

Geodemographic Analysis using GIS Software

by Theresa Alexandra Darzins

Submission date: 15-May-2022 01:04PM (UTC+0100)

Submission ID: 180072966

File name:

19458_Theresa_Alexandra_Darzins_Geodemographic_Analysis_using_GIS_Software_419142_246313777.docx
(3.7M)

Word count: 5908

Character count: 31872



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

Geographical Information Systems



[1]

School of Applied Computing	Assignment Title: Geodemographic Analysis Using GIS Software	Code: ACCA 5027
	Module: Geographical Information Systems	
Student: Theresa Darzins No 1909721	Programme: Computing Portfolio BSc Computing	Lecturer: Beverley Holland Date: 15 th May 2022

Contents

1.0	INTRODUCTION	- 1 -
1.1	Report structure	- 1 -
1.2	Aims	- 2 -
1.3	Objectives	- 2 -
2.0	TASK 1 – DEVELOPMENT LOG	- 3 -
2.1	UK Regions	- 3 -
2.2	Wales Local Health Boards	- 5 -
2.3	Case Study Carmarthenshire Output Area - Hywel Dda LHB	- 7 -
2.3.1	Categorisation of Residents	- 8 -
2.3.2	Deprivation Index	- 8 -
2.3.3	Levels of Health	- 10 -
2.3.4	Covid Cases Just Carmarthenshire Area	- 13 -
2.3.5	Overlaid with Very Bad Health	- 14 -
2.4	Covid Data for Wales by Local Health Board (LHB)	- 15 -
2.4.1	Covid Deaths in Wales	- 16 -
2.4.2	Covid Vaccination Centres in Wales	- 17 -
2.5	Data, File Types and Reasons Used	- 20 -
2.5.1	Data Sets	- 20 -
2.5.2	File Types	- 20 -
2.5.3	Reasons	- 21 -
3.0	TASK 2 – RESULTS OF GEOGRAPHICAL INFORMATION SYSTEMS BUILD	- 23 -
3.1	Wales LHB Deaths Proportionate to Population	- 23 -
3.2	Wales LHB Vaccinations Proportionate to Population	- 24 -
3.2.1	Herd Immunity	- 25 -
3.3	Combined Rankings for Low Deaths and High Vaccination Rates by LHB	- 26 -
3.4	Vaccination Centres	- 27 -
3.4.1	Locations of Vaccination Centres - Categorised by LHB	- 28 -
3.4.2	Number of Vaccination Centres Categorised by LHB with Population Alphabetically Sorted	- 29 -
3.4.3	Number of Vaccination Centres Categorised by LHB with Population in Size Order	- 29 -
3.4.4	Vaccination Centres Categorised by LHB – Ranked by which Serving Least/Most	- 30 -
3.5	Possible Reasons for Individual LHB's Success or Failure	- 31 -
3.5.1	Powys' Success with Both High Vaccination and Low Death Rate	- 31 -
3.5.2	Highest Death Rate - Cwm Taf Morgannwg	- 32 -

3.5.3	Lowest Vaccinations - Swansea Bay	32 -
3.6	Carmarthenshire Case Study – Hywel Dda’s Ranking on LHB’s	32 -
3.6.1	Least Deaths and Most Vaccinations	32 -
3.6.2	Vaccination Centres	33 -
3.7	What the Carmarthenshire Case Study Revealed	33 -
3.7.1	Urban and Crowded = More Covid Cases	33 -
3.7.3	Countryside and Least Populated = Less Covid Cases	33 -
3.7.4	The More Deprived and Bad Health Areas = More Covid Cases	33 -
3.8	Summary of Whole of Wales LHB Performance	34 -
3.9	Thematic Maps Used to Highlight Findings	35 -
4.0	CONCLUSION	36 -
4.1	Best LHB For Least Deaths and Most Vaccinations - Powys	36 -
4.2	Worst LHB for Deaths – Cwm Taf Morgannwg	36 -
4.3	Worst LHB for Vaccinations – Swansea Bay	36 -
4.4	Most Vaccination Centres Per Head of Population – Betsi Cadwaladr	36 -
4.5	Least Vaccination Centres Per Head of Population – Cardiff & Vale	36 -
4.6	Recommendations	37 -
5.0	REFERENCES	38 -
	Figure 1 UK Regions Map	3 -
	Figure 2 Wales Only Map	3 -
	Figure 3 Motorways Wales	4 -
	Figure 4 Wales Local Health Boards	5 -
	Figure 5 Wales Local Health Boards with Legend	6 -
	Figure 6 Carmarthenshire Output Area in Hywel Dda	7 -
	Figure 7 Carmarthenshire OA (without motorways)	7 -
	Figure 8 Carmarthenshire Residents Status and Legend	8 -
	Figure 9 Carmarthenshire Output Area (Blank)	9 -
	Figure 10 Carmarthenshire Levels of Deprivation	9 -
	Figure 11 Carmarthenshire Levels of Health 0-4	11 -
	Figure 12 Carmarthenshire Health Levels Very Good to Very Bad	11 -
	Figure 13 Carmarthenshire Residents Deprived in all 4 Areas	12 -
	Figure 14 Carmarthenshire Covid Cases	13 -
	Figure 15 Carmarthenshire Covid Cases Overlaid with Very Bad Health	14 -
	Figure 16 Covid Vaccination Percentages for Wales by Local Health Board	15 -
	Figure 17 Covid Death in Wales Categorised by Percentage of LHB	16 -
	Figure 18 Covid Vaccination Centres per head of Population by LHB	17 -
	Figure 19 Reminder of the Deaths (underneath previous map)	18 -
	Figure 20 Deaths by LHB Ranked in Proportion to Population	23 -
	Figure 21 Vaccinations by Local Health Board (Percentages)	24 -

