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# Adverse Childhood Experiences and their association with chronic disease and health service use in the Welsh adult population

Welsh Adverse Childhood Experiences (ACE) Study

## Preface

**This is the third in a series of reports examining the prevalence of Adverse Childhood Experiences (ACEs) in the Welsh adult population and their impact on health and well-being across the life course. The series includes:**

- The prevalence of Adverse Childhood Experiences and their association with health-harming behaviours in the Welsh adult population.
- The impact of Adverse Childhood Experiences on mental well-being in Welsh adults.
- The impact of Adverse Childhood Experiences on chronic disease and the use of health services in Welsh adults.

Over 2,000 adults aged 18-69 years participated in the ACE Study for Wales, providing anonymous information on their exposure to ACEs before the age of 18 years and their health and lifestyles as adults. The study achieved a compliance rate of 49.1% and the sample was designed to be representative of the general population in

Wales. Data were collected through face to face interviews in participants' places of residence using an established questionnaire incorporating the short ACE tool developed by the US Centers for Disease Control and Prevention and based on work by Felitti et al [1].

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# Adverse Childhood Experiences and their association with **chronic disease and health service use** in the Welsh adult population

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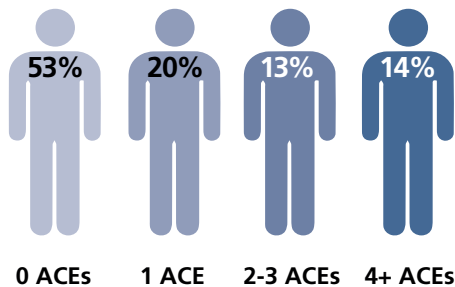




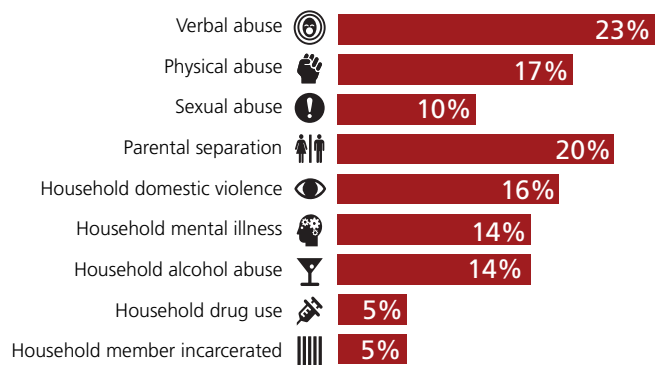
# Adverse Childhood Experiences, chronic disease and health service use in Wales

Adverse Childhood Experiences (ACEs) have harmful impacts on health and well-being across the life course. The Welsh ACE Study measured exposure to nine ACEs in the Welsh population and their association with chronic disease development and health service use in adulthood.

47% of adults in Wales suffered at least one ACE as a child and 14% suffered four or more

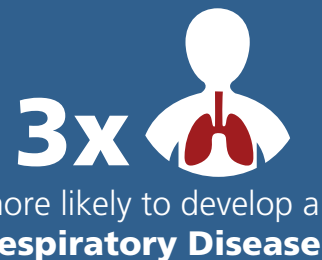
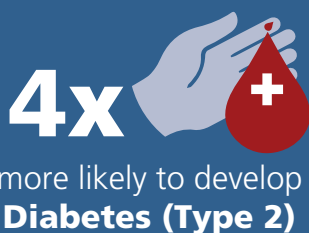


Proportion of Welsh adults suffering each ACE



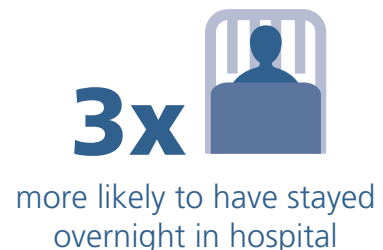
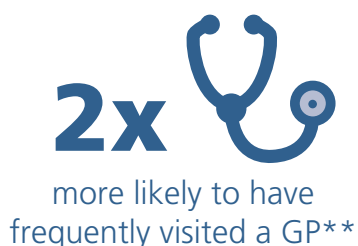
Up to the age of 69 years, those with four or more ACEs were 2x more likely than those with no ACEs to be diagnosed with a chronic disease\*<sup>5</sup>

For specific diseases they were:



Levels of health service use were higher in adults who experienced more ACEs\*<sup>#</sup>

Over a 12 month period, compared to people with no ACEs, those with four or more ACEs were:



The national survey of Adverse Childhood Experiences in Wales interviewed approximately 2000 people (aged 18-69 years) from across Wales at their homes in 2015. Of those eligible to participate, just under half agreed to take part and we are grateful to all those who freely gave their time.

\*After taking age, sex, ethnicity and residential deprivation into account. All data was self-reported.; <sup>5</sup>Includes Type 2 Diabetes, Stroke, Cancer, Coronary Heart Disease, Liver or Digestive Disease and Respiratory Disease; <sup>#</sup>Excluding reasons relating to pregnancy; \*\*Visited a GP six or more times over the past 12 months.

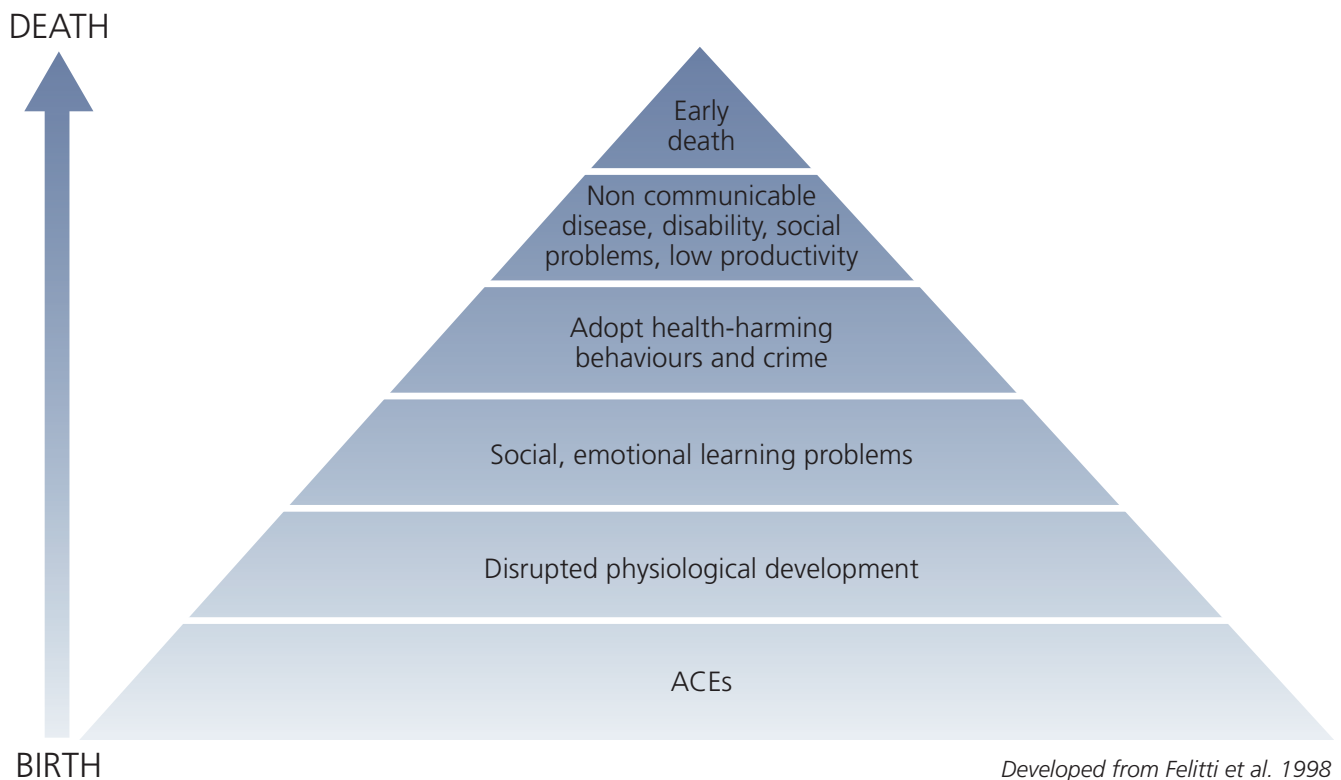
## Introduction

**Adverse childhood experiences (ACEs) are stressful events occurring in childhood such as being a victim of neglect and child abuse (physical, sexual and/or emotional) or growing up in a household in which there are adults experiencing alcohol and drug use problems, mental health conditions, domestic violence or criminal behaviour resulting in incarceration.**

Evidence from Wales and internationally has demonstrated a strong and cumulative association between exposure to adversity during childhood, and the adoption of health-harming behaviours and poor mental health across the life course [1-4]. Early life trauma from ACEs does not only expose children to immediate harm (for example, injury resulting from physical abuse) but has also been associated with changes in childhood neurological, immunological and hormonal development [5-6] which have detrimental effects on health across the life course. Prolonged exposure to childhood stressors can result in children becoming 'locked' into a higher state of alert to threat; physiologically adapted to short-term survival as they become permanently prepared to respond to further trauma. Such adaptation also increases tissue inflammation and long-term wear and tear on the body [6]. In addition, ACEs in childhood can compromise how children learn to regulate their emotions, control their impulses or manage their behaviour [7]. Reduced self-control and difficulty with social interactions increase individuals' vulnerability to engaging in health-harming behaviours, such as alcohol, tobacco and drug use, which are often adopted as coping mechanisms [3-4]. The uptake of such behaviours, as well as the physiological changes resulting directly from chronic childhood trauma, increase the risk of individuals developing non-communicable diseases (NCDs) such as cancer and heart disease earlier in life [8-9], and can ultimately result in premature mortality [10] (Figure 1).

Children who are exposed to adversity are also more likely to have problems developing secure attachments with others, which can threaten their self-image or sense of self worth [11]. Consequently, experiencing ACEs can have a long-term impact on mental health, increasing the risk of depression, anxiety and psychosis [12-13], and having a negative impact on general mental well-being [14]. Lower mental well-being is itself associated with health-harming behaviours and increased risk of poor health and NCDs [12]. In addition, individuals exposed to ACEs are likely to have low self-control which can lead to increased levels of violence perpetration and victimisation in later life [12].

