All Wales Medicines Strategy Group

Grŵp Strategaeth Meddyginiaethau Cymru Gyfan

GP Cluster Level Comparators

CONTENTS

1.0 INTRODUCTION

This report outlines a proposed method for the development of cluster group comparators, based on socio-economic similarity and disease prevalence, to enable benchmarking of prescribing. The respiratory therapeutic area is used here to illustrate the method, due to the impact of respiratory illness on the population, the high cost of prescribing respiratory items, recent changes in the evidence base and the potential for prescribing review.

Historically, patients or prescribing units (which account for patient population size, age and sex) have been used to present prescribing data. The overall aim of this work is to enable health boards and localities to benchmark their prescribing, taking into account additional variables such as disease prevalence and deprivation to add context to the data. There are limitations to the interpretation of prescribing data for therapeutic areas, as the model is not intended to explain variations in prescribing, and it should be recognised that a variety of other factors, both national and local, can influence prescribing behaviour. Particularly when interpreting respiratory data, it is important to account for outcomes such as admission and exacerbation rates.

The report highlights:
- The methodology of producing comparators for each GP cluster in Wales based on disease prevalence and socio-economic data, for the purposes of benchmarking prescribing with demographically similar areas;
- Respiratory prescribing data for GP cluster groups in Wales presented in eight groups of the most similar clusters based on respiratory disease prevalence and deprivation. This is presented as an example, and will enable GP cluster groups and health boards to compare their prescribing rates with areas of a similar demographic profile, and may highlight where variations in prescribing are due to prescribing practice and not due to variations in disease prevalence and other demographic factors.

The next stages in this project will include:
- A detailed respiratory prescribing report incorporating the GP cluster level comparators. The report will include prescribing data at national, health board and GP cluster level, presented in a way that allows GP clusters to benchmark against their most similar comparators in terms of disease prevalence and deprivation;
- Production of sets of homogenous GP cluster comparators for other therapeutic areas, such as cardiovascular disease and diabetes;
- As the ultimate aim of the work, production of GP cluster comparators for various therapeutic areas for the purpose of benchmarking on a platform such as a dashboard. It is intended that the dashboard will enable prescribing leads to use an interactive tool to look at their prescribing data, with an option to benchmark within a group of similar GP clusters based on disease prevalence and/or other socio-economic factors.

GP clusters are groups of 4–13 practices in a geographical area with patient numbers ranging from 20,000 to 100,000. The Public Health Wales Observatory produced a set of profiles in 2013 to support the development of GP clusters. GP clusters do not have specific geographical confines; however, the GP clusters work in partnership with other health and social care agencies who are confined to administrative or geographical boundaries such as health boards and local authorities[1].

2.0 OPTIMISING COMPARATORS

To make realistic comparisons of primary care prescribing between Wales and England, between the health boards and between the 64 established GP clusters in Wales, consideration of all confounding factors is essential. It would be useful for Wales as a whole, and for health boards and cluster groups within Wales, to have comparators, which are similar in terms of disease prevalence and socio-economic variables, in order to appropriately benchmark prescribing data and influence prescribing behaviour accordingly.

The intention is to utilise this method of presenting prescribing data for a range of therapeutic areas, such as cardiovascular, endocrine and mental health, if it is considered useful. The method could also potentially be applied to Clinical Commissioning Groups (CCGs) in England in order to make comparisons between Welsh health boards and English CCGs.

In this paper, overall respiratory prescribing for GP clusters is analysed and therefore relevant variables for comparators are respiratory disease prevalence and deprivation.

Other considerations
It may be appropriate to view comparators in the context of other differences in practice, especially when making comparisons with areas in England or other nations. These could include local initiatives, dispensing GP practices, procurement costs, prescription charge exemptions and differences between local guidelines and formularies.

2.1 Disease prevalence
Disease prevalence varies across the health boards in Wales, and data on prevalence are available at GP cluster level from the GP Cluster Profiles 2013[1]. The source of the data is Audit+ – a non-mandatory analysis tool for GP practices used by more than 95% of GP practices in Wales to submit data weekly. Audit+ provides a count of patients with the identified chronic condition by 10-year age groups and sex. Another possible source of disease prevalence data would be the Quality and Outcomes Framework (QOF), as chronic conditions are defined in the same way in both. QOF data is used primarily to monitor GP practice performance against a contract; secondary use of QOF data must be interpreted with caution[1].

2.2 Deprivation
The link between poor health and deprivation is well recognised and people in the most deprived areas have higher levels of mental illness, hearing and sight problems, and in particular chronic conditions such as respiratory disease, cardiovascular disease and arthritis[2]. In Wales, the majority of deprived areas are found in areas of Cardiff, Swansea and Newport, the Welsh valleys and areas of the North Wales coast[3].

While disease prevalence gives a straightforward measure of the proportion of the population with a condition, deprivation can have a more complex effect on prescribing levels through factors such as behavioural determinants, access to services and education[4].

2.2.1 Index of Multiple Deprivation
Deprivation is multi-dimensional and takes into account many factors, which include income, housing, employment, general health, education, access to services, community safety and physical environment. The four countries of the UK each have their own index of multiple deprivation (IMD), each with slightly different ways of weighting certain factors. However, around half of the weight of each IMD comes from employment and income; factors which are common to all four countries and are major drivers of deprivation. Therefore, it may be appropriate to use the countries' IMDs for purposes of comparison if the differences in weightings are adjusted for[5].

3.0 METHOD

3.1 Variable selection
For the GP cluster respiratory analysis, asthma and chronic obstructive pulmonary disease (COPD) prevalence and deprivation data were taken from Cluster Profiles 2013 developed by the Public Health Observatory Wales[1].

3.2 Determining similarity of GP clusters
In order to assign GP clusters into comparator groups, a method was needed to determine the similarity of GP clusters based on respiratory disease prevalence and deprivation.