Figure 22 Levels of Immunity - Best, Worst and If No Vaccines Administered.....	25 -
Figure 23 Locations of Vaccination Centres in Wales	27 -
Figure 24 Vaccination Centres per head of Population by LHB	30 -
Table 1 Browser for Local Health Boards	5 -
Table 2 Carmarthenshire Deprivation Browser	8 -
Table 3 Data Health Carms Browser	10 -
Table 4 Covid Cases Browser CarmsCovidCasesByLocation	13 -
Table 5 AllWalesDeathsByLHB Browser	16 -
Table 6 VaxCentres Browser	17 -
Table 7 Excel Chart Showing How Many Each Vaccination Centre Serves per LHB	17 -
Table 8 All Wales Population By Local Health Board	18 -
Table 9 All Wales Covid Deaths Ranked Proportionate to Population of Local Health Board.....	19 -
Table 10 Summary of Files Used and Why.....	22 -
Table 11 All Wales Covid Deaths Ranked by LHB Proportionate to Population	23 -
Table 12 All Wales Vaccinations Ranked Proportionate to LHB Population	24 -
Table 13 Vaccinations by LHB Browser	24 -
Table 14 Wales Immunity If Immunity Wanes After 2+ years/2 Years % of Immunity	25 -
Table 15 Highest and Lowest Immunity in Wales by Age Group	25 -
Table 16 Vaccinations Ranked Proportionate to LHB Population.....	26 -
Table 17 Combined Rankings for Low Death/High Vaccination per % of LHB Population	26 -
Table 18 Locations of Vaccination Centres by LHB	28 -
Table 19 No. of Vaccination Centres by LHB with Population in Alphabetical Order.....	29 -
Table 20 No. of Vaccination Centres by LHB with Population Size Order	29 -
Table 21 Vaccination Centres by LHB Ranked by which Serving Least to Most	30 -
Table 22 Possible Reasons for LHB's Success/Failure	31 -
Table 23 Least Deaths/Most Vaccinations by % Population of LHB	32 -
Table 24 – See the Ranking of Hywel Dda (Carmarthenshire)	33 -
Table 25 Summary of Whole of Wales Local Health Boards Performance (Rankings)	34 -
Table 26 Vaccination Centre Rankings.....	34 -
Table 27 Thematic Maps Used to Highlight Findings.....	35 -
Table 28 Recommendations by Areas of Concern	37 -

1.0 INTRODUCTION

1.1 Report structure

1. Introduction

2. Task 1 – Development Log

- Log
 - UK Regions
 - Wales Local Health Boards (LHB)
 - Case Study - Carmarthenshire Output Area
 - Covid Data for Wales
- Data Sets, File Types and Reasons Used
 - Data Sets
 - File Types
 - Reasons

3. Task 2 - Results of Geographical Information Systems Build

- Ranked Local Health Boards According to:
 - Deaths
 - Vaccinations
 - Vaccination Centres
- Possible Reasons for LHB's Success or Failure
- Carmarthenshire Case Study - Hywel Dda's Ranking
 - Deaths and Vaccinations
 - Number of Vaccination Centres
 - What the Carmarthenshire Case Study Revealed
- Summary of Performance of Wales LHB's
- Thematic Maps Used to Highlight Findings (Recap)

4. Conclusion

- Best LHB For Least Deaths and Most Vaccinations
- Worst LHB for Deaths
- Worst LHB for Vaccinations
- Best LHB for Vaccination Centres Per Head of Population
- Worst LHB for Vaccination Centres Per Head of Population
- Recommendations

5. References

1.2 Aims

To showcase the science and technology, and management of Geographical Information Systems.

