical conditions including coronary heart disease, diabetes, stroke, hypertension, osteoarthritis, complications in pregnancy and some cancers and can significantly reduce life expectancy.
- People who are obese may also experience mental health problems, bullying or discrimination in the workplace.
- Improvements to Body Mass Index (BMI) and diet will reduce a range of conditions leading to significant savings for the NHS and local authorities.

7.1. Unhealthy diet, overweight and obesity: health, social and economic dimensions

Over half of men and women in Wales are considered overweight or obese and this may be an under-estimate (see below). This appears to be an upward trend. In the next 20 years, it is predicted that three in four people in Wales will be overweight or obese (Bhimjiyani, Knuchel-Takano & Hunt, 2016). The Child Measurement Programme in Wales for 2014/15 indicates that the majority of reception year children in Wales who were measured were of a healthy weight; however 26.2% were either overweight or obese. In both children and adults there is a strong relationship between levels of obesity and deprivation, with those living in our more deprived communities more likely to be overweight or obese. This is consistent with the Marmot Review (Marmot et al., 2010) which found that obesity is related to social disadvantage with marked trends, especially in children, by area of residence.

In the UK, obesity is most prevalent among Black Caribbean, Black African and Irish men – and least prevalent among Chinese and Bangladeshi men. Among women, it is more prevalent among those of Black African, Black Caribbean and Pakistani origin – and least prevalent among Chinese women (Health and Social Care Information Centre, 2005).

Being overweight or obese can lead to both chronic and severe medical conditions (Butland et al., 2007). It is estimated that life expectancy is reduced by an average of 2 to 4 years for those with a BMI of 30 to 35 kg/m², and 8 to 10 years for those with a BMI of 40 to 50 kg/m² (National Obesity Observatory, 2010). Overweight and obesity is a significant contributor to the rising prevalence of type 2 diabetes. Women who are obese are estimated to be around 13 times more likely to develop type 2 diabetes and 4 times more likely to develop hypertension than women who are not obese (Health and Social Care Information Centre, 2014). Men who are obese are estimated to be around 5 times more likely to develop type 2 diabetes and 2.5 times more likely to develop hypertension than men who are not obese (Health and Social Care Information Centre, 2014). People who are obese may also experience mental health problems as a result of stigma and bullying or discrimination in the workplace (Puhl & Heuer, 2009).

Over the next 20 years rising levels of obesity could lead to around an additional 4.62 million cases of type 2 diabetes (221,700 in Wales*); 1.63 million cases of coronary heart disease (78,200 in Wales*) and 670,000 new cases of cancer (32,200 in Wales*) (Bhimjiyani, Knuchel-Takano & Hunt, 2016).

Key statistics for Wales:

Welsh Health Survey 2015 (Welsh Government, 2016)

- 63% of men and 56% of women were either overweight¹¹ or obese¹².
- 23% of men and 24% of women were obese.
- Adults in the most deprived quintile were more likely to be overweight or obese (63%), compared to the least deprived quintile (54%).
- Current guidelines recommend that we should eat at least 5 portions of fruit and vegetables a day, with one portion being around 80 grams. Only around a third of men (31%) and women (33%) meet the guidelines for consumption of fruit and vegetables and there has been a decrease in the percentage of adults eating 5 or more portions of fruit and vegetables a day since 2008 (36%) to 2015 (32%).

¹¹ Body Mass Index 25 to 30 kg/m²

¹² Body Mass Index 30 kg/m² and above

- Persons in the most deprived quintile are less likely to eat the recommended amount of fruit and vegetables (26%), compared to the least deprived quintile (37%).

Public Health Wales Observatory (Public Health Wales Observatory, 2014)

- There has been an increase in the percentage of obese adults across all deprivation groups between 2004/5-08 and 2009-12.
- The 45-64 age group has the highest percentage of overweight or obese adults at 67% in 2009-12.

Child Measurement Programme for Wales Annual Report 2014/15 (Public Health Wales, 2016)

- Nearly three-quarters of children (72.9%) were a healthy weight¹³, and just over a quarter (26.2%) were overweight¹⁴ or obese¹⁵.
- There was a strong relationship between levels of obesity and deprivation – 28.4% of children living in the most deprived areas of Wales were overweight or obese, compared to 20.9% in the least deprived areas.
- There are higher levels of overweight or obesity in boys (26.9%) than in girls (25.4%).

Health Behaviour in School-aged Children (HBSC) survey 2013/14 (Welsh Government, 2015b)

- 21% of boys and 15% of girls aged 11-16 are overweight or obese (based on self reported height and weight).
- A quarter of young people eat sweets once a day or more (24%).
- Just under a third (31%) of young people aged 11-16 eat fruit once a day or more, with a quarter (24%) of children eating fruit once a week or less.
- Slightly more (33%) eat vegetables once a day or more, with a fifth of young people eating vegetables only once a week or less.

Comparison between England and Wales

- In 2015 in Wales 59% of adults are overweight or obese (Welsh Government, 2016) compared to 62% of adults in England¹⁶ (Health and Social Care Information Centre, 2015).

¹³ BMI second centile up to but not including the 85th centile

¹⁴ BMI 85th centile up to but not including the 95th centile

¹⁵ 95th centile and above

¹⁶ Wales data are taken from the Welsh Health Survey and are self reported. England data are taken from the Health Survey for England and respondents are measured by the interviewer or a nurse. This may mean that

- In Wales 26.2% of children aged 4-5 years are overweight or obese (Public Health Wales NHS Trust, 2016) compared to 22.5% in England¹⁷ (Health & Social Care Information Centre, 2015).
- The percentage of adults eating the recommended amount of fruit and vegetables a day in Wales was 32% in 2014, in Wales was 32% in 2015, in England in 2013 it was 26%¹⁸ (Welsh Government, 2015a; Welsh Government, 2016).

7.2. Impact and costs of obesity and poor diet - to the individual, the health system, wider society and the economy

Unhealthy diets account for an estimated 15.3 million disability adjusted life years lost in Europe (World Health Organization, 2014a).

Obese individuals incur health expenditure more than 30% higher than those of normal weight. Obesity accounts for 0.7 to 2.8% of total health expenditure in most countries (Withrow and Alter, 2011).

In 2008/09 obesity was estimated to cost the NHS in Wales over £73 million. This increased to nearly £86 million if overweight people were included. It was estimated that between £1.40 million and £1.65 million was spent each week treating diseases resulting from obesity, £25 and £29 per person and between 1.3% and 1.5% of total healthcare expenditure in Wales (Phillips et al., 2010).

The direct cost of obesity to the NHS was estimated to be £5.1 billion UK-wide in 2011 (Scarborough et al., 2011). Based on this estimate, inflated to 2012/13 prices, the cost to the NHS was estimated to be £ 6.048 billion (NICE 2014a). It has been further estimated that by 2050 NHS costs attributable to people being obese or overweight would be £9.7 billion per year (Butland et al., 2007). This would represent a cost for the NHS in Wales of £465 million*.

the prevalence of overweight or obesity in Wales is underestimated.

¹⁷Both the Child Measurement Programme for Wales and the National Child Measurement Programme use similar methods and results are comparable.

¹⁸ Survey questions are slightly different in England and Wales, the Welsh Health Survey asks respondents to check off foods and amounts from a list, and based on these responses the number of portions are calculated. In the Health Survey for England the interviewer asks questions about the type and amount of fruit and vegetables eaten. These different question types mean comparing Wales and England should be done with caution.

The cost to society and the economy of people being overweight or obese was estimated at almost £16 billion UK-wide in 2007 (more than 1% of gross domestic product) with the wider costs to society and business being estimated to reach £49.9 billion in today's prices by 2050 if obesity rates continue to rise (Butland et al., 2007) - £2.4 billion for Wales alone*.

Obese women are more likely to experience complications associated with pregnancy and additional costs are incurred when women develop conditions such as gestational diabetes and pre-eclampsia. These were estimated to cost an additional £1,139 (Kitzmilller et al., 1998) and £8,628 (Simon et al., 2006) per person respectively, compared to an uncomplicated pregnancy (2010 costs). Obese women are more likely to need a caesarean section, which costs an additional £1,987 compared to a vaginal delivery (payment by result tariff, England 2010–11). The daily excess bed day charge for a caesarean section with complications is £385 (NHS national (England) tariff 2010-2011).

7.3. Cost-effectiveness and return on investment of a public health approach and interventions

If improvements to BMI are achieved and maintained, this will reduce a range of conditions associated with obesity. This includes coronary heart disease, type 2 diabetes, stroke, hypertension, osteoarthritis and some cancers (Bhimjiyani, Knuchel-Takano and Hunt, 2016). This could lead to significant savings for the NHS and local authorities. Diabetes, for example, cost the NHS approximately £23.7 billion in 2010/11 and is predicted to rise to £39.8 billion by 2035/36 (NHS Choices, 2012). Preventing a 1% increase in the number of people who are overweight or obese could save the NHS and local authorities in England around £97 million per year (NICE 2014b).

It has been estimated that offering counselling to obese people in primary care could provide an additional 5,700 years of life in good health each year in Wales* (Organisation for Economic Co-operation and Development, 2014).

Along with physical inactivity, unhealthy diet is a major risk factor for obesity. Appendix 1 summarises public health interventions identified by the WHO as producing a return on investment or cost-saving (World Health Organization, 2014b; World Health Organization, 2011). Other interventions that have been identified as 'best buys' by the WHO include reducing salt intake, replacing trans fatty acids and raising public awareness of healthy diet and managing food taxes and subsidies (World Health Organization, 2014b). Public Health England have identified restricting marketing of food and beverages to children across all media

(including digital platforms and through sponsorship) as an 'area for action' for reducing sugar intake (Tedstone et al., 2015).

It has been estimated that mass media campaigns on healthy diets can lead to an increase in fruit and vegetables intake by more than 18g (quarter of a portion) per person per day for a cost below £1.40¹⁹ (US\$2) per capita (Sassi, 2010).

In the USA it has been estimated that the elimination of the subsidy for advertising unhealthy food to children would prevent 129,061 (95% uncertainty interval (UI) 48,200 to 212,365) cases of childhood obesity by 2025. Healthcare costs saved per dollar spent would be \$ 32.53 (95% UI 12.42 to 53.35). A sugar sweetened beverage excise tax would prevent 575,936 (95% UI 131,794 to 1,890,715) cases of childhood obesity by 2025 and would save healthcare costs per dollar spent of \$30.78 (95% UI 6.07 to 112.94). Implementing nutrition standards for food and beverages sold in schools outside of meals could prevent 344,649 (95% UI 163,023 to 522,285) cases of childhood obesity by 2025 and save healthcare costs per dollar spent of \$ 4.56 (95% UI 2.13 to 7.01) (Gortmaker et al., 2015).

