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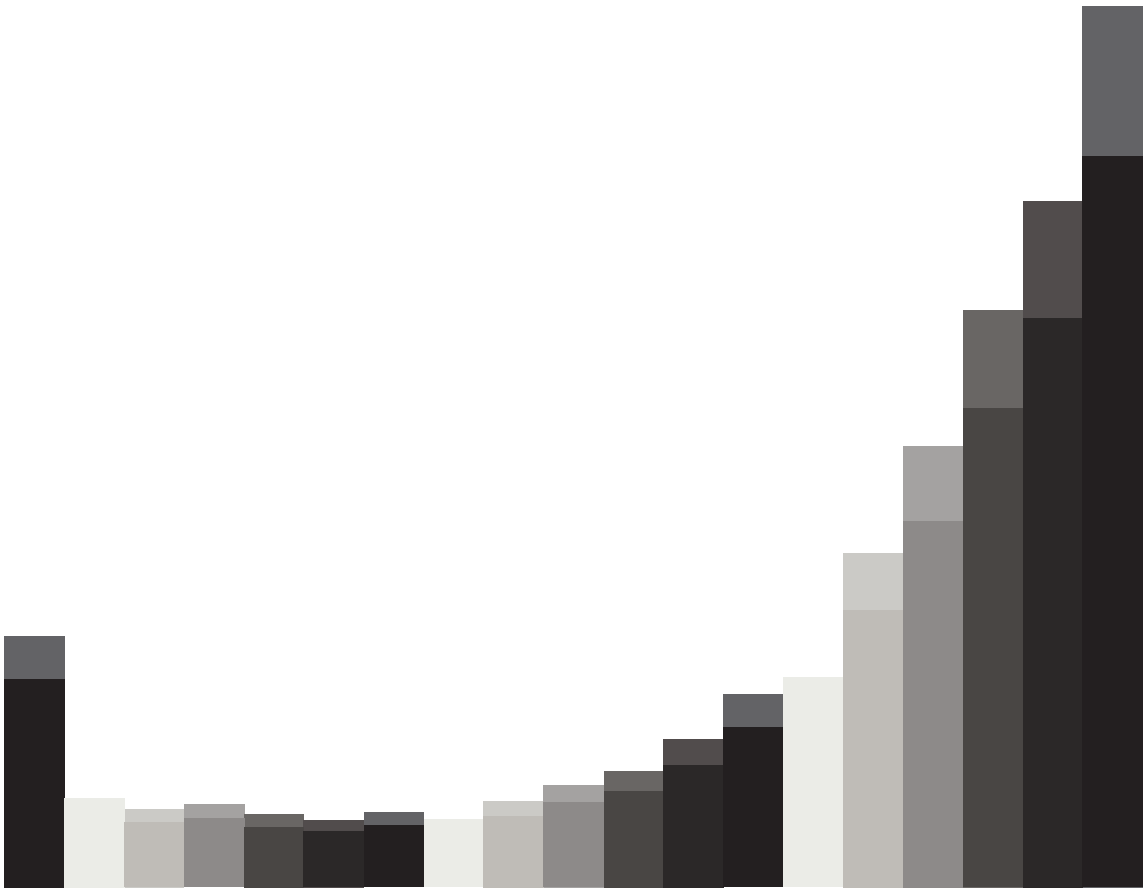
The path to sustainability
Technical appendix



The Health Foundation

About this appendix

This appendix is produced to supplement the Health Foundation report, *The path to sustainability: Funding projections for the NHS in Wales to 2019/20 and 2030/31*.

It provides details of the methods used in the research.

The path to sustainability is available to order or download from www.health.org.uk/publication/path-sustainability

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Introduction

The Health Foundation published *The path to sustainability* in October 2016. For this report we made use of available national data to model the spending pressures facing the NHS in Wales in 2014/15 to create projections for the likely funding pressures in the years up to and including 2030/31.

We split the projections into two periods:

- 2015/16 to 2019/20, for which UK spending plans were set in the November 2015 Comprehensive Spending Review (CSR).
- 2020/21 to 2030/31, where the likely level of funding is unknown. For this period, we modelled a range of scenarios from flat funding to budget growth in line with GDP forecasts.

We also used data research from WIHSC on the expected effect of prudent health on the trends in provision for health services in Wales.

This appendix provides additional details of the methods used in the report. It is intended for readers with a strong level of technical knowledge of health data and statistical methods. We also don't aim to cover all aspects of the work, just those specific to the complex process of producing a model to project the demand for NHS services.

This paper is split into three sections.

- Section 1 provides a broad overview of the model used in *The path to sustainability*, briefly describing each of the five steps taken to produce the funding projections presented in the report.
- Section 2 digs deeper into the model, describing the process of projection for each of the subsections of the health service in Wales separately that we model. Section 2 is very detailed and should only be read by those who are seeking to replicate our model, or have a particular technical interest in the work. There is also a fair amount of repetition across Section 1 and Section 2, so we recommend reading either one or the other.
- Section 3 covers in detail our use of WIHSC's research on the allocative effects of prudent health care, as well as some more detailed results from our analysis.

All monetary values in the report are given in 2016/17 prices, using the July 2016 GDP deflator[1] unless stated otherwise. This means that we explored the real-terms impact of the projected funding pressures, after accounting for inflation.

Section 1: Overview of our method

The NHS in Wales provides a wide range of different services for the population, such as maternity care, front-line emergency care, ongoing treatment for long-term conditions and palliative care. These services are often provided in different settings and all are faced with differing patterns of demand pressures.

To reflect the different patterns of demand, as well as the data availability for the different service types, we developed a 'combined model' approach.[2] We built different models for different service types. The level and complexity of the model used depended on the data available for the service type: each of the service types were then 'stacked' together to develop an overall projection model.

Our approach can be split into five steps (as depicted in Figure 1 of the main report):

- **Step 1:** Estimating the contribution of the listed area of treatment to current patterns of care up to2014/15. For example we estimate, for a 60-65 year old woman in Cardiff and Vale, how likely they are to have a chronic condition and how often they will visit hospital or their GP.
- **Step 2:** Estimating future service activity based on projections of the key factors identified in Step 1, namely population growth (by age, sex and health board), fertility, mortality and prevalence of selected chronic conditions.
- **Step 3:** Applying unit costs from the 2014/15 reference cost data, and PSSRU GP costs, inflated to 2016/17 prices and adjusting them to reflect the potential real-terms growth in health service pay rates.
- **Step 4:** To the costed data we applied projected changes in activity levels at a level described in Section 3.
- **Step 5:** Each service-specific projection is then combined to match the total Welsh spending on health care, with adjustments made to account for services for which data were not available.

In the following sections we explain these steps in more detail for each service type.

All analysis was done using SAS Enterprise Guide 7.1.

Step 1: Analysing current activity

In 2015/16, the NHS in Wales spent £6.5bn (in 2016/17 prices) on providing health services to the population; worth £2,074 per head. The largest area of spend was for acute services, including inpatient outpatient and accident and emergency.

Where data was available we examined each service type. There are varying levels of data available for each service type. We were not able to model activity in all service types, specifically community services was modelled using only reference cost data and population statistics, due to lack of activity data.

In the acute sector we modelled each of the following five service types separately:

- emergency inpatient care
- non-emergency inpatient care
- non-emergency day cases
- outpatient care
- A&E.

Every patient care interaction with the acute sector is recorded in one of the following datasets:

- The Patient Episode Database for Wales (PEDW) records all inpatient and day case activity undertaken in Wales, and for Welsh residents treated in England.[3]
- The Outpatient Attendance Dataset (OAD) records all outpatient appointments that occur in Wales.
- The Emergency Department Data Set (EDDS) records all attendances at a major A&E department in Wales.[4]

Each dataset includes a unique pseudonymised patient identifier, which is consistent across all datasets and years. This allows us to track patient activity across each acute service over time.

The PEDW and EDDS record all data for Welsh residents receiving inpatient care in Wales or England; the outpatient data only record activity that occurs in Wales. We were therefore unable to include outpatient appointment for Welsh residents that occurred in England. This is likely to have the greatest impact for Powys Teaching Health Board, as for much of the population the closest hospital is in England. Less than half of 1% of outpatient appointments occurred in England for residents of Cwm Taf University Health Board, whereas 54% occurred in England for residents of Powys Teaching Health Board.

Patients treated in a hospital in Wales who are not Welsh residents will not be funded from the Welsh NHS budget. We have therefore only included patients for whom the lower super output area (LSOA) of the home address are in Wales.

For each service type we produced person-level regression models to estimate the annual average activity rates depending on a number of key drivers of demand:

- age
- sex
- geographical region*
- whether it was their last year of life
- whether they had received inpatient hospital care with a chronic condition

We used only data from 2014/15 to estimate the use of health care services for each type of patient, as defined by the categories above. The size of the population who had not received hospital care in 2014/15 was calculated using population estimates based on the 2014 Census by age, sex and health board.[5]

Alongside population growth, recent rising trends in the proportion of the population living with chronic conditions are likely to have an impact on the demand for NHS services. We identified people with a chronic condition receiving inpatient care using diagnosis codes. The specific conditions that we included were based on the Department of Health chronic disease management compendium of information,[6] with additions based on expert guidance. These were:

- arthritis
- cancer
- chronic obstructive pulmonary disease (COPD) or asthma
- coronary heart disease (CHD) or heart failure
- dementia
- diabetes
- epilepsy
- mental ill-health
- renal disease
- stroke.

Full details on how we identified people with chronic conditions are provided in Section 2.