GP clusters were assigned into groups using Ward's statistical method of hierarchical classification. Ward's method uses Squared Euclidean Distance (SED) as a similarity measure; two GP clusters are said to be similar if the SED, based on standardised[*] respiratory disease prevalence and deprivation data, is small.

3.3 Grouping GP clusters
There are two proposed methods of grouping the GP clusters; respiratory prescribing for methods i) and ii) is shown in Appendix 1 and 2 respectively.

i) Grouping GP clusters into *n* exclusive groups
This method groups all 64 GP clusters into *n* groups based on SED (in Appendix 1, *n* = 8). The groups may be different sizes as this method allocates GP clusters to maximise within-group similarity and for this reason it may not be statistically appropriate to force the number of groups to contain a set number of GP clusters, i.e. it may not be appropriate to force GP clusters into eight groups of eight, as overall within-group similarity may be lower than for unequal group sizes.

This method may be useful for the purposes of presenting national respiratory data at cluster level and comparing prescribing among demographically similar clusters.

ii) Grouping each GP cluster with its *n* most similar GP clusters
This method groups each of the 64 GP clusters with their *n* most similar GP clusters based on SED (in Appendix 2, *n* = 8). This way each cluster has a group of *n* GP clusters with which to benchmark prescribing.

This method would be less suitable for national reporting of data at cluster level due to the large numbers of groups and may be more suited to use by individual GP clusters or health boards as a tool for comparison when analysing prescribing.

To illustrate degree of similarity between GP clusters, the following categories are defined:
- **Extremely similar** if they have an SED of less than 1% of the range.
- **Very similar** if they have an SED of less than 2.5% of the range.
- **Similar** if they have an SED of less than 5% of the range.
- **Somewhat similar** if they have an SED of less than 10% of the range.
- **Not similar** if they have an SED of more than 10% of the range.

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[*] Respiratory disease prevalence and deprivation data were 'z-score' standardised prior to calculating SED due to the variables being measured on different scales.

REFERENCES

1   NHS Wales. GP Cluster Profiles 2013. 2013. Available at:
    http://www.wales.nhs.uk/sitesplus/922/page/67714. Accessed May 2014.
2   Public Health England. Health Profile 2010 - North East. 2014. Available at:
    http://www.apho.org.uk/resource/item.aspx?RID=95362. Accessed May 2014.
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    Demography Profile. 2014. Available at:
    http://www.wales.nhs.uk/sitesplus/922/page/49931. Accessed May 2014.
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    Available at:
    http://www2.nphs.wales.nhs.uk:8080/HIATDocs.nsf/public/2EAEBE01733430F88
    02576EA004BC063/$file/Deprivationreport10Dec04.pdf. Accessed Aug 2014.
5   Office for National Statistics. UK indices of multiple deprivation - a way to make
    comparisons across constituent countries easier. 2012. Available at:
    http://www.ons.gov.uk/ons/rel/hsq/health-statistics-quarterly/no--53--spring-
    2012/uk-indices-of-multiple-deprivation.html. Accessed Mar 2014.

APPENDIX 1: ANALYSIS OF GP CLUSTER LEVEL DATA FOR RESPIRATORY PRESCRIBING

Appendix 1 shows the Welsh GP clusters assigned to eight groups based on their statistical similarity according to figures from the Welsh Index of Multiple Deprivation and asthma and COPD prevalence. Prescribing data can be presented nationally at cluster level, factoring in disease prevalence and deprivation variables to allow a GP cluster to benchmark within these groups. Other prescribing measures such as quantities or daily defined doses could be explored as a way of presenting the data in the most appropriate way and this may change depending on the specific area or products being analysed. The model can also be manipulated to look specifically at an area of prevalence e.g. COPD when looking at respiratory products used primarily in COPD treatment, although limitations of the prescribing data mean that specific products cannot be linked to an indication or diagnosis.

Below is a proposed way of presenting respiratory prescribing data for GP cluster analysis in Wales. Each figure presents respiratory prescribing data for a group of clusters, allocated using the classification methodology described in Section 3.3 (i). Group assignment is represented visually in the dendrogram in Appendix 3.

The graphs show prescribing of all respiratory product items per 1,000 prescribing units (PUs) for each group of demographically similar GP clusters for the period April 2013–March 2014.

From the figures below it can be clearly seen that there is variation in prescribing within cluster groups, which is due to reasons other than disease prevalence and/or deprivation, and only local knowledge can help to interpret this. Presentation of prescribing data in this format should help to direct review of prescribing in specific areas.

Primary care cluster prescribing data: All respiratory products (1 April 2013–31 March 2014)