Following the introduction of a 10% tax on sugar sweetened drinks in Mexico, there was an average 6% reduction in purchases of sugar sweetened drinks, with a higher reduction of 9% in lower socio-economic households (Tedstone et al., 2015).

¹⁹ Calculated using an online currency convertor (www.xe.com/currencyconverter/) on 5/5/16.

8. Protection from disease and early identification

Key messages:

- Infectious diseases are still a major health and economic burden in Wales.
- Rates of HIV and other sexually transmitted infections and some blood-borne infections are increasing.
- Inequalities in health exist for some communicable diseases.
- Vaccination provides a return on investment.
- Cancers are a major cause of ill health and premature death in Wales.
- The number of new cases (incidence) of cancer in residents of Wales continues to rise, both in men and women.
- Screening for cancer can be cost-effective.
- Early identification of cancer might lead to a reduction in cancer identified through emergency admission to hospital; more appropriate referrals to secondary care for suspected cancer; extended survival for people with cancer and reduced mortality from cancer.
- There is a marked deprivation gradient in all of the adult screening programmes, but no gradient in participation in newborn hearing screening.

8.1 Health protection and early identification of disease: health, social and economic dimensions

Communicable diseases

Many childhood diseases are controlled through highly successful immunisation programmes with vaccine uptakes exceeding 95% in many areas of Wales (Public Health Wales, 2015a). The measles outbreak in South West Wales in 2013 (1,202 notifications with 88 hospital admissions and one death), provides a reminder of the potential impact of these diseases and the importance of investing in these programmes to maintain good coverage across Wales (Public Health Wales, 2014a).

The latest annual COVER report 2015/16 (Public Health Wales, 2016a) shows that annual coverage of immunisations in the babies and the youngest children in Wales remains high, however slight decreases in uptake of some routine immunisations were seen, especially affecting older toddlers and children. The proportion of children who are up-to-date with their routine immunisations by four years of age decreased slightly

for the second year in a row to 85%. Within this age-group, uptake of the second dose of MMR was lowest and also saw the largest decrease.

The gap in immunisation coverage between four year olds residing in the most and least deprived areas increased for the second year in a row, to 7.2%, but remained lower than the 9% gap reported in 2012/13 (Public Health Wales, 2016a).

In Wales in 2014 there were 189 new diagnoses of HIV (Public Health Wales, 2016b). In the same year an estimated 103,700 people in the UK were living with HIV. Of these an estimated 18,100 (17%) were unaware they were infected (Public Health England, 2015a). Late diagnosis, that is, after antiretroviral treatment should have begun, or when the person already has an AIDS-defining illness, is one of the most important factors associated with HIV-related prevention, disease development and death in the UK. Late diagnosis remains a significant problem among heterosexuals with 55% (1,381/2,490) newly diagnosed at a late stage of infection in 2014, of whom 51% (700/1,381) were black African (Public Health England, 2015a).

In the UK the number of reported diagnoses of gonorrhoea increased 25% from 2010 to 2011 and in 2012 there were 8,741 cases of tuberculosis (TB), which is considered high compared to most Western European countries (Health Protection Agency, 2013). An estimated 25% of the population is affected by gastrointestinal infection each year leading to approximately 1 million GP visits and nearly 29 million days lost from school or work (Office for National Statistics, 2012 as cited in The Parliamentary Office of Science and Technology, 2014). In 2011, 21% of all days of work were lost because of coughs, cold and flu (Office for National Statistics, 2012 as cited in The Parliamentary Office of Science and Technology, 2014).

Chronic hepatitis B and C are the leading cause of liver disease worldwide (Perz, 2006) and the second most common cause of liver disease in the UK, after alcohol (NICE, 2012).

In 2011, 589 acute or probable acute cases of hepatitis B were reported in England (Health Protection Agency, 2012). The total number of acute infections will be greater than the number reported. A study that estimated the annual incidence of hepatitis B in England and Wales conducted between 1995 and 2000 estimated the annual incidence of hepatitis B, from laboratory reports, to be around 7.4 per 100,000 people (Health Protection Agency 2012; Hahné et al., 2004), around 3,700 acute infections per year and around 270 cases of chronic hepatitis B per year.

Hepatitis C is a blood-borne viral infection transmitted through contact with infected blood, for example through sharing of needles and other equipment whilst injecting drugs. In the UK, hepatitis C is primarily

acquired through injecting drug use. Approximately 70–75% of people who are infected with acute hepatitis C develop a chronic condition that can result in liver failure and liver cancer (NICE, 2012). A recent national estimate suggests that around 216,000 people in the UK have chronic hepatitis C (Health Protection Agency, 2012; Scottish Executive, 2008). Of these, around 160,000 live in England (Harris, 2012).

The Food Standards Agency (FSA) estimates that up to 5.5 million people in the UK are affected by food poisoning each year. In recent years, rates of salmonella food poisoning have declined but rates of campylobacter enteritis, the most common cause of food poisoning, remain high (Public Health Wales, 2014b).

Autumn 2015 saw an increase in the incidence of cryptosporidium, a water borne parasite (Public Health Wales, 2016c). Control of this parasite remains a high priority for the water industry in Wales, but also for the leisure industry with indoor swimming pools becoming increasingly important as a source of transmission.

Influenza and norovirus activity peaks each winter, causing excess morbidity and mortality and placing a burden on health and care services and schools (Public Health Wales, 2016c).

Key statistics for Wales:

- Since 2010 there has been a general increase in the number of diagnoses of some sexually transmitted infections (STIs) in Wales (Public Health Wales, 2013).
- The number of new HIV diagnoses reported from all settings across Wales has increased since 2012, reaching the highest annual number in the last 15 years in 2014 (189 new diagnoses; 6 per 100,000 population) (Public Health Wales, 2016b).
- In 2012 the incidence of syphilis diagnoses in sexual health clinics was 1.7; gonorrhoea 30.1 and Chlamydia 158.4 (per 100,000 population) (Public Health Wales, 2013).
- In Wales, 50% of people who inject drugs (PWID) are thought to be infected with hepatitis C, a figure similar to England, but higher than a decade ago in Wales (19% in 2003-2005) (Public Health England, 2015b).
- Since 1996, seasonal influenza activity, as measured by consultations in general practice, has peaked at between 10 and 200 consultations per 100,000 population per week. This will be an underestimate of the true incidence as many people with influenza will not attend general practice (Public Health Wales, 2016d).
- TB rates remain relatively stable in Wales at between 4 and 7 newly diagnosed cases per 100,000 population per year (Public Health Wales, 2016e).

- 60% of TB cases are in people in black and other minority ethnic groups, although cases persist in some deprived predominantly white communities in South Wales (Public Health Wales, 2016e).
- In 2015 there were 3,793 laboratory reports of campylobacter in Wales (126 per 100,000 population) (Public Health Wales, 2016c).
- In Wales, of healthcare associated infections, E.coli is emerging as a significant cause of bacteraemia, resulting in 81 cases per 100 000 bed days in 2014 (Public Health Wales, 2015b).
- in 2014/15 there were three cases of *Clostridium difficile* per 1,000 hospital admissions in Welsh hospitals, 0.4 cases of MRSA (methicillin-resistant *Staphylococcus aureus*) bacteraemia per 1,000 hospital admissions and 1.7 cases of MSSA (methicillin-sensitive *Staphylococcus aureus*) bacteraemia per 1,000 hospital admissions (Public Health Wales, 2015b).

Population Screening Programmes

Screening is a process of identifying apparently healthy people who may be at increased risk of a condition. In each programme, eligible people are offered a screening test, which sifts out people at increased risk of the condition who are then offered diagnostic testing. Once the diagnosis is made the screening pathway ends and participants are referred for the appropriate treatment.

Screening tests will always fail to identify some people with the condition (false negatives) while identifying others as being at increased risk when they do not really have the condition (false positives). False negative and false positive results can never be totally eliminated. The test and investigation can also have adverse effects, while some disease identified by screening would not have caused harm during the individual's lifetime. There is therefore the potential for screening programmes to do more harm than good. In order to ensure this does not happen, the UK National Screening Committee (UKNSC) advises Ministers and the NHS in the four UK home nations about all aspects of screening. Potential screening programmes are reviewed against internationally recognised criteria (Appendix 2), with public consultation on its recommendations. Screening programmes are only offered by the NHS in Wales if they meet the criteria and are recommended by the UKNSC (Public Health Wales, 2015c).

Key statistics for Wales:

- The number of new cases (incidence) of cancer in residents of Wales continues to rise, both in men and women. There were 19,118 new cases in 2014, up by over 14% since 2005 (Welsh Cancer Intelligence and Surveillance Unit, 2016).

Cervical cancer

- 164 new cases of cancer of the cervix were registered in Wales in 2014. The European Age Standardised Rate²⁰ (EASR) was 10.7, similar to that in 2001 (11.00). There were 52 deaths from cancer of the cervix in 2014; the EASR was 3.2 in 2014 and 6.1 in 2001 (Public Health Wales, 2016f).

Cervical screening

- At 31 March 2015, 78.0% of women in the target age group (25-64 years) had been screened with an adequate result at least once in the last 5 years, whilst coverage exceeds 76% in all Health Boards (Public Health Wales, 2015d).
- In 2014/15 around 279,400 women aged 25-64 were invited for screening, and 207,600 were screened (Public Health Wales, 2015c)
- Laboratories examined around 218,500 samples on Welsh residents in 2014/15 (Public Health Wales, 2015d).
- 7,900 new patients were seen at colposcopy clinics in Wales in 2014/15, 75% having been directly referred by Cervical Screening Wales and 26% for clinical reasons (Public Health Wales, 2015d).

Colorectal cancer

- In 2014 there were 1,327 new cases of colorectal cancer registered in men in Wales; the EASR was 94.5 similar to that in 2001 (95.4) (Public Health Wales, 2016f).
- In 2014 there were 1,008 new cases of colorectal cancer registered in women in Wales; the EASR was 59.5, an increase from that in 2001 (55.5) (Public Health Wales, 2016f).
- 528 men in Wales died from colorectal cancer in 2014. The EASR was 39.1; in 2001 this rate was 45.3. There were 399 deaths in women. The EASR was 22.5 in 2014 and 27.6 in 2001 (Public Health Wales, 2016f).

Bowel Screening

- At 1st October 2015 50.3% of people in the eligible age range had been screened within the previous two and a half years. Coverage is

²⁰ Age-standardisation adjusts rates to take into account how many old or young people in the population are being looked at. When rates are age-standardised, you know that differences in the rates over time or between geographical areas do not simply reflect variations in the age structure of the populations. This is important when looking at cancer rates because cancer is a disease that predominantly affects the elderly. So if cancer rates are not age-standardised, a higher rate in one country is likely to reflect the fact that it has a greater proportion of older people.

higher in females (52.9%) than males (47.6%) (Public Health Wales, 2016g).