In order to model prescribing activity we used data that covers all prescriptions dispensed by community pharmacies, appliance contractors and dispensing doctors in Wales.

These data are collected by the Primary Care Services of NHS Wales Shared Services Partnership. We explored the trend in the number of items prescribed per population between 2004 and 2014 for each type, as defined by the relevant British National Formulary (BNF) chapter.[7]

* Defined by the health board of the person's residence.

The average annual number of consultations with a GP and a practice nurse per population, split by age and sex, from 2003 to 2014, were estimated from the Welsh Health Survey.[8] Using these, we modelled the trends by age and sex for the under-16s, 16- to 74-year-olds (in ten-year age bands) and the over-75s.

To model maternity services we used estimated birth projections from StatsWales. These estimates were consistently within 3% of the number of births recorded in the PEDW between 2004 and 2014. StatsWales estimate that the birth rate in wales is set to fall 0.6% a year from 2014/15 to 2030/31.

For community care we used the reference cost data from 2010/11 to 2014. These contain only total costs, with no measure of activity or personal characteristics of people receiving services.

Step 2: Projections

Demographic factors are a fundamental driver for health care spending. Projecting future spending will be greatly influenced by population projections over time. We used the principal projections for population and mortality by age, sex and health board.[5] These data are shortly to be updated by StatsWales, unfortunately after publication of this report.

Rising numbers of the population are being diagnosed with chronic conditions due to lifestyle habits, improving technology and better identification of unmet need. As the number of people living with single or multiple conditions rises, their treatment costs also rise. Using diagnosis codes recorded in the inpatient records in the PEDW, we identified where people have been admitted with certain chronic conditions. Using data from 2004/05 to 2014/15, we calculated the proportion of the population who had received at least one inpatient admission with each condition, each year, split by age and sex for those aged 50 and over. We explored the specific trend for all conditions described in Step 1. We explored the trend for each of these conditions on their own, and for each combination of co-morbidities in the cases of diabetes, heart disease and cancer. For other less prevalent or costly conditions, we looked at the trend in individual conditions or multiple conditions collected as a whole. Results from this analysis are reported in Section 2.

For each condition or combination of conditions, we calculated the mortality rates. We then assumed that these trends continue beyond 2015/16 to 2030/31, and applied them to the projected population.

For GP and practice nurse appointments, we explored the age- and sex-specific trends in average annual numbers per population between 2004 and 2011. We then applied these to the future population projections.

For prescription items, we used the trend in items per person a year between 2004 and 2014, split by BNF chapter. Due to the data available, we were unable to adjust for age and sex. Assumptions for maternity where taken from the ONS projections.

Step 3: Costs

To translate projected activity into a projection for total spending, we applied unit costs from the 2014/15 reference cost data.

Acute activity was costed according to the 2014/15 Welsh national reference costs. For inpatient data we applied the specific cost to each episode determined by the Healthcare Resource Group (HRG). The episodes were then grouped into spells to get the estimated spell costs, and then divided by the length of stay to get an average cost per day. This allowed us to explore the impact on total spending of a change in the average length of stay.

The reference costs for outpatient attendances provided an average for all attendances by specialty. However, first attendances require more resources than a follow-up, as do procedures. We therefore costed each procedure on whether it was a first attendance or follow up and whether it involved a procedure. A&E costs were based an average cost per attendance.

Maternity spells were costed in the same way as the inpatient data. We identified all inpatient activity for antenatal treatment and birth, and calculated the average annual cost for someone giving birth at £2,903 in 2014/15 cash terms, which we applied to the principal ONS fertility projections.

The cost for consultations at a GP practice were taken from the 2014 Personal Social Services Research Unit (PSSRU) English unit costs[9] at £44 for a consultation with a GP* and £14 for a consultation with a practice nurse.† However, this overestimated the total spend on GP practices in Wales, so we re-adjusted the values to £23.78 and £7.57 respectively, to maintain the English ratio.

We applied the average cost for an item in each BNF chapter in 2014/15 to the activity projection. The average costs for most chapters have been falling steadily in recent years; a continued fall in the average cost of prescribed drugs is not sustainable. In our base case scenario we therefore assume that the average cost will stay constant at 2014/15 prices. .

To explore future funding pressures, we looked at the impact of rising real wage costs on the unit cost of health care. Data from the Department of Health provider economics impact assessment model show that the workforce accounts for 68.7% of hospital costs (Welsh Government, 2016). For the 31.3% of hospital costs that are non-pay, we assume that unit costs will increase in line with inflation. Similarly, unit costs for items prescribed were assumed to increase in line with inflation.

The community reference cost data from 2010/11 to 2014 contains no measure of activity. We therefore estimated trends of community spend per head of the population by subcategory. The reference cost data are recorded in the following subcategories: Local 1, Local 2, Regional, Screening, DA Services, HDD and Mental Health. Community costs grew 2.4% on average from 2010/11 to 2014/15 in real terms.

* Per surgery consultation lasting 11.7 minutes (average)

† Practice nurse cost per hour of face to face time of £56. With the average consultation lasting 15.5 minutes.

Step 4: Prudent health activity adjustment

Our model follows a 'bottom-up' projection method, modelling separately different areas of the health service and aggregating them to project the whole.

This allows us to look at what happens to total health care costs if activity levels in different services were to change. Individually we model: inpatient (for both elective and non-elective, visit frequency and length of stay), outpatient, A&E, maternity, primary care, prescribing, community provision, mental health provision. We are therefore able to project NHS Wales' total expenditure on the back of assumed changes in activity levels for each of these categories.

Prudent health care, as discussed in the main report, is a set of principles designed to promote the optimal use of available resources in the treatment of the population. Part of this will be the reallocation of treatment away from the acute sector and into primary and community care. In step 4 of the model we apply an estimate for this expected change in activity to the model to see to what extent prudent health care might affect the cost of the health service.

We use results from research by WIHSC on the estimated changes in health care activity resulting from prudent health care (presented in Appendix 2). WIHSC have focused on patients with mental health conditions, chronic conditions (long-term care) and frail and elderly patients. Their research generated an estimate for how activity would change for each service area that we model, for each subset of patients that they looked at.

We are able to analyse the effects of these estimated changes on the total cost of NHS Wales.

This is covered in greater detail in Section 3.

Step 5: NHS spending

The final step was to combine the projections for each service (acute care and A&E; maternity; prescribing; and GP consultations) to create an estimate of total NHS spending on services in Wales. We first applied an adjustment for the results of each service type. We were not able to account for the total cost for some service types due to a lack of data, such as critical care for inpatients. We accounted for this by applying an aggregation factor so that the value estimated in 2014/15 matched the amount spent on the service type in the same year. We then made a final adjustment to account for the service types that we did not model (other primary and secondary care), assuming that these sectors grow in line with those modelled. The resulting final figure therefore relates to aggregate NHS spending on activity in 2015/16 (£6.5bn) from the supplementary budget.[10]

Section 2: In depth method and definitions

Here we describe in detail Steps 1 – 3 from the overview of the method presented in Section 1. We do so for each service area: acute care, maternity, community prescribing, general medical services and community care. Step 4 is discussed in Section 3.

2.1 Acute care

Acute care comprises of inpatient, outpatient and A&E activity. Each activity type was modelled separately using national activity-level data. We further split inpatient activity into emergency care, non-emergency care and non-emergency day cases.

2.1.1 Data

Every interaction that a person has with the acute sector is recorded in one of the following datasets:

- The Patient Episode Database for Wales (PEDW) records all inpatient and day case activity undertaken in Wales, and for Welsh residents treated in England.[3]
- The Outpatient Attendance Dataset (OAD) records all outpatient appointments.
- The Emergency Department Dataset (EDDS) records all attendances at a major A&E department in Wales.[4]

Each dataset includes unique pseudonymised patient identifier, which are consistent across each dataset and year. This means it is possible to track patients across each dataset through time, while protecting that person's identity.

PEDW and EDDS contains all data for Welsh residents receiving inpatient care in Wales or England, however the OAD only record activity that occurred in Wales. If a Welsh resident received an outpatient appointment or attended an A&E department in England, this would not be included in the data, but would be paid for out of the budget for the Welsh NHS. We therefore have to exclude records for Welsh residents from the English outpatient records in the Hospital Episode Statistics (HES).

Patients treated in hospital in Wales who are not Welsh residents will not be funded out of the Welsh NHS budget. We have therefore only included patients for whom the lower super output area (LSOA) of the home address is in Wales.

Inpatient definitions

The **Admission method** field in the inpatient data was used to identify elective, non-elective and maternity activity as below. Instances where the data did not fall into these categories were excluded.

- Elective: first integer of the admission method code = 1
- Non-elective: first integer of the admission method code = 2
- Maternity: first integer of the admission method code = 3

The **Patient class** field was used to further split elective episodes into:

- Day case: Patient Class = 2, D, E, O or U
- Regular Day Attendance: Patient Class = 3, 4
- Other: Patient Class = 1, 5

Spells of inpatient care can last for any number of days and include multiple episodes of care. For our model we included the number of spells that had a **discharge date** between 1 April and 31 March of the financial year of interest (2014/15 in the regression models).

An inpatient spell can be made up of a number of fixed consultant episodes. To ensure that we only count each spell once, only episodes where the **Last episode in spell** was indicated were included for the number of spells in a year.

The length of stay (LoS) for a spell is taken from the last episode of that spell, defined using Last episode in spell equal to one, and calculated as:

- LoS = discharge date – admission date + 1

Only spells for which the **LHB of residence** starts with '7' were included, to remove people treated who live outside of Wales.