International and national evidence also suggests there are associations between exposure to ACEs and health care use including visits to doctors, surgeries, hospitalisations and higher annual healthcare costs in adulthood [8,15-18]. Increased use of health care services amongst those who have experienced adversity in childhood may be a direct result of poor physical health, but also a consequence of poor mental health [19] or perceived health needs [20]. Individuals who have been exposed to ACEs have been shown to hold more negative perceptions of their own general health, suggesting they may perceive a greater need for health care intervention irrespective of actual ill health [21].



**Figure 1: Model of ACE impacts across the life course [1]**

### The Welsh ACE survey

In 2015, Public Health Wales undertook the first survey of ACEs amongst the Welsh population and results demonstrated that ACEs were associated with an increased risk of adopting health-harming behaviours and having poor mental health (Box 1).

Face-to-face interviews were undertaken with a representative sample of just over 2,000 adults aged

18-69 years, resident across Wales. Respondents provided anonymous information on their exposure to ACEs before the age of 18 years and their health and lifestyles as adults. Full details of the general study methodology<sup>1</sup> can be found in the first published report [4] and details about the study population surveyed can be found at Appendix 1 Table i.

#### Box 1: Selected findings from previous Welsh ACE Reports [4,22]

For every 100 adults in Wales, 47 suffered at least one ACE during their childhood and 14 suffered four or more.

The prevalence of individuals participating in health-harming behaviours and reporting low mental well-being as adults increased with the number of ACEs experienced. Compared to individuals who had experienced no ACEs, those who had experienced four or more ACEs were more likely to have participated in health-harming behaviours, or report low mental well-being as adults. For example, individuals who had experienced four or more ACEs were 4.4 times more likely to be high-risk drinkers as adults and 4.7 times more likely to have low mental well-being compared to individuals reporting no ACEs.

Results also suggest that preventing ACEs in future generations could reduce the prevalence of health-harming behaviours in the Welsh population, for example high-risk drinking by 35% and low mental well-being in Welsh adults by 27%.

<sup>1</sup> A total of 14,893 households were visited during the study period. Contact was made with 6,293 households, of which 4,127 individuals conformed to the inclusion criteria. Thus, of the known eligible households, 2,099 (50.86%) opted out of the survey, leaving a compliance rate of 49.14% (n=2028).

This report aims to explore relationships between ACEs and both chronic disease development and health care use by adults in Wales. Improving our understanding of the relationship between ACEs and long-term health outcomes has the potential to better inform and

target efforts to prevent NCDs. Moreover, it should also support more holistic patient-centred care that addresses the root causes of complex morbidity. A better understanding of such life course issues has the potential to improve patient experience and outcomes.

## How we measured chronic disease and health service use

### Self-reported chronic disease

Within the Welsh ACE survey, all respondents were asked whether they had ever been diagnosed by a doctor or nurse with any chronic disease. Diseases included within the survey are listed in Box 2.

To understand the association between the number of ACEs reported and the development of chronic disease,

life tables were calculated based on first diagnosis of each disease as the terminating event. To take account of age effects and adjust for other socio-demographics (deprivation, birth cohort, sex and ethnicity), survival analyses were also undertaken using Cox regression analysis methods to calculate hazard ratios (HR).

#### Box 2: Chronic diseases included in the Welsh ACE survey

All respondents were asked the following question regarding diagnosis of chronic disease at any point in their lifetime up until their current age, including how many years since they were first diagnosed.

##### Has a doctor or nurse ever told you that you have any of the following?:

- Cancer
- Type 2 Diabetes
- Coronary Heart Disease or Heart Attack
- Stroke
- Respiratory Disease such as chronic bronchitis/emphysema/chronic obstructive pulmonary disease
- Liver Disease
- Digestive Disease such as gastritis/ulcer/Crohn's Disease/colitis.

### Self-reported health service use

Respondents were asked a series of questions on frequency of personal use of health services over the past 12 months, which included how many times they visited a General Practitioner (GP) for themselves, how many times they attended an Accident and Emergency (A&E) department as a patient and how many times they had stayed overnight in hospital. Respondents were asked to exclude all reasons related to pregnancy.

Bivariate analysis methods were used to outline the prevalence of service use, the relationship with number of ACEs reported and the relationship with socio-demographics. Binary logistic regression methods were also used to calculate the adjusted means prevalence and the adjusted odds ratios (AORs) by number of ACEs reported, after controlling for the confounding effects of age, sex, ethnicity and deprivation.



## Results

### Association between ACEs and chronic disease

**Overall, 14.6% of respondents to the Welsh ACE survey reported that they had been told by a doctor or nurse they had one or more of the chronic diseases studied in this survey (see Box 2).**

The rates of chronic disease increased with age. However, the cumulative proportion of individuals who reported having ever received a diagnosis of one or more chronic disease increased at a significantly greater rate with age in those reporting more ACEs (Figure 2). Thus, **by the age of 49 years, 24.9% of individuals with four or more ACEs reported having ever been diagnosed with one or more chronic disease while this figure was only 6.9% in those with no ACEs.** This difference remained at 59 years (41.3% vs. 20.9% respectively) and at 69 years; although with a slight reduction in the gap (68.4% vs. 50.6% respectively<sup>2</sup>).

After accounting for socio-demographic confounders (using Cox regression) those with four or more ACEs had a 2.34 times higher rate of diagnosis of chronic

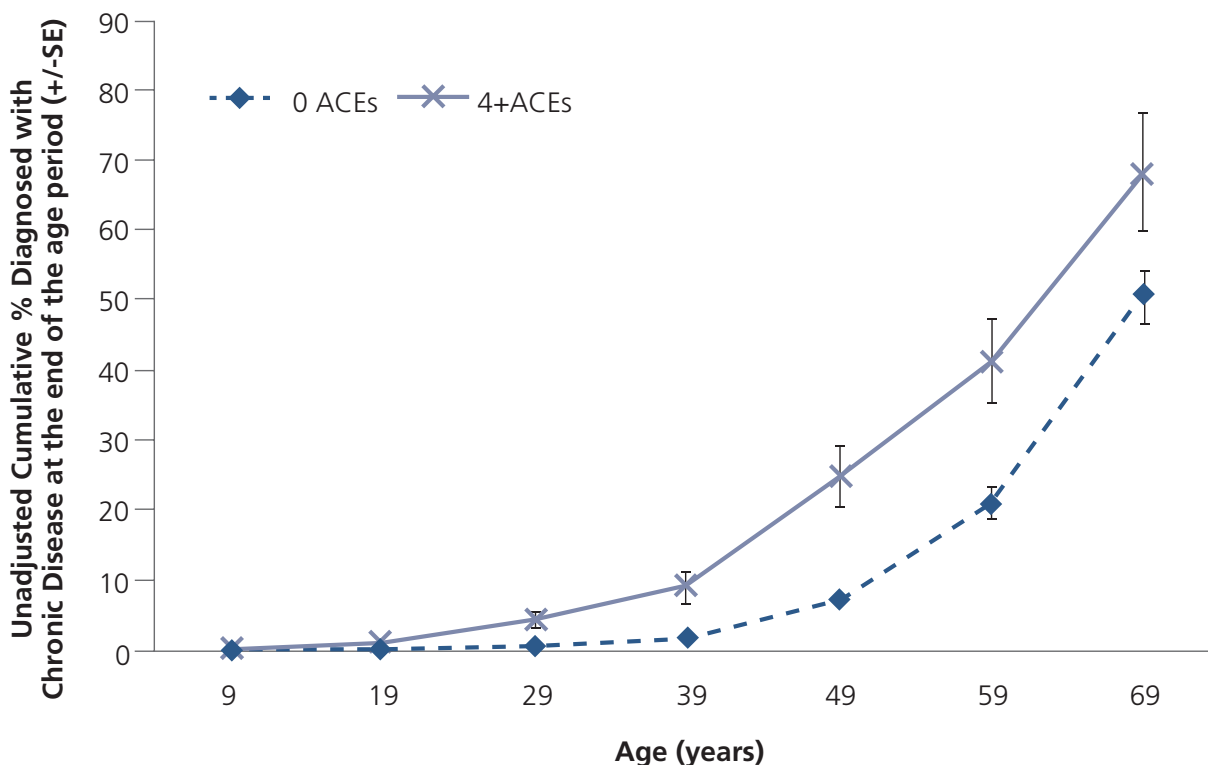
disease up to the age of 69 years compared with those with no ACEs (95% Confidence Intervals (CI) 1.66-3.31;  $P < 0.001$ ; Figure 3). Rates of chronic disease diagnosis reporting were also higher amongst those who had reported one ACE (HR 1.47; 95%CI 1.09-1.98;  $p = 0.012$ ) and two or three ACEs; although the latter failed to reach significance (HR 1.32; 95%CI 0.93-1.88;  $p = 0.116$ ; Appendix 1 Table ii).

While those in the most deprived quintile had a 34% higher rate of reporting having been diagnosed with any chronic disease than those in the most affluent quintile, this did not reach statistical significance (HR 1.31, 95%CI 0.92-1.88,  $P = 0.135$ ; Appendix 1 Table ii). However, study sample size and consequently statistical power may be a factor. This is explored further in the discussion.

<sup>2</sup> See discussion for consideration of the impact of mortality.