- Coverage is higher in those living in the least deprived areas (57.1% compared to 41.5% in the most deprived areas) (Public Health Wales, 2016g).
- For the period April 2014 and March 2015 (Public Health Wales, 2016g):
 - 257,368 participants were invited for bowel screening
 - 148,093 test kits were validated of which 3.7% were spoilt and could not be tested
 - 236 people were diagnosed with cancer and 1,269 participants with polyps detected and removed in the year.

Breast cancer

- There were 2,872 new cases of breast cancer in women registered in Wales in 2014. The EASR was 176.1; in 2001 this rate was 147.8 (Public Health Wales, 2016f).
- In 2014 there were 577 deaths from breast cancer in women in Wales. The EASR was in 34.8 2014 and 46.8 in 2001 (Public Health Wales, 2016f).

Breast screening

- As of 31st March 2014 67% women aged 53-70 had been screened in the previous three years (Public Health Wales 2016h). Just over 117,000 women aged 49 and over were screened in 2013-14. This represents the largest ever yearly volume and sees the programme return to full capacity following disruptions caused by digital implementation (Public Health Wales, 2016h).
- In 2013-14 over 146,000 women aged 50-70 were invited for screening, of whom 71.9% attended (Public Health Wales, 2016h)
- 5.1% women screened were referred for assessment, and a total of 1235 cancers were detected in women screened aged 49 and over (Public Health Wales, 2016h).

Abdominal Aortic Aneurysm Screening

- In 2014-15 uptake was 74.4%, ranging from 71.5% in Powys Teaching Health Board to 76.6% in Hywel Dda University Health Board. Uptake figures are higher in those men living in the least deprived areas (79.5%) compared to the most deprived areas (67.7%) (Public Health Wales 2016i).
- Between April 2014 and March 2015 (Public Health Wales, 2016i):
 - 20,685 eligible men were invited by the programme in this time period.

- 16,243 men attended for their first Wales abdominal aortic aneurysm (AAA) screening programme scan and had a definitive scan result. Of these, 208 AAA (1.3%) were detected by the screening programme.
- 277 surveillance appointments were attended and 257 (92.8%) were seen within standard (medium AAA on quarterly surveillance within 11 to 15 weeks, small AAA on annual surveillance within 50 to 56 weeks of their previous successful scan).
- 31 men were scanned and needed a referral to the elective vascular network multidisciplinary team. Most men (96.8%) were referred within two working days of the scan being taken.
- 27 men had open repair or endovascular aneurysm repair surgery, 23 (85.2%) of these had their surgery completed within 4 or 8 weeks of referral received depending on size of AAA detected.

Newborn hearing screening Wales

- During 2013-14, the number of babies eligible and suitable for screening was 33,928 and screening was offered to 99.9% of eligible babies with 99.4% tested, with very few parents declining the screen (Public Health Wales, 2016j).
- For well babies 92.7% of screening appointments were attended. 7.1% of screening appointments were not attended or were cancelled (Public Health Wales, 2016j).
- Across Wales, 74.5% of well babies are screened within 7 days of birth (Public Health Wales, 2016j).
- 100% of high risk babies are completing the screening programme and 98.1% of well babies are completing screening within 4 weeks (Public Health Wales, 2016j).
- In babies born between 1st April 2013 and 31st March 2014, the prevalence of diagnosed permanent hearing loss greater than 40 dBHL is 0.9 per 1000 of those babies screened (Public Health Wales, 2016j).
- 78.6% of babies were fitted with hearing aids within 4 weeks of confirmation of hearing loss (Public Health Wales 2016j).
- Since the introduction of universal newborn screening, the prevalence of permanent significant bilateral hearing loss (defined as greater than 40 dBHL) in children under 5 years is 1.4 per 1000 (Public Health Wales, 2016j).

8.2 Impact and costs - to the individual, the health system, wider society and the economy

Communicable disease

The WHO estimates that 15.9 million DALYs²¹ are lost in Europe every year as a result of communicable disease (World Health Organization, 2014).

Economic data for burden of communicable disease and cost-effectiveness of prevention is not currently available for Wales specifically. In the UK each unplanned influenza admission was estimated to cost the NHS £347–774 (World Health Organization, 2014; Department of Health, 2010) and in a modelling study, although deaths from H1N1v were comparatively rare, the overall burden of illness was estimated to be more than 28,000 QALYs lost over the two waves of infection in England (van Hoek et al., 2011).

It was estimated that the measles epidemic cost the NHS £433,000–995,000 over the two-year period 2008/9 (World Health Organization, 2014; Department of Health, 2010).

Estimates of the HIV-related lifetime costs for diagnosed individuals range between £280,000 and £360,000 in the UK. (NICE, 2011c; Health Protection Agency, 2009 report).

The annual healthcare costs per person associated with the management of de-compensated cirrhosis are estimated to be £11,588 (Wright et al., 2006).

The Food Standards Agency (FSA) is currently analysing the full impact of campylobacter in the UK, but previous estimates have indicated that campylobacter causes more than 100 deaths a year, and costs the UK economy about £900 million (Food Standards Agency, 2016).

Population Screening Programmes

Cervical Cancer

Cervical screening aims to reduce the incidence of cervical cancer by detecting and treating premalignant changes in the cervix. A recent review of cervical screening in Wales by Cancer Research UK (Cervical Screening Wales, 2012) found that cervical cancer would be four times as common if the screening programme did not exist.

Bowel Cancer

²¹ DALYs (disability adjusted life years) are widely used as a measure of premature mortality and ill health – one DALY can be thought of as one lost year of healthy life

Offering screening for bowel cancer to men and women aged 50-74 has been shown to reduce mortality from bowel cancer by 16% (UK National Screening Council, 2016). Bowel screening is the only cancer screening programme to invite both men and women. Screening in Wales is offered to men and women aged 60-74. Participation rates are lower than standard and the programme is keen to maximise benefit from screening in this age group before offering to younger people. In addition, limited capacity for diagnostic colonoscopy in Wales requires careful titration of demand and supply to avoid destabilising symptomatic services. The UK NSC has recently (November 2015) recommended the implementation of a more sensitive test. An implementation plan is in preparation. Ministerial approval will be required.

Breast Cancer

Recent concerns that breast screening could be doing more harm than good as a result of over diagnosing women (diagnosing cancers by screening that would never have been diagnosed symptomatically in the women's lifetime) led to an independent review (Independent UK Panel on Breast Cancer Screening, 2012) carried out on behalf of CRUK. The review found that the evidence overall continued to support the offer of organised screening for women aged 50-70, as offered in Wales. The panel estimated that around 1% of women invited to screening would experience over diagnosis as a result.

There is a marked deprivation gradient in all of the adult screening programmes, but no gradient in participation in newborn hearing screening (Appendix 3). In bowel screening, which is offered to men and women, men are systematically less likely to participate than women. These findings are replicated across the UK.

8.3 Cost-effectiveness and return on investment of a public health approach and interventions

Communicable disease

Public health interventions for communicable disease identified by the WHO as producing a return on investment or cost-saving are included in Appendix 1.

If there was a 1% shift with patients with HIV being diagnosed at an earlier stage of disease this would have the effect of reducing treatment costs and creating savings. This could lead to savings of around £212,000 a year for men who have sex with men and £265,000 a year for black Africans in England (£12,114 and £15,143 respectively for Wales*). The estimated savings in year 1 from avoidance of onward transmission may

be £0.9 million for men who have sex with men and £0.3 million for black Africans in England (NICE, 2011c).

All new and recent routine immunisation programmes introduced in the UK have to be shown to be cost-effective in relation to the usual NICE thresholds.

Economic modelling showed that, at current levels of immunisation, efforts to increase uptake of the measles vaccine were highly cost-effective in groups with both high and low immunisation coverage. Increasing uptake among low coverage groups was shown to be marginally more efficient than increasing uptake among high coverage groups (this is true if the cost per child were the same in each group.) It would also do more to reduce health inequalities. The modelling suggested that home visits (likely to be the most expensive means of increasing coverage by one percentage point) would be a cost-effective use of NHS resources. The implication is that almost any method of increasing coverage would be cost-effective. The model underestimated the cost-effectiveness of the MMR vaccine because it did not ascribe any benefits to the concurrent prevention of mumps and rubella infection (the vaccine offers simultaneous protection against three different infections) (NICE, 2009).

In illustration, the cost of measles treatment in Europe was estimated to be €209-480 (£159-356) per case, while the cost of measles vaccination and control was estimated at €0.17-0.97 (£0.13-0.74) per person (Carabin, 2003 as cited in World Health Organization, 2013b).

A study of the impact of Pandemic Influenza H1N1 on health-related quality of life concluded that "...only the prompt use of antivirals was significantly associated with a reduction in the QALYs lost, and only in the confirmed cases." (van Hoek et al., 2011).

Screening

Public health interventions identified by the WHO as producing a return on investment or cost-saving are included in Appendix 1.

Early identification of cancer might lead to a reduction in cancer identified through emergency admission to hospital; more appropriate referrals to secondary care for suspected cancer; extended survival for people with cancer and reduced mortality from cancer (NICE 2015). It has been estimated that if the proportion of cancer diagnosed at stages 1 and 2 increased by 10%, between 7000 and 9000 more people would survive cancer for 5 years (Department of Health & Public Health England, 2014).

Cervical screening

It has been estimated that screening for cervical cancer through visual inspection and treatment of pre-cancerous lesions to prevent cervical

cancer could avert 5 million DALYs in Europe - 6% of the total cancer burden (World Health Organization, 2014).

Bowel screening

It is estimated that screening for colorectal cancer at age 50 and treatment could avert 7 million DALYs in Europe - 9% of the cancer burden (World Health Organization, 2014).

The potential saving from a 1% reduction in cases of colorectal cancer identified by emergency admission from the current 25% to 24% is estimated to be £488,898 (National Cancer Intelligence Network 2013; NICE, 2015).

Breast cancer screening

The independent review of the evidence for breast screening carried out on behalf of CRUK (Independent UK Panel on Breast Cancer Screening, 2012) found that the evidence overall continued to support the offer of organised screening for women aged 50-70, as offered in Wales, and concluded that, based on the best available evidence, for every 10,000 women invited for screening from age 50-70, 681 cancers would be diagnosed, of which 129 would represent over diagnosis; 43 women's lives would be saved. This corresponds to one breast cancer death averted for every 235 women invited to screening for 20 years and one death averted for every 180 women who attend. Across the whole of the UK, this would correspond to the avoidance of 1,300 breast cancer deaths per year. In round terms, this means approximately three cases of breast cancer will be over diagnosed and treated for each life saved.

The WHO estimate that early case finding of breast cancer through mammographic screening (50-70 years) and treatment of all stages could avert 15 million DALYs in Europe - 19% of the estimated burden of cancer (World Health Organization, 2014).