Outpatient definitions

Unlike the PEDW data for inpatients, the Outpatients Appointments Dataset (OAD) does not include Welsh residents treated in English hospitals. We do not have access to English HES recently enough to include it so we cannot capture those patients.

We only want to include appointments that occurred. Therefore only activity for which the value of the attended field was 5 or 6 were included.

Activity where **first attendance** recorded as 1, 4, 7, 10, 21, 24, 27 or 30 were counted as first appointments, those recorded as 2, 5, 8, 11, 22, 25, 28 or 31 were counted as follow-up attendances. Activity with any other value were excluded.

Maternity was modelled separately, so related attendances were removed by excluding activity where **treatment specialty** equalled: 501, 510, 520 or 560.

Only spells for which the **LSOA of residence** starts with 'W' were included, to remove people treated who live outside of Wales.

Chronic conditions

Each Inpatient episode includes at least one **diagnosis code** that follows the ICD-10 definition. We flagged a person as having a condition if they had at least one of the relevant codes (see Table 1) recorded in at least one episode between 1 April and 31 March of the relevant year.

Table 1: A list of chronic condition definitions

Condition	ICD-10 Codes (unless specified)
Arthritis	M05x to M09x, M13x, M15x to M19x or M47
Cancer	C00x to C99x
Chronic obstructive pulmonary disease (COPD) or asthma	J41x to J47x
Coronary heart disease (CHD) or heart failure	I11x, I13x, I20x to I25x, or I50x
Dementia	F00x to F03x, F10.7 or F18.7
Diabetes	E10x to E14x
Epilepsy	G40x, G41x
Mental ill-health	Consultant treatment specialty between 700 and 799
Renal disease	N17x to N19x and I12 to I13
Stroke	I60x to I69x, or G45x

Note: ICD-10 codes consist of a letter followed by three numbers. Where a code ends in 'x', this implies any code with the first three characters.

There is a general trend for increasing numbers of patients diagnosed with chronic conditions as a proportion of the population. Between 2004/05 and 2014/15 the proportion of the population with more than one of these chronic conditions almost doubled from 1.6% to 2.6%.

Mortality data

Patient level mortality data from the Office for National Statistics (ONS) was supplied by the Welsh government, and attached to the hospital data we received in the form of a **died in year** dummy variable. In 2014/15 non-elective admissions cost 59% more for patients in their last year of life than other patients over the age of 50. In our modelling it is important to be able to control for this 'cost of death'.

Population data

Estimates and projections for population and mortality data by age, sex and health board were produced by the Office for National Statistics (ONS) and taken from StatsWales.[5] For each group, the number of people identified as having hospital activity was subtracted from the population estimate, giving us a value for the number of people not receiving any hospital activity in 2014/15.

2.1.2 Model

In order to estimate the usage of each patient in a given year we ran a series of regression models for each activity type. The dependant variable in each case was the number of elective inpatient admissions, elective day case admissions, non-elective inpatient admissions, outpatient appointments and A&E attendances in a year. We used a Poisson regression model,* with an empirical adjustment to account for observed over-dispersion in the model. To ensure models accounted for the correct population, the natural logarithm of the estimated number of people by age, sex, health board and death within the year were included as the offset value.

In each case the population was split into three age groups to account for the different patterns of service use observed for each of people in their first year of life, the under 50s and the over 50s. We therefore have the following separate dependent variables (shown as different columns of Table 2)

- Non elective admissions: People aged 0, 1 to 49, Over 50 (Nel_0, Nel_1_49, Nel_Ovr50)
- Elective day cases: People aged 0, 1 to 49, Over 50 (El_DC_0, El_DC_1_49, El_DC_Ovr50)
- Elective admissions: People aged 0, 1 to 49, Over 50 (El_LS_0, El_LS _1_49, El_LS _Ovr50)
- Outpatient appointments: People aged 0, 1 to 49, Over 50 (OP_0, OP_1_49, OP_Ovr50)
- A&E visits: People aged 0, 1 to 49, Over 50 (AE_0, AE _1_49, AE _Ovr50)

The independent variables included:

- age in five-year age bands, as a categorical viable (AgeCat)
- sex, as a Boolean variable (Female)
- whether the patient died within the year as a Boolean variable (DiedInYear)
- health board of person's home, as 6 mutually exclusive Boolean dummy variables (HB_7A2, HB_7A3, HB_7A4, HB_7A5, HB_7A6, HB_7A7). 7A1 (Betsi Cadwaladr University) Health Board was used for the comparator health board.

For people aged 50 and over we also included eight mutually exclusive Boolean variables to indicate whether the patient had at least one inpatient admission for:

* We used PROC GENMOD in SAS

- Diabetes and for no other condition in the year (Diab)
- COPD or asthma, and for no other condition in the year (COPD_Asthma)
- Arthritis and for no other condition in the year (Arthritis)
- Epilepsy and for no other condition in the year (Epilepsy)
- Mental ill-health and for no other condition in the year (MH)
- Stroke and for no other condition in the year (Stroke)
- Renal and for no other condition in the year (Renal)
- Cancer and for no other condition in the year (Cancer)
- Dementia and for no other condition in the year (Dementia)
- CHD or heart failure, and for no other condition in the year (CHD_HF)
- Diabetes AND COPD or asthma, and for no other condition in the year (Diab_Asth_COPD)
- Diabetes AND CHD or heart failure, and for no other condition in the year (Diab_CHD_HF)
- COPD or asthma AND CHD or heart failure, and for no other condition in the year (Asth_COPD_CHD_HF)
- COPD or asthma AND Cancer, and for no other condition in the year (Asth_COPD_Cancer)
- any other combination of selected conditions (MultiCond).

The results of the regression models are provided in Table 2 overleaf.

2.1.3 Projection

Population and mortality projections were estimated by the Office for National Statistics, and retrieved from StatsWales. These projections are by age group, health board and sex and unfortunately have not been updated since 2011.

To be able to estimate the number of people with chronic conditions that are expected to receive acute care in each year, we identified the number of people doing so in each year between 2004/05 and 2014/15. We calculated the proportion of people receiving inpatient care with each combination of chronic conditions, as specified in Table 2. We did this split by sex and five-year age bands, for people aged 50 and over.

We then calculated the trend in prevalence over the ten-year period and projected this trend forward, using a simple linear least squares regression model. We decided to adopt a simple least squares regression due to the large number of trends to be calculated (fifteen condition groups, eight age groups and two sex groups; 240 groups in total).

Table 2: Regression results

Parameter	Age 0					Age 1-49					Age Over 50				
	Outpatient	Non-elective	Elective Day Case	Other Elective	A&E	Outpatient	Non-elective	Elective Day Case	Other Elective	A&E	Outpatient	Non-elective	Elective Day Case	Other Elective	A&E
Intercept	0.1460	-0.7737	-3.9736	-3.6737	-1.0216	-0.9665	-2.6664	-4.6211	-5.3886	-1.0823	-3.8452	-1.0524	-2.8546	-1.2669	-2.1296
Female	-0.1722	-0.2755		-0.0227	-0.1736	0.2719	0.2945	0.2607	0.3969	-0.0914	0.0184		-0.1236		0.0124
AgeCat						0.0277	-0.0403	0.1587	0.1837	-0.0392	0.0399	0.0674	0.0208	-0.1681	0.0224
DiedInYear					-1.1310	1.3824	2.8587	1.6233	3.4151	1.2673	0.4842	-0.5269	-0.8722	-0.2190	0.3209
HB_7A2	0.1192	0.3143		-0.4546	0.1612	0.0708	0.1001	0.0860	-0.0651	0.3208	-0.0304	0.0348	0.2655	-0.2641	0.1739
HB_7A3	0.2198	0.4427		-0.2233	0.2256	0.3419	0.2843	0.2938	0.3254	0.3878	-0.0568	0.3230	0.1674	-0.1491	0.1846
HB_7A4	-0.0936	0.1305		0.4617	0.1679	0.3629	-0.0756	0.3362	0.6667	-0.0224	-0.0730	0.4075	0.0534	0.2334	-0.0041
HB_7A5	-0.2302	0.4899		-1.0515	0.6165	0.4280	0.3602	-0.0139	0.0665	0.5226	0.0299	0.5232	-0.1044	-0.0131	0.3585
HB_7A6	-0.4071	0.1071		-1.6784	0.3268	-0.1825	0.3017	-0.0097	0.6805	0.1887	-0.0789	-0.0971	-0.1433	-0.0525	-0.1418
HB_7A7	-16.3107	-16.3388		-18.6037	-15.0037	-1.6451	-4.3719	-1.1406	-4.0057	-0.4912	-1.1718	-1.5969	-0.8638	-1.9430	-0.8349
Diab											2.6862	1.1571	2.3102	2.2868	1.2959
COPD_ Asthma											3.0101	1.0338	2.1165	2.2302	1.5843
Arthritis											2.3571	1.1850	2.0995	3.2619	1.0943
Epilepsy											3.2064	1.0187	1.8783	2.0227	1.9206
MH											3.5920	0.8747	0.9220	2.3271	1.9384
Stroke											3.3372	0.6948	0.8431	1.7566	1.8283
Renal											3.1757	1.1670	1.8476	4.7492	1.5331
Cancer											2.6558	1.7685	2.6110	5.1269	1.0034
Dementia											3.1801	0.1724	0.6169	1.2212	1.8890
CHD_HF											3.0911	0.9652	2.0097	2.2483	1.5964
Diab_Asth_ COPD											3.1217	1.2139	2.1455	2.2003	1.6697
Diab_CHD_ HF											3.1676	1.2047	2.0596	2.4436	1.6492
Asth_ COPD_ CHD_HF											3.4117	1.1151	1.9230	2.3048	1.9322
Asth_ COPD_ Cancer											3.1488	1.8627	2.6714	5.2197	1.4613
MultiCond											3.4604	1.3061	1.9281	4.0235	1.8933

Then, using the **died in year** variable in the acute data we calculated the proportion of people, by age and sex, with an inpatient admission for each chronic condition group that had died in the year between 2004/05 and 2014/15. We applied a log transformation to the dependant variable to ensure that the projected value would not fall below 0% for any age- sex- condition- combination.