1.3 Objectives

Develop critical understanding of underlying theories of GIS through examination of current GIS software trends through:

- Construction of a System to inform healthcare professionals on:
 - **uptake of the Covid-19 Vaccination Programme in Wales**, using latest data set provided.
- Highlighting:
 - **one Local Authority area where uptake of vaccination is high/low.**
- Pose:
 - **possible reasons for this high/low uptake.**

2.0 TASK 1 – DEVELOPMENT LOG

2.1 UK Regions

Figure 1 UK Regions Map

UK_Regions Map

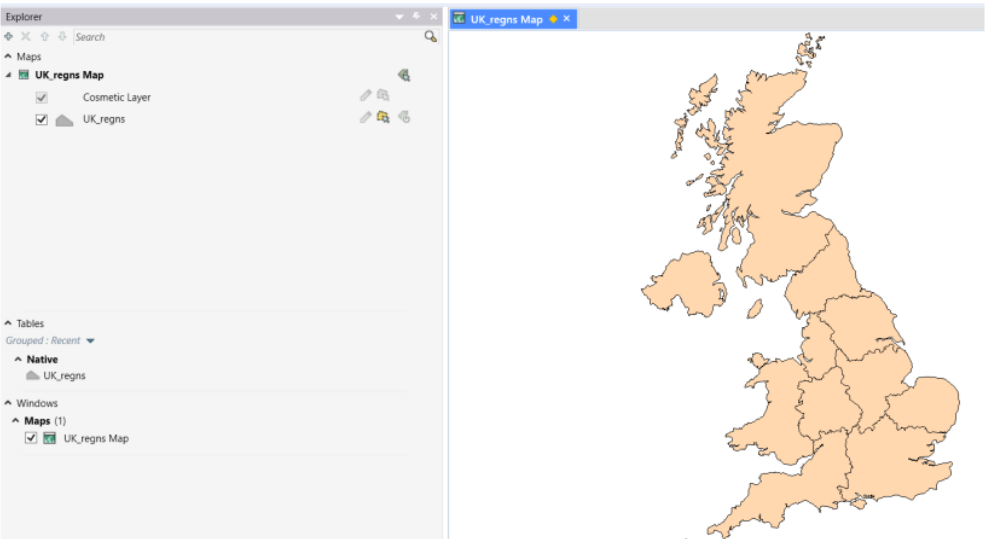


Figure 2 Wales Only Map

Wales_only, regns Map

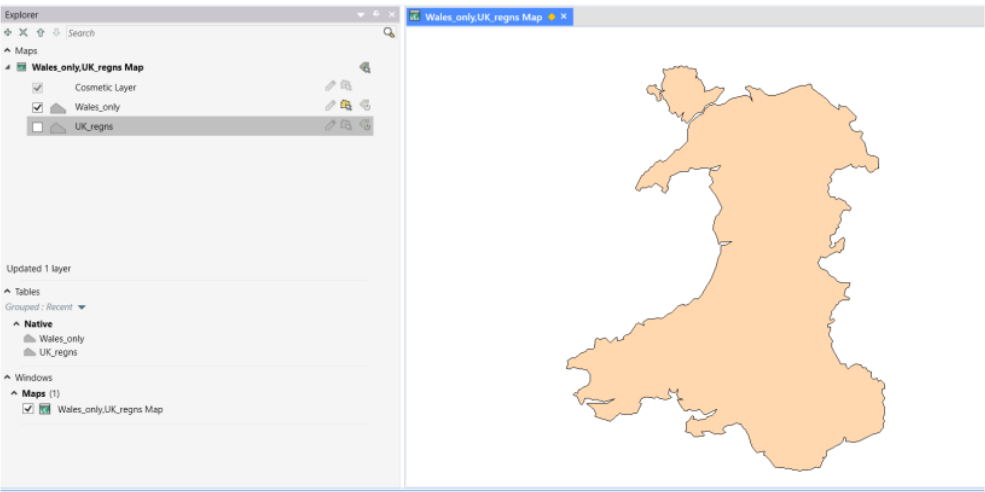
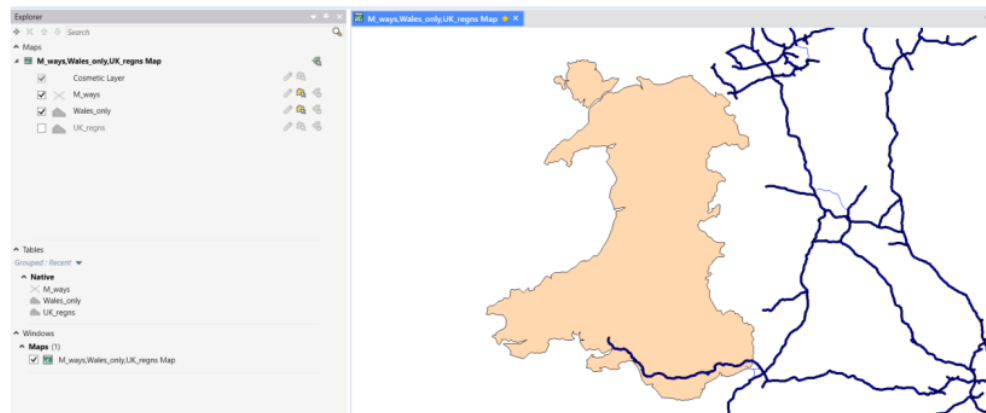


Figure 3 Motorways Wales