Abdominal aortic aneurysm

It has been estimated that the long-term incremental cost-effectiveness of the AAA screening programme in England was £5,758 (95% confidence interval £4,285 to £7,410) per life-year gained, or £7,370 (£5,467 to £9,443) per quality-adjusted life-year (QALY) gained (2010-11 prices) (Glover et al., 2014).

Addressing wider economic, social and environmental determinants of health

9. Reducing economic and social inequalities

Key messages:

- Income inequalities have persisted over the last few decades causing wider gaps in health and life expectancy between and within countries.
- In Wales, people in the most deprived communities live more years in poor health and are more likely to adopt unhealthy behaviours, compared to people in the least deprived communities.
- Such inequalities have a direct impact on society as they result in higher levels of disability, illness, loss of years of life, productivity losses and higher welfare payments.
- The effects are multi-generational, immediate and long term, with influence on the future generation and their entire life prospects.
- Environmental and social interventions to address inequalities in health may be cost-saving or provide a return on investment.
- Preventing ill health across the population is generally more effective at reducing health inequalities than a focus on clinical interventions.

9.1. Inequalities: health, social and economic dimensions

It is widely recognised that health follows a social gradient. Health increases with socio-economic position. People living in deprived areas in Wales are more likely to spend fewer years in good health and have shorter lives than those living in the least deprived areas (Public Health Wales, 2011). This difference in healthy life expectancy has persisted over time.

Income inequalities have persisted (and widened) over the last few decades causing wider gaps in health and life expectancy between and within countries (Weiss, 2015). Health inequalities caused over 700,000

deaths and 33 million cases of ill health in EU countries in 2004 (World Health Organization, 2014). This issue is particularly relevant for Wales as OECD 2010 data shows that Wales' level of health inequalities among young people is higher than the OECD average and the levels found in Scotland and England (Welsh Government, 2011).

Such inequalities have a direct impact on society as they result in higher levels of disability, illness and loss of years of life. The Marmot Review found that if the whole population of England had the same death rate as the most privileged groups in 2009, this would have resulted in 2.8 million additional years free of illness or disability as well as between 1.3 and 2.5 million extra years of life among the population groups dying prematurely as a result of health inequalities (Marmot et al., 2010).

Economic and social inequalities have a negative impact on people's health and well-being and trigger health inequalities (Whitehead et al., 2014). In Wales, people living in the most deprived areas are more likely to adopt unhealthy behaviours such as smoking or unhealthy diet and suffer from a greater burden of obesity or alcohol-related mortality (Public Health Wales, 2011; Welsh Government, 2015).

The effects are multi-generational, immediate and long-term, with influence on the future generation and their entire life prospects. For example, children who grow up in disadvantaged households have higher than average infant mortality rate and are more likely to become poor adults themselves – thus, perpetuating the same vicious circle (Field, 2010).

Austerity measures may impact disproportionately on the poor, socially deprived, physically and mentally disadvantaged groups and thereby increase inequalities. For example, in Scotland it was found that while all income groups were net losers from the social security reforms, the poorest were proportionately more impacted (Taulbut et al., 2016) and The Inquiry Panel on Health Equity for the North of England has estimated that the rise in the number of UK households living in fuel poverty during the current financial crisis costs the NHS at least £2.5 billion a year; infants living in fuel poverty homes have a 30% greater risk to be admitted to hospital or to need primary care services (Whitehead et al., 2014).

Key Statistics for Wales:

- In Wales in 2015, the difference in healthy life expectancy at birth between Welsh regions was 10 years in males and 10 years in females. The highest healthy life expectancy was found in Monmouthshire (69.8 for males and 70.7 for females). The lowest healthy life expectancy was found in Blaenau Gwent for males (59.6

years) and in Merthyr Tydfil for females (59.3 years). This means that women living in the most deprived areas spend 74% of their life in good health versus 86% for their counterparts living in less deprived areas. Men living in the most deprived areas spend 77% of their life in good health whereas those living in the least deprived areas can enjoy 89% of their life healthy (Public Health Wales Observatory, 2016).

- Based on Welsh Health Survey data for 2015 (Welsh Government, 2016):
 - People in the most deprived quintile are less likely to eat the recommended amount of fruit and vegetables (26%), compared to the least deprived quintile (37%).
 - People in the most deprived quintile are more likely to be overweight or obese (63%), compared to the least deprived quintile (54%).
 - People in the most deprived quintile are more likely to smoke (29%), compared to the least deprived quintile (11%).
 - People who have never worked or are long term unemployed have the highest smoking prevalence (43%), whilst those in managerial or professional occupations have the lowest prevalence of 11%.
 - 40% of adults in the most deprived quintile reported being physically active for less than 30 minutes in the previous week, compared with 23% in the least deprived quintile (Welsh Government, 2016).
- Death rates due to smoking are twice as high in deprived areas. Data from the 2012 report of the Public Health Wales Observatory shows that in the most deprived areas, smoking is responsible for 25.5% of adult deaths for men and 16.4% for women, while in the least deprived areas it only accounts for 19.8% of death in men and 11.1% in women (Public Health Wales Observatory, 2012).
- Data from the Welsh Health Survey between 2007 to 2009 show that deprived areas experience a greater burden of mortality due to alcohol and that alcohol consumption is a source of health inequalities. While percentages drinking above guidelines are lower in the most deprived areas (39%) compared with the least deprived (50%), the alcohol-attributable mortality rates for males in the most deprived fifth of areas are almost 3 times higher than rates in the least deprived areas (rate ratio of 2.7), and almost double for women (rate ratio 1.8) (figures for 2007/9) (Public Health Wales, 2011).

9.2. Impact and costs of inequalities – to the individual, the health system, wider society and the economy

It has been estimated that the total welfare loss due to health inequalities in the EU amounts to 9.4% of gross domestic product (GDP) or €980 billion (World Health Organization, 2014). According to 2009 data, inequality in illness in England results in £31 to £33 billion of productivity losses per year as well as £20 to 32 billion of lost taxes and higher welfare payment (Marmot et al., 2010). The equivalent figures for the Welsh economy would be £1.8 to £1.9 billion a year in productivity losses and £1.1 to £1.8 billion a year in welfare costs and lost taxes due to inequality in illness*.

9.3. Cost-effectiveness and return on investment of a public health approach and interventions

Interventions identified by the WHO (2014) as being cost-effective or providing a return on investment to improve health are included in Appendix 1.

Drawing on the WHO (2014) review and other documents, a more recent briefing from NHS Scotland suggests the following evidence based actions could improve health and reduce health inequalities (NHS Health Scotland, 2016):

- Programmes that ensure adequate incomes, reduce debt and reduce income inequalities
- Programmes that reduce unemployment in vulnerable groups or areas and that promote physical and mental health in the workplace
- Programmes that improve physical environments, such as traffic calming schemes and the creation of green space
- Programmes that target vulnerable groups by investing in more intensive services and other forms of support for such groups, in the context of universal provision
- Early years programmes
- Policies that use regulation and price (for example, minimum unit pricing or taxes) to reduce risky behaviours.

Evidence from other reviews and the individual studies they examined can provide examples to support these themes. Policies and interventions which directly address the social and economic inequalities that drive health inequalities are likely to be most effective (NHS Health Scotland, 2016). For example, British and American studies on the implementation

of a living wage have shown that such a policy is associated with improved mental health and lower mortality risks, with possible trans-generational effects (Public Health England and Institute of Health Equity, 2014). In another example, it is estimated that unemployment is associated with a 20-25% higher mortality rate in the 10 years following the loss of a job, compared to those employed in the equivalent occupational group (Bethune, (1997) as cited in Public Health England and Institute of Health Equity, 2014).

Improving the physical environments where people live can help reduce health inequalities. For example, a cross-sectional study in England found that populations that are exposed to the greenest environments also have lowest levels of health inequality related to income deprivation. In the least green areas, the ratio of all-cause mortality for the most income deprived quartile compared with the least deprived was 1.93 (95% CI 1.86–2.01), whereas it was 1.43 (1.34–1.53) in the most green areas (Mitchell, (2008) as cited in Public Health England and Institute of Health Equity, 2014b). Traffic calming schemes such as that recommended by NICE to implement 20 mph speed zones in disadvantaged areas where children and young people are at risk, can help. NICE estimates that such action could lead to a 100% return on investment in the first 12 months, based on the costs recovered from injury and deaths avoided (NICE, 2012).

Examples on investing in more intensive support services targeted to disadvantaged groups are available from NICE. The estimated cost per QALY of intervening with disadvantaged groups to help them stop smoking (or to discourage them from taking up the habit in the first place) is usually low or very low, and is unlikely to exceed £6,000. (NICE guidance generally considers interventions costing below £20,000–£30,000 per QALY to be cost-effective (NICE, 2012).

An analysis of the use of statins to prevent a first occurrence of CVD among disadvantaged women found that it is cost-effective, if more than 14% of the population is at risk. For example, when 40% were at risk of CVD, prevention activities were estimated to cost £8,500 per QALY gained (£4,900 per QALY for finding the person and £3,600 per QALY for treating them). This compared with about £125,600 when only 1.6% were at risk (£122,000 per QALY for finding them and £3,600 per QALY for treating them) (NICE, 2012).

Investing in targeted and universal interventions as well as paid parental leave could contribute to address over £1.5 trillion worth of the cost of social problems (such as crime, mental ill health, family breakdown, drug abuse and obesity) in the UK; equating to £72 billion on a crude per capita basis for Wales* (Marmot et al., 2010).

Emerging evidence also suggests that interventions using taxes, regulations or legislation are particularly cost-effective. They require fewer resources to deliver and they have wide reach. They also rely less on individuals' capacity to take on board and act on messages than services providing advice to try and change behaviours. However, they may have wider economic consequences, both positive and negative, that are not usually measured in cost-effectiveness studies (NHS Health Scotland, 2016). For example in Scotland, in the year that followed the introduction of the legislation prohibiting smoking in enclosed public spaces in 2006, hospitals admission for heart attack and acute coronary syndrome dropped by 14% in smokers and 21% in non-smokers (World Health Organization, 2015). In Wales, the introduction of Smoke Free legislation in 2007 was followed by a reduction of reported exposure to second hand smoke from 70% in 2007 to 40% in 2008 (Malam, 2015).

An American study from 2005 has found that reducing the price of healthy food like fruits and vegetables by only 1% through public subsidy would prevent almost 10,000 cases of coronary heart disease and ischemic strokes, with disadvantaged consumers benefiting the most from such a measure (World Health Organization, 2015).

A modelling study on the potential impact of alcohol tax and pricing policies on health inequalities in England in 2014-2015, estimates that volumetric taxes and minimum unit pricing on alcohol would reduce alcohol consumption by up to 6% in the poorest quintile and 2-3% among all heavy drinkers, leading to a reduction of alcohol-related mortality among this group by up to 8% (Meier et al., 2016).