We then applied the regression models for hospital activity to the estimated future population make up using the population and mortality projections, with these projections for hospital admissions with chronic conditions.

2.1.4 Costs

Acute activity was costed using the 2014/15 Welsh national reference costs, provided by the Welsh government. For inpatient data we applied the reference cost to each episode determined by its Healthcare Resource Group (HRG) code and whether it was a part of an elective, elective day case or non-elective spell. Episodes were then grouped into spells to get the estimated spell costs, and then divided by the length of stay to get an average cost per day. This allowed us to assess the impact on total spending of a change in the average length of stay. Where HRG Codes did not match the patient level data, we were forced to apply the average elective, elective day case or non-elective costs.

The reference costs for outpatient activity provided an average for all appointments by specialty. However, we know from our costing work with English data that a first appointment requires more resources than a follow-up, and so costs about twice as much. We have been provided with both the average first cost and the average follow up for each of the outpatient specialties by the Welsh government.

A&E costs were based an average cost per attendance of £157 in cash terms, based on 2014/15 reference cost data supplied by the Welsh government.

For each service type the unit costs were then split into staff costs (68.7%) based on data provided by the Welsh government. This meant that we could explore the impact of wage pressures on the projections by adjusting the size of the cost element associated with staff. For the report we increased the staff element by two per cent a year in real terms to reflect the long-run average.

2.2 Maternity

Patient level maternity data was excluded from the main model for acute care. Although we will not look at any scenarios in our current research, it allows the option to do so in the future. The model for costs associated with maternity depends heavily on the ONS projections for birth rates. We therefore estimated an average cost for activity associated with giving birth, pre- and post-natal, and then applied this estimated cost to the ONS estimate for fertility. The ONS are currently projecting a fall in the birth rate in the period 2014/15 to 2030/31 of 0.6% per year.

2.3 Community prescribing

Prescription items dispensed by community pharmacy in Wales rise by about 4% each year. Accounting for population growth, items per head has still risen by an average of 3.5% a year between 2002 and 2014 from 16.7 to 25.3 items per head of population. At the same time the average cost of items fell by an average of 6% a year, largely due to a large number of patents for high costs drugs expiring allowing for substitution to cheaper generic drugs. As a result, the total spending on community prescribing has remained broadly flat in real terms. But the trend in falling costs per item is not likely to continue as the big wave of patent expiries for high-volume drugs such as statins comes to an end. We have therefore assumed that unit costs will rise in line with inflation over the next five years, which would see a large increase in spending.

The rate has increased for all but one drug type, as defined by the BNF chapters (Table 3). The only type for which the rate fell was for dressings, which accounted for 2% of total pharmacy cost in 2014/15.

The conditions that account for the most items are for cardiovascular system (7.6 items a year per head of population, accounting for 11% of total spend in 2014/15) and central nervous system (5 items a year per person, accounting for 22% of total spend on prescribing in 2014/15).

If these trends continue, spending on community prescribing would be 55% higher in real terms in 2030/31, than in 2014/15, assuming that the unit costs remained at the 2014/15 level. This is an average real terms increase of 2.8% a year.

2.3.1 Data

Prescribing data are collected nationally by the Primary Care Services of NHS Wales Shared Services Partnership. They cover all prescriptions dispensed by community pharmacies, appliance contractors and dispensing doctors in Wales.

The data record the number of items dispensed and total net ingredient cost (NIC) for 20 of the British National Formulary (BNF) chapters[7] between 2002 and 2014.

2.3.2 Projection

Using the ONS population estimates for each year we calculated the number of items dispensed per head of population in Wales. We then applied ordinary least squares (OLS) regressions to the data using PROC REG in SAS. Table 3 shows the results for the model for each BNF chapter.

We estimated the number of items dispensed for each chapter in each year by applying the projected number of items per head of population for the models in Table 3 to the StatsWales projection for the size of the population. The total expenditure on community prescriptions was then calculated by multiplying these estimates by the appropriate average unit cost for each chapter.

Table 3: Results of ordinary least squares regressions of items dispensed per head of population in Wales between 2002 and 2014

BNF chapter	BNF chapter name	Intercept	Year coefficient	Average cost per item in 2014, in 2014/15 prices
1	Cardiovascular system	-470.7	0.2377	£2.66
2	Central nervous system	-263.8	0.1334	£8.27
3	Endocrine system	-189.9	0.0955	£10.90
4	Gastro-intestinal system	-165.4	0.0833	£4.62
5	Respiratory system	-86.8	0.0440	£15.37
6	Nutrition and blood	-103.6	0.0520	£10.18
7	Infections	-22.9	0.0119	£5.14
8	Skin	-12.3	0.0065	£6.97
9	Obstetrics, gynae + urinary tract disorders	-44.4	0.0223	£12.12
10	Musculoskeletal & joint diseases	-2.2	0.0015	£5.23
11	Eye	-25.3	0.0128	£5.73
12	Appliances	-41.9	0.0210	£11.46
13	Ear, nose and oropharynx	-18.0	0.0091	£5.94
14	Immunological products & vaccines	-2.4	0.0013	£7.99
15	Malignant disease & immunosuppression	-6.8	0.0034	£40.57
19	Stoma appliances	-7.1	0.0036	£53.90
20	Dressings	12.6	-0.0061	£16.55
21	Incontinence appliances	-2.2	0.0011	£26.91
22	Anaesthesia	-1.3	0.0007	£6.41
23	Other drugs and preparations	0.6	-0.0003	£28.37

In our model we make assumptions as to what will happen to the average price of prescription medication. Prescribing costs in primary care accounted for 8.4% of total NHS Wales expenditure in 2015/16. The total number of items prescribed in Wales through NHS providers has increase consistently between 2002 and 2014 by around 60%. The

total cost of prescribing has fallen by 11% in real terms as a result of the average unit cost of prescribed drugs almost halving in that time, from £13 to £7 in 2014/15 figures. However, a continued fall in the average cost of prescribed drugs is not sustainable. In our base case scenario we therefore assume that the average cost will stay constant at 2014/15 prices (just over £7 per item).

2.3.3 Costs

Between 2002 and 2014 the average cost per item has fallen in real terms for most BNF chapters. We therefore ran OLS regressions for the cost per item of each chapter. In our results the cost per item of prescribed drugs is held constant at 2014 levels. Given that a continued fall in cost per item is unlikely in the long run according to advice from the Welsh government's Principal Pharmacist.

2.4 GP consultations

General medical services

There were a total of 17.9m consultations with a GP in 2014/15, and 8.3m with a practice nurses. These have increased by an average of 1.7% and 2.3% a year respectively since 2007/08, although much of the growth appears to be accounted for by the growing and ageing of the population, as opposed to an increase in the frequency of primary care visits.

2.4.1 Data

We used data from the Welsh Health Survey[8] to estimate the average annual number of consultations at a GP practice per head of population between 2003 and 2014. The data gave the number of consultations per person in a year with a GP and with a practice nurse, by age and sex. The data were available for each year in ten-year age bands from 16-24 to 65-74, and for 75+. For people aged under 16, the number of consultations with a GP was only available from 2007 onwards, and was not available for consultations with a practice nurse.

2.4.2 Projections

We applied OLS regressions to the data for each available age-sex group using PROC REG in SAS, the results of which are in Table 4. We applied these models to the ONS population projections to estimate the number of consultations we that would expect to see at a GP practice.

2.4.3 Costs

The costs for consultations at a GP practice were taken from the 2014/15 PSSRU unit costs[9] at £44 for a consultation with a GP, and £14 for a consultation with a practice nurse. However, this led to an estimate for the total spend in 2014/15 of £891m, compared with the actual spend of £481m. We therefore adjusted the values to £23.78 and £7.57, respectively, to provide an accurate estimate for total spend, while maintaining the cost ratio between consultations with a GP and a practice nurse.