Figure 1. Group 1: Respiratory items per 1,000 PUs

Figure 2. Group 2: Respiratory items per 1,000 PUs

Figure 3. Group 3: Respiratory items per 1,000 PUs
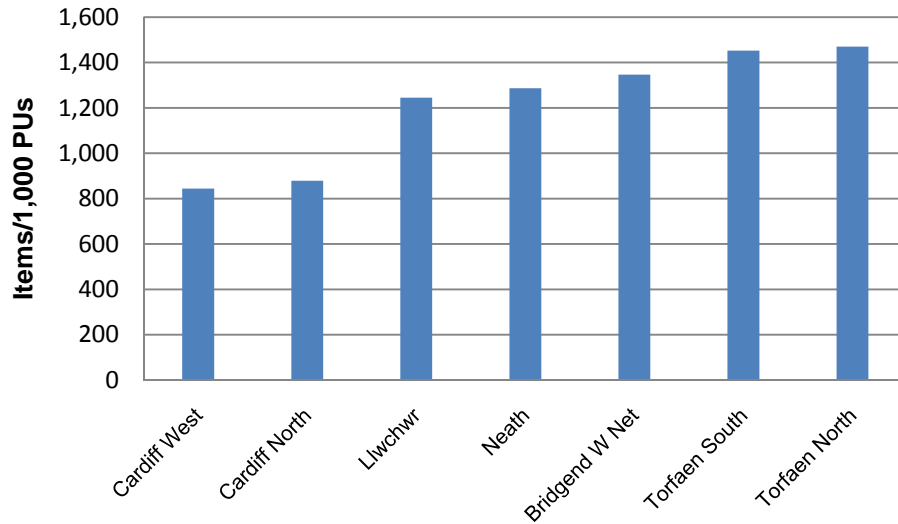
Figure 4. Group 4: Respiratory items per 1,000 PUs
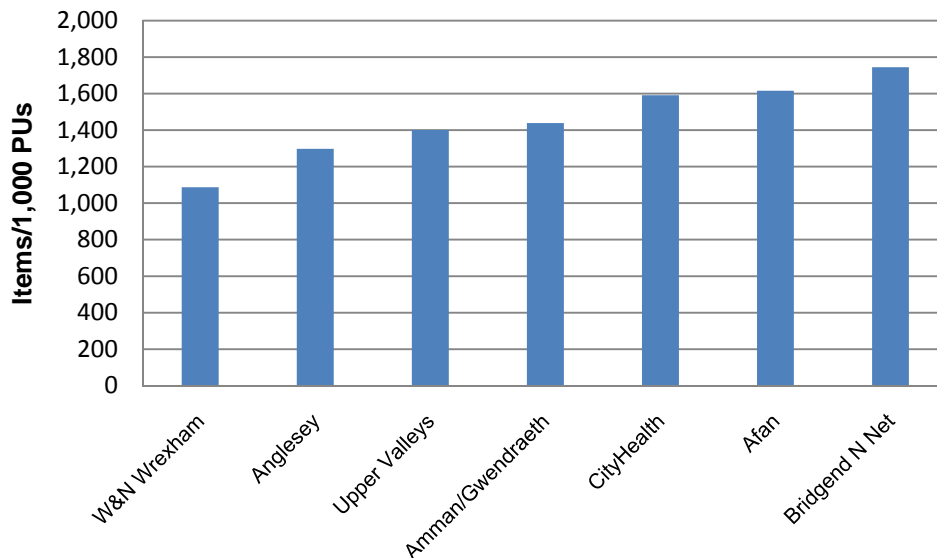
Figure 5. Group 5: Respiratory items per 1,000 PUs
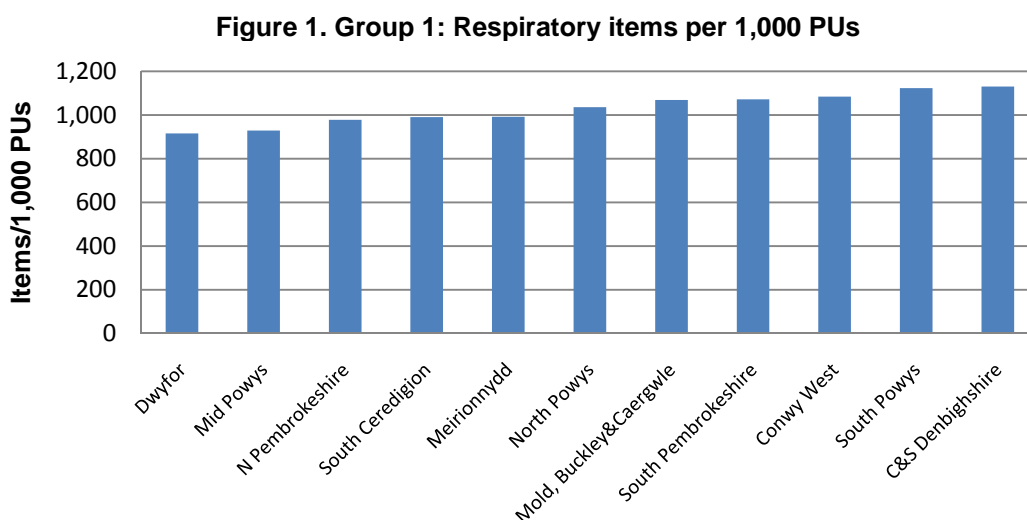

