Chapter 1

Results 2: Models

This chapter reports results of an analysis conducted to answer research questions 1 and 2 namely:

In people over the age of 65 in Scotland:

1. (a) What are the socioeconomic, demographic, and geographic patterns in the use of social care?
   (b) Is there an association between multimorbidity status and the amount and type of social care use over time? Does this vary by the patterns described in 1(a)?

2. (a) Is there an association in the use of social care services, multimorbidity status and unplanned admission to hospital?

As described in section **??**, receipt of social care was measured by an individual having a record present in the SCS of any year. This could be in relation to any form of social care provided, or commissioned, by a local authority. As linkage rates from the SCS to the population spine varied at the local authority level, direct comparison of levels of care across all councils is impossible. For this reason two subsets, together representing ~58% of the overall cohort, are compared in relation to research question 1 in the first two sections of this chapter. The third and final section aims to answer research question 2.

1.1 Social care - subset 1

1.1.1 Models for councils with link rate greater than 96%

In this section results of logistic regression models applied to the subset of individuals in local authorities where a match rate greater than 96% was achieved when linking the

SCS to the population spine. Nine local authorities are included in the logistic regression models: Falkirk, Angus, East Ayrshire, Inverclyde, South Lanarkshire, Stirling, North Ayrshire, Dumfries & Galloway, and Argyll & Bute.

In total, five models are reported - one for each financial year of data. As in the previous chapter, where results are broadly consistent across years, 2015/16 is used as a reference year to convey results.

The R code for the model fitted to this first subset of data was as follows:

```
glm(scs_flag ~            #Flag for social care as dependent variable
    sex*age_grp +         #Interaction : Sex and Age group
    simd*meds_grp +       #Interaction : SIMD and repeat medicines
    age_grp*meds_grp +    #Interaction : Age group and repeat medicines
    council*simd,         #Interaction : Council and SIMD
  family = binomial(),    #logistic regression
  data = thesis)          #identify which data to use
```

R automtically fits all included variables individually before adding interaction terms.

1.1.2 Descriptive statistics

There were 234,392 individuals included included in the model for 2015/16 (table 1.1) which accounts for 25.4% of the overall cohort in that year. There are similar numbers included in models for other years. Proportions of females/males, age groups, SIMD decile, and repeat medicine groups are broadly similar to the overall cohort as reported in chapter **??**. Also in concordance with results in chapter **??**, table 1.1 shows higher percentages of females received social care as well as patterns indicating increasing social care use through age groups (young to old), SIMD deciles (affluent to deprived), and repeat medicine groups (low to high). Statistically significant results are found for all variables with Chi-squared tests for differences within groups.

There is notable variation in the percentage of individuals receiving social care depending on the local authority of residence ranging from 14.9% in Falkirk to 9.1% in Dumfries & Galloway. These values, unlike other variables in the models, can fluctuate over time as shown in table 1.1. There is no discernable pattern across council areas, some show gradual decreases over time, others gradual increases, whilst others fluctuate in both directions. Generally, all councils saw an increase in the percentage of those receiving care from 2014/15 onwards reflecting the change in data collection to include individuals receiving community alarm or telecare services at any time in the financial year. However, this increase was not sustained in all areas: Falkirk, Angus, and South Lanarkshire showing reductions in 2015/16 compared to the previous year.

Variable	Value	No Social Care	Social Care	Total	p-value
Sex	Male	97151 (91.7)	8834 (8.3)	105985	<0.001
	Female	109096 (85.0)	19311 (15.0)	128407	
Age group	65-69	71604 (97.1)	2129 (2.9)	73733	<0.001
	70-74	53870 (94.6)	3052 (5.4)	56922	
	75-79	40083 (89.2)	4867 (10.8)	44950	
	80-84	24936 (78.2)	6970 (21.8)	31906	
	85-89	11302 (63.2)	6593 (36.8)	17895	
	90-94	3579 (50.4)	3523 (49.6)	7102	
	95 plus	873 (46.3)	1011 (53.7)	1884	
SIMD decile	1 - most deprived	15102 (83.1)	3066 (16.9)	18168	<0.001
	2	20121 (85.0)	3543 (15.0)	23664	
	3	23024 (85.3)	3974 (14.7)	26998	
	4	24301 (87.0)	3621 (13.0)	27922	
	5	24673 (88.5)	3196 (11.5)	27869	
	6	27751 (89.6)	3234 (10.4)	30985	
	7	20881 (89.4)	2470 (10.6)	23351	
	8	20264 (90.2)	2195 (9.8)	22459	
	9	19711 (91.4)	1853 (8.6)	21564	
	10 - most affluent	10419 (91.3)	993 (8.7)	11412	
Repeat medicines group	0-2	59467 (96.9)	1898 (3.1)	61365	<0.001
	3-5	61424 (92.2)	5189 (7.8)	66613	
	6-8	46699 (85.6)	7852 (14.4)	54551	
	9+	38657 (74.5)	13206 (25.5)	51863	
Local Authority	Falkirk	22839 (85.5)	3858 (14.5)	26697	<0.001
	Angus	20814 (88.2)	2793 (11.8)	23607	
	East Ayrshire	19294 (86.1)	3122 (13.9)	22416	
	Inverclyde	12793 (84.9)	2280 (15.1)	15073	
	South Lanarkshire	46724 (88.1)	6304 (11.9)	53028	
	Stirling	13202 (87.7)	1859 (12.3)	15061	
	North Ayrshire	23407 (88.3)	3094 (11.7)	26501	
	Dumfries and Galloway	30568 (90.9)	3073 (9.1)	33641	
	Argyll and Bute	16606 (90.4)	1762 (9.6)	18368	

Total N used in model = 234,392
All values n(%) unless otherwise stated
Row-wise percentages within grouped variables

Table 1.1: Subset 1. Characteristics of those receiving/not receiving social care. 2015/16

	Data collected during census week only			Expanded data collection for telecare and alarm services	
	2011/12	**2012/13**	**2013/14**	**2014/15**	**2015/16**
Falkirk	14.1	15	14.8	15.2	14.5
Angus	15.1	13.8	13.5	13.7	11.8
East Ayrshire	12.9	13.3	13.2	13.8	13.9
Inverclyde	12.1	12.5	12.4	13.1	15.1
South Lanarkshire	11.7	11.4	12.4	13	11.9
Stirling	10.9	11.1	11.8	12.2	12.3
North Ayrshire	10.8	11	11.1	11.4	11.7
Dumfries and Galloway	8.4	8	7.5	8.1	9.1
Argyll and Bute	8.2	8.7	9.2	9.6	9.6