Table 4: Results of OLS regressions of number of GP and practice nurse consultations per head of population in Wales between 2004 and 2011 (under 16s from 2007 to 2011)

		Consultations with GP		Consultations with practice nurse	
Sex	**Age**	**Intercept**	**Coefficient**	**Intercept**	**Coefficient**
Male	Under 16	-168.786	0.086166	N/A	N/A
Male	16-24	56.62749	-0.02689	-30.553	0.015599
Male	25-34	37.48651	-0.01715	-11.4206	0.006154
Male	35-44	-314.485	0.158349	-224.147	0.112303
Male	45-54	-165.748	0.084924	49.06505	-0.02326
Male	55-64	216.933	-0.10497	-34.9974	0.019149
Male	65-74	-20.0645	0.013495	-164.814	0.084741
Male	75+	-121.638	0.064619	-349.612	0.17749
Female	Under 16	-80.6744	0.04243	N/A	N/A
Female	16-24	-52.8553	0.029109	-11.9526	0.006984
Female	25-34	-138.815	0.07234	-125.691	0.063764
Female	35-44	-217.603	0.111137	-128.861	0.065271
Female	45-54	-139.068	0.072424	-133.661	0.067878
Female	55-64	77.88643	-0.03566	148.9197	-0.07247
Female	65-74	66.33922	-0.02941	94.22186	-0.04451
Female	75+	-134.992	0.071405	-378.347	0.191263

2.5 Community

£689m was spent on providing community care services in 2014/15, or around 12% of all NHS Wales costs. This figure grew 4.2% a year in cash terms from 2010/11 and 2014/15 according to the reference cost data, 2.4% in real terms. With a drive to move health care away from acute services this service is expected to grow further. Specifically with regard to prudent health we estimate that community care costs will grow faster than any other

service (more detail in Section 3). In spite of being such a large area of spending for NHS Wales the data for community care is very limited. Activity data is not available, only costs, collected by community service areas, such as midwifery and palliative care. These services are collected in the following levels: Learning Difficulties, Local 1, Local 2, MH Services, Regional, Screening, Direct Access (DA) and Home Delivery Drugs (HDD).

Table 5 shows how the service areas are grouped and their cash terms spend in 2014/15 from the reference cost data.

Table 5: Community care reference cost data

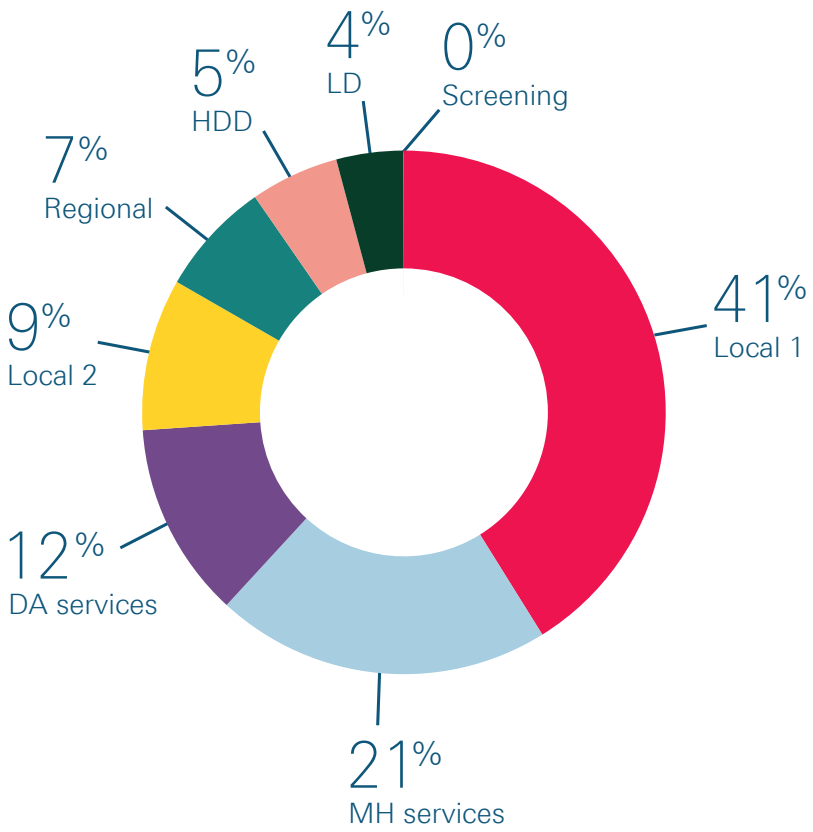
Level of service	Community service areas	Expenditure (£)
CS LD	Learning disabilities	28,603,947
CS Local 1	Audiology	10,329,426
CS Local 1	Chiropody	14,835,675
CS Local 1	Community physiotherapy	29,026,538
CS Local 1	Dietetics	9,011,176
CS Local 1	District Nursing	80,207,592
CS Local 1	Family Planning (Nursing & Medical)	8,401,416
CS Local 1	General Medical Services	206,208
CS Local 1	Health Visiting	30,827,550
CS Local 1	Immunisation/Vaccines	6,209,069
CS Local 1	Incontinence Products and Medical Supplies	7,958,488
CS Local 1	Midwifery	24,378,728
CS Local 1	Occupational Therapy	11,707,436
CS Local 1	Paediatric Medical Services	12,011,367
CS Local 1	Palliative Care	4,402,484
CS Local 1	School Nursing	10,095,339
CS Local 1	Specialist Nurses	9,654,232
CS Local 1	Speech Therapy	14,305,815
CS Local 2	Asylum Seekers	185,664
CS Local 2	Burns Outreach Team	122,819
CS Local 2	Cardiac Rehab	3,480,863
CS Local 2	Child protection	2,813,394
CS Local 2	Community Resource Teams / Integrated Community Teams/Virtual Wards	20,422,584
CS Local 2	Community Brain Injury	1,138,487
CS Local 2	Continuing Care	7,937,581
CS Local 2	COPD Outreach Team	858,925
CS Local 2	Community Bed Contract (Powys only)	65,102
CS Local 2	Ethnic Minorities Services	291,995
CS Local 2	Family Health Workers - Surestart	1,433,184
CS Local 2	Family Support Team	433,561
CS Local 2	Health Promotion	1,041,627

Level of service	Community service areas	Expenditure (£)
CS Local 2	Home Enteral Feeding	872,533
CS Local 2	Loan Equipment	1,260,404
CS Local 2	Orthoptic Clinic	3,821,164
CS Local 2	Orthotics	3,691,679
CS Local 2	Other (Cochlear Implant)	1,292,891
CS Local 2	Paediatric Community Programmes	1,700,859
CS Local 2	Partnership Schemes	9,096,286
CS Local 2	Psychology Services	988,497
CS Local 2	Seating Service	372,950
CS Local 2	Virtual Clinics	1,381,163
CS MH Services	Child and adolescent psychiatry	11,507,968
CS MH Services	Drugs and Alcohol (Substance Misuse)	11,520,015
CS MH Services	Old age psychiatry	24,763,085
CS MH Services	Other mental illness	83,202,976
CS MH Services	Specialised mental health services	2,517,583
CS MH Services	Crisis Resolution/Management Teams	9,229,301
CS Regional	Rehab Engineering	855,974
CS Regional	Community Dental Services	16,128,350
CS Regional	Community dialysis	6,884,493
CS Regional	Cystic Fibrosis & Home Ventillation Services (Incl. Nebs, Vents & CPAPS)	1,123,603
CS Regional	Diabetic Retinopathy Screening	3,963,292
CS Regional	Haemophilia Recombinant Products	7,380,192
CS Regional	HIV Drug Therapy & Related Monitoring Prog.	9,469,587
CS Regional	Home Parenteral Nutrition Services (Adult)	127,651
CS Regional	Lymphodaema (ABMU)	776,630
CS Regional	Lymphoma Panel	598,882
CS Regional	Pharmacy QA	531,005
CS Regional	Perinatal Pathology	260,389
CS Regional	Specialised Pharmaceutical Services	660,539
CS Screening	Screening Services: Bowel Screening	92,532
CS Screening	Cervical screening	241
DA Services	Biochemistry (proposed 07/08)	10,662,691
DA Services	Haematology (proposed 07/08)	6,490,721

Level of service	Community service areas	Expenditure (£)
DA Services	Blood Sciences	16,495,952
DA Services	Histopathology (proposed 07/08)	9,315,146
DA Services	Medical Microbiology (Trust) (proposed 07/08)	5,645,146
DA Services	PHLS (proposed 07/08)	3,453,268
DA Services	Physiotherapy	4,072,946
DA Services	Radiology services	25,216,703
DA Services	Other Services	1,876,404
HDD	Dermatology	4,076,395
HDD	General Medicine	1,664,813
HDD	Medical gastroenterology	7,319,209
HDD	Medical Oncology	1,024,888
HDD	Nephrology	805,234
HDD	Neurology	3,107,858
HDD	Paediatrics	92,219
HDD	Respiratory Medicine	2,234,003
HDD	Rheumatology	16,279,792
HDD	Acute Mental Illness	282,014
HDD	Forensic Psychiatry	324,931
HDD	LDS	161,300
HDD	Cardiology	69
HDD	GUM	292,944
HDD	Clinical Haematology	17,572
HDD	Ophthalmology	189
HDD	T & O	19
HDD	Other (for new HDD that relate to specialties not listed above)	8
HDD	Disaggregated NICE/High Cost Drugs	362

We also show the 2014/15 community care costs by service grouping (Figure 1), to give a sense of how the overall spend in community falls over local, regional and other services. Local 1 is responsible for almost half of total community spend, or around 5% of total NHS Wales' costs. Community mental health services comprise the next largest cost to community services, this service is covered in more detail in the next section.

Figure 1: Community care costs by service level, 2014/15



We used NHS Wales reference cost data to model the average expenditure per capita for each of the Welsh population, by service area.

2.5.1 Projections

We applied OLS regressions to the data for each available Community subgroup: Local 1, Local 2, Regional, Screening, DA Services, HDD and Mental Health. We applied the trend cost per capita of these subgroups (through OLS regression) to the projected population in Wales from 2014/15 to 2030/31. This gave us projections for the total spend in community health services, and separately community mental health services.