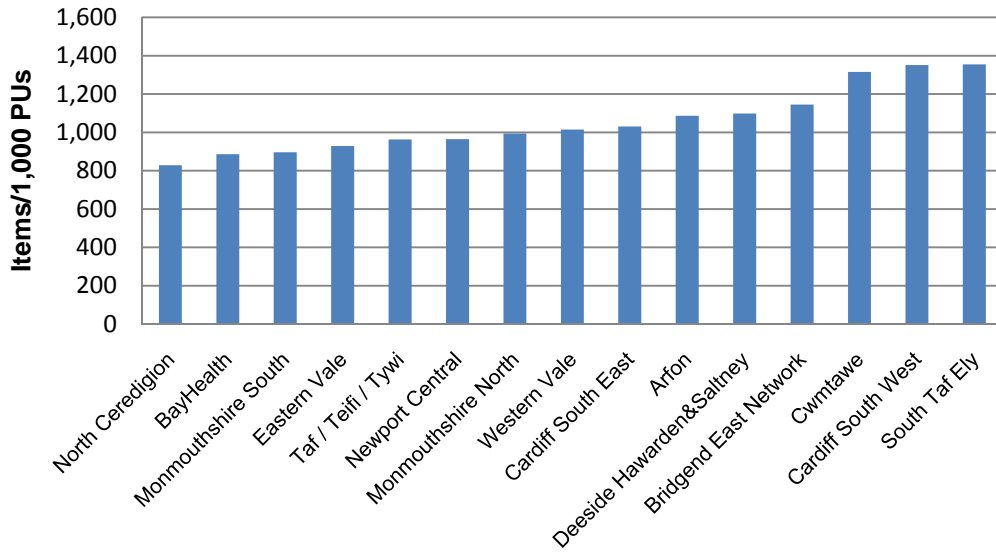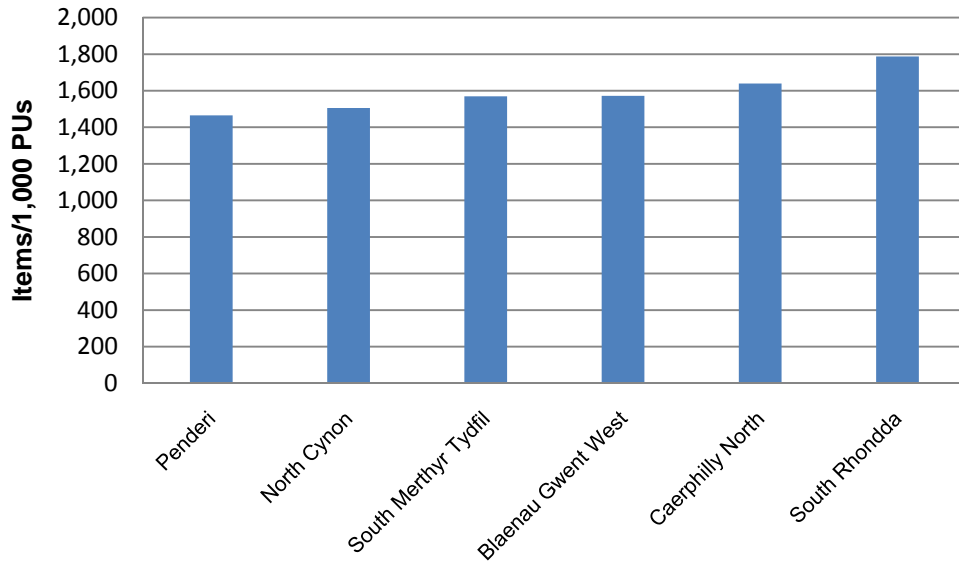**Figure 6. Group 6: Respiratory items per 1,000 PUs**
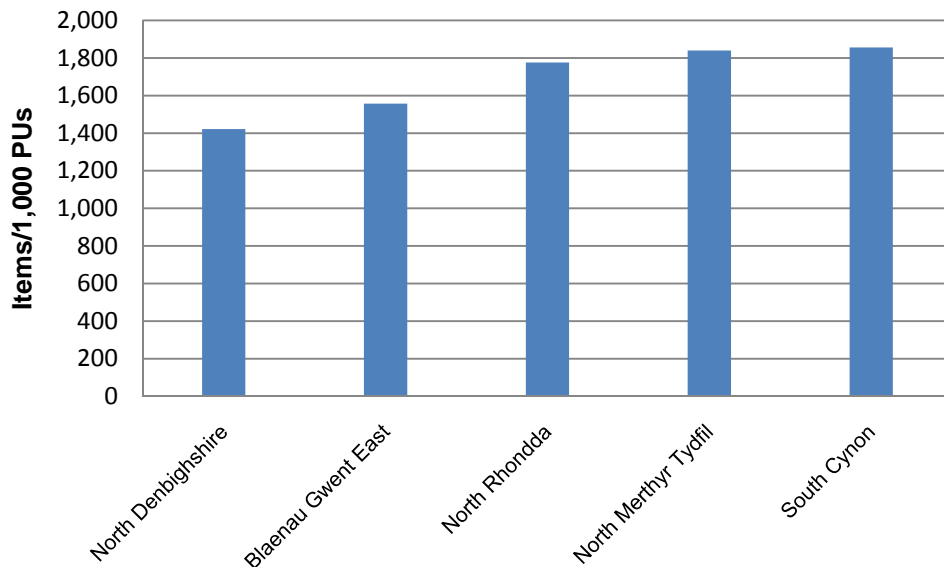
Figure 7. Group 7: Respiratory items per 1,000 PUs
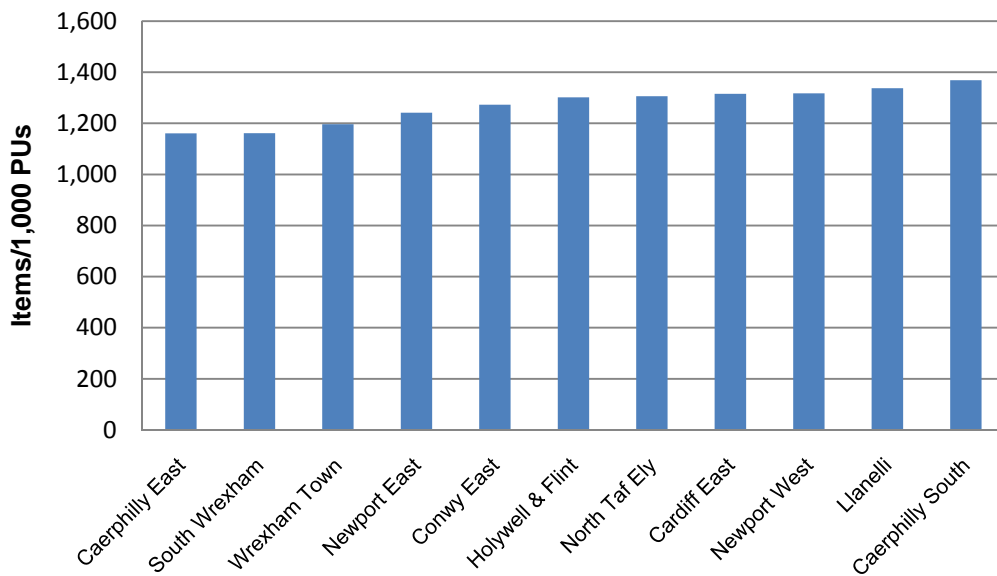
Figure 8. Group 8: Respiratory items per 1,000 PUs
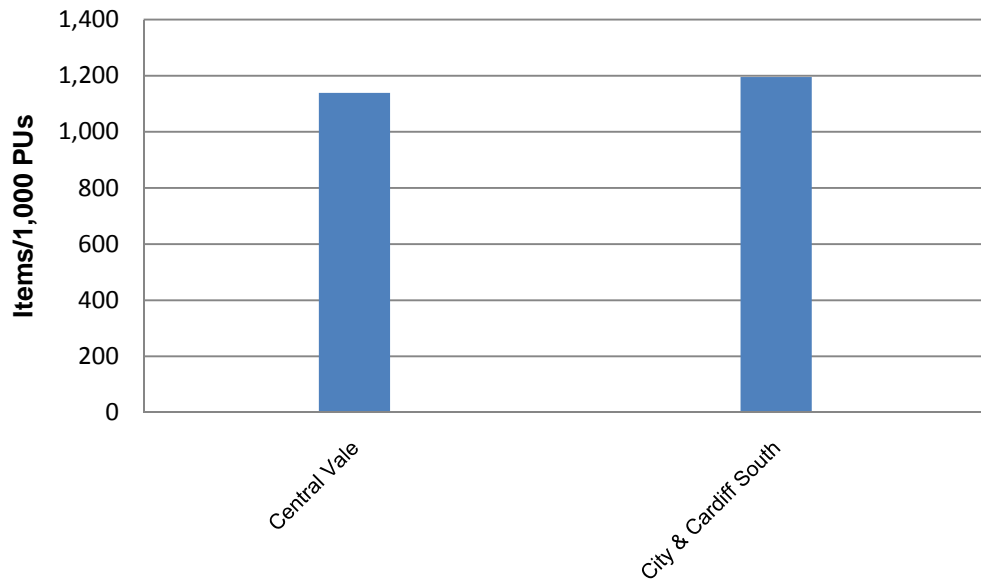
APPENDIX 2: WELSH GP CLUSTERS WITH EIGHT MOST SIMILAR CLUSTERS