Table 1.2: Subset 1. Percentage of over 65s receiving any form of social care
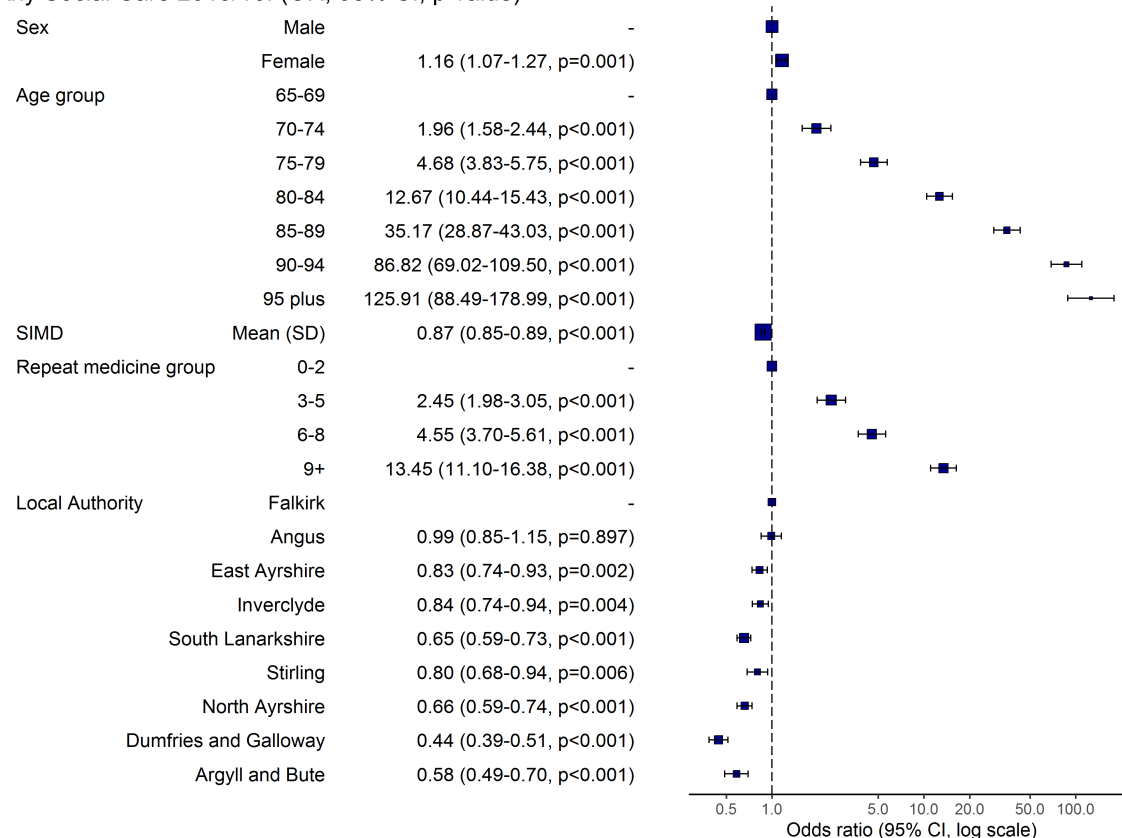
1.1.3   Model results

Figure 1.1: Subset 1 - odds ratios

Odds ratios for age groups and repeat medicine groups in the fitted model (for 2015/16) increase from young-to-old and low-to-high respectively (figure 1.1). Females are shown to be more likely to receive social care than males, whilst the effect of SIMD modelled as a continuous variable is marginally negative which indicates an increase in SIMD decile from deprived to affluent is associated with reduced chance of receiving social care. All local authorities show reduced odds of receiving social care compared to the reference group (Falkirk), but not all differences are statistically significant.

Given the difficulties in interpretation of interaction terms in logisitic regression models (discussed in section **??**), these are not shown in figure 1.1. Tabulation of full model results for 2015/16 are available in table **??** in Appendix D.

In order to aid interpetation of the magnitude of influece each variable has on the receipt of social care, Average Partial Effects (APEs) were calculated. These are discussed fully in section **??**. In short, APEs indicate the marginal effect of each value of a variable on the outcome taking into account all other variables and interactions.

APEs for each variable in each model (year) are plotted in figure 1.2 with values for 2015/16 shown in table 1.3. Age has the largest positive effect of receiving social care with the probability approximately 45% higher for those over 95 compared to those aged 65-69 in all models (specifically 46.6% in 2015/16). Age bands 90-94, 85-89,
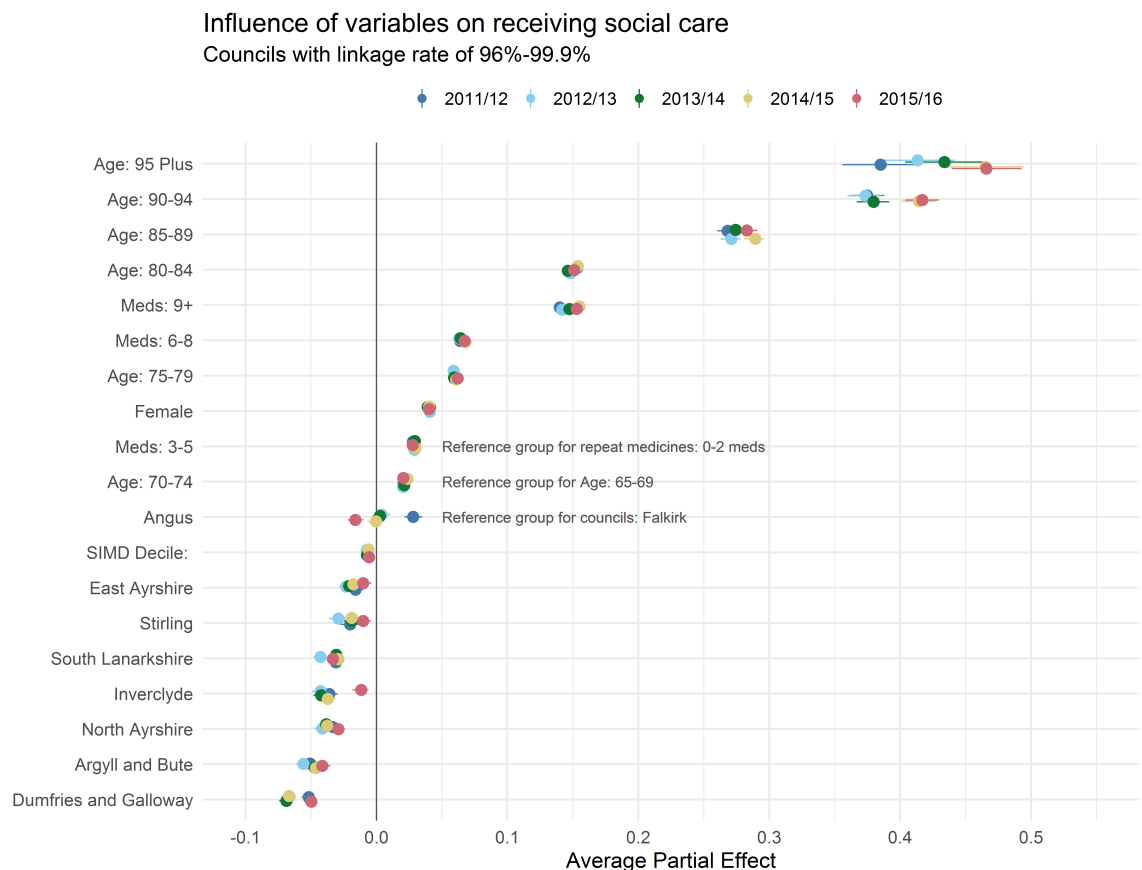
Figure 1.2: Subset 1. Average Partial Effects

and 80-84 also show very strong effects (~40%, ~28%, and ~15% higher probability of receiving social care across all models).