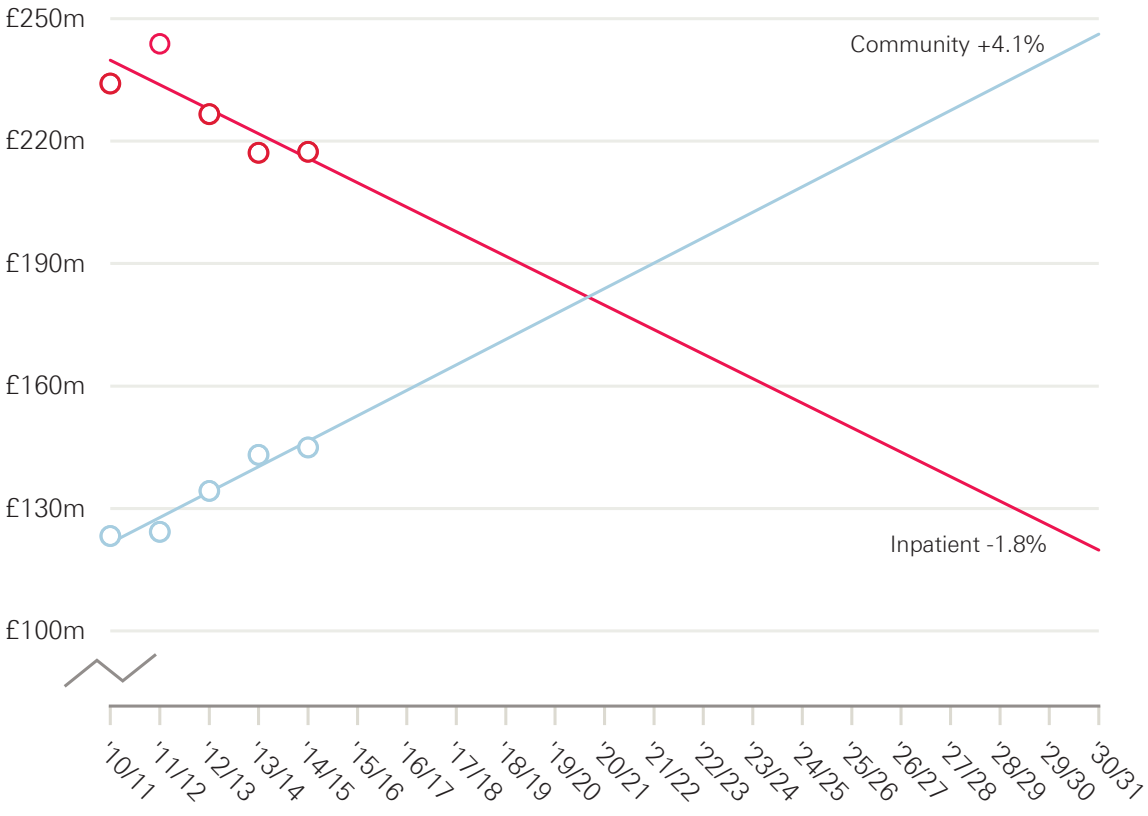
Subgroup	Intercept	Year
Local 1	318.9	-0.11
Local 2	-4515.5	2.25
Regional	-29.1	0.02
Screening	-18.0	0.01
Direct access	1601.5	-0.78
Home delivery drugs	-2012.7	1.01
Mental health	-3314.5	1.67

2.6 Mental health

Mental health is a condition treated both in acute services and in the community. Therefore we model each separately. Acute mental health care fits in with the projection method described in Section 1. Community mental health costs are recorded separately in the reference cost data, and we therefore able to model each activity separately. Unfortunately only costs are available for mental health community care and therefore we use the same methodology as reported in Section 2.5.

We do see an apparent shift in the care of patients with mental health problems. Figure 2 shows the reference costs associated with inpatient mental health appointments and community care. This indicates a possible movement in treatment of mental health conditions to community care, potentially supplying better care in the home, reducing costs and the amount of time spent in hospital. However, this is just one possible conclusion. More detailed data for community mental health is not available; it could be the case that costs are rising in mental health community care, but without an increase in activity. In which case cost reductions in acute care result in unmet need, rather than a transfer of treatment. Further research into this potential change would be interesting but beyond the current scope of the data.

Figure 2: Reference costs for mental health inpatient activity and community care



2.7 Social care

For publicly funded adult social care, Wales-specific projections were not available. The best estimate for pressures therefore comes from the projection for England drawn from Personal Social Services Research Unit (PSSRU) aggregate projection models at the London School of Economics and Political Science (LSE).[11] This estimated that total spending pressures for public provision of adult social care in England would rise by an average of 4.4% a year in real-terms between 2015 and 2030. This is around 3.7% a year per head of population aged 16 and over. By applying the same growth per head of population to Wales, we estimate total spending pressures in Wales would rise by 4.1% a year in real terms.

We take the total current spending on adult social care from the 2016 Public Expenditure Statistical Analysis (PESA), table 10.3. In 2014/15 a total of £1.8bn was spent on personal social services. From this we subtract the £0.6bn spend on personal social services for family and children. This gives a total spend for adult social care of £1.2bn in 2014/15. If this rises in line with the average increase of 4.1% a year to 2030/31, total spending on adult social care would need to rise to £2.3bn.

We recognise that this is not a perfect option, especially given national differences in social care provision. For example, spending per head in Wales is higher than in England, at £403 in 2014/15 compared to £295 in England. But it does provide a useful working estimate. Given the high projected pressures, further analysis to understand the specific pressures in Wales would aid political and policy decisions on how to achieve a fiscally sustainable social care system.

2.8 Total NHS spend

Having produced projections for each service type for which data were available, the next step was to combine them into a projections for the whole NHS. This wasn't a simple case of summing the results, for a number of reasons.

Firstly, although the models for each service accounted for the majority of costs for that service, we could not account for all of them, such as critical care for non-elective inpatient services. We therefore applied an adjustment factor to the cost estimates for each year so that the estimated spend in 2015/16 matched the actual spend according to the Welsh Government Costing Return 2015/16. Any changes were then accounted for by the supplementary budget,[10] including the NHS Delivery RDEL and Health Central Budgets RDEL.

Next, due to data availability, we were unable to model all activity types provided by the NHS in Wales. These included pharmaceutical, dental and ophthalmic services for primary care, and assessment unit activity and day care for secondary care. We therefore had to adjust the combined estimates for primary and secondary care to match the values from the costing return. Although not an ideal solution, it was better to assume that the demand for these services grew at a similar rate as the modelled services, rather than exclude them entirely. The adjustments for primary and secondary sectors are provided in Table 6.*

* In this version of the model we see that we currently overestimate the spend on secondary care, this has not occurred in previous version and leads us to believe that we may be inadvertently double counting some area of secondary care. This is something we will need to look into.

We were unable to create a model for any services that were neither primary nor secondary care. These included goods and services; continuing care; NHS-funded nursing care; voluntary organisations; local authorities; and private providers. So the combined adjusted values for primary and secondary care were multiplied by 1.36 and 1.03 respectively (Table 6) to account for these services.

This meant that we had an estimate for spending on the services included in the Welsh Costing Return. However the estimates for the funding scenarios that we used are based on total spending according to PESA. These are higher because they also include funding for education and training, research and development, and public health. We therefore applied one final adjustment to account for this.

Table 6: Adjustments used to ensure modelled spend matched actual spend in 2014/15

Service Type	Adjustment
Acute	1.01
Maternity	1.07
Community Prescribing	0.94
GP Consultations	1.02
Community Care	1.06
All Primary Care	1.36
All Secondary Care	1.03
Other services	1.16
Supplementary budget	1.08

Section 3: Prudent health

The aim of prudent health care is to make a real practical difference to the broad sweep of those millions of encounters which take place every year between Welsh people and their health service.[12] Our model allows us to assess individually the likely changes in activity of each subset of those publicly provided services.

One of the goals of this project was to provide an indication of what is required in terms of institutional change in order to maintain an effective and affordable health service. In order to assign a figure to these potential changes it must first be established what the extent of these changes are likely to be. This was done through a survey and a series open discussions with medical and policy experts within each field, to be conducted by Marcus Longley and Mark Llewellyn of the Welsh Institute of Health and Social Care (WIHSC) at the University of South Wales. We used their results to assess what is likely to happen to the use and cost of publicly provided health care in Wales. While we will give a brief summary of their method here, more detail can be found in Appendix 2. This describes their research method in greater detail and WIHSC is due to publish a full report in 2017.

WIHSC's research consisted of a survey, followed by discussion groups at the local health board and then the national level. Surveys and discussions were conducted separately with experts in:

- in mental health care,
- frail and elderly / palliative care,
- care in long term / chronic conditions and
- early years and preventative care.

The focus of this research was to estimate the expected change in activity **away from trend** for each category and for each patient to each of the following areas of health care: elective admissions, non-elective admissions, average length of stay - both elective and non-elective, outpatient visits, A&E visits, prescriptions, community contact and GP appointments. Our model follows a 'bottom up' projection and as such models separately each of these areas and aggregates them to project the whole. We are therefore able to project expenditure changes on the back of assumed changes in activity levels for each of these categories.

From the national level discussion, expert participants were presented with initial survey results and discussion results from Local Health Board level discussions and current trends in activity. The purpose of these national level meetings was to validate findings from the earlier local work, extend the discussion into clinical areas that had not been considered, to amend conclusions as necessary and to develop a national level consensus as to the likely

effect of prudent health care. We therefore take an average expected activity change from each of the national discussants, for each of the three subsets of the treated public – mental health, long-term care and frail and elderly / end of life patients.