Appendix 2 shows each of the Welsh GP clusters with the eight most similar clusters as determined by the SED based on the Welsh Index of Multiple Deprivation and asthma and COPD prevalence. The smaller the SED, the more similar the groups. This method of grouping GP clusters may be more useful for individual GP clusters or health boards to benchmark their prescribing. Presenting national data in this format may not be appropriate due to the need for 64 separate groups of eight clusters.

Anglesey		Arfon		Central & South Denbighshire		Conwy East		Conwy West		Deeside, Hawarden & Saltney	
West & North Wrexham	0.285	Deeside, Hawarden & Saltney	0.040	Dwyfor	0.457	South Wrexham	0.272	South Pembrokeshire	0.333	Arfon	0.040
Amman/ Gwendraeth	0.658	South Wrexham	0.253	Conwy West	0.612	Wrexham Town	0.344	Mid Powys	0.349	South Pembrokeshire	0.179
Upper Valleys	0.842	Newport Central	0.257	Mid Powys	0.640	Holywell & Flint	0.416	Wrexham Town	0.592	South Wrexham	0.229
Torfaen North	1.043	South Ceredigion	0.292	North Powys	1.151	Penderi	0.585	Central & South Denbighshire	0.612	South Ceredigion	0.244
Neath	1.470	Bridgend East Network	0.334	South Pembrokeshire	1.221	Torfaen North	0.680	South Powys	0.658	Wrexham Town	0.296
Bridgend West Network	1.651	South Pembrokeshire	0.364	Meirionnydd	1.268	North Pembrokeshire	0.706	North Powys	0.713	Newport Central	0.320
North Pembrokeshire	1.885	Wrexham Town	0.368	South Powys	1.324	North Taf Ely	0.753	Holywell & Flint	0.833	North Powys	0.380
Conwy East	1.892	North Powys	0.414	South Ceredigion	1.418	Newport East	0.849	South Ceredigion	0.839	South Taf Ely	0.412

☐ (orange) =	Extremely similar (SED < 1% of range)
☐ (yellow) =	Very similar (SED < 2.5% of range)
☐ (green) =	Similar (SED < 5% of range)
☐ (blue) =	Somewhat similar (SED < 10% of range)
☐ (grey) =	Not similar (SED >10% of range)
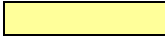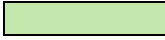
Dwyfor			Holywell & Flint			Meirionnydd			Mold, Buckley & Caergwle			North Denbighshire			South Wrexham	
Mid Powys	0.261		North Taf Ely	0.156		North Pembrokeshire	0.547		South Powys	0.705		North Cynon	2.063		Wrexham Town	0.038
North Powys	0.436		Wrexham Town	0.238		South Powys	0.617		Taf/Teifi/Tywi	0.761		South Cynon	2.814		Deeside, Hawarden & Saltney	0.229
Central & South Denbighshire	0.457		South Wrexham	0.315		Conwy West	0.912		Bridgend East Network	0.917		Blaenau Gwent East	3.448		Arfon	0.253
South Ceredigion	0.521		Conwy East	0.416		Mid Powys	1.103		North Pembrokeshire	1.016		North Merthyr Tydfil	3.513		Conwy East	0.272
Monmouthshire North	0.683		Caerphilly South	0.497		North Powys	1.173		North Powys	1.038		South Rhondda	3.738		Holywell & Flint	0.315
South Pembrokeshire	0.780		Newport West	0.620		Mold, Buckley & Caergwle	1.232		Meirionnydd	1.232		Blaenau Gwent West	3.778		North Taf Ely	0.349
South Powys	0.859		Caerphilly East	0.790		West & North Wrexham	1.256		South Ceredigion	1.375		South Merthyr Tydfil	4.099		North Pembrokeshire	0.430
Conwy West	0.925		South Pembrokeshire	0.793		Central & South Denbighshire	1.268		Monmouthshire North	1.389		Caerphilly North	4.430		South Pembrokeshire	0.470