Multimorbidity also has a strong positive effect on receipt of social care, although the magnitude of this effect is lower than that of higher age groups. Those receiving 9 or more repeat medicines have ~15% higher probability of receiving social care compared to those receiving 0-2 repeat medicines in all years (15.3% in 2015/16). This effect is a similar magnitude as the APE of being 80-84 compared to 65-69 years of age. Medicine groups 6-8 and 3-5 have respectively ~7% and ~3% increased probability of receiving social care compared to those receiving 0-2 medicines.

After controlling for other variables in the model females have an increased probability of receiving care of ~4% compared to males for all models (exactly 4% in 2015/16). SIMD decile was modelled as a continuous variable. The APE of -0.006 in 2015/16 (table 1.3) indicates the coefficient of the slope at the average value of SIMD (5.2, SD 2.6). The small value of this slope suggests SIMD decile had little effect on the receipt of social care. This can be seen in the conditional effect of SIMD shown in figure **??** in Appendix D.

With the exception of higher age groups where numbers are small, local authorities display more variation in APEs across models than other variables. This is more easily visualised in figure 1.3 which shows that the difference in APEs across councils is fairly

Variable	Average Partial Effect	Standard Error	p-value	Lower 95% CI	Upper 95% CI
Age: 95 Plus	0.466	0.014	<0.001	0.439	0.493
Age: 90-94	0.417	0.007	<0.001	0.404	0.43
Age: 85-89	0.283	0.004	<0.001	0.276	0.291
Meds: 9+	0.153	0.002	<0.001	0.149	0.157
Age: 80-84	0.151	0.002	<0.001	0.147	0.155
Meds: 6-8	0.067	0.002	<0.001	0.063	0.07
Age: 75-79	0.062	0.002	<0.001	0.059	0.065
Female	0.04	0.001	<0.001	0.038	0.043
Meds: 3-5	0.028	0.002	<0.001	0.025	0.031
Age: 70-74	0.02	0.001	<0.001	0.017	0.022
SIMD Decile:	-0.006	0	<0.001	-0.006	-0.005
East Ayrshire	-0.01	0.003	0.001	-0.015	-0.004
Stirling	-0.01	0.003	0.003	-0.017	-0.004
Inverclyde	-0.012	0.003	<0.001	-0.018	-0.006
Angus	-0.016	0.003	<0.001	-0.022	-0.01
North Ayrshire	-0.029	0.003	<0.001	-0.034	-0.024
South Lanarkshire	-0.033	0.002	<0.001	-0.038	-0.029
Argyll and Bute	-0.041	0.003	<0.001	-0.047	-0.035
Dumfries and Galloway	-0.05	0.002	<0.001	-0.055	-0.045

Reference group for age: 65-69
Reference group for meds: 0-2 repeat medicines
Reference group for local authority: Falkirk

Table 1.3: Subset 1. Average partial effects. 2015/16

stable and shows some narrowing in 2015/16.

Comparing the APEs shown in figure 1.3 to the difference in overall percentage of individuals receiving social care (figure 1.4, adapted from table 1.2) shows that after controlling for age, sex, deprivation status, and multimorbidity status, APEs for some councils are less than would be expected.

For example, Inverclyde and South Lanarkshire councils have a higher percentage of individuals receiving social care compared to Stirling council (with the exception of 2015/16 where Stirling has a marginally higher percentage than South Lanarkshire, table 1.2 and figure 1.4). However, APEs (figure 1.3) suggest the probability of receiving social care in Inverclyde and South Lanarkshire is lower than Stirling in all models. Similarly, despite having higher overall percentages of individuals receiving social care, APEs for East Ayrshire are almost identical to those of Stirling. Conversely, the difference between the APE for Angus council and the reference value in Falkirk council is negligible in 2012/13 to 2014/15 despite there being a higher percentage of individuals in Falkirk receiving care.

Table 1.4 shows the results of diagnostic tests for the models applied to each financial year of data. McFadden's pseudo R^2 statistic ranges from 0.218 for the model applied to 2011/12 to 0.236 for the model applied to 2015/16. As discussed in section **??**, this suggests the the model has an excellent fit to all years of data with improvement in more recent years.
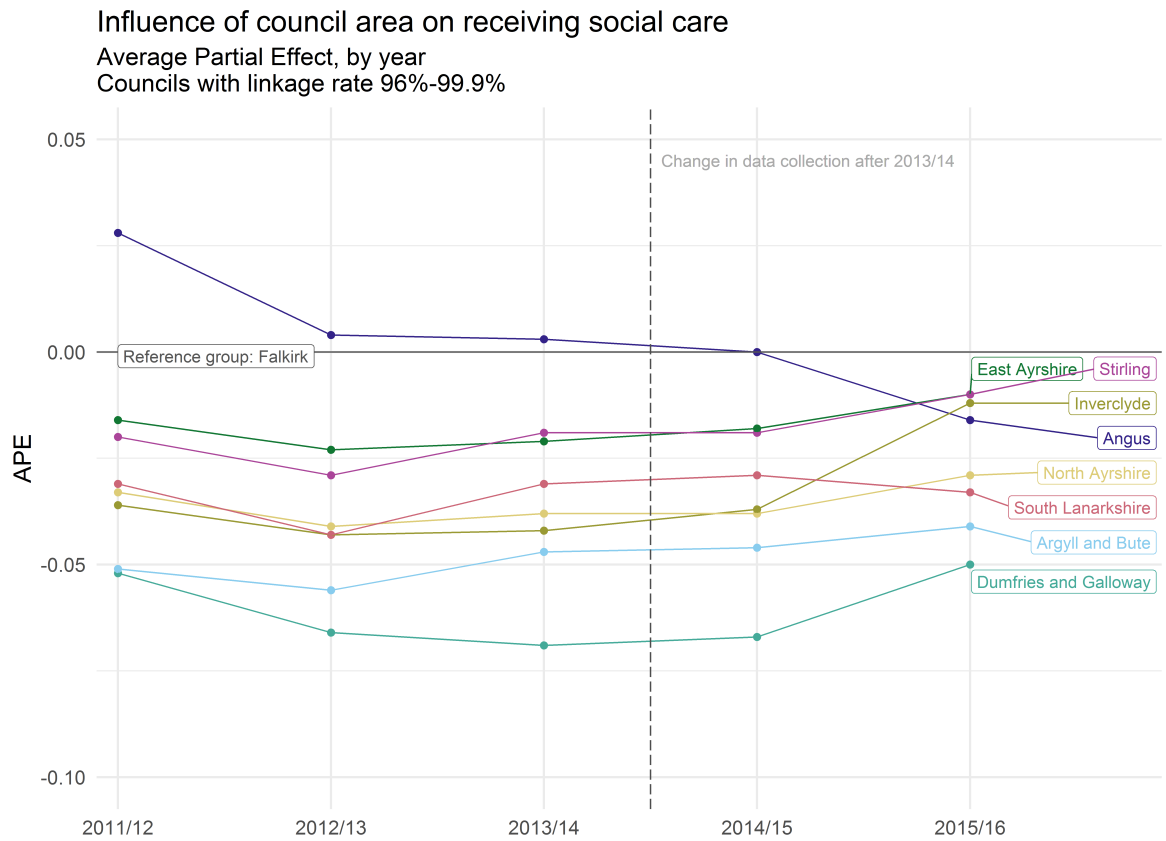
Influence of council area on receiving social care
Average Partial Effect, by year
Councils with linkage rate 96%-99.9%