Taxation is viewed by the WHO as the single most cost-effective action in tobacco control (World Health Organization, 2015). Smoking rates are higher in the more deprived groups (Welsh government 2016), and are a key contributing factor to health inequalities. The WHO (2015) cite examples of European studies that have found that increasing the price of cigarettes by 10%, decreases cigarette consumption by 2.5% to 5% (Townsend, 1997; Gallues et al., 2003).

10. Ensuring safe and health promoting natural and built environments

Key messages:

- Injury is a leading cause of death and disability amongst people under the age of 45 and older people in Wales.
- Graduated Driver Licensing is an evidence-based intervention that could save lives and reduce societal costs in Wales.
- Exposure to air pollution reduces life expectancy by increasing risks from heart disease and strokes, respiratory diseases, lung cancer and other effects and imposes a considerable cost to society.
- Inequalities in health may arise due to different exposure to air pollution across communities in Wales.

10.1. Safe and healthy environment: health, social and economic dimensions

Risks to health and well-being arising from the environmental we live in include occupational risks, urban outdoor air pollution, unsafe water, indoor smoke from solid fuels, lead exposure and global climate change. In this report we cover injury, air pollution and housing as these were identified by PHW as the most important and relevant to this report.

Injury

Injury is a leading cause of death and disability amongst people under the age of 45 in Wales; it is also important amongst older people. However, it is also known that many injuries are under-reported and poorly recorded, meaning that this is likely to be a low estimate of the burden of injury on health services (Jones et al., 2012). Falls and fall-related injuries are a common and serious problem for older people. People aged 65 and older have the highest risk of falling, with 30% of people older than 65 and 50% of people older than 80 falling at least once a year (NICE, 2013).

Key statistics for Wales:

- In 2009, in Wales, it was estimated that there were 1,100 deaths due to injuries, 42,000 in-patient admissions and 445,000 emergency department attendances (Jones et al., 2012).

Air Pollution

Exposure to air pollution is a significant determinant of health (World Health Organization, 2015; Lim et al., 2012); it reduces life expectancy by increasing mortality and morbidity risks from heart disease and strokes, respiratory diseases, lung cancer and other effects (World Health Organization, 2013). On average, the life expectancy of every person is reduced by 7-8 months (Department for Environment, Food and Rural Affairs, 2007). In the contemporary context of air quality management, the main pollutants of public health concern are nitrogen dioxide (NO₂) and particulate matter (PM₁₀ and PM_{2.5}). In the UK, the health burden associated with exposure to these pollutants is substantial. Around 29,000 deaths and 307,000 lost life-years (Gowers et al., 2014), and 23,500 deaths and 277,000 lost life-years (Department for Environment, Food and Rural Affairs, 2015a), are attributed annually to PM_{2.5} and NO₂ exposure, respectively. In Wales, around 1,320 deaths and 13,549 lost life-years are attributed annually to PM_{2.5} exposure, and 1,100 deaths and 13,200 lost life-years to NO₂ exposure. Given the impact overlap of different pollutants, it has been estimated that around 40,000 deaths (range 44,750-52,500) occur each year in the UK as a result of exposure to outdoor pollution generally (RCPCH/RCP, 2016).

Despite improvements in general UK air quality over the past 50-60 years, it is clear that problems persist which continue to pose significant risks to population health. At the local level, some 620 Air Quality Management Areas (AQMAs) across 250 (62%) UK Local Authorities (as of April 2015) have been declared (Department for Environment, Food and Rural Affairs, 2015b). In Wales, 35 separate AQMAs exist. This is of concern because some communities may be exposed to higher concentrations of air pollution than elsewhere. Additionally, local-level health risks and impacts will vary considerably, not only influenced by differential air pollution exposures but also by individual and population-level susceptibilities. These factors may be 'intrinsic' (e.g. age, sex, genetics) and/or 'acquired' (e.g. income, education, housing, employment, service access, lifestyle/behaviour-related chronic illnesses). The *triple jeopardy* of air pollution, impaired health and social deprivation is said to compound problems by creating disproportionate and amplified disease burdens *between* and *within* regions (Public Health Wales, 2014).

Key statistics for Wales:

- Around 1,320 deaths and 13,549 lost life-years are attributed annually to PM_{2.5} exposure, and 1,100 deaths and 13,200 lost life-years to NO₂ exposure (Department for Environment, Food and Rural Affairs, 2015a).
- 35 separate Air Quality Management Areas have been declared in Wales (Department for Environment, Food and Rural Affairs, 2015b).

Housing

Poor quality housing, including issues such as mould, poor warmth and energy efficiency, infestations, second-hand smoke, overcrowding, noise, lack of green space and toxins, is linked to physical and mental ill health as well as costs to the individual, society and the NHS in terms of associated higher crime, unemployment and treatment costs (Public Health Wales, 2015b).

Health problems associated with these issues include respiratory problems, depression, anxiety, neurological, cognitive, developmental, cardiovascular and behavioural conditions, cancers, poisoning and death. Wales has a higher proportion of poor housing than England, with 29% and 22% having at least one major health hazard, respectively. Recent figures for England and Wales predicted that over the last five winters there have been around 42,734 Excess Winter Deaths due to cold homes. Estimates for the winter of 2014/15 show the highest rate of cold home deaths in over five years, with around 12,806 deaths attributed to cold home for that winter (Public Health Wales, 2015b).

10.2 Impact and costs - to the individual, the health system, wider society and the economy

Injury

It is estimated that emergency department attendances because of injury cost the NHS in Wales at least £25.9 million in 2009 (Jones S et al., 2012). 59,177 DALYs would be associated with these injuries if the cost of each DALY was £30,000. This is estimated to represent a minimum of £1.8 billion in social costs each year (Jones et al., 2012).

The Department for Transport calculate that every road traffic fatality in 2014 cost the UK economy around £1.8 million (Department for Transport, 2015). In Wales in 2014, there were 104 road traffic fatalities, costing the economy approximately £187.2 million. The serious casualties cost around £200,000 in 2014. These data can then be applied to any road traffic intervention to measure effect (and they regularly are).

The human cost of falling includes distress, pain, injury, loss of confidence, loss of independence and mortality. Falling also affects the family members and carers of people who fall. Falls are estimated to cost the NHS more than £2.3 billion per year (NICE, 2013).

Air pollution

The financial individual and societal cost of air pollution has been estimated at approximately £20 billion annually in the UK, nearly £1 billion per year for Wales* (adding together costs associated with reduced productivity through lost work-days, and health service costs) (Royal College of Physicians and Royal College of Paediatrics & Child Health, 2016). The cost of premature deaths from air pollution in the UK was estimated to be US\$ 83,069 million in 2010 and the economic costs of these were estimated to be 3.7% of GDP in the same year (World Health Organization, 2015a). The WHO also estimate that 360, 700 DALYs were lost as a result of air pollution in the United Kingdom in 2010 (World Health Organization, 2015a).

Housing

Dealing with category one hazards, which include unsafe stairs and steps, electrical hazards, damp and mould growth, excessive cold and overcrowding, cost around £67 million per year to the NHS in Wales, as estimated in 2011 (Public Health Wales, 2015b). The wider cost to society, including factors such as poor educational attainment and reduced life chances were estimated at £168 million a year. It was estimated that the total costs to society could be recuperated in nine years if investment was made to address these problems (Public Health Wales, 2015b).

10.3 Cost-effectiveness and return on investment of a public health approach and interventions

Although there are serious gaps in the economic evidence due to the complexity of environmental hazards and long lag of visible effect (i.e. disease), the WHO suggests that public health approaches with health, social, economic and environmental benefits which have been shown to be cost-effective with potential returns on investment, include active transport, safe green spaces, low emission zones, speed management, heat wave plans, chemical regulation and removal of lead and mercury (World Health Organization, 2015b).

Injury

There are evidence-based interventions aimed at preventing injuries, which provide a return on investment, which have not been implemented in Wales; Public Health Wales estimate that the introduction of a Graduated Driver Licensing scheme in Wales would, per year, save 27

lives, prevent 300 casualties and save the economy £13 million (Public Health Wales, 2015a).

Preventing falls and fractures, by implementing NICE guidance, could reduce hospital costs. For example, NICE estimated in 2013 that avoiding a hip fracture might save hospital admission costs averaging £5744 per patient (NICE, 2013). There may also be reduced ambulance service costs as a result of reduced falls in the community, saving around £230 per call-out (NICE, 2013).

Air pollution

Low emission zones and speed management may produce a return on investment. Evidence from Germany suggests that an investment of 1 billion US dollars led to health benefits estimated at 2 billion dollars (Ubido and Scott-Samuel, 2015).

Introducing the London traffic congestion charge has been associated with a 9% reduction in bronchiolitis (lung condition) hospitalisations (World Health Organization, 2015a).

Housing

Poor quality housing, including issues such as mould, poor warmth and energy efficiency, infestations, second-hand smoke, overcrowding, noise, lack of green space and toxins, is linked to physical and mental ill health as well as costs to the individual, society and the NHS in terms of associated higher crime, unemployment and treatment costs (Public Health Wales, 2015b).

Investing in housing improvements provides a cost-effective way of preventing ill health and reducing health inequalities. It could lead to less time off from school or work, increased use of the home for study and leisure, and improved relationships between household members (Public Health Wales, 2015b).

Investing in insulation and heating to address cold and damp housing could save £859 million (assuming full coverage) at a cost of £251 million, resulting in return of £608 million to the NHS in England. This would translate to nearly £35 million for the NHS in Wales (World Health Organization 2014, Chartered Institute of Environmental Health, 2008).

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Building resilience across the life course and settings

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Appendices

Appendix 1: Public health interventions identified as producing a return on investment or cost-saving

2. PROMOTING MENTAL WELL-BEING AND PREVENTING MENTAL ILL HEALTH

Public health interventions for children identified as producing a return on investment or cost-saving

Intervention	Findings	Source
Reducing conduct problems through school-based social and emotional learning ²²	Cost: £132 per pupil per year Savings of £39 to health sector in first year, rising to £751 by fifth year Net societal savings of £6369 for whole of society by fifth year (mostly through reduced crime)	WHO 2014 citing Knapp et al., 2011 UK; Modelling study
Intervention for prevention of childhood conduct disorder for a one-year cohort	Timescale: based on projected lifetime savings Cost: £210 million (total cost of parenting programme for 35,000 children with conduct disorder (estimated UK annual incidence) or £6000 per individual in the programme Savings: £5.2 billion or £150,000 per case (total benefits of preventing of 35,000 cases of child conduct disorder)	WHO 2014 citing Friedli & Parsonage, 2007 UK; Empirical study
Anti-bullying interventions in schools	Can return as much as £15 for every £1 spent	WHO 2014 citing Knapp et al., 2011 UK; Modelling study
Parenting programmes to prevent conduct disorder	Pay back £8 over six years for every £1 invested	WHO 2014 citing Knapp et al., 2011 UK; Modelling study
Interventions designed to prevent	ICER: US\$ 5400 per DALY (health sector perspective) ^{23,24}	WHO 2014 citing Mihalopoulos et al.,

²² Phase 1 of the [Transforming Health Improvement Programme](#) in Wales (2014) identified multi-component schools-based programme for mental health including curriculum; student/pupil support; links with services; home component; emotional literacy and resilience and multi-component as evidence-based interventions for implementation.