- = Extremely similar (SED < 1% of range)
- = Very similar (SED < 2.5% of range)
- = Similar (SED < 5% of range)
- = Somewhat similar (SED < 10% of range)
- = Not similar (SED >10% of range)

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West & North Wrexham		Wrexham Town		Mid Powys		North Powys		South Powys		Amman/Gwendraeth	
Anglesey	0.285	South Wrexham	0.038	North Powys	0.104	South Ceredigion	0.050	North Powys	0.138	Upper Valleys	0.036
North Pembrokeshire	1.035	Holywell & Flint	0.238	South Ceredigion	0.166	Mid Powys	0.104	North Pembrokeshire	0.249	Anglesey	0.658
Meirionnydd	1.256	Deeside, Hawarden & Saltney	0.296	South Pembrokeshire	0.191	South Powys	0.138	Mid Powys	0.278	Neath	0.779
Torfaen North	1.623	North Pembrokeshire	0.337	Dwyfor	0.261	Monmouthshire North	0.220	South Ceredigion	0.302	Bridgend West Network	0.857
Conwy East	1.770	North Taf Ely	0.341	South Powys	0.278	South Pembrokeshire	0.308	Arfon	0.472	Afan	0.930
Amman/ Gwendraeth	1.800	Conwy East	0.344	Conwy West	0.349	Deeside, Hawarden & Saltney	0.380	South Pembrokeshire	0.485	Bridgend North Network	0.997
Mold, Buckley & Caergwle	2.002	Arfon	0.368	Monmouthshire North	0.482	Arfon	0.414	Deeside, Hawarden & Saltney	0.495	Torfaen North	1.071
South Powys	2.058	South Pembrokeshire	0.386	Deeside, Hawarden & Saltney	0.509	Dwyfor	0.436	Wrexham Town	0.577	CityHealth	1.222

(orange) =	Extremely similar (SED < 1% of range)
(yellow) =	Very similar (SED < 2.5% of range)
(green) =	Similar (SED < 5% of range)
(light blue) =	Somewhat similar (SED < 10% of range)
(grey) =	Not similar (SED >10% of range)

Llanelli		North Ceredigion		North Pembrokeshire		South Ceredigion		South Pembrokeshire		Taf/Teifi/Tywi	
Cardiff East	0.140	Western Vale	1.699	South Powys	0.249	North Powys	0.050	Deeside, Hawarden & Saltney	0.179	Eastern Vale	0.307
Newport West	0.163	South Taf Ely	1.805	Wrexham Town	0.337	Monmouthshire North	0.111	Mid Powys	0.191	Cardiff South West	0.313
Newport East	0.224	BayHealth	1.881	South Wrexham	0.430	Mid Powys	0.166	South Ceredigion	0.234	Monmouthshire North	0.475
Cwmtawe	0.752	Dwyfor	1.906	Meirionnydd	0.547	South Pembrokeshire	0.234	North Powys	0.308	Bridgend East Network	0.504
Caerphilly East	0.765	Monmouthshire North	2.193	Arfon	0.650	Deeside, Hawarden & Saltney	0.244	Conwy West	0.333	Western Vale	0.592
North Taf Ely	0.802	Eastern Vale	2.253	North Powys	0.704	Arfon	0.292	Arfon	0.364	BayHealth	0.653
Penderi	0.870	Monmouthshire South	2.298	Conwy East	0.706	South Powys	0.302	Wrexham Town	0.386	Cardiff South East	0.707
Caerphilly South	0.934	South Ceredigion	2.582	Deeside, Hawarden & Saltney	0.716	South Taf Ely	0.321	Caerphilly South	0.468	Monmouthshire South	0.738

=	Extremely similar (SED < 1% of range)
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=	Somewhat similar (SED < 10% of range)
=	Not similar (SED >10% of range)

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Afan	
CityHealth	0.453
Upper Valleys	0.689
Bridgend North Network	0.848
Amman/Gwendraeth	0.930
Bridgend West Network	1.078
Blaenau Gwent West	1.240
Caerphilly North	1.618
Torfaen North	1.629

BayHealth	
Monmouth-shire South	0.131
Eastern Vale	0.192
Western Vale	0.235
Cardiff South East	0.354
South Taf Ely	0.355
Monmouth-shire North	0.392
Cardiff South West	0.595
Taf/Teifi/Tywi	0.653

Bridgend East Network	
Arfon	0.334
Cardiff South West	0.429
Taf/Teifi/Tywi	0.504
Cwmtawe	0.554
Deeside, Hawarden & Saltney	0.602
Newport Central	0.614
South Powys	0.715
South Wrexham	0.776

Bridgend North Network	
Upper Valleys	0.670
Afan	0.848
Amman/Gwendraeth	0.997
CityHealth	2.311
Anglesey	2.415
Bridgend West Network	2.843
Blaenau Gwent West	3.064
Neath	3.205

Bridgend West Network	
Torfaen North	0.271
CityHealth	0.350
Cardiff West	0.507
Cardiff North	0.766
Amman/Gwendraeth	0.857
Torfaen South	0.920
Upper Valleys	0.996
Afan	1.078

CityHealth	
Bridgend West Network	0.350
Afan	0.453
Torfaen North	0.621
Penderi	0.703
Blaenau Gwent West	0.763
Caerphilly North	0.966
Upper Valleys	1.161
Amman/Gwendraeth	1.222

▭ =	Extremely similar (SED < 1% of range)
▭ =	Very similar (SED < 2.5% of range)
▭ =	Similar (SED < 5% of range)
▭ =	Somewhat similar (SED < 10% of range)
▭ =	Not similar (SED >10% of range)