Figure 1.3: Subset 1. Local authority APE across models

Percentage difference in over 65s receiving social care
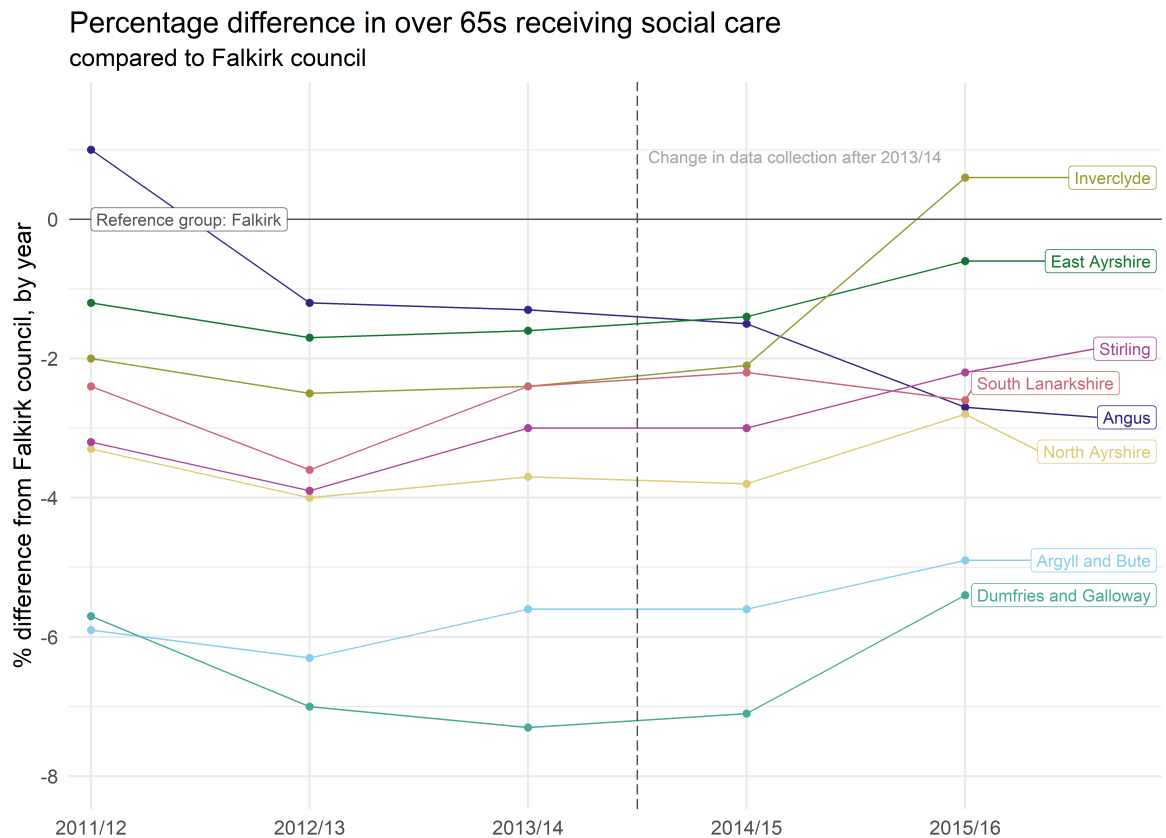compared to Falkirk council

Figure 1.4: Subset 1. % difference in over 65s receiving social care

| Financial Year | McFadden's pseudo R^2 | Fitted model | | | Null model | | | AIC | BIC |
		Deviance	Log Likelihood	Degrees of freedom	Deviance	Log Likelihood	Degrees of freedom		
2011/12	0.218	122092.147	-61046.073	218335	156192.796	-78096.398	218389	122202.147	122768.319
2012/13	0.222	124626.619	-62313.309	223999	160148.076	-80074.038	224053	124736.619	125304.199
2013/14	0.222	128595.553	-64297.777	228726	165344.874	-82672.437	228780	128705.553	129274.282
2014/15	0.233	131849.309	-65924.654	231616	171893.338	-85946.669	231670	131959.309	132528.728
2015/16	0.236	131443.94	-65721.97	234337	172080.12	-86040.06	234391	131553.94	132124.002

Table 1.4: Subset 1. Goodness-of-fit

1.2 Social Care - subset 2

1.2.1 Models for councils with link rate between 92% and 95.9%

In this section results of logistic regression models applied to the subset of individuals in local authorities where a match rate between 92% and 95.9% was achieved when linking the SCS to the population spine. Nine local authorities are included in the models: Shetland Islands, Glasgow City, Na h-Eilenanan Siar, East Renfrewshire, City of Edinburgh, East Dunbartonshire, Fife, Perth & Kinross, and South Ayrshire.

In a similar fashion as the previous section, five models are reported - one for each financial year of data and where results are broadly consistent across years, 2015/16 is used as a reference year to convey results. Results here are restricted to show differences with the models fitted in the previous secion.

The R code for the model fitted to the second subset was identical to that reported in the previous section, the underlying subset of data being the only change.

1.2.2 Descriptive statistics

In this second subset, the nine included councils represented approximately 33% of the overall cohort (e.g. 311,004 individuals in 2015/16, table 1.5). There were smaller percentages of individuals receiving social care in all sociodemographic and multimorbidity groups compared to subset 1 (table 1.1). For example, 7.2% of males and 12.9% of females received social care in subset 2 compared to 8.3% of males and 15% of females in subset 1. Less than 10% of individuals over 65 received social care in four of the nine councils in subset 2 including the second largest council in Scotland - City of Edinburgh. Only two councils in subset 1, Dumfries & Galloway and Argyll & Bute, provided less than 10% of over 65s with social care.