²³ To determine the “worth” of interventions, a \$50 000 per DALY “value-for-money” threshold was adopted.

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Intervention	Findings	Source
childhood depression (ages 11–17)		2012 Australia; Modelling study
Promoting mental health	<p>“best buys”²⁵ include:</p> <p>Supporting parents and early years: parenting skills training/pre-school education/home learning environment;</p> <p>Supporting lifelong learning: health promoting schools and continuing education;</p> <p>Improving working lives: employment/workplace;</p> <p>Positive steps for mental health: lifestyle (diet, exercise, sensible drinking) and social support;</p> <p>Supporting communities: environmental improvements.</p>	Friedli and Parsonage 2009 Wales

Public health interventions for adults identified by the World Health Organization as producing a return on investment or cost-saving

Intervention	Findings	Source
Workplace screening for depression and anxiety disorder	<p>Timescale: 1–2 years</p> <p>Cost: £20,600 in first year (per 500 employees)</p> <p>Savings: £19,700 (500 employees) in first year and £63,500 by second year</p>	WHO 2014 citing Knapp et al., 2011 UK; modelling study
Mental health promotion and	<p>Timescale: 1 year</p> <p>Cost: US\$ 100–400 per person per</p>	WHO 2014 citing Wang et al., 2007

Incremental cost-effectiveness ratios (ICERs) that fell below this threshold were considered “good” value for money, and interventions whose ICERs fell above this threshold were considered “poor” value-for-money.

²⁴ NICE has never identified an ICER above which interventions should not be recommended and below which they should. However, in general, interventions with an ICER of less than £20,000 per QALY gained are considered to be cost effective. Where advisory bodies consider that particular interventions with an ICER of less than £20,000 per QALY gained should not be provided by the NHS they should provide explicit reasons As the ICER of an intervention increases in the £20,000 to £30,000 range, an advisory body's judgment about its acceptability as an effective use of NHS resources should make explicit reference to the relevant factors considered above. Above a most plausible ICER of £30,000 per QALY gained, advisory bodies will need to make an increasingly stronger case for supporting the intervention as an effective use of NHS resources with respect to the factors considered above (NICE Social value judgments; principles for the development of NICE guidance <https://www.nice.org.uk/get-involved/citizens-council>)

²⁵ See glossary for definition of ‘best buys’

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Intervention	Findings	Source
prevention of depression in the workplace: early diagnosis and intervention for employees with depressive symptoms ²⁶	year Savings: US\$ 1800 per employee per year	US; empirical study
Promoting well-being in the workplace	Timescale: 1 year Cost: £40,000 Savings: £340,000 within 1 year	WHO 2014 citing Knapp et al., 2011 UK; modelling study
Early identification of postnatal depression with intervention (health visitor)	Timescale: 18 months Cost: preventive intervention group cost £119 more than standard treatment Net savings: £383 per mother–infant pair per month (societal)	WHO 2014 citing Petrou et al., 2006 UK; Empirical study
Psychosocial group therapy for older people identified as lonely	Timescale: 2 years Cost: €881 per person Savings: Mean net reduction in health care costs: €943 per person per year	WHO 2014 citing Pitkala et al., 2009 Finland; Empirical study
One-day training programme for police officers that improves interactions with mentally ill individuals	Timescale: 6 months Cost: US\$ 120 per officer (663 officers trained) Savings: more than US\$ 80 000 in the following 6 months (because officers spent less time on calls to mentally ill individuals following training)	WHO 2014 citing Krameddine et al., 2013 Canada; Experimental study
Cost-effectiveness of a stepped care intervention to prevent depression and anxiety in late life	Timescale: 1 year Cost: £412 per recipient to deliver £3196 per disorder-free year gained compared to routine primary care	WHO 2014 citing Van't Veer-Tazelaar et al., 2010 Netherlands; Experimental study
Mental health promotion and the prevention of depression in older age: regular participation in exercise classes by older people in England	Timescale: within 2 years Cost-effective in England: €17 172 per QALY (2004 prices) (health system perspective)	WHO 2014 citing Munro et al., 2004 UK; Cluster randomised trial
Befriending of older adults	Timescale: in the first year for the NHS (2008-2009 prices)	WHO 2014 citing Knapp et al., 2011

²⁶ Workplace mental health programmes including supportive policy; staff counselling and assistance programmes and active management of sickness absence were identified by phase one of Transforming Health Improvement in Wales as evidence-based interventions for implementation.

Intervention	Findings	Source
	<p>Cost £85 per older person (cost to public services for 12 hours befriending contact)</p> <p>Approximate savings of £40 per £85 invested so not cost-effective from a public expenditure perspective but if analysis includes quality of life benefits associated with reduced depressive symptoms there is potential to create further improvements worth £270 per person therefore likely to be cost-effective with an incremental cost-effectiveness ratio (ICER) of around £2,900.</p>	UK; modelling study

3. PREVENTING VIOLENCE AND ABUSE

Public health interventions identified as producing a return on investment or cost-saving

Intervention	Findings	Source
Assessment of the Violence Against Women Act 1994 USA. Five year programme to increase penalties for perpetrators, improve resources for police, prosecutors, and victim service providers and implement national stalker and domestic violence reduction programs.	For a cost of US\$ 1.6 billion for programmes over 5 years there was a saving of US\$ 14.8 billion in net averted social costs. At individual level costs of US\$ 15.50 per woman led to a saving of US\$ 159 per woman in averted costs of criminal victimization	WHO 2014 citing Clark et al., 2002 Cost-benefit analysis
UK programme to detect and provide better care for female victims of intimate partner violence (IPV). The programme provided education and support for primary care clinicians to increase their identification of survivors of IPV and to refer them to a specialist advocacy agency or a psychologist with specialist skills.	Costs adjusted to 2005 prices. Admin costs for the intervention £5,210 per year. Estimated incremental cost per woman estimated £23.22. Included the cost of screening tool, increased costs of downstream management plus any savings as a result of reduced violence. Incremental cost-effectiveness ratio (ICER) was £742 per quality-adjusted life-year (QALY £30,000 willingness to pay threshold) which indicated that the intervention was likely to be cost-effective.	WHO 2014 citing Norman et al., 2010 Cost-effectiveness evaluation
UK Primary care programme to improve identification and referral for women experiencing domestic violence.	Intervention would produce societal cost-savings per woman registered in the general practice of £37 (95% CI £178 saved to a cost of £136) over 1 year. The	WHO 2014 citing Devine et al., 2012 Cost-

Intervention	Findings	Source
	incremental quality-adjusted life-year was estimated to be 0.0010 (95% CI 0.0157 to 0.0101) per woman. Probabilistic sensitivity analysis found 78% of model replications under a willingness to pay threshold of £20 000 per quality-adjusted life-year.	effectiveness study based on simulation
A cost-benefit analysis of multisystemic therapy ²⁷ (MST) with serious and violent juvenile offenders in the USA	Found reductions in criminality in the MST versus individual therapy conditions were associated with substantial reductions in expenses to taxpayers and intangible losses to crime victims, with cumulative benefits ranging from \$75,110 to \$199,374 per MST participant. It was estimated that every dollar spent on MST provides \$9.51 to \$23.59 in savings to taxpayers and crime victims. Follow up was 13.7 years	WHO 2014 citing Klietz et al., 2010 Economic assessment using rearrest data from an RCT
Anti-bullying interventions in schools	Can return as much as £15 for every £1 spent	WHO 2014 citing Knapp et al., 2011 UK; Modelling study

²⁷ Multisystemic therapy is an intensive home based intervention for families of youth with social, emotional and behavioural problems

4. REDUCING THE PREVALENCE OF SMOKING

Public health interventions identified by the World Health Organization as producing a return on investment or cost-saving

Intervention	Findings	Source
Protecting people from tobacco	"very cost-effective" < GDP per person	WHO 2014
Warning people about the dangers of tobacco	"very cost-effective" < GDP per person	WHO 2014
Enforcing bans on tobacco advertising	"very cost-effective": < GDP per person	WHO 2014
Raising taxes on tobacco	"very cost-effective" < GDP per person	WHO 2014
Offering counselling to smokers	"quite cost-effective": < 3 x GDP per person	WHO 2014

5. REDUCING THE PREVALENCE OF ALCOHOL AND SUBSTANCE MISUSE

Public health interventions identified as producing a return on investment or cost-saving

Intervention	Findings	Source
Combination of restricting access to retailed alcohol, enforcing bans on alcohol advertising and raising taxes on alcohol	"very cost-effective" (< GDP per person): Estimated to be able to avert 5–10 million DALYs related to harmful alcohol use representing 10 to 20% of the alcohol burden in Europe	WHO 2014
Enforcing drink-driving laws (breath-testing)	"quite cost-effective (< 3 x GDP per person).	WHO 2014

Intervention	Findings	Source
Offering brief advice for hazardous drinking ²⁸	"quite cost-effective (<3 × GDP per person).	WHO 2014
Drugs treatment	Every £1 spent saves society £2.50 in reduced NHS and social care costs and reduced crime	Kings Fund citing NTA 2012

6. PROMOTING PHYSICAL ACTIVITY

Public health interventions identified by the World Health Organization as producing a return on investment or cost-saving

Intervention	Findings	Source
Promoting physical activity in schools	"less cost-effective ²⁹ ": >3x GDP per person	WHO 2014
Supporting active transport strategies	"quite cost-effective" ³⁰ : <3x GDP per person	WHO 2014
Offering counselling in primary care	"less cost-effective>3x GDP per person	WHO 2014
Promoting physical activity in worksites	"less cost-effective>3x GDP per person	WHO 2014
Switching from car to active transport ³¹	<p>Timescale: 1 year</p> <p>Benefits of moving from car to walking: £1220 per person per year (5 days a week, 46 weeks per year; by evaluating four effects: the change in exposure to ambient air pollution for the individuals who change their transportation mode, their health benefit, the health benefit for the general population due to reduced pollution and the risk of accidents).</p> <p>Benefits of moving from car to cycling: £1121 per person per year (5 days a week, 46 weeks per year; by</p>	WHO 2014 citing Davies 2011 UK: modelling study

²⁸ Brief interventions for alcohol were [identified](#) as evidence-based interventions to be considered for implementation in phase 1 of the [Transforming Health Improvement Programme](#) in Wales in 2014.