Cwmtawe	
Newport Central	0.226
Arfon	0.458
Cardiff East	0.543
Bridgend East Network	0.554
Deeside, Hawarden & Saltney	0.624
South Wrexham	0.662
Llanelli	0.752
Cardiff South West	0.857

Llwchwr	
Neath	2.080
Torfaen South	3.235
Cardiff West	4.110
Cardiff North	4.289
Bridgend East Network	4.774
Mold, Buckley & Caergwle	4.781
Bridgend West Network	4.839
Cardiff South West	5.060

Neath	
Amman/Gwendraeth	0.779
Bridgend West Network	1.092
Upper Valleys	1.103
Anglesey	1.470
Torfaen North	1.517
Torfaen South	1.706
Cardiff West	1.789
Llwchwr	2.080

Penderi	
Newport East	0.327
Blaenau Gwent West	0.355
Caerphilly North	0.363
Conwy East	0.585
Newport West	0.682
CityHealth	0.703
Torfaen North	0.769
Cardiff East	0.833

Upper Valleys	
Amman/Gwendraeth	0.036
Bridgend North Network	0.670
Afan	0.689
Anglesey	0.842
Bridgend West Network	0.996
Neath	1.103
CityHealth	1.161
Torfaen North	1.269

Cardiff East	
Llanelli	0.140
Newport East	0.158
Newport West	0.524
Cwmtawe	0.543
Penderi	0.833
Cardiff North	0.886
Cardiff West	0.954
Conwy East	0.958

= Extremely similar (SED < 1% of range)

= Very similar (SED < 2.5% of range)

= Similar (SED < 5% of range)

= Somewhat similar (SED < 10% of range)

= Not similar (SED >10% of range)

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Cardiff South East	
Monmouthshire South	0.080
BayHealth	0.354
Eastern Vale	0.363
Western Vale	0.499
Cardiff South West	0.531
Taf/Teifi/Tywi	0.707
Monmouthshire North	1.192
South Taf Ely	1.370

City & Cardiff South	
Central Vale	2.467
North Ceredigion	3.854
Caerphilly East	4.167
Caerphilly South	4.414
South Taf Ely	5.099
North Taf Ely	5.688
Newport Central	6.161
South Pembrokeshire	6.237

Cardiff North	
Cardiff West	0.103
Torfaen South	0.301
Bridgend West Network	0.766
Torfaen North	0.807
Cardiff East	0.886
Cwmtawe	1.061
Newport East	1.180
CityHealth	1.556

Cardiff South West	
Taf/Teifi/Tywi	0.313
Bridgend East Network	0.429
Cardiff South East	0.531
BayHealth	0.595
Eastern Vale	0.650
Newport Central	0.655
Monmouthshire South	0.656
Monmouthshire North	0.841

Cardiff West	
Cardiff North	0.103
Torfaen South	0.125
Torfaen North	0.369
Bridgend West Network	0.507
Cardiff East	0.954
Cwmtawe	1.009
Conwy East	1.094
Newport East	1.132

Central Vale	
City & Cardiff South	2.467
Llanelli	4.471
Newport West	4.752
Caerphilly East	4.870
Caerphilly South	5.371
Cardiff East	5.454
Newport East	5.877
North Taf Ely	6.224

▮ =	Extremely similar (SED < 1% of range)
▮ =	Very similar (SED < 2.5% of range)
▮ =	Similar (SED < 5% of range)
▮ =	Somewhat similar (SED < 10% of range)
▮ =	Not similar (SED >10% of range)

Eastern Vale	
Western Vale	0.052
BayHealth	0.192
Monmouthshire South	0.215
Taf/Teifi/Tywi	0.307
Monmouthshire North	0.356
Cardiff South East	0.363
Cardiff South West	0.650
South Taf Ely	0.745

Western Vale	
Eastern Vale	0.052
BayHealth	0.235
Monmouthshire South	0.259
Monmouthshire North	0.444
Cardiff South East	0.499
Taf/Teifi/Tywi	0.592
South Taf Ely	0.795
South Ceredigion	0.977

North Cynon	
South Merthyr Tydfil	0.615
South Rhondda	0.770
North Rhondda	0.907
North Merthyr Tydfil	0.937
Blaenau Gwent East	1.006
Caerphilly North	1.736
Blaenau Gwent West	1.856
North Denbighshire	2.063

North Merthyr Tydfil	
Blaenau Gwent East	0.031
North Rhondda	0.768
North Cynon	0.937
South Cynon	1.614
South Rhondda	2.466
South Merthyr Tydfil	2.504
North Denbighshire	3.513
Caerphilly North	4.931

North Rhondda	
North Merthyr Tydfil	0.768
Blaenau Gwent East	0.807
North Cynon	0.907
South Merthyr Tydfil	1.130
South Rhondda	1.198
Caerphilly North	3.081
Blaenau Gwent West	3.742
South Cynon	3.896

North Taf Ely	
Caerphilly South	0.098
Holywell & Flint	0.156
Caerphilly East	0.256
Wrexham Town	0.341
South Wrexham	0.349
South Pembrokeshire	0.521
Newport West	0.524
Deeside, Hawarden & Saltney	0.537

=	Extremely similar (SED < 1% of range)
=	Very similar (SED < 2.5% of range)
=	Similar (SED < 5% of range)
=	Somewhat similar (SED < 10% of range)
=	Not similar (SED >10% of range)

South Cynon	
Blaenau Gwent East	1.317
North Merthyr Tydfil	1.614
North Denbighshire	2.814
North Cynon	3.118
North Rhondda	3.896
South Rhondda	4.900
South Merthyr Tydfil	6.096
Blaenau Gwent West	8.227