Table 1.6 reveals that Shetland Islands council provided a much higher percentage of over 65 with social care than other councils in most years although this rate reduced over time. Other council areas show fluctuating percentages of their populations receiving social care. The change in data collection from 2014/15 onwards resulted in some

Variable	Value	No Social Care	Social Care	Total	p-value
Sex	Male	127450 (92.8)	9839 (7.2)	137289	<0.001
	Female	151392 (87.1)	22323 (12.9)	173715	
Age group	65-69	92859 (97.3)	2605 (2.7)	95464	<0.001
	70-74	68999 (95.3)	3428 (4.7)	72427	
	75-79	54048 (91.5)	5038 (8.5)	59086	
	80-84	36738 (83.0)	7540 (17.0)	44278	
	85-89	18252 (70.4)	7687 (29.6)	25939	
	90-94	6408 (58.7)	4505 (41.3)	10913	
	95 plus	1538 (53.1)	1359 (46.9)	2897	
SIMD decile	1	31012 (86.8)	4727 (13.2)	35739	<0.001
	2	25243 (87.6)	3573 (12.4)	28816	
	3	21948 (86.5)	3416 (13.5)	25364	
	4	23057 (87.7)	3223 (12.3)	26280	
	5	25118 (88.7)	3208 (11.3)	28326	
	6	21785 (89.4)	2572 (10.6)	24357	
	7	23311 (90.9)	2338 (9.1)	25649	
	8	26783 (91.3)	2548 (8.7)	29331	
	9	34987 (92.1)	3015 (7.9)	38002	
	10	45598 (92.8)	3542 (7.2)	49140	
Repeat medicines group	0-2	82052 (97.3)	2259 (2.7)	84311	<0.001
	03-May	81945 (93.1)	6084 (6.9)	88029	
	06-Aug	61694 (87.2)	9094 (12.8)	70788	
	9+	53151 (78.3)	14725 (21.7)	67876	
Local Authority	Shetland Islands	3393 (86.1)	548 (13.9)	3941	<0.001
	Glasgow City	67579 (88.4)	8853 (11.6)	76432	
	Na h-Eileanan Siar	4716 (85.4)	809 (14.6)	5525	
	East Renfrewshire	14084 (87.5)	2005 (12.5)	16089	
	City of Edinburgh	62236 (91.0)	6177 (9.0)	68413	
	East Dunbartonshire	18664 (92.0)	1626 (8.0)	20290	
	Fife	59594 (89.0)	7358 (11.0)	66952	
	Perth and Kinross	26295 (90.1)	2893 (9.9)	29188	
	South Ayrshire	22281 (92.2)	1893 (7.8)	24174	

Total N used in model = 311,004
All values n(%) unless otherwise stated
Row-wise percentages within grouped variables

Table 1.5: Subset 1. Characteristics of those receiving/not receiving social care. 2015/16

councils showing a higher rate receiving care, whilst there was a drop in the percetnage receiving care in other areas.

	Data collected during census week only			Expanded data collection for telecare and alarm services	
	2011/12	**2012/13**	**2013/14**	**2014/15**	**2015/16**
Shetland Islands	17.8	16.8	15.9	14.8	13.9
Glasgow City	14.2	14.7	11.9	11.3	11.6
Na h-Eileanan Siar	11.6	10.7	11.6	11.2	14.6
East Renfrewshire	10.2	8.7	11.2	10.4	12.5
City of Edinburgh	9.5	9.1	9.7	10.5	9
East Dunbartonshire	9.6	9.9	9.7	10.3	8
Fife	9	9.3	9.1	10.5	11
Perth and Kinross	8.1	8.4	7.6	9.3	9.9
South Ayrshire	8.1	8.4	8.5	7.8	7.8

Table 1.6: Subset 2. Percentage of over 65s receiving any form of social care

1.2.3 Model results

Odds ratios for indiviudal values show similar patterns, but lower values, to those found in subset 1. A full table of model results for subset 2 (2015/16) can be found in figure **??** and table **??** in Appendix D.

Broadly similar values for APEs are found for sociodemographic and multimorbidity group variables in subset 2 as were found in subset 1 (figure 1.5). The only slight exceptions were for the oldest two age groups and the highest multimorbidity group where APEs were slightly less and 85-89 age group where the APE was slightly higher compared to subset 1.

More variation is seen across years for council areas than was evident with subset 1 and noticeably larger confidence intervals can be seen in figure 1.5. Once again, comparison of overall percentages of individuals receiving social care (table 1.6 and figure 1.7) with APE values over time (figure 1.5) suggests some council areas have lower APEs than may be expected.

The table and figures reveal that from 2011/12 to 2014/15 Glasgow City council has a higher percentage of individuals receiving social care than Na h-Eileanan Siar, East Renfrewshire, Fife, Perth & Kinross, and City of Edinburgh councils. However, the APEs in figure 1.6 show that after adjusting for all other variables in the model, there is a decreased probability of receiving social care in the Glasgow City area compared to these other councils. This pattern in repeated in 2015/16 with the exception that higher percentages of individuals receive care in Na h-Eileanan Siar and East Renfrewshire in this year. Table 1.7 shows the results of diagnostic tests for the models applied to each financial year of data. McFadden's pseudo R^2 statistic ranges from 0.196 for the model applied to 2011/12 to 0.209 for the model applied to 2015/16. The models

Influence of variables on receiving social care
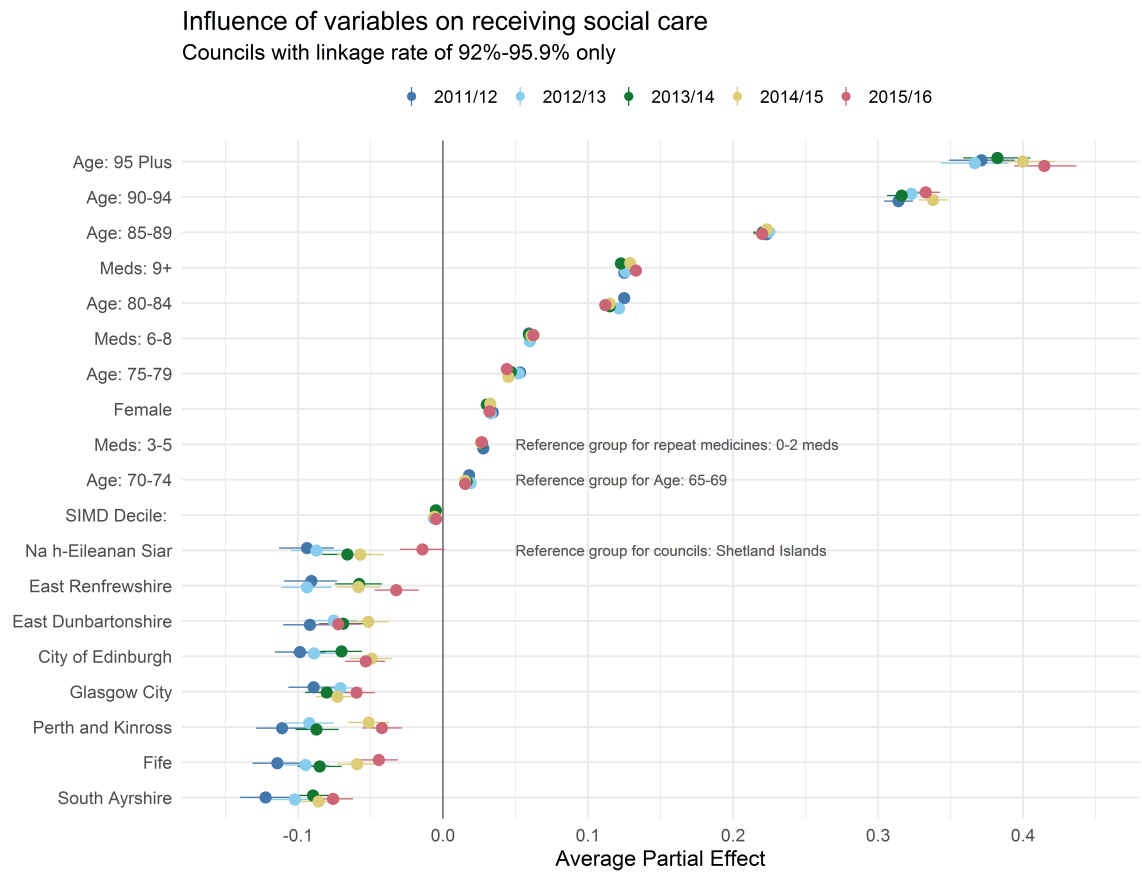Councils with linkage rate of 92%-95.9% only