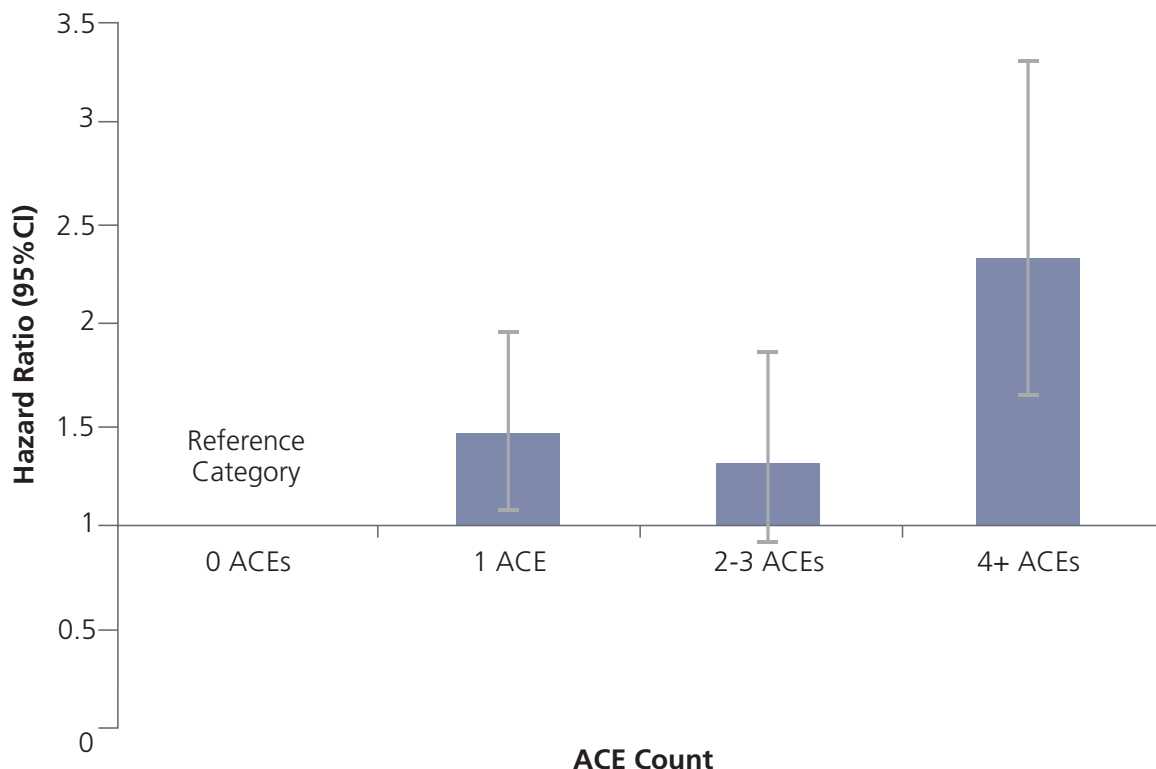


**Figure 2: Unadjusted cumulative percentage of individuals reporting diagnosis of a chronic disease\* by age and ACE count**

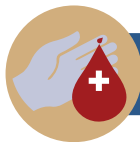


\*Where respondents reported being diagnosed with any of the following diseases: cancer, type 2 diabetes, coronary heart disease or heart attack, stroke, respiratory disease, liver disease or digestive disease. SE = Standard Error

**Figure 3: Hazard ratios and 95% confidence intervals for reported disease diagnosis\* up until the age of 69 years by ACE count**



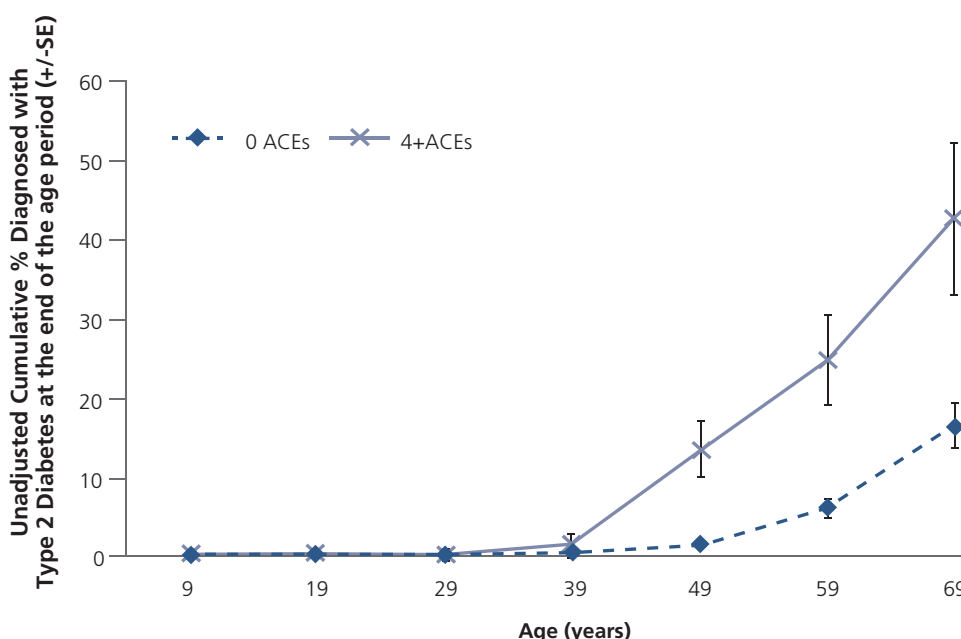
\*Where respondents reported being diagnosed with any of the following diseases: cancer, type 2 diabetes, coronary heart disease or heart attack, stroke, respiratory disease, liver disease or digestive disease. Hazard ratios have been adjusted for age, sex, deprivation and ethnicity and birth cohort. 0 ACEs is used as the reference category. 95% CI=95% Confidence Intervals.



## Type 2 Diabetes

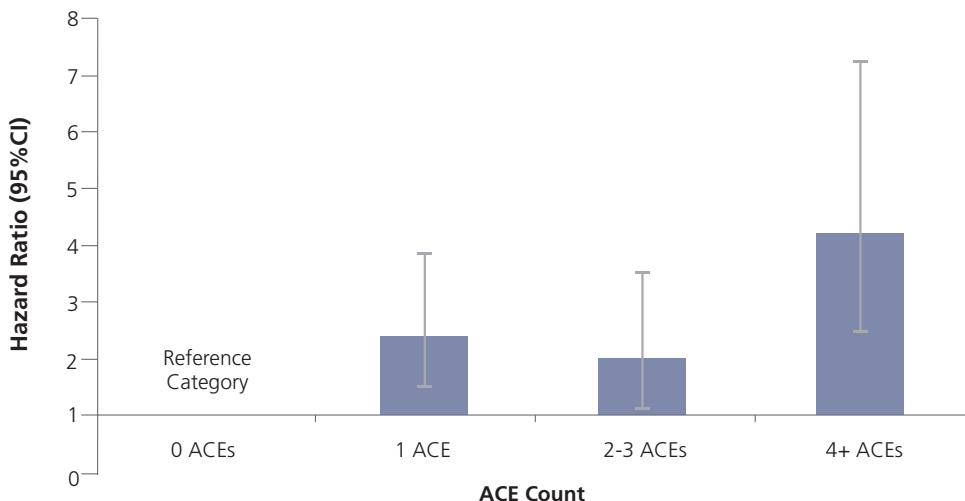
Analyses indicate that the cumulative proportion of individuals who reported having ever been diagnosed with type 2 diabetes increased at a significantly greater rate with age in those reporting more ACEs (Figure 4). By the age of 49 years, the cumulative level of reported diagnosis with age was 1.6% with no ACEs, compared to 13.7% in those with four or more ACEs. These differences increased by the age of 59 years (6.2%, no ACEs; 25.1%, four or more ACEs) and again by 69 years (16.6%, no ACEs; 43.1%, four or more ACEs). After accounting for socio-demographic confounders, respondents with four or more ACEs had a 4.22 times higher rate of diagnosis of type 2 diabetes (up to the age of 69 years) than those individuals with no ACEs (95% CI 2.45-7.26;  $p < 0.001$ ; Figure 5). Rates of type 2 diabetes diagnosis were also higher in individuals exposed to one ACE (HR 2.40; 95% CI 1.48-3.89;  $p < 0.001$ ) and two to three ACEs (HR 2.00; 95% CI 1.13-3.54;  $p = 0.017$ ; Figure 5; Appendix 1 Table ii) compared to those with no ACEs.

**Figure 4: Unadjusted cumulative percentage of individuals reporting diagnosis of type 2 diabetes by age and ACE count**



SE = Standard Error

**Figure 5: Hazard ratios and 95% confidence intervals\* for reporting diagnosis with type 2 diabetes up until the age of 69 years by ACE count**



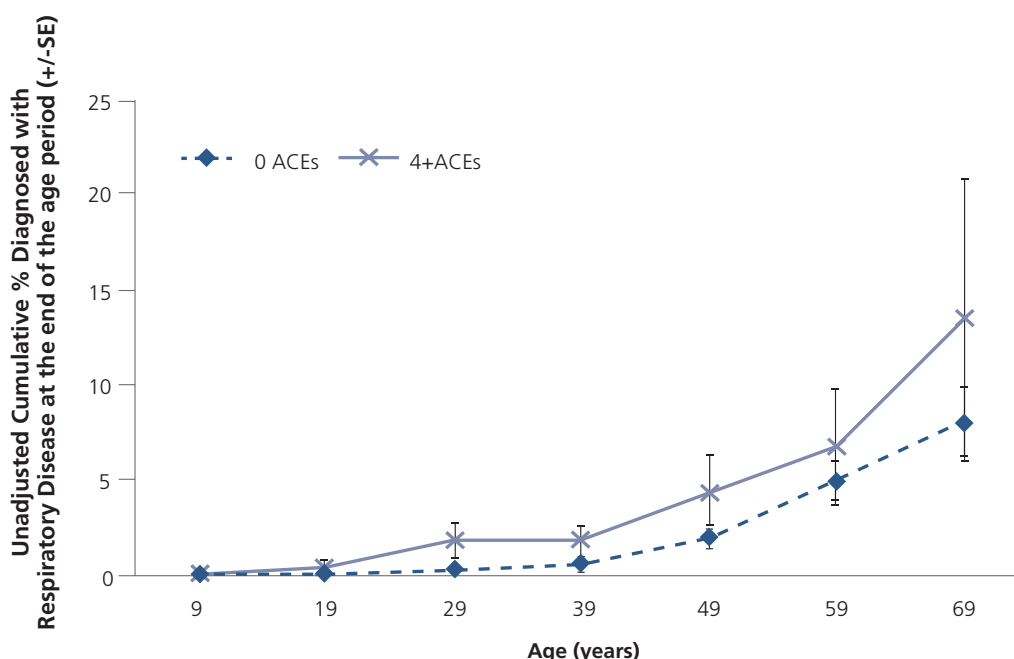
\*Hazard ratios have been adjusted for age, sex, deprivation and ethnicity and birth cohort. 0 ACEs is used as the reference category. 95% CI=95% Confidence Intervals.