South Merthyr Tydfil	
South Rhondda	0.349
Caerphilly North	0.562
North Cynon	0.615
Blaenau Gwent West	0.865
North Rhondda	1.130
Penderi	1.202
Newport West	1.265
Holywell & Flint	1.742

South Rhondda	
South Merthyr Tydfil	0.349
Caerphilly North	0.669
North Cynon	0.770
Blaenau Gwent West	0.961
North Rhondda	1.198
Penderi	1.901
Blaenau Gwent East	2.363
North Merthyr Tydfil	2.466

South Taf Ely	
Monmouthshire North	0.239
South Ceredigion	0.321
BayHealth	0.355
Newport Central	0.356
Deeside, Hawarden & Saltney	0.412
Arfon	0.485
South Pembrokeshire	0.564
North Powys	0.622

Blaenau Gwent East	
North Merthyr Tydfil	0.031
North Rhondda	0.807
North Cynon	1.006
South Cynon	1.317
South Rhondda	2.363
South Merthyr Tydfil	2.610
North Denbighshire	3.448
Caerphilly North	4.951

Blaenau Gwent West	
Caerphilly North	0.083
Penderi	0.355
CityHealth	0.763
South Merthyr Tydfil	0.865
South Rhondda	0.961
Afan	1.240
Newport East	1.298
Conwy East	1.355

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= Similar (SED < 5% of range)

= Somewhat similar (SED < 10% of range)

= Not similar (SED >10% of range)

Caerphilly East		Caerphilly North		Caerphilly South		Monmouthshire North		Monmouthshire South		Newport Central	
Caerphilly South	0.072	Blaenau Gwent West	0.083	Caerphilly East	0.072	South Ceredigion	0.111	Cardiff South East	0.080	Cwmtawe	0.226
North Taf Ely	0.256	Penderi	0.363	North Taf Ely	0.098	North Powys	0.220	BayHealth	0.131	Arfon	0.257
Deeside, Hawarden & Saltney	0.468	South Merthyr Tydfil	0.562	South Pembrokeshire	0.468	South Taf Ely	0.239	Eastern Vale	0.215	Deeside, Hawarden & Saltney	0.320
Newport Central	0.537	South Rhondda	0.669	Holywell & Flint	0.497	Eastern Vale	0.356	Western Vale	0.259	South Taf Ely	0.356
South Pembrokeshire	0.595	CityHealth	0.966	Deeside, Hawarden & Saltney	0.518	BayHealth	0.392	Cardiff South West	0.656	Caerphilly East	0.537
Arfon	0.674	Newport East	1.107	South Wrexham	0.604	Western Vale	0.444	Taf/Teifi/Tywi	0.738	Bridgend East Network	0.614
South Wrexham	0.677	Newport West	1.361	Wrexham Town	0.628	Taf/Teifi/Tywi	0.475	Monmouthshire North	0.844	Cardiff South West	0.655
South Taf Ely	0.712	Conwy East	1.612	Newport West	0.753	Arfon	0.478	South Taf Ely	0.918	Monmouthshire North	0.704

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▮ =	Similar (SED < 5% of range)
▮ =	Somewhat similar (SED < 10% of range)
▮ =	Not similar (SED >10% of range)

Newport East	
Cardiff East	0.158
Llanelli	0.224
Penderi	0.327
Newport West	0.367
Conwy East	0.849
Caerphilly North	1.107
Cardiff West	1.132
Cwmtawe	1.135

Newport West	
Llanelli	0.163
Newport East	0.367
Cardiff East	0.524
North Taf Ely	0.524
Holywell & Flint	0.620
Penderi	0.682
Caerphilly South	0.753
Caerphilly East	0.795

Torfaen North	
Bridgend West Network	0.271
Cardiff West	0.369
Torfaen South	0.585
CityHealth	0.621
Conwy East	0.680
Penderi	0.769
Cardiff North	0.807
Anglesey	1.043

Torfaen South	
Cardiff West	0.125
Cardiff North	0.301
Torfaen North	0.585
Bridgend East Network	0.871
Cwmtawe	0.895
Bridgend West Network	0.920
Conwy East	1.191
Cardiff East	1.358

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	= Similar (SED < 5% of range)
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	= Not similar (SED >10% of range)

APPENDIX 3: DENDROGRAM OF GP CLUSTER GROUPING

Rescaled Distance Cluster Combine

North Merthyr Tydfil	28
Blaenau Gwent East	42
North Rhondda	39
South Cynon	40
North Denbighshire	43
Blaenau Gwent West	30
Caerphilly North	31
Penderi	36
South Merthyr Tydfil	29
South Rhondda	41
North Cynon	27
Anglesey	49
West & North Wrexham	55
Afan	24
CityHealth	26
Amman/Gwendraeth	44
Upper Valleys	45
Bridgend North Network	25
Cardiff North	46
Cardiff West	47
Torfaen South	59
Bridgend West Network	33
Torfaen North	48
Llwchwr	11
Neath	62
South Powys	3
North Pembrokeshire	8
Meirionnydd	14
Mold, Buckley & Caergwrle	20
Central & South Denbighshire	18
Dwyfor	19
North Powys	2
South Ceredigion	4
Mid Powys	1
South Pembrokeshire	9
Conwy West	7
Cardiff South West	12
Taf / Teifi / Tywi	15
Bridgend East Network	10
Monmouthshire North	6
South Taf Ely	13
Arfon	53
Deeside, Hawarden & Saltney	54
Newport Central	52
Cwmtawe	56
Cardiff South East	16
Monmouthshire South	17
Eastern Vale	22
Western Vale	23
BayHealth	5
North Ceredigion	21
Central Vale	38
City & Cardiff South	63
Llanelli	32
Cardiff East	34
Newport East	37
Newport West	35
Caerphilly East	57
Caerphilly South	58
Holywell & Flint	61
North Taf Ely	64
South Wrexham	50
Wrexham Town	51
Conwy East	60