Figure 1.5: Subset 2. Average partial effect plot

applied to the most recent two years of data have an excellent fit, whereas the previous three models are only marginally below the threshold of 0.2 generally regarded as representing an excellent fit.
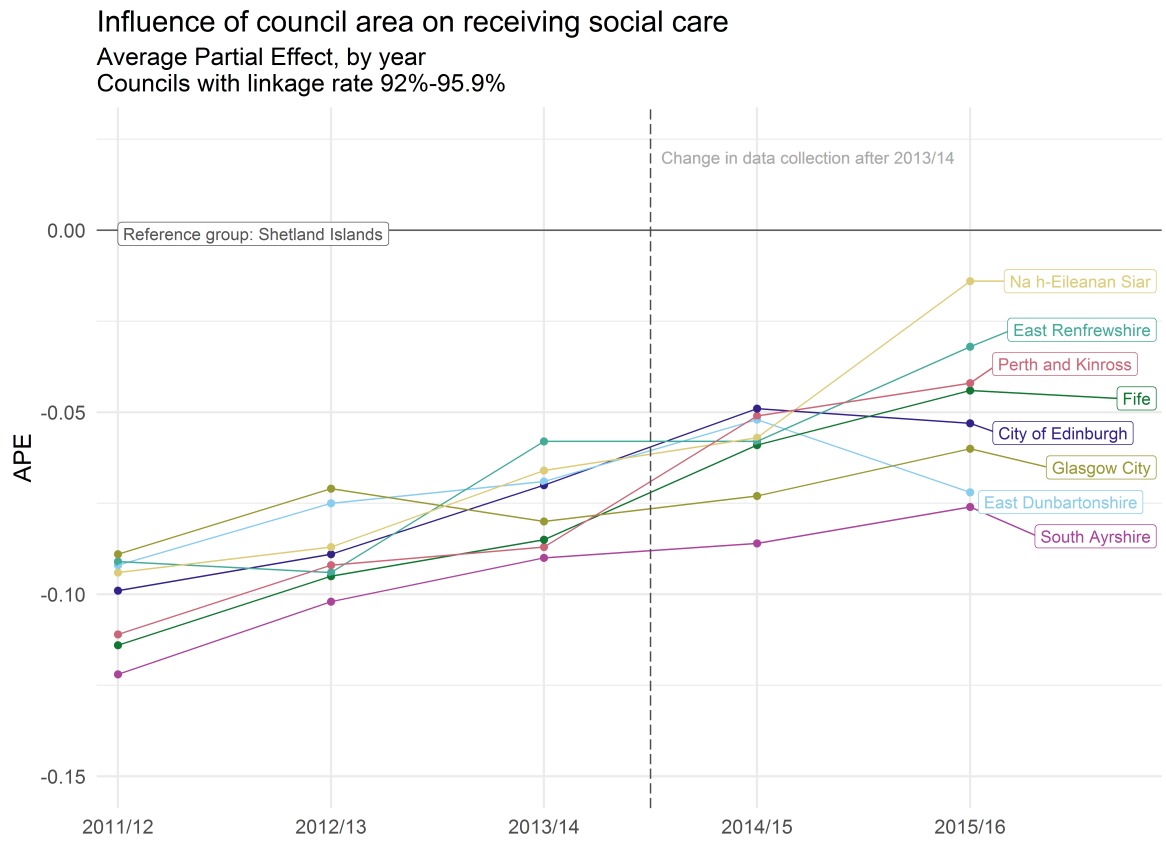
Influence of council area on receiving social care
Average Partial Effect, by year
Councils with linkage rate 92%-95.9%

Figure 1.6: Subset 2. Local authority APE across models

Percentage difference in over 65s receiving social care
compared to Shetland Islands council
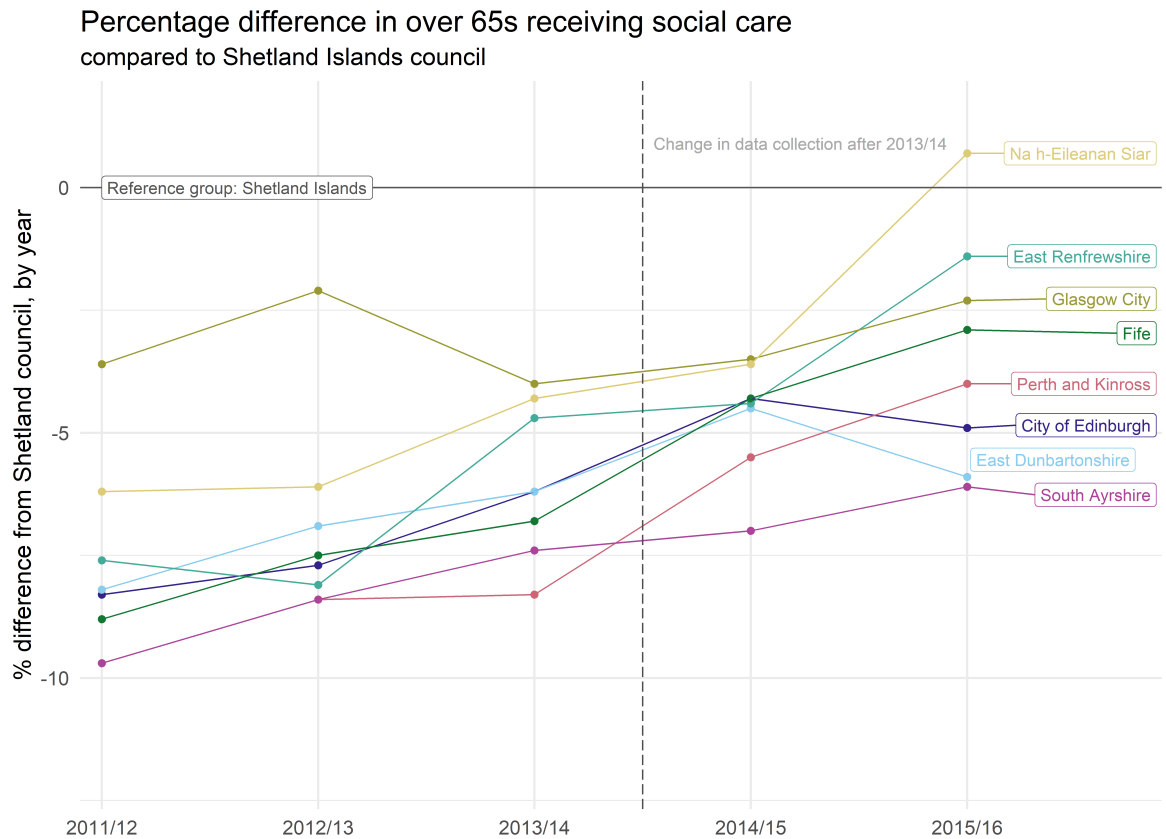
Figure 1.7: Subset 1. % difference in over 65s receiving social care