²⁹ Produces a healthy year of life for more than three times GDP per capital per person

³⁰ Produces a healthy year of life for less than three times GDP per capita per person

³¹ Active travel to increase population level physical activity was [identified](#) as interventions to be considered for research and development in phase 1 of the [Transforming Health Improvement Programme](#) in Wales in 2014.

Intervention	Findings	Source
	evaluating four effects: the change in exposure to ambient air pollution for the individuals who change their transportation mode, their health benefit, the health benefit for the general population due to reduced pollution and the risk of accidents).	
Introducing pedestrian crossings and other pedestrian facilities	At 1999 prices mean cost of intervention £27,296; mean annual accidents saved 1.02; expenditure per accident saved £28,036 (expenditure per accident saved is the average cost of the scheme type divided by the average annual accidents saved). Timescale: 1 year; Average first year rate of return - 246%	WHO 2014 citing Gorell & Tootill 2001 UK; from an analysis of a database of safety engineering schemes implemented by local authorities in the UK
Effect of increasing active travel (walking and cycling) in urban England and Wales on costs to the NHS	Timescale: 20 years Savings: £17 billion for the NHS (reduction in the prevalence of type 2 diabetes, dementia, ischaemic heart disease, cerebrovascular disease and cancer)	WHO 2014 citing Jarrett et al., 2012 UK; modelling study
Birmingham <i>Be Active</i> Programme (free use of leisure centres and other initiatives)	This assumed that the benefits of increased physical activity are sustained over 5 years, participation in the programme increased quality-adjusted life expectancy by 0.06 years, at an expected discounted cost of £3552 - £400 per QALY.	King's Fund (undated) citing Frew et al., 2014 UK; natural experiment and economic analysis
Counselling programmes to promote physical activity and a community based walking scheme	Timescale 6 months Cost: £9.50-220 per participant (community-based) QALY gains from 3.0 per 1000 individuals over 6 months (physical activity counselling intervention) to 28.3 per 1000 individuals over 6 months (community-based walking programme)	WHO 2014 citing Windle et al., 2008 UK; systematic review of effectiveness and cost

7. PROMOTING A HEALTHY DIET AND REDUCING OBESITY.

Public health interventions identified by the World Health Organization as producing a return on investment or cost-saving

Intervention	Findings	Source
Promotion of healthy eating in schools	"less cost-effective >3x GDP per person ³²	WHO 2014
Workplace health education	"less cost-effective >3x GDP per person	WHO 2014
Primary care interventions including tailored advice	"quite cost-effective <3 x GDP per person ³³	WHO 2014
Reduce salt intake	Very cost-effective <GDP per person ³⁴	WHO 2011
Replace trans fat with poly unsaturated fat	Very cost-effective <GDP per person	WHO 2011
Promote public awareness about diet	Very cost-effective <GDP per person	WHO 2011
Restrict marketing of food and beverages to children	Very cost-effective <GDP per person	WHO 2011
Replace saturated fat with unsaturated fat	Very cost-effective <GDP per person	WHO 2011
Manage food taxes and subsidies	Very cost-effective <GDP per person	WHO 2011
Offer counselling in primary care	Quite cost-effective <3xGDP per person	WHO 2011
Provide health education in worksites	Less cost-effective >3xGDP per person ³⁵	WHO 2011
Promote healthy eating in schools	Less cost-effective >3x GDP per person	WHO 2011

³² Produces a healthy year of life for more than three times GDP per person

³³ Produces a healthy year of life for less than three times GDP per person

³⁴ Produces a healthy year of life for less than GDP per person

8. PROTECTION FROM DISEASE AND EARLY IDENTIFICATION

Public health interventions identified as producing a return on investment or cost-saving

Intervention	Findings	Source
Measles, mumps and rubella (MMR) vaccination in the UK	It is estimated that UK costs are £0.17–0.97 per person and would yield savings of £240 730–544 490 over 10 years in reduced treatment costs	WHO 2013 Modelling study
Pneumococcal vaccination for children under two in Spain	Estimated cost €38.36 per dose + €4.88 administration per person and was estimated to achieve €22 million in savings over one year.	WHO 2014, citing Morano et al., 2011
Prevention of liver cancer via hepatitis B vaccination	Estimated in the USA that this would cost US\$ 164 per life-year saved for perinatal immunization (societal perspective) WHO consider this very cost-effective ³⁴	WHO 2014 citing Margolis et al., 1995 Modelling study
Human norovirus vaccination	In the US could avert approximately 1.0–2.2 million cases (efficacy 50%, 12 month duration), costing an additional \$400 million to \$1.0 billion, but could save ≤\$2.1 billion (48 month duration)	WHO 2014, citing Bartsch et al., 2012 Simulation modelling
Implementation of bivalent Human Papilloma virus vaccination in young women plus cervical cancer screening for women over 40 years	In the Netherlands has been estimated to cost €19 500 per QALY over 10 years (WHO 2014; Coupe et al., 2009)	WHO 2014, citing Coupe et al., 2009 Simulation modelling
Human papilloma virus vaccination programmes (in girls)	In Austria are estimated to yield an ICER of €64,000 per life-year gained and €50,000 per life-year gained (payer's and societal perspectives, respectively)	WHO 2014 citing Zechmeister et al., 2009 Modelling study
Human papilloma virus vaccination	In Iceland estimated that the ICER was €18 500 per QALY saved	WHO 2014, citing Oddsson et al., 2009 Modelling study
Routine rotavirus vaccine coverage and health care utilization for diarrhoea in children (under 5 years of age) pre and post routine vaccination	In the USA it was estimated that vaccination led to US \$278 million in reduced treatment costs	WHO 2014, citing Cortes et al., 2011 Used data from health insurance claims databases uncontrolled before and after study
Cost-effectiveness of introducing rotavirus	Estimated that the programme would cost US\$ 220 000 in 2012 and might	WHO 2014 citing Jit et al., 2011

Intervention	Findings	Source
vaccination in Armenia	reduce health care costs by \$34,000 in the first year, rising to \$180,000 by 2019. Cost-effectiveness was estimated to be US\$ 650 per DALY (health sector perspective); US\$ 820 per DALY (societal perspective). WHO would this to be very cost-effective ³⁶	Modelling study
Flu vaccination in England and Wales	It is estimated £1.35 would be returned for every £1 spent on targeted flu vaccination. These savings would rise to savings of £12 per vaccination when health care workers are included	WHO 2014, citing Scuffham & West, 2002 and Burls et al., 2006 Modelling study
Screening for cervical a cancer through visual inspection and treatment of pre-cancerous lesions to prevent cervical cancer	It has been estimated that this could avert 5 million DALYs in Europe, 6% of the total cancer burden WHO consider that this is very cost-effective	WHO 2014
WHO estimate that early case-finding of breast cancer through mammographic screening (50–70 years) and treatment of all stages	It is estimated that this could avert 15 million DALYs in Europe, 19% of the estimated burden of cancer WHO consider this to be quite cost-effective	WHO 2014
Screening for colorectal cancer at age 50 and treatment	Estimated that could avert 7 million DALYs in Europe; 9% of the cancer burden. WHO consider this to be quite cost-effective	WHO 2014

9. REDUCING ECONOMIC AND SOCIAL AND ECONOMIC INEQUALITIES

Interventions to address social determinants identified as providing a return on investment

Determinant	Intervention	Findings	Source
Housing	Affordable warm housing: insulation and heating UK	<ul style="list-style-type: none"> Investment of £251 million to reduce domestic impacts of excess cold Savings of £859 million (assuming full coverage) will result in a £608 million 	WHO 2014, citing CIEH 2008

³⁶ Produces a healthy year of life for <GDP per capita

Determinant	Intervention	Findings	Source
		return of savings to NHS (England) • Return on investment within 0.3 years	
	Supported housing for families with complex emotional needs and chaotic lives UK	• Empirical study (pilot project in 1999) • Timescale: unavailable • Savings: £12 000 per client for local authorities	WHO, 2014 citing DOH 2009
	Preventing bath water scalds: a cost-effectiveness analysis of introducing bath thermostatic mixer valves in social housing	• Costs: treating bath water scald £25 226–71 902 • Net saving: £1887–75 520 • Return on investment: £1.41 saved for every £1 spent	WHO, 2014 citing Phillips et al., 2011
Debt	Debt advice services (<i>United Kingdom</i>)	• Modelling study • Timescale: 2–5 years • Pay-off: £2.92 per £1 expenditure	WHO, 2014 citing Knapp et al., 2011
Employment	Individual active treatment combined with group exercise for acute and sub acute low back pain (<i>United Kingdom</i>)	• Savings: £250–578 per patient • Timescale: 1–2 weeks	WHO, 2014 citing Wright et al., 2005
	Coordinated and tailored work rehabilitation undertaken with workers on sick leave due to musculoskeletal disorders (<i>Denmark</i>)	• Economic evaluation based on a randomized controlled trial • Timescale: 6–12 months • Cost: US\$ 2200 per person • Savings: US\$ 1366 per person at 6 months; US\$ 10 666 per person at 12 months	WHO 2014, citing Bultmann et al., 2009
	Workplace screening for depression and anxiety disorder (<i>United Kingdom</i>)	• Modelling study • Timescale: 1–2 years • Cost: £20 600 in first year (per 500 employees) • Savings: £19 700 (500 employees) in first year and £63 500 by second year	WHO 2014 citing Knapp et al., 2011
	Mental health promotion and prevention of depression in the workplace: early diagnosis and intervention for employees with depressive symptoms	• Empirical study • Timescale: 1 year • Cost: US\$ 100–400 per person per year • Savings: US\$ 1800 per employee per year	WHO 2014 citing Wang et al., 2007
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Determinant	Intervention	Findings	Source
	<i>(United States)</i>		
	Promoting well-being in the workplace <i>(United Kingdom)</i>	<ul style="list-style-type: none"> • Modelling study • Timescale: 1 year • Cost: £40 000 • Savings: £340 000 within 1 year 	WHO 2014 citing Knapp et al., 2011

Interventions to address social determinants identified as cost-saving

Determinant	Intervention	Findings	Source
Housing	Enhancing ventilation in homes of children with asthma <i>(United Kingdom)</i> Cost-effectiveness study alongside randomized control trial	<ul style="list-style-type: none"> • Timescale: 12 months • Cost: £1718 per child given tailored package of housing interventions (ventilation and heating) • ICER: £234 per point improvement on asthma scale (£165 for children with severe asthma) 	WHO 2014 citing Edwards et al., 2011
	Falls prevention leaflets <i>(United Kingdom)</i>	<ul style="list-style-type: none"> • Timescale: 12 months • Cost: £349 per person • ICER: £3320 per fall averted 	WHO 2014 citing Irvine et al., 2010
Employment	Seasonal influenza vaccination of healthy working-age adults <i>(United States)</i>	<ul style="list-style-type: none"> • Review of economic evaluations • Costs: US\$ 85.92 per person • Net savings: US\$ 68.96 per person • Cost-effectiveness ratio (2 studies): US\$ 26 565–50 512 per QALY (societal perspective) 	WHO 2014 citing Gatwood et al., 2012