Table 7: Areas of assumed adjustment to activity trends in 5 years as a result of prudent health (annual average values in brackets)

DOMAIN	Elective admissions	Non-elective admissions	Length of stay (elective)	Length of stay (non-elective)	Outpatients	A&E	Prescriptions	Community contact	GP
Mental health	-3% (-0.7%)	-7% (-1.9%)	-7% (-1.7%)	-8% (-2.0%)	-3% (-0.8%)	-10% (-2.6%)	-5% (-1.2%)	10% (2.4%)	3% (0.8%)
Chronic conditions	-4% (-1.0%)	**-8% (-2.0%)**	-3% (-0.6%)	-3% (-0.8%)	-5% (-1.1%)	-5% (-1.4%)	-5% (-1.2%)	8% (1.8%)	3% (0.8%)
Frailty and end of life care	-1% (-0.2%)	-5% (-1.3%)	-1% (-0.3%)	-4% (-0.9%)	1% (0.1%)	-5% (-1.3%)	-5% (-1.2%)	8% (1.8%)	3% (0.8%)

Source: WIHSC

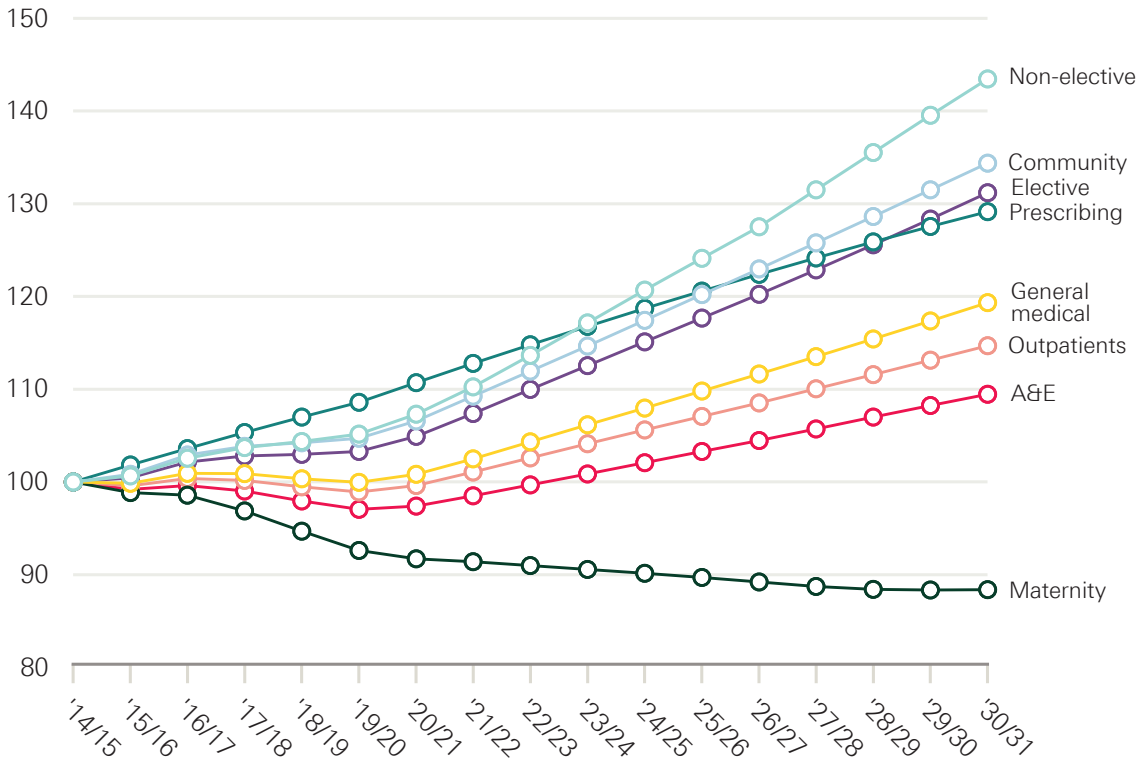
So as an example, the highlighted cell in the table above means that for patients with chronic conditions (long term care), the professionals surveyed by WIHSC expect that non-elective admissions will be 7.9% lower in 5 years **than would otherwise have been** as a result of prudent health care.

We are not able to model early years and prevention, predominantly because the cohort effects of changes in preventative care are likely to be outside the bounds of our 15-year projections, given their focus in shaping the long term needs for health and other support.

As discussed in *The path to sustainability* we find that, should prudent health care generate results similar to those detailed in WIHSC's research, it will be broadly cost neutral. From a cost perspective the benefits generated by reducing pressure on acute services will be countered to a large extent by the increase in costs associated with investment in primary and community care. This would suggest that if applying prudent principals can increase the quality and appropriateness of services in Wales, this can be done without a major increase in cost pressures.

Here we look at the estimated effect of prudent health care on the growth rate of different services. Figure 3 shows the indexed growth rates of each sector of NHS Wales under assumptions laid out in Figure 11 of the main report (ie assuming the pay deal until 2019/20 and 2% wage growth thereafter as well as 1.5% overall efficiency to 2019/20, followed by 1% efficiency thereafter).

Figure 3: Index of cost growth by sector, assuming 1.5% efficiency to 2019/20, 1% efficiency thereafter and the public sector pay deal



We assume that prescribing is not affected by the pay deal and therefore in the initial period it is the fastest growing area in terms of costs. Thereafter costs associated with non-elective admissions grow fastest, followed by community, elective admissions and general medical services respectively*. Figure 4 shows the same chart, but in this case we assume that each area is affected by prudent health in the manner laid out in Table 7. We also assume that this effect is ongoing to 2030/31.

Under the assumptions for prudent health care, both community care and general medical services would grow faster than acute services in terms of cost growth. Not only that, but non-elective cost growth has fallen below elective under the assumptions of prudent health care. This effect comes as a result of an expected shift in activity away from acute and into primary and secondary care. It is worth noting that, as shown by the index charts, costs for each of the services is still estimated to be higher with prudent health care, just lower than would otherwise have been (with the exception of maternity).

As stated in the main report we estimate that, should activity change in the manner that it does in Table 7, prudent health care will be broadly cost neutral. However, the modelled expenditure by service looks very different in terms of projected growth rates. When we take into account the relative size of each sector then the effect of prudent health care is slightly less obvious. Figure 5 shows the share of total expenditure from each service area in our base year (2015/16). Figure 6 shows the expenditure shares in 2030/31, including our modelling of prudent health care on the top and excluding it on the bottom.

* Maternity costs are projected to fall, this is because StatsWales expect the birth rate to fall in this period.

Figure 4: Index of cost growth by sector, assuming 1.5% efficiency to 2019/20 and pay deal as well as the estimated effect of prudent health

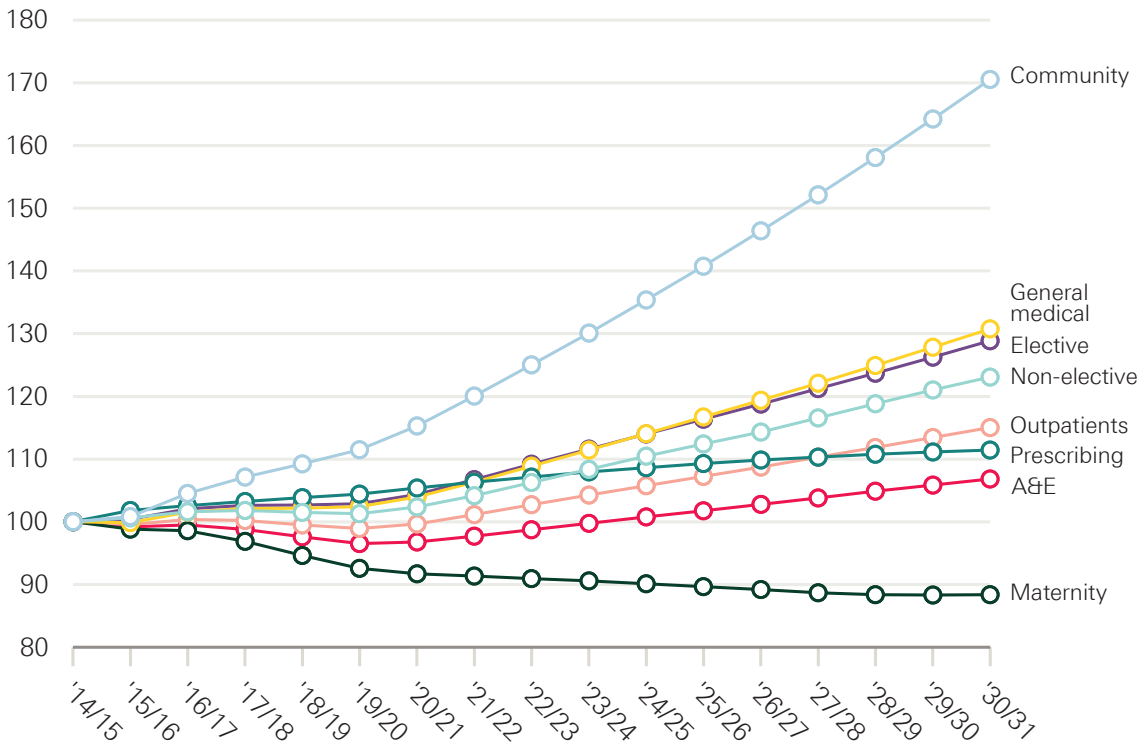


Figure 5: 2015/16 expenditure share by service

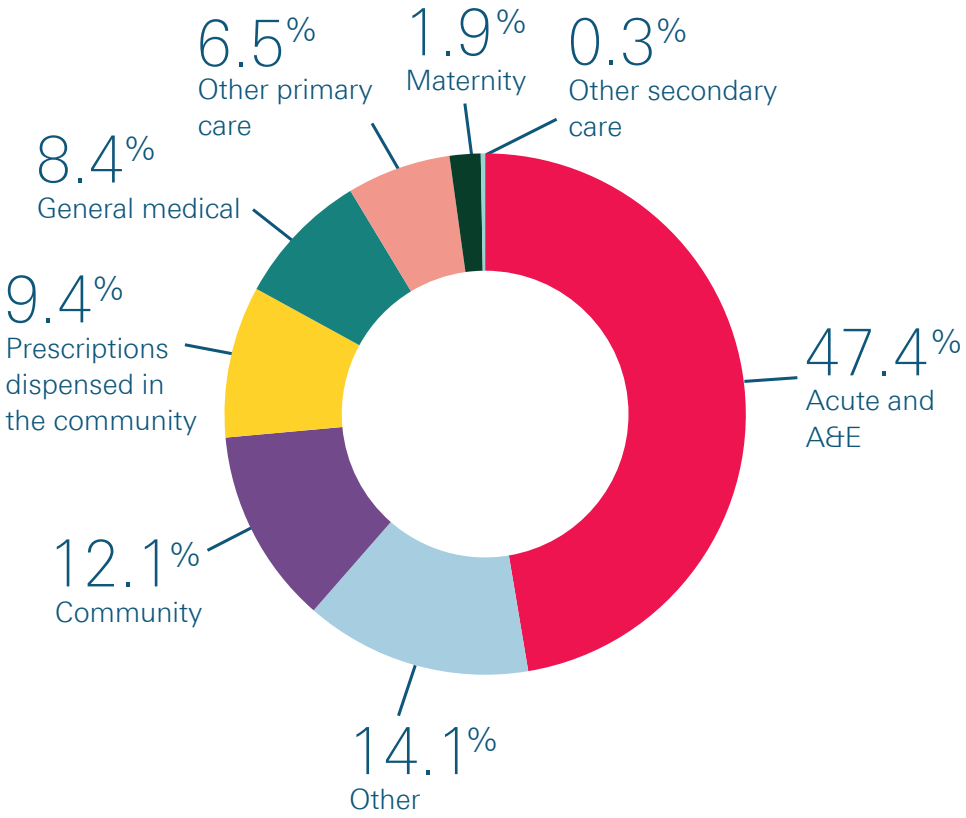
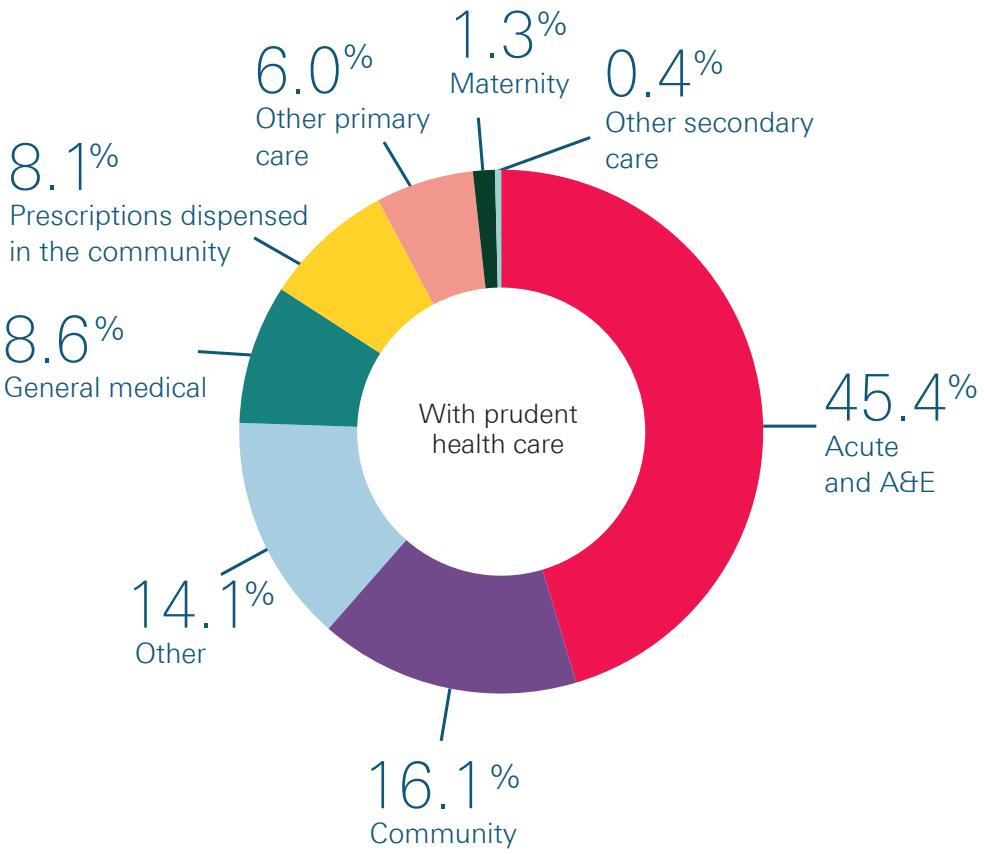
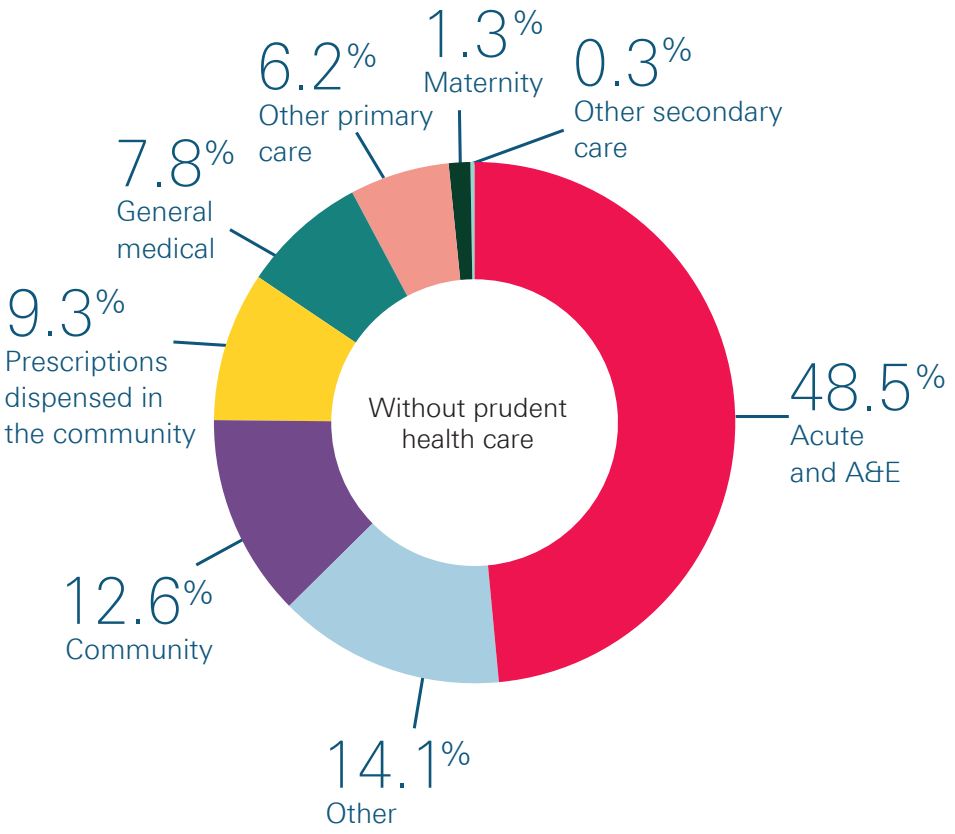


Figure 6: 2030/31 expenditure share by service both with (top) and without (bottom) prudent health care





The modelled effects of prudent health care here appear more subtle, but significant. Acute and A&E is clearly affected: shown to increase as a share of total expenditure from 47.4% to 48.5% without prudent health care, but shrinking compared to other services when prudent health care is included, to 45.4%. The opposite can be said for primary care, a key factor in the success of prudent health care. Without prudent health care we estimate that primary care spending would fall compared to the whole, with prudent health care it is expected to rise. Community care's share of total spending grows by more than double as a result of prudent health care.

Over the long term we estimate that the Welsh NHS would be fiscally sustainable if it maintains trend growth in efficiency, and funding rises in line with GDP growth. We find that if quality can be improved through the adoption of prudent principals, this can be done without major changes to the expected overall spending pressures.

In our model we take into account the effect of increases in the levels of chronic conditions. Prudent health care, if it works as planned, will hopefully further improve the treatment and prevention of chronic conditions, contributing to a more sustainable health care system. Therefore we could expect to see a reduction the trend increase in the prevalence of chronic conditions. However, this potential benefit is not taken into account in our model.

The above outlines the extent of flexibility we have in the use of our model, around where we use assumptions of what might happen to generate the likely cost implications of activity changes in the short/medium term. The numbers used here are purely indicative: they show that, in order for prudent health care to have a large impact on NHS Wales' finances, the benefits of reduced acute hospital activity must vastly outweigh the required investment in community and primary care. However, our results do indicate that Wales will be able to provide a higher quality of service, without incurring high adjustment costs.

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We make links between the knowledge we gain from working with those delivering health and health care and our research and analysis. Our aspiration is to create a virtuous circle, using what we know works on the ground to inform effective policymaking and vice versa.

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