		Fitted model			Null model				
Financial Year	McFadden's pseudo R^2	Deviance	Log Likelihood	Degrees of freedom	Deviance	Log Likelihood	Degrees of freedom	AIC	BIC
2011/12	0.196	159534.227	-79767.114	293867	198430.468	-99215.234	293921	159644.227	160226.736
2012/13	0.198	162331.401	-81165.7	299514	202476.6	-101238.3	299568	162441.401	163024.956
2013/14	0.199	159148.11	-79574.055	305011	198718.545	-99359.2725	305065	159258.11	159842.666
2014/15	0.204	164081.461	-82040.731	308392	206217.188	-103108.594	308446	164191.461	164776.623
2015/16	0.209	163509.29	-81754.645	310949	206829.494	-103414.747	311003	163619.29	164204.906

Table 1.7: Subset 2. Goodness-of-fit

1.3 Unplanned hospital admission

In this section the dependent variable for modelling is any unplanned hospital admission in the six months following the end of each financial year. This time period was chosen to allow inclusion of social care (measured by presence in the SCS collected at the end of each financial year) as an independent variable in the model.

As in previous sections in this chapter, logistic regression models are applied to each financial year of data, five models in total, and 2015/16 is used as a reference year where results are consistent across models. Exploratory models revealed Local Authority and Health Board area of residence had little impact on outcomes so they were omitted from the final models. This meant data was not subset as in previous sections and models were fitted to the whole cohort in each year.

The R code for the model fitted to the data was as follows.

```
glm(adm_six ~              #Flag for unplanned hospital admission
      sex*age_grp +        #Interaction : Sex and Age group
      simd*meds_grp +      #Interaction : SIMD and repeat medicines
      age_grp*meds_grp +   #Interaction : Age group and repeat medicines
      scs_flag*age_grp +   #Interaction : Social care receipt and Age group
      usc_flag +           #Any USC use in previous financial year
      care_home,           #Flag indicating residence in a care home
    family = binomial(),   #logistic regression
    data = thesis_usc)     #identify which data to use
```

1.3.1 Descriptive statistics

In 2015/16, 886,331 individuals were included in the model representing 95.9% of the cohort in that year (table 1.8) with only those that died during the financial year being omitted from models. As such the sociodemographic make up is representative of the overall cohort. Chi-squared testing reveals no statistically significant difference between the numbers of females and males with an unplanned admission. There are however, statistically significant diffrences in all other groups with older, more deprived, and individuals with higher multimorbidity being more likely to have an admission. Those

Variable	Value	No unplanned admission	At least one unplanned admission	Total	p-value
Sex	Male	362216 (90.9)	36145 (9.1)	398361	0.221
	Female	444060 (91.0)	43910 (9.0)	487970	
Age group	65-69	264091 (94.8)	14522 (5.2)	278613	<0.001
	70-74	196494 (93.2)	14418 (6.8)	210912	
	75-79	152457 (90.4)	16208 (9.6)	168665	
	80-84	106369 (86.9)	15983 (13.1)	122352	
	85-89	58183 (83.1)	11831 (16.9)	70014	
	90-94	22701 (80.2)	5610 (19.8)	28311	
	95 plus	5981 (80.1)	1483 (19.9)	7464	
SIMD decile	1 - most deprived	63364 (86.9)	9527 (13.1)	72891	<0.001
	2	71876 (88.6)	9247 (11.4)	81123	
	3	80768 (89.4)	9602 (10.6)	90370	
	4	83216 (90.3)	8947 (9.7)	92163	
	5	85840 (91.0)	8456 (9.0)	94296	
	6	87908 (91.6)	8027 (8.4)	95935	
	7	84892 (92.2)	7215 (7.8)	92107	
	8	82592 (92.6)	6602 (7.4)	89194	
	9	83433 (92.8)	6519 (7.2)	89952	
	10 - most affluent	82387 (93.3)	5913 (6.7)	88300	
Repeat medicines group	0-2	233426 (96.4)	8617 (3.6)	242043	<0.001
	3-5	236155 (93.7)	15852 (6.3)	252007	
	6-8	181810 (89.8)	20653 (10.2)	202463	
	9+	154885 (81.6)	34933 (18.4)	189818	
Any form of social care	No Social Care	729724 (92.8)	56233 (7.2)	785957	<0.001
	Social Care	76552 (76.3)	23822 (23.7)	100374	
Any USC episode in previous year	No USC	601891 (94.5)	34814 (5.5)	636705	<0.001
	USC	204385 (81.9)	45241 (18.1)	249626	
Residence	Not Care Home	777019 (91.2)	75348 (8.8)	852367	<0.001
	Care Home	23535 (83.7)	4592 (16.3)	28127	

Total N used in model = 886,331
All values n(%) unless otherwise stated
Row-wise percentages within grouped variables

Table 1.8: Characteristics of those with/without any unplanned hospital admission in the six months following end of 2015/16

in receipt of social care, with an episode of USC in the previous year, and those resident in a care home were also more likely to have an unplanned hospital admission.

1.3.2 Model results

Figure **??** and table **??** in Appendix D show odds ratios for individual variables in model fitted to data for 2015/16.

The APEs for models with unplanned admission to hospital as dependent variable are much lower in magnitude for all variables (figure 1.8 and table 1.9) compared with models fitted in sections 1.1.3 and 1.2.3 where social care was the dependent variable.

High multimorbididty, measured by prescription of 9 or more repeat medicines, has the largest magnitude of APE in the unplanned hospital admission model in all years (an 8.3% increased probability of having an unplanned admission compared to those with 0-2 repeat medicines in 2015/16, table 1.9). Other multimorbidity groups also show increases in probability of admission compared to the reference value with a linear increase from low-to-high multimorbidity.