Interventions to address environmental determinants identified as providing a return on investment

Determinant	Intervention	Findings	Source
Road traffic injuries	Nationwide speed limit reduction (<i>United States</i>) • Cost-benefit analysis	<ul style="list-style-type: none"> • Timescale: 1 year • Savings: US\$ 13 billion annually (including a US\$ 2 billion reduction in trauma care costs) 	WHO 2014 citing Shafi et al., 2008)
	Seat-belt use (<i>United States</i>)	<ul style="list-style-type: none"> • Timescale: 1 year • Savings: US\$ 50 billion annually 	WHO 2014 Shafi et al., 2008)
	Airbag use (<i>United States</i>)	<ul style="list-style-type: none"> • Timescale: 1 year • Savings: US\$ 1.94 billion annually 	WHO 2014 citing Shafi et al., 2008
	Photo radar speed enforcement programme on an inner city motorway (<i>Spain</i>)	<ul style="list-style-type: none"> • Empirical study • Timescale: 2 years • Cost: €14.5 million • Net savings: €6.8 million over 2 years 	WHO 2014 citing Perez et al., 2007
	Economic cost-savings associated with state motorcycle helmet laws (<i>United States</i>)	<ul style="list-style-type: none"> • Timescale: 2 years • Savings: US\$ 725 per registered motorcycle (societal perspective) 	WHO 2014 citing CDC, 2012
	Alcohol-impaired driving: "The Australian Campaign" (<i>Australia</i>)	<ul style="list-style-type: none"> • Modelling study • Timescale: 23 months • Costs: AU\$ 403 174 per month • Savings: AU\$ 8 324 532 per month, including AU\$ 3 214 096 in averted medical costs 	WHO 2014 citing Elder et al., 2004
	Safety camera enforced speed limits (<i>United Kingdom</i>)	<ul style="list-style-type: none"> • Empirical study • Timescale: 4 years • Costs: £96 million per year • Savings: £258 million per year 	WHO 2014 citing Gains et al., 2005
Greenspace	The US study for Philadelphia city parks (<i>United States</i>)	<ul style="list-style-type: none"> • Empirical study • Timescale: within 5 years • Savings: US\$ 69.4 million per year through avoided health care costs 	WHO 2014 citing Trust for Public Land, 2008
	Conservation volunteering projects (<i>United Kingdom</i>)	<ul style="list-style-type: none"> • Empirical study • Timescale: over 5 years • Return on investment: £7.35 for every £1 invested 	WHO 2014 citing Greenspace Scotland, 2009)
Climate	Heat warning systems (<i>Europe</i>)	<ul style="list-style-type: none"> • Systematic review • Timescale: 4 years 	WHO 2014 citing Toloo et

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Determinant	Intervention	Findings	Source
		<ul style="list-style-type: none"> • Cost: US\$ 210 000 • Savings: US\$ 468 million 	al., 2013
Active transport	Switching from car to active transport (<i>United Kingdom</i>)	<ul style="list-style-type: none"> • Modelling study • Timescale: 1 year • Benefits of moving from car to walking: £1220 per year • Benefits of moving from car to cycling: £1121 per year 	WHO 2014 citing Davis, 2011)
	Introducing pedestrian crossings and other pedestrian facilities for 579 schemes (<i>United Kingdom</i>)	<ul style="list-style-type: none"> • Timescale: 1 year • Net first year rate of return – 246% 	WHO 2014 citing Gorell & Tootill, 2001
	Effect of increasing active travel in urban England and Wales on costs to the NHS (<i>United Kingdom</i>)	<ul style="list-style-type: none"> • Timescale: 20 years • Savings: £17 billion for the NHS (reduction in the prevalence of type 2 diabetes, dementia, ischaemic heart disease, cerebrovascular disease and cancer) 	WHO 2014 citing Jarrett et al., 2012
Environmental hazards	Reducing childhood exposure to mercury through mercury and air toxics standards (MATS) (<i>United States</i>)	<ul style="list-style-type: none"> • Empirical study • Timescale: 10 years • Savings: > US\$ 37 billion per year in health benefits 	WHO 2014 citing EPA, 2011
	Window replacement and residential lead paint hazard control (<i>United States</i>)	<ul style="list-style-type: none"> • Timescale: 12 years • Net savings: US\$ 1700–2000 per housing unit 	WHO 2014 citing Dixon et al., 2012
	Removal of lead from domestic paint and plumbing in at-risk neighbourhoods (<i>France</i>)	<ul style="list-style-type: none"> • Modelling study • Timescale: projected life-year • Cost: €3600–9200 per home • Savings: €8800–51 400 reduction in cost of illness per de-lead home 	WHO 2014 citing Pichery et al., 2011

Interventions to address environmental determinants identified as cost-saving

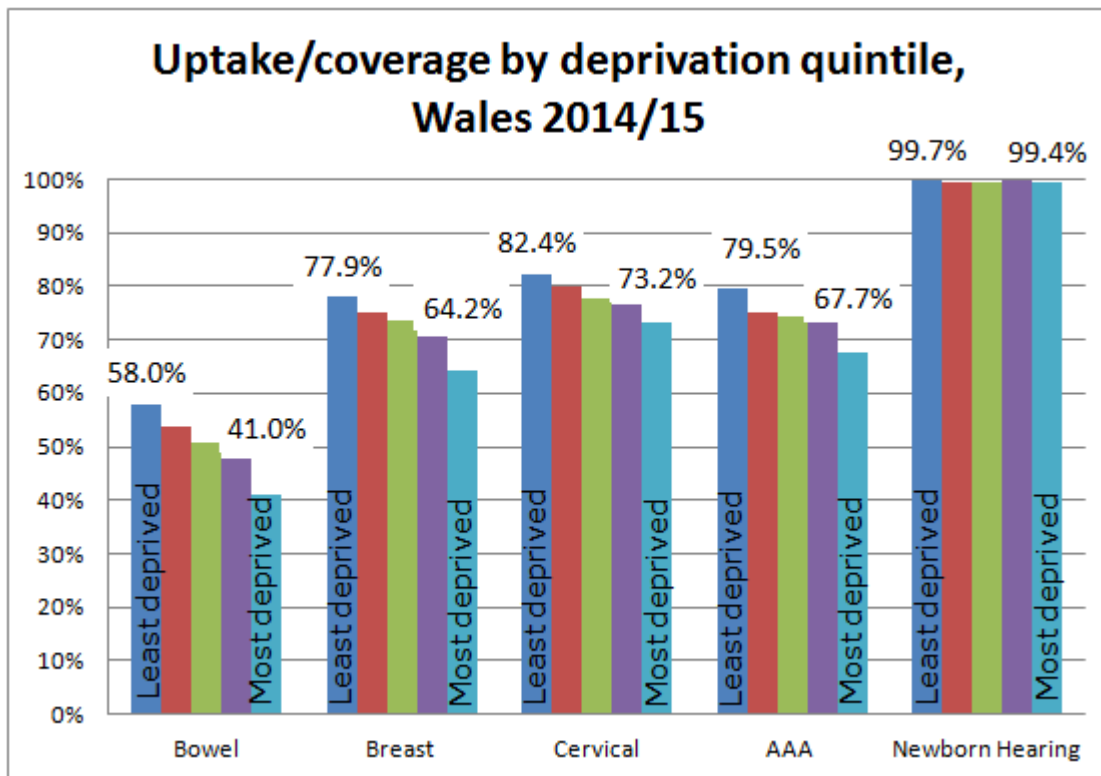
Determinant	Intervention	Findings	Source
	Injury awareness education programme on outcomes of juvenile justice offenders in western Australia (<i>Australia</i>)	<ul style="list-style-type: none"> • Economic analysis • Timescale: 5 years • Cost of programme: US\$ 33 735 • Annual savings: US\$ 3765 (from serious injury) • Cost-effectiveness: <ul style="list-style-type: none"> • cost per offence prevented: US\$ 3124; • cost per serious injury avoided: US\$ 42 169; cost per discounted life-year gained: US\$ 17 910 	WHO 2014 citing Ho et al., 2012
	Counselling programmes to promote physical activity and a community based walking scheme (<i>United Kingdom</i>)	<ul style="list-style-type: none"> • Timescale 6 months • Cost: £9.50–220 per participant (community-based) • QALY gains: from 3.0 per 1000 individuals over 6 months (physical activity counselling intervention) to 28.3 per 1000 individuals over 6 months (community-based walking programme) 	WHO 2014 citing Windle et al., 2008

Appendix 2: Summary of UKNSC Criteria

- The condition:
 - Is it an important health problem?
 - Is its epidemiology understood?
 - Is there robust evidence about the association between the disease marker and serious or treatable disease
- The test
 - Is there a simple, safe, precise and validated screening test?
 - Is there a suitable agreed cut-off level
 - Is it acceptable to the target population?
 - Is there an agreed policy on further diagnostic investigation of people with positive screening test results?
 - If the test is for a mutation or set of genetic variants is the method for their selection and review clear?
- The intervention
 - Is there an effective intervention, with evidence that treatment at a pre-symptomatic stage leads to better outcomes?
 - Are there agreed evidence based policies covering which individuals should be offered treatment?
- The programme
 - Is there evidence from high quality RCTs that the screening programme reduces mortality or morbidity?
 - Is there evidence that the complete screening programme is acceptable to health professionals and the public?
 - Does the benefit gained by individuals from the programme outweigh the harms?
 - Is the opportunity cost of the screening programme economically balanced in relation to expenditure on medical care as a whole (value for money)?
- Implementation criteria
 - Have clinical management of the condition and patient outcomes been optimised in all health care providers before implementing the programme?
 - Have all other options for managing the condition been considered to ensure that no more cost-effective intervention could be introduced?
 - Is there a plan for managing and monitoring the screening programme and agreed quality assurance standards?
 - Are there adequate facilities for testing, diagnosis and treatment?
 - Is there evidence based information for participants
 - Has public pressure for widening eligibility criteria been anticipated?

More details about the criteria and the evidence review process can be found on the UKNSC website at <https://www.gov.uk/government/groups/uk-national-screening-committee-uk-nsc>, along with a full list of recommendations, the underpinning evidence and responses to public consultations.

Appendix 3: Participation in screening in Wales according to WMD deprivation quintiles 2014-15³⁷



³⁷ Public Health Wales (2015) *Screening Division Annual Report 2014/2015*. Cardiff, Public Health Wales. Available at: <http://www.wales.nhs.uk/sitesplus/888/news/40136> [Accessed 4 July 2016]