## Respiratory Disease

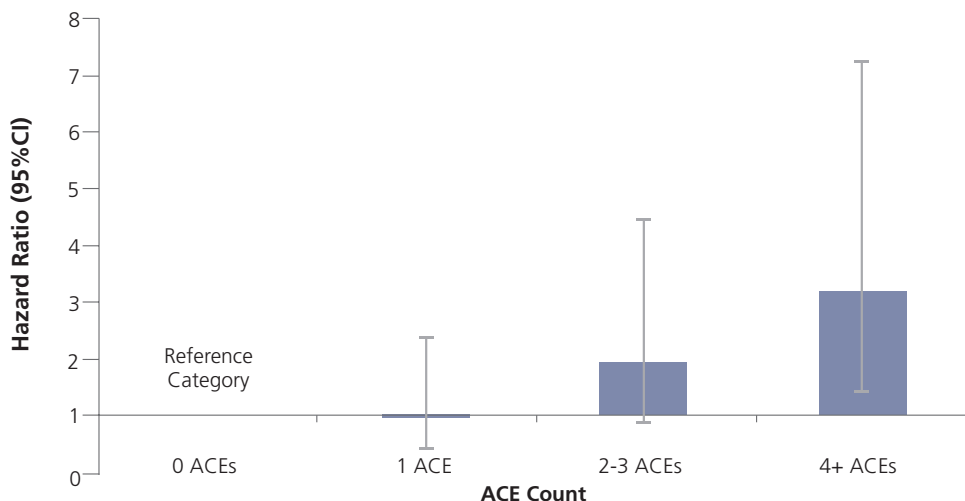
In the study sample, differences in rates of respiratory disease diagnosis between those with four or more ACEs and those with none were evident from a young age. By the age of 29 years 1.8% of respondents with four or more ACEs reported having been diagnosed with a respiratory disease compared to only 0.2% of respondents with no ACEs (Figure 6). The difference increased with increasing age, and by the age of 69 years, 13.6% of those with four or more ACEs reported having been diagnosed with respiratory disease compared to only 8.0% of those with no ACEs. After accounting for socio-demographic confounders, compared to individuals with no ACEs, those with four or more ACEs had a 3.19 times higher rate of respiratory disease diagnosis up to the age of 69 years (95% CI 1.40-7.26;  $p=0.006$ ; Figure 7). Rates were also higher in individuals with two to three ACEs (HR 1.95; 95% CI 0.85-4.49), although this result failed to reach statistical significance ( $p=0.117$ ; Appendix 1 Table ii).

**Figure 6: Unadjusted cumulative percentage of individuals reporting diagnosis of respiratory disease by age and ACE count**



SE = Standard Error

**Figure 7: Hazard ratios and 95% confidence intervals\* for reporting diagnosis of a respiratory disease up until the age of 69 years by ACE count**



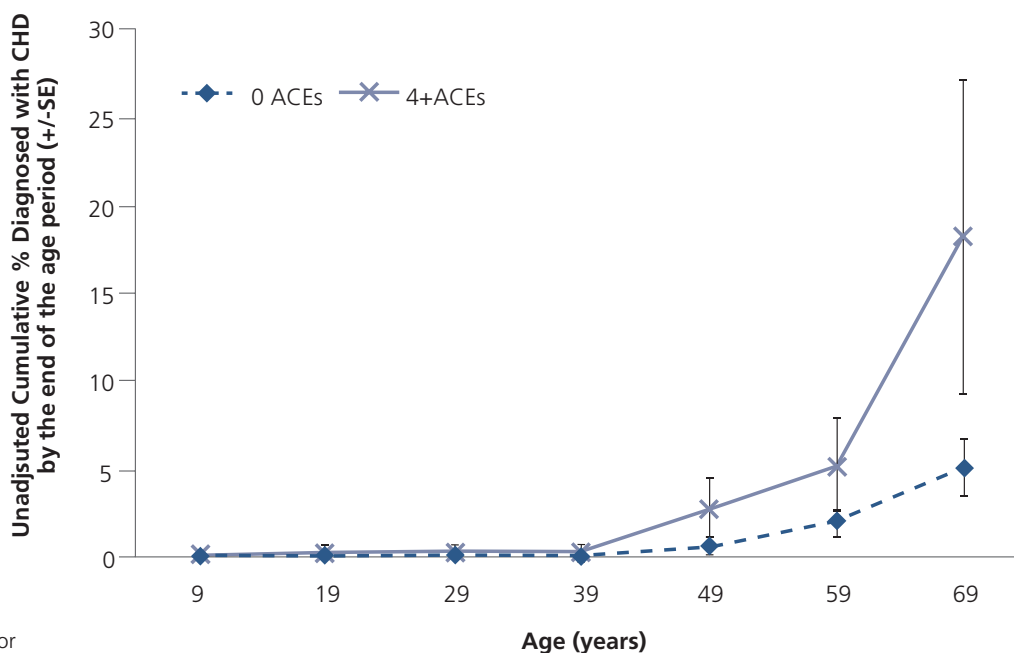
\*Hazard ratios have been adjusted for age, sex, deprivation and ethnicity and birth cohort. 0 ACEs is used as the reference category. 95% CI=95% Confidence Intervals.



## Coronary Heart Disease

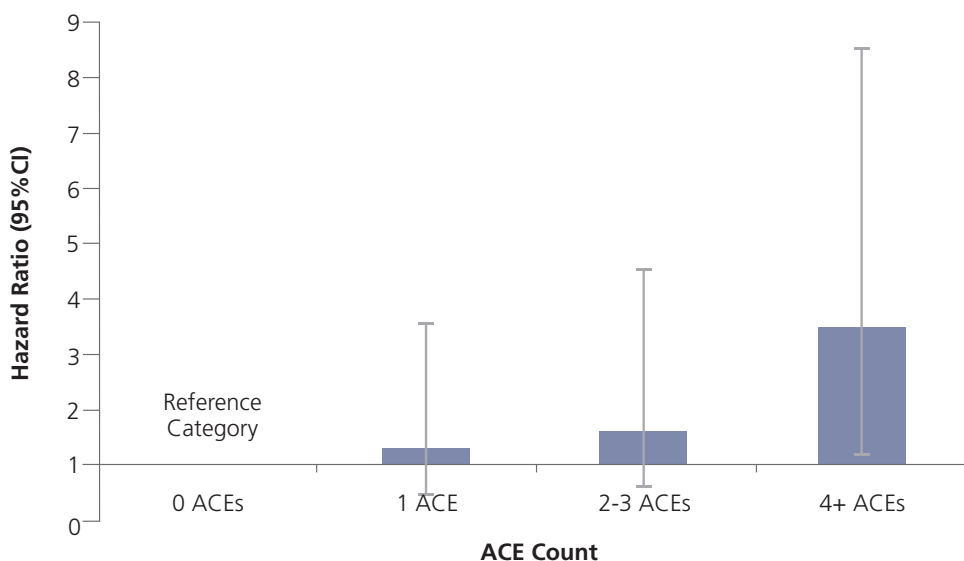
By the age of 49 years, 2.8% of those with four or more ACEs reported a diagnosis of coronary heart disease (CHD) compared to 0.7% of individuals with no ACEs. This difference increased at 59 years (5.2%, four or more ACEs; 2.1%, 0 ACEs) and 69 years (18.2%, four or more ACEs; 5.2%, no ACEs; Figure 8). After accounting for socio-demographics, respondents with four or more ACEs had a 3.21 times higher rate of increase in diagnosis of a coronary heart disease up to the age of 69 years compared to those with no ACEs (95% CI 1.20-8.57;  $p=0.020$ ; Figure 9; Appendix 1 Table ii).

**Figure 8: Unadjusted cumulative percentage of individuals reporting diagnosis of coronary heart disease by age and ACE count**



SE = Standard Error

**Figure 9: Hazard ratios and 95% confidence intervals\* for reporting diagnosis of coronary heart disease up until the age of 69 years by ACE count**



\*Hazard ratios have been adjusted for age, sex, deprivation and ethnicity and birth cohort. 0 ACEs is used as the reference category. 95% CI=95% Confidence Intervals.

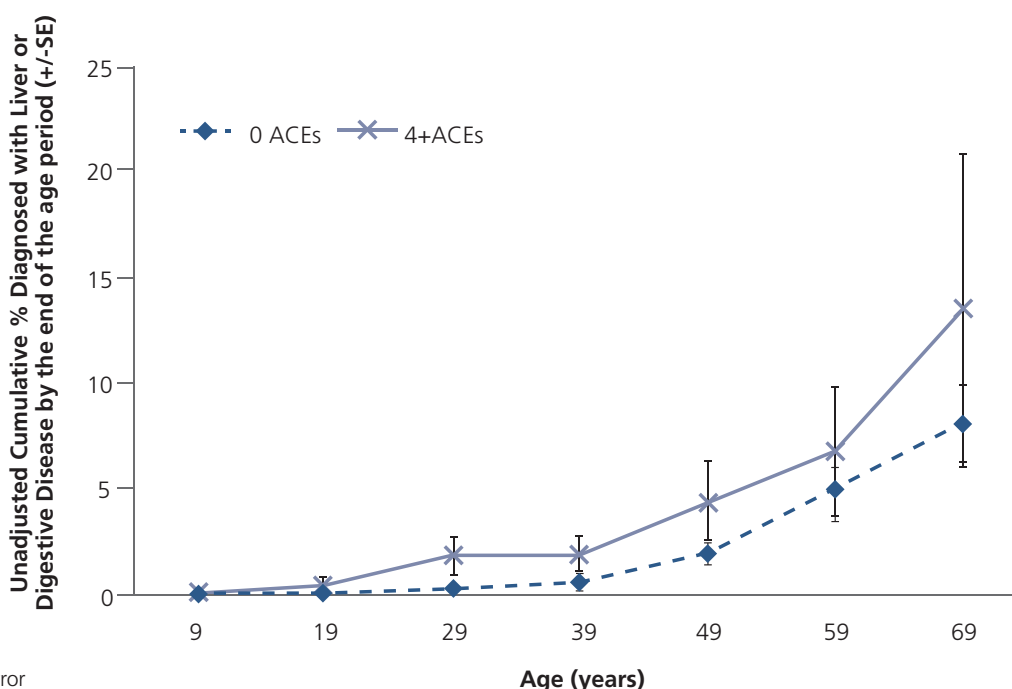




## Liver or Digestive Disease

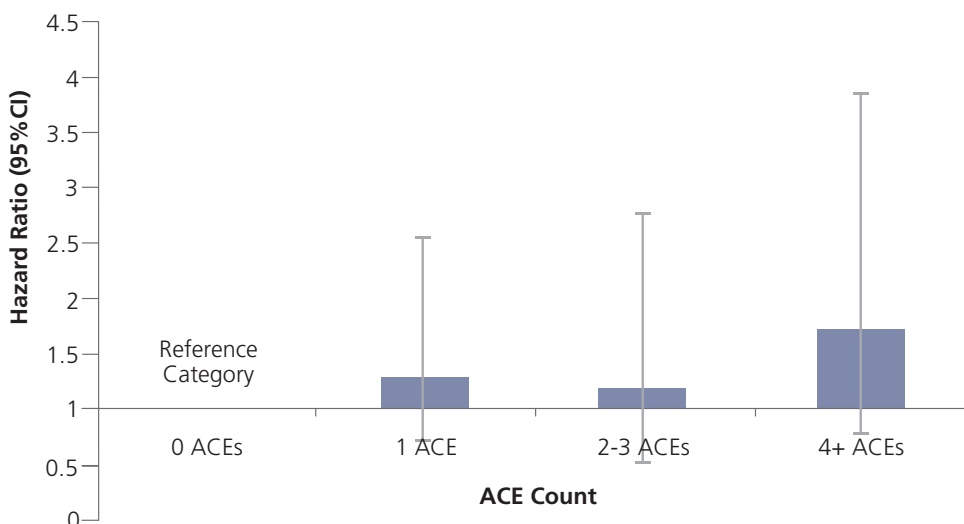
The cumulative proportion of individuals who reported having received a diagnosis of liver or digestive disease was higher for those individuals with four or more ACEs compared to those reporting no ACEs (Figure 10). This difference was most noticeable at the age of 69 years where 13.6% of respondents with four or more ACEs reported a diagnosis of liver or digestive disease compared to 8.0% of those with no ACEs. Although after accounting for the confounding effects of socio-demographic factors, the rate of liver or digestive disease diagnosis in those with four or more ACEs appeared 72% higher compared to those with no ACEs, this failed to reach significance (HR 1.73; 95% CI 0.77-3.88; p=0.185; Figure 11; Appendix 1 Table ii).

**Figure 10: Unadjusted cumulative percentage of individuals reporting diagnosis of liver or digestive disease by age and ACE count**



SE = Standard Error

**Figure 11: Hazard ratios and 95% confidence intervals\* for reporting diagnosis with liver or digestive disease up until the age of 69 years by ACE count**



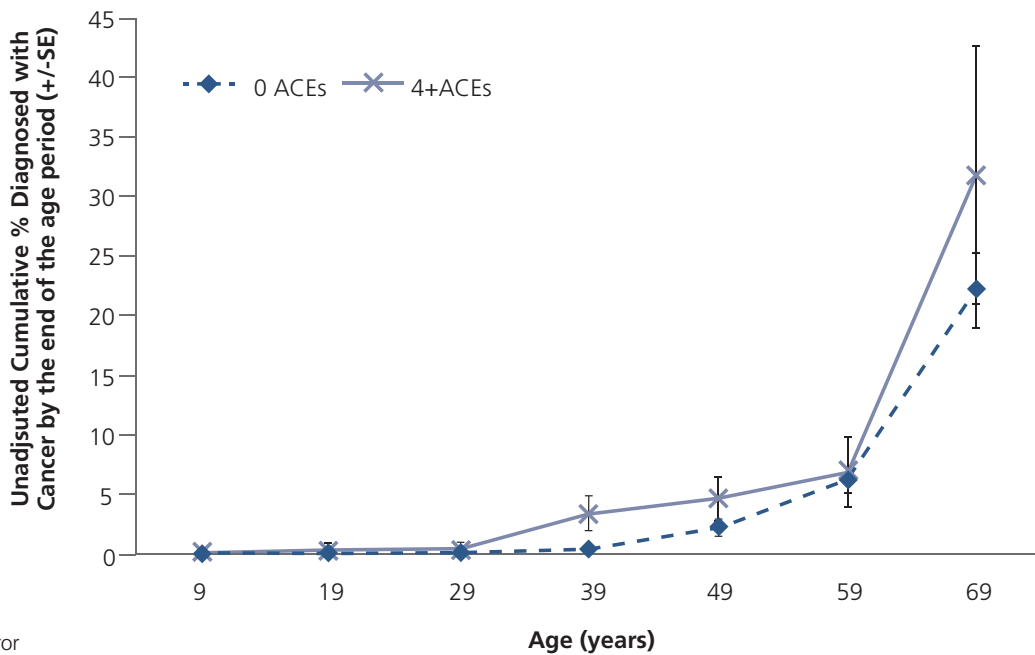
\*Hazard ratios have been adjusted for age, sex, deprivation and ethnicity and birth cohort. 0 ACEs is used as the reference category. 95% CI=95% Confidence Intervals.



# Cancer

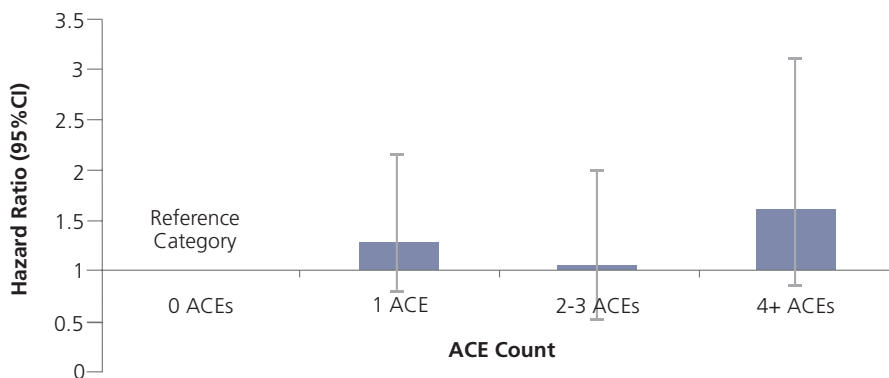
The cumulative proportion of individuals who reported a diagnosis of cancer by the age of 69 years was higher for those with four or more ACEs (31.7%) compared to those with no ACEs (22.1%; Figure 12). After accounting for the confounding effects of socio-demographic factors, the rate of cancer diagnosis in those with four or more ACEs appeared 59% higher compared to those with no ACEs (HR 1.59; 95% CI 0.81-3.11; Figure 13; Appendix 1 Table ii). However, this failed to reach significance (p=0.175). The limitations of study sample size and its potential impact on results is addressed in the discussion.

**Figure 12: Unadjusted cumulative percentage of individuals reporting diagnosis of cancer by age and ACE count**



SE = Standard Error

**Figure 13: Hazard ratios and 95% confidence intervals\* for reporting diagnosis of cancer up until the age of 69 years by ACE count**



\*Hazard ratios have been adjusted for age, sex, deprivation and ethnicity and birth cohort. 0 ACEs is used as the reference category. 95% CI=95% Confidence Intervals.

# ACEs and self-reported health service use<sup>3</sup> in the past 12 months



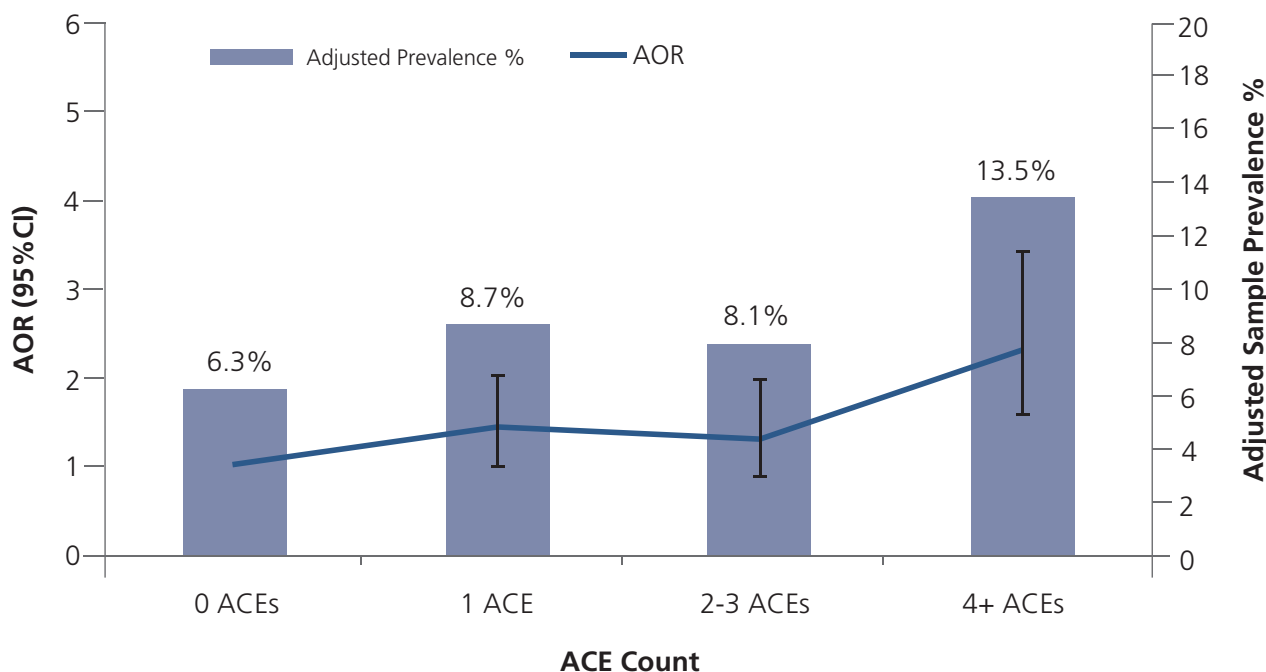
## Frequently visited a General Practitioner (GP)

Respondents who had visited their GP six or more times over the past 12 months (excluding attendances related to pregnancy) were classified as having frequently visited their GP.

Overall, 12.5% of respondents to the Welsh ACE survey reported having visited their GP at least six times over the past year. Frequently visiting the GP increased with increasing age ( $p < 0.001$ ) but there were no significant differences by sex, ethnicity or deprivation. **The adjusted prevalence<sup>4</sup> of frequent GP attendance increased from 6.3% of individuals with no ACEs to 13.5% amongst individuals reporting four or more ACEs** ( $p < 0.001$ ; Figure 14; Appendix 1 Table iii).

In logistic regression analysis, individuals with four or more ACEs (independent of age) were 2.33 times more likely than those with no ACEs to frequently visit the GP (95% CI 1.57-3.45;  $p < 0.001$ ; Figure 14). However, groups with one, or two to three ACEs, while higher than those with no ACEs, failed to reach significance (one ACE,  $p = 0.052$ ; two to three ACEs,  $p = 0.209$ ; Appendix 1 Table iv).

**Figure 14: Adjusted sample prevalence, Adjusted Odds Ratios (AORs)\* and 95% Confidence Intervals for frequently visiting a GP in the past 12 months by ACE count**



\* AORs (adjusted odds ratios) have been adjusted for age, sex, deprivation and ethnicity. 0 ACEs is used as the reference category. 95% CI= 95% Confidence Intervals.

<sup>3</sup> Excludes all reasons relating to pregnancy.

<sup>4</sup> Adjusted for socio-demographics within sample. See methods for more details.

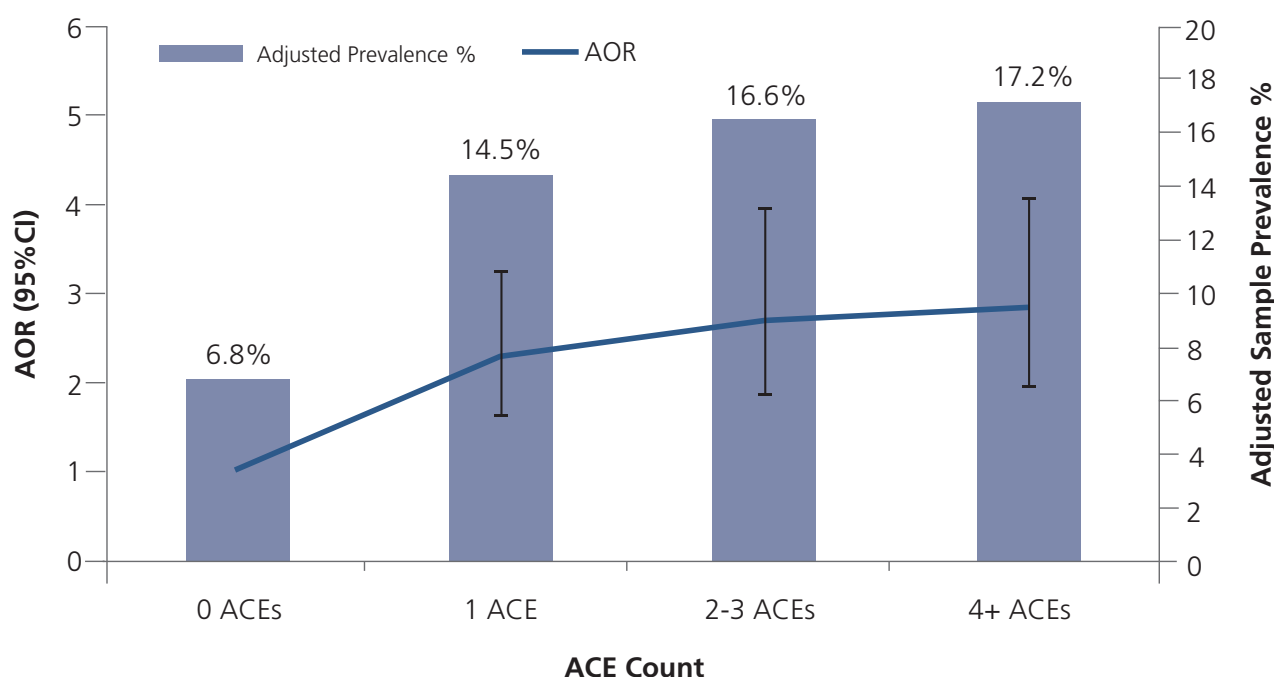


## Patient attendance at an Accident and Emergency (A&E) department

Overall, 13.3% of respondents to the Welsh ACE survey reported attending an A&E department as a patient at least once over the past 12 months. There was evidence to suggest increased likelihood of reported A&E attendance with increasing number of ACEs. **The adjusted prevalence<sup>5</sup> of attendance at A&E increased from 6.8% of individuals with no ACEs to 17.2% amongst individuals reporting four or more ACEs** ( $p < 0.001$ ; Figure 15; Appendix 1 Table iii).

By comparison to those who had experienced no ACEs, the odds of attending A&E were 2.31 times higher amongst those with one ACE (95% CI 1.63-3.27;  $p < 0.001$ ), 2.71 times higher amongst those with two to three ACEs (95% CI 1.85-3.97;  $p < 0.001$ ), and 2.83 times higher amongst those with four or more ACEs (95% CI 1.95-4.10;  $p < 0.001$ ; Figure 15).

**Figure 15: Adjusted\* sample prevalence, Adjusted\* Odds Ratios (AORs) and 95% Confidence Intervals of ever attending A&E as a patient in the past 12 months by ACE count**



\*AORs (adjusted odds ratios) have been adjusted for age, sex, deprivation and ethnicity. 0 ACEs is used as the reference category. 95% CI= 95% Confidence Intervals.

<sup>5</sup> Adjusted for socio-demographics within sample. See methods for more details.





## Overnight stay in a hospital

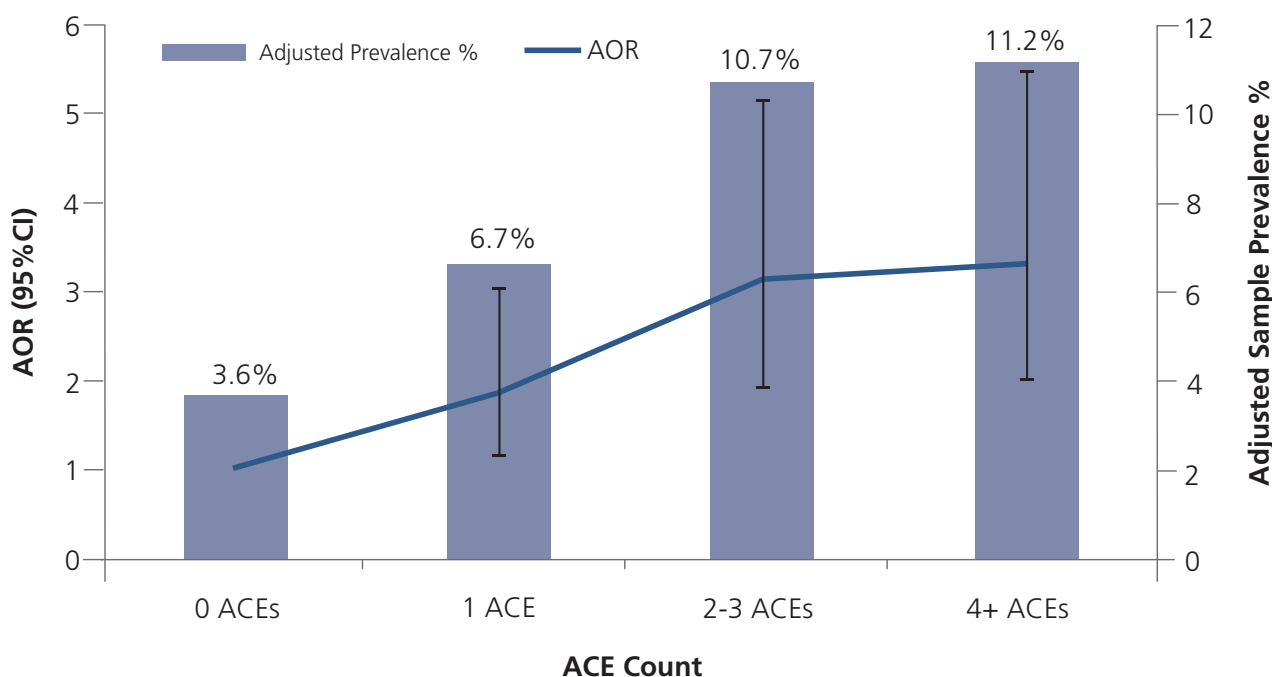
Overall, 6.8% of respondents to the Welsh ACE survey reported staying overnight in hospital at least once over the past 12 months. There was a strong positive association between staying overnight and increasing age and deprivation ( $p < 0.001$ ). **The adjusted prevalence<sup>6</sup> of individuals who had stayed overnight in a hospital increased from 3.6% of those with no ACEs, to 11.2% amongst individuals reporting four or more ACEs** ( $p < 0.001$ ; Figure 16; Appendix 1 Table iii).

By comparison to those who had experienced no ACEs, the odds of staying overnight in hospital were

1.88 times higher amongst those with one ACE (95% CI 1.15-3.09;  $p = 0.012$ ), 3.16 times amongst those with two to three ACEs (95% CI 1.94-5.15;  $p < 0.001$ ), and 3.32 times amongst those with four or more ACEs (95% CI 2.00-5.52;  $p < 0.001$ ; Figure 16).

The adjusted odds of staying overnight in hospital over the past 12 months also increased with increasing deprivation. Individuals in the most deprived quintile were 2.06 times more likely than individuals in the most affluent to have stayed overnight in hospital (95% CI 1.19-3.55;  $p = 0.010$ ; Appendix 1 Table iv).

**Figure 16: Adjusted\* sample prevalence, Adjusted\* Odds Ratios (AORs) and 95% Confidence Intervals of ever staying overnight in hospital in the past 12 months by ACE count**



\* AORs (adjusted odds ratios) have been adjusted for age, sex, deprivation and ethnicity. 0 ACEs is used as the reference category. 95% CI= 95% Confidence Intervals.

<sup>6</sup> Adjusted for socio-demographics within sample. See methods for more details.

## Discussion

**This is the first study to explore the association between ACEs, diagnosis of chronic disease and health service use in a representative sample of the Welsh population. The findings support other international studies [1-2,8,15], and are consistent with ACEs having a significant association with both the development of chronic disease throughout the life course and increased health service use in Wales.**



### Premature morbidity

The rate of chronic disease diagnosis at ages up to 69 years was over two times higher amongst those who reported four or more ACEs compared to those who reported no history of ACEs. Disease specific differences were also greatest amongst those who experienced four or more ACEs, with a fourfold increase in the rate of diagnosis of type 2 diabetes, and a threefold increase in the rate of diagnosis of coronary heart disease and respiratory disease (compared to those with no ACEs). **Levels of chronic disease diagnosis in those with four or more ACEs were similar to individuals aged around ten years older with no ACEs.** (Figure 2, 4 and 8). Small increases in cancer and liver or digestive disease were also found, but these differences were not statistically significant. This may be due to the small sample size, differences in diagnosis and self-reporting between populations with or without ACEs, or that these conditions result in premature death (before the age of 70 years). There is a strong association between ACEs and premature mortality, with those individuals with a history of high ACE counts who had developed these diseases and subsequently died would not have been included within this study [10].

The association between ACEs and chronic disease is likely to be mediated through the direct effects of abuse, neglect and other chronic stressors on children's development [23], alongside the longer term effects on mental well-being and a propensity to adopt health-harming behaviours. Previous reports from the Welsh ACE survey have demonstrated that ACEs are associated with uptake of poor health behaviours, such as increased smoking and alcohol consumption, and low mental well-being in adult life [4,22]; all factors which can lead to the development of poor physical health and chronic disease.

Premature morbidity in adulthood by those who experience adversity in childhood is of significant importance when considering the longer term impact of ACEs on both individual physical and mental health [15,24], and the potential costs and consequences to wider society through premature mortality of the working age population. A study from the United States of America (USA) estimated that individuals with six or more ACEs die up to 20 years earlier, on average, than those with no ACEs, and are approximately twice as likely to die before the age of 65 years [10].

## Health service use

A number of international studies have demonstrated a positive association between history of ACEs and health service use [15,16,19,20]. This study in Wales found that individuals with four or more ACEs were more than twice as likely to frequently visit their GP, or attend A&E and three times more likely to have stayed overnight in hospital in the past 12 months. This is comparable to results found in a similar study of ACEs and health care use in England [15].

Abusive experiences in childhood have been associated with greater primary care attendance in adulthood and frequent attendees are more likely to consult with physical symptoms and mental health disorders [19]. A history of childhood physical and sexual abuse has also been associated with higher health service use for women across mental health services, hospital outpatient, emergency department, speciality care and pharmacy services [21] while people exposed to ACEs have been shown to hold more negative perceptions of their own general health and vitality. Such perceptions may result in a greater need for health care intervention, irrespective of actual ill health [21].

A large population study in the USA demonstrated that those with four or more ACEs are likely to have an additional 2.2 and 2.9 more days respectively in poor physical or mental health each month, and that the number of unhealthy days increases with number of ACEs reported [25]. In this study (data not shown) we found that the association between higher health care use and ACEs was more evident among those without a long term condition. This highlights the importance of early ACEs identification and intervention to address risk factors for chronic disease and premature morbidity in this population. Overall, in Wales and elsewhere, there is strong evidence of substantively increased mental and physical health needs in adults with ACEs and higher use of health services and consequently the need for public health, health care and other key stakeholders to tackle ACEs in partnership.

## Limitations

Results from this study may underestimate the association between ACEs and the development of chronic disease. As the Welsh ACE survey included adults aged between 18-69 years old, it was unable to capture individuals who developed a disease



from the age of 70 years, and so will underestimate the prevalence of some diseases that present at older ages. Further, individuals with more ACEs and consequently greater levels of physical and mental ill health are likely to suffer higher premature mortality. Therefore, it is likely that individuals with high ACE counts will have suffered disproportionate mortality before the age of 70 years. Consequently, this may have reduced the observed differences in ill health and health service use between those with and without high ACE counts.

The study relied on the self-reporting of ACEs which may be subject to non-disclosure and result in underestimating the effect of ACEs on chronic disease and health service use. Long term conditions and health service use were also self reported and are also subject to recall bias. For example, primary care use may be underestimated, whereas recall of previous hospital admission is likely to be more accurate as these are usually more serious events. The compliance rate (49.1%) was comparable to other studies of this type but representativeness of the sample is also a limitation of the study design due to the exclusion of certain groups (individuals who are homeless, resident in healthcare settings or incarcerated) and may mean the generalisability of the findings are limited. We did not explore differences in health care use by type of ACE, but evidence suggests that, because of the high correlation between ACEs, the number of ACEs is a critical predictor of poor health [26].

## Implications for practice

This study adds to the evidence base demonstrating increased rates of chronic disease, premature morbidity and increased health care use amongst adults who have a history of ACEs. Other studies have shown that the consequences of ACEs on adult health may be evident from as early as 18 years of age [25] and that evidence based approaches are available to improve health outcomes for adult survivors of ACEs [26].

In Wales, it is recognised that the first 1000 days, starting just before a baby is conceived and up to the age of two, are the most important. Tackling poverty programmes such as Flying Start<sup>7</sup> aim to:

- Identify and intervene where children may already be victims of abuse, neglect or living in adverse childhood environments
- Better equip parents and care-givers with the necessary skills to avoid ACEs arising within the home environment and encourage development of social and emotional well-being and resilience in the child
- Ensure that indirect harms from for instance domestic abuse in the household are identified, addressed and the impact on children minimised.

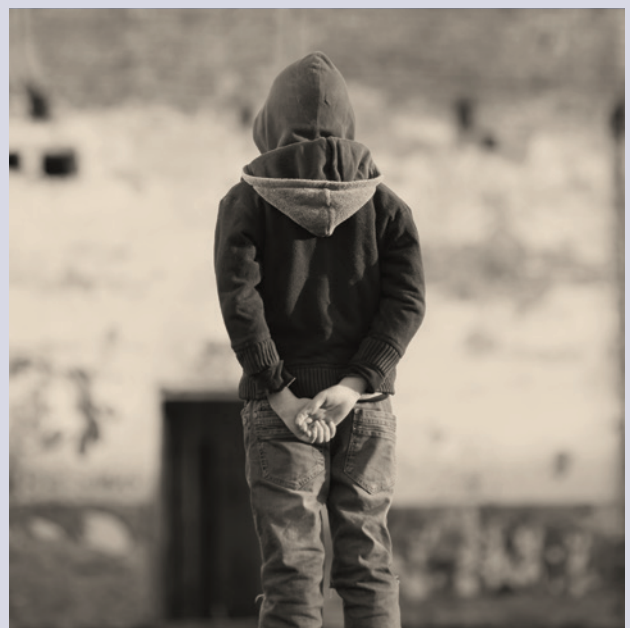
These programmes alongside national policies such as Building a Brighter Future: Early Years and Childcare Plan 2013-2023 [27] are all critical initiatives to prevent ACEs from occurring in Wales, and help to reduce the impact of ACEs by focussing on building resilience and promoting positive parent-child relationships.

Informed assessment by trained professionals that asks about ACEs and early identification of those who are at risk of ACEs using evidence-based approaches are successful models for preventing ACEs. For example, the Safe Environment for Every Kid (SEEK) model developed by Dubowitz et al [28] illustrates how informed primary care health professionals assessed patients to improve patient outcomes. Routine enquiry into ACEs in Wales through the development of trauma informed services that understand the root causes of problems that individuals present with ACEs have the potential to be a cost effective way of improving outcomes for those who experience ACEs and protect against the negative effects of ACEs, without increasing distress experienced by an individual in the process [29]. However, this is not only limited to health care professionals. Work is currently on-going in Wales to develop ACE informed services across the public sector, for example ACE informed police services (Box 3).

### Box 3: Early intervention and prevention: breaking the generational cycle of crime

Through a successful bid to the police innovation fund and in partnership with Public Health Wales, South Wales Police and the National Society of the Prevention of Cruelty to Children (NSPCC) are developing and testing an ACE informed approach to policing in collaboration with other key partners.

The project aims to increase early intervention and prompt positive action across all vulnerability by ensuring that the police and partners have the right knowledge, skills and support to identify and respond appropriately and effectively to early indicators of harm and vulnerability through the lens of ACEs. The objectives of this project fall within a bigger societal ambition to break the generational cycles of crime, violence and harm, thus reducing the risk of poor outcomes for individuals and families.



<sup>7</sup> More information on Flying Start can be found at the following web address: <http://gov.wales/topics/people-and-communities/people/children-and-young-people/parenting-support-guidance/help/flyingstart/?lang=en> (accessed 04 September 2016).



Public Health Wales, in collaboration with the Welsh Future Generations Commissioner and the third sector, are currently developing an ACE prevention support hub to engage, inspire and support individuals, communities, organisations and government to intervene early to prevent ACEs, build protective factors against ACEs and to mitigate the long-term impact of ACEs. Public Health Wales, in collaboration with other public sector organisations, the Welsh Future Generations Commissioner and the third sector are currently developing an ACE prevention hub. This aims to engage, inspire and support individuals, communities and organisations to intervene early to prevent ACEs, build resilience against their impacts and respond to the needs of those affected by them. This work is being taken forward with United in Improving Health<sup>9</sup>, a collaboration that provides the opportunity to coordinate assets from public sector bodies across Wales.

## Research

In this series of reports we have helped develop the understanding between ACEs and physical and mental health and health care use in Wales. Following individuals over time to better understand how exposure to ACEs impacts on our health and outcomes

across the life course and help identify potential points in the life course to intervene, will better inform policy and practice. For example, a study using the Secure Anonymised Information Linkage (SAIL) databank for Wales is currently underway exploring the association between ACEs, healthcare utilisation and educational outcomes during childhood.

This contributes to a wider work programme currently being developed by Public Health Wales and other stakeholders which aims to:

- Raise understanding and awareness of ACEs and their impact on individuals, communities, organisations and services across Wales.
- Inform how to respond to ACEs and deliver ACE-informed practice that recognises the impact of childhood adversity on people's health and well-being across the life course.

By working together to build ACE-informed communities, it will be possible to intervene early to prevent ACEs, develop resilient children, families and communities to protect against the negative effects of ACEs, and provide appropriate services and responses that reduce their long-term impact on health and well-being.

## Conclusion

### **The Welsh ACE survey demonstrates strong associations between ACEs and poor physical health and premature morbidity in adulthood as well as increased use of primary and hospital care.**

Increasing our understanding of the consequence of ACEs on an individual's mental and physical health supports the case for investment in ACE prevention, early identification and health and social systems capable of reducing their consequences. This can contribute to the prevention of chronic diseases and ultimately reduce the financial burden on the health system. The current policy context in Wales, including the Well-being of Future Generations (Wales) Act 2015 [30], provides an ideal policy framework for tackling ACEs and protecting the health of future generations.

Through the principles of the Well-being of Future Generations (Wales) Act 2015 [30] and multi-agency initiatives, such as United in Improving Health<sup>9</sup>, Wales is well placed to develop and deliver an effective and systemic programme of ACE prevention, early identification and informed support for those affected by ACEs. This should improve child health, promote health and well-being across the life course, reduce costs associated with poor health and ultimately improve the health and prosperity of Wales.

<sup>9</sup> More information on United in Improving Health can be found at the following web address: <http://www.wales.nhs.uk/sitesplus/888/news/37242> (accessed 04 September 2016).



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## Appendix 1: Data Tables

**Table i: Sample demographics and comparison with the Welsh national population<sup>a</sup> (aged 18-69)**

		Sample		Population		X <sup>2</sup>	P
		n	%	n	%		
<b>Age Years</b>	18-29	617	30.4	487,274	23.9	63.17	<0.001
	30-39	287	14.2	349,286	17.1		
	40-49	360	17.8	423,900	20.8		
	50-59	355	17.5	401,040	19.7		
	60-69	409	20.2	379,068	18.6		
<b>Sex</b>	Male	1009	49.8	1,012,433	49.6	0.015	0.901
	Female	1019	50.2	1,028,135	50.4		
<b>Deprivation quintile</b>	1 <sup>b</sup>	441	21.7	404,334	19.8	116.8	<0.001
	2	394	19.4	527384	25.8		
	3	393	19.4	314271	15.4		
	4	380	18.7	407730	20.0		
	5	420	20.7	386849	19.0		
<b>Ethnicity</b>	White <sup>c</sup>	1933	96.6	1943973	95.6	4.434	0.035
	Other <sup>d</sup>	69	3.5	89539	4.5		

a Population data obtained from Office for National Statistics, Lower Super Output Area population estimates mid-2013 and the 2011 Census for Ethnicity

b From 1 (least deprived) to 5 (most deprived).

c Including White British, White Irish, White Gypsy or Irish Traveller, White Other.

d Including Indian, Pakistani, Bangladeshi, Chinese, Other Asian and Other Ethnicities.



**Table ii: Modelled changes in risk of chronic disease development with ACE count and socio-demographics<sup>a</sup> using Cox regression survival analysis**

Diagnosis of chronic disease before the age of 69 years												
	Any chronic disease		Type 2 Diabetes		Respiratory disease		Cancer		CHD or heart attack		Liver or Digestive disease	
	HR (95%CI)	p	HR (95%CI)	p	HR (95%CI)	p	HR (95%CI)	p	HR (95%CI)	p	HR (95%CI)	p
<b>ACE Count</b>												
0 ACEs	ref	<0.001	ref	<0.001	ref	0.025	ref	0.490	ref	0.137	ref	0.587
1 ACE	1.47 (1.09-1.98)	0.012	2.40 (1.48-3.89)	<0.001	0.95 (0.38-2.38)	0.910	1.30 (0.78-2.17)	0.315	1.28 (0.45-3.59)	0.644	1.31 (0.66-2.59)	0.446
2-3 ACEs	1.32 (0.93-1.88)	0.116	2.00 (1.13-3.54)	0.017	1.95 (0.85-4.49)	0.117	1.04 (0.54-2.01)	0.905	1.61 (0.57-4.56)	0.369	1.21 (0.52-2.80)	0.653
4+ ACEs	2.34 (1.66-3.31)	<0.001	4.22 (2.45-7.26)	<0.001	3.19 (1.40-7.26)	0.006	1.59 (0.81-3.11)	0.175	3.21 (1.20-8.57)	0.020	1.73 (0.77-3.88)	0.185
<b>Deprivation Quintile<sup>b</sup></b>												
1 (least deprived)	ref		ref		ref		ref		ref		ref	
2	1.38 (0.98-1.95)	0.069	1.05 (0.59-1.87)	0.878	1.88 (0.69-5.10)	0.216	1.36 (0.76-2.44)	0.307	0.60 (0.18-1.20)	0.404	1.51 (0.73-3.12)	0.269
3	1.01 (0.70-1.47)	0.950	0.97 (0.52-1.79)	0.916	1.76 (0.62-4.95)	0.287	0.63 (0.31-1.30)	0.21	0.70 (0.23-2.13)	0.526	0.55 (0.21-1.46)	0.228
4	0.89 (0.60-1.33)	0.577	0.75 (0.38-1.46)	0.393	1.02 (0.31-3.33)	0.980	0.82 (0.42-1.64)	0.579	1.14 (0.41-3.14)	0.807	0.75 (0.31-1.84)	0.528
5 (most deprived)	1.31 (0.92-1.88)	0.135	1.41 (0.81-2.47)	0.228	2.05 (0.76-5.56)	0.158	0.28 (0.69-2.34)	0.435	0.68 (0.22-2.10)	0.506	0.82 (0.35-1.95)	0.655
<b>Sex</b>												
Male	ref		ref		ref		ref		ref		ref	
Female	1.02 (0.48-3.48)	0.858	0.93 (0.63-1.37)	0.721	1.30 (0.70-2.41)	0.407	1.48 (0.97-2.25)	0.068	0.25 (0.10-0.63)	0.003	2.21 (1.23-3.97)	0.008

Abbreviations: ACEs Adverse Childhood Experiences; CHD Coronary Heart Disease; CI Confidence Intervals; HR Hazard Ratio; ref Reference category.

a Adjusted for age, sex, ethnicity and deprivation within the Cox regression model.

b Relationships with deprivation are adjusted for ACE count and therefore should not be interpreted as an observed distribution of chronic disease by deprivation.

**Table iii: Adjusted<sup>a</sup> prevalence (%) of self reported health service use over the past 12 months, by ACE Count**

Health service over past 12 months <sup>b</sup>	ACE Count			
	0	1	2-3	4+
Frequently visited a GP (more than six times)	6.3	8.7	8.1	13.5
Patient attendance at an A&E department	6.8	14.5	16.6	17.2
Overnight stay in hospital	3.6	6.7	10.7	11.2

Abbreviations: ACE Adverse Childhood Experience; GP General Practitioner; A&E Accident and Emergency

a Adjusted for age, sex, ethnicity and deprivation.

b Excluding reasons relating to pregnancy.

**Table iv: Adjusted<sup>a</sup> odds ratios for health service use<sup>b</sup> over the past 12 months by ACE count and socio-demographics factors**

	Frequently visited the GP (six or more times)		Patient attendance at an A&E department		Overnight stay in hospital	
	AOR (95%CI)	p	AOR (95%CI)	p	AOR (95%CI)	p
<b>ACE Count</b>						
0 ACEs	ref	<0.001	ref	<0.001	ref	<0.001
1 ACE	1.43 (1.00-2.05)	0.052	2.31 (1.63-3.27)	<0.001	1.88 (1.15-3.09)	0.012
2-3 ACEs	1.31 (0.86-2.00)	0.209	2.71 (1.85-3.97)	<0.001	3.16 (1.94-5.15)	<0.001
4+ ACEs	2.33 (1.57-3.45)	<0.001	2.83 (1.95-4.10)	<0.001	3.32 (2.00-5.52)	<0.001
<b>Deprivation Quintile<sup>c</sup></b>						
1 (least deprived)	ref		ref		ref	
2	1.52 (1.00-2.32)	0.049	1.09 (0.71-1.67)	0.685	0.82 (0.42-1.58)	0.547
3	1.17 (0.75-1.83)	0.482	0.89 (0.57-1.38)	0.590	1.06 (0.56-1.99)	0.859
4	0.96 (0.60-1.53)	0.866	1.25 (0.82-1.91)	0.293	1.95 (1.11-3.44)	0.021
5 (most deprived)	1.46 (0.96-2.23)	0.078	1.43 (0.96-2.13)	0.080	2.06 (1.19-3.55)	0.010
<b>Age, years</b>						
18-29	ref		ref		ref	
30-39	1.53 (0.91-2.60)	0.111	0.85 (0.57-1.25)	0.404	1.25 (0.69-2.31)	0.476
40-49	2.70 (1.71-4.25)	<0.001	0.55 (0.36-0.83)	0.004	1.17 (0.64-2.12)	0.609
50-59	2.32 (1.45-3.73)	<0.001	0.63 (0.42-0.95)	0.027	1.27 (0.69-2.33)	0.437
60-69	4.89 (3.21-7.45)	<0.001	0.65 (0.44-0.96)	0.030	3.12 (1.90-5.14)	<0.001
<b>Sex</b>						
Male	ref		ref		ref	
Female	0.91 (0.69-1.20)	0.503	1.09 (0.84-1.43)	0.515	1.15 (0.80-1.65)	0.454
<b>Ethnicity</b>						
Other <sup>d</sup>	ref		ref		ref	
White <sup>e</sup>	0.40 (0.12-1.31)	0.129	0.74 (0.34-1.60)	0.441	1.01 (0.35-2.88)	0.933

Abbreviations: ACEs Adverse Childhood Experiences; GP General Practitioner; A&E Accident and Emergency; CI Confidence Interval

a Adjusted for age, sex, ethnicity and deprivation.

b Excluding reasons relating to pregnancy.

c Relationships with deprivation are adjusted for ACE count and therefore should not be interpreted as an observed distribution of service use by deprivation.

d Including Indian, Pakistani, Bangladeshi, Chinese, Other Asian and Other Ethnicities.

e Including White British, White Irish, White Gypsy or Irish Traveller, White Other.

## About us

Public Health Wales exists to protect and improve health and wellbeing and reduce health inequalities for people in Wales.

We are part of the NHS and report to the Minister for Health and Social Services in the Welsh Government.

Our vision is for a healthier, happier and fairer Wales. We work locally, nationally and, with partners, across communities in the following areas:

**Health protection** – providing information and advice and taking action to protect people from communicable disease and environmental hazards.

**Primary, community and integrated care** – strengthening its public health impact through policy, commissioning, planning and service delivery.

**Microbiology** – providing a network of microbiology services which support the diagnosis and management of infectious diseases.

**Safeguarding** – providing expertise and strategic advice to help safeguard children and vulnerable adults.

**Screening** – providing screening programmes which assist the early detection, prevention and treatment of disease.

**Health intelligence** – providing public health data analysis, evidence finding and knowledge management.

**NHS quality improvement and patient safety** – providing the NHS with information, advice and support to improve patient outcomes.

**Policy, research and international development** – influencing policy, supporting research and contributing to international health development.

**Health improvement** – working across agencies and providing population services to improve health and reduce health inequalities.

### Further information

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