In terms of other service use, having any USC episode in the previous financial year is associated with a ~7.5% increase in probability compared to those with no previous
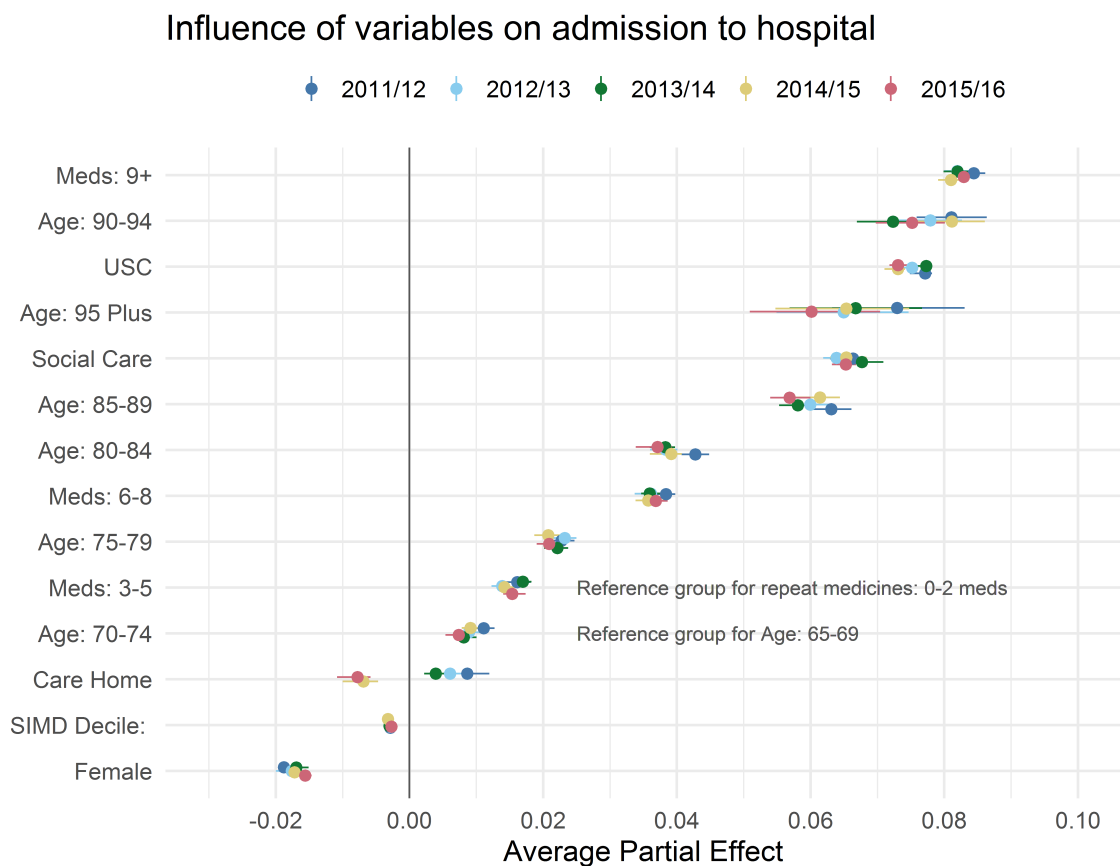
Figure 1.8: Unplanned hospital admissions. Average Partial Effects

USC use. Similarly, receipt of social care measured in the SCS is associated with a ~6.5% increase in the probability of having an unplanned hospital admission compared to those with no social care. There is a split in the direction of the effect of living in a care home after 2013/14. After this year being in a care home is associated with a decrease in the probability of unplanned admission of almost 1% whilst in previous years the probability had increased by almost 1%.

Higher age groups are also associated with higher APEs compared to other variables in the models though there are wider confidence intervals than seen with social care models. Furthermore, the magnitude of the effect of increasing age is much lower than the effect on receipt of social care. For example, in 2015/16 being 90-94 is associated with a 7.5% increase probability of having an unplanned hospital admission compared to being 65-69. The corresponding value for receiving social care in that age group is a 41.7% increased probability (subset 1, section 1.1.3). Otherwise, linear increases in APEs are seen through age groups.

Despite no statistically significant difference in the number of males and females with an unplanned admission in descriptive table 1.8, modelling reveals that females are almost 2% less likely to have an admission after adjusting for other variables (1.6% in 2015/16).

SIMD decile, again fitted as a continous variable, has a very small effect on hospital

Variable	Average Partial Effect	Standard Error	p-value	Lower 95% CI	Upper 95% CI
Meds: 9+	0.083	0.001	<0.001	0.081	0.085
Age: 90-94	0.075	0.003	<0.001	0.07	0.08
USC	0.073	0.001	<0.001	0.072	0.075
Social Care	0.065	0.001	<0.001	0.063	0.067
Age: 95 Plus	0.06	0.005	<0.001	0.051	0.07
Age: 85-89	0.057	0.001	<0.001	0.054	0.06
Age: 80-84	0.037	0.001	<0.001	0.034	0.039
Meds: 6-8	0.037	0.001	<0.001	0.035	0.039
Age: 75-79	0.021	0.001	<0.001	0.019	0.023
Meds: 3-5	0.015	0.001	<0.001	0.014	0.017
Age: 70-74	0.007	0.001	<0.001	0.005	0.009
SIMD Decile:	-0.003	0	<0.001	-0.003	-0.003
Care Home	-0.008	0.001	<0.001	-0.011	-0.006
Female	-0.016	0.001	<0.001	-0.017	-0.015

Reference group for age: 65-69
Reference group for meds: 0-2 repeat medicines

Table 1.9: Unplanned hospital admission. Average Partial Effects. 2015/16

admission after accounting for other variables. The coefficient of the slope at the average value of SIMD (5.6, SD 2.8) is -0.003 (table 1.9) indicating a very flat line which can be viewed in figure **??** in Appendix D

Financial Year	McFadden's pseudo R^2	Fitted model			Null model			AIC	BIC
		Deviance	Log Likelihood	Degrees of freedom	Deviance	Log Likelihood	Degrees of freedome		
2011/12	0.113	447862.4	-223931.2	821187.0	504865.0	-252432.5	821234.0	447958.4	448516.1
2012/13	0.112	454527.8	-227263.9	841129.0	512028.3	-256014.2	841176.0	454623.8	455182.7
2013/14	0.114	466492.6	-233246.3	858910.0	526463.8	-263231.9	858957.0	466588.6	467148.4
2014/15	0.111	471115.4	-235557.7	870332.0	530199.5	-265099.8	870379.0	471211.4	471771.8
2015/16	0.113	475554.4	-237777.2	880446.0	535977.2	-267988.6	880493.0	475650.4	476211.4

Table 1.10: Unplanned hospital admission. Goodness-of-fit

Table 1.10 shows the results of diagnostic tests for each model. The value of McFadden's R^2 is fairly stable over time varying from 0.111 to 0.114. These values are well below those seen for social care models and represent a poorer fit to the data in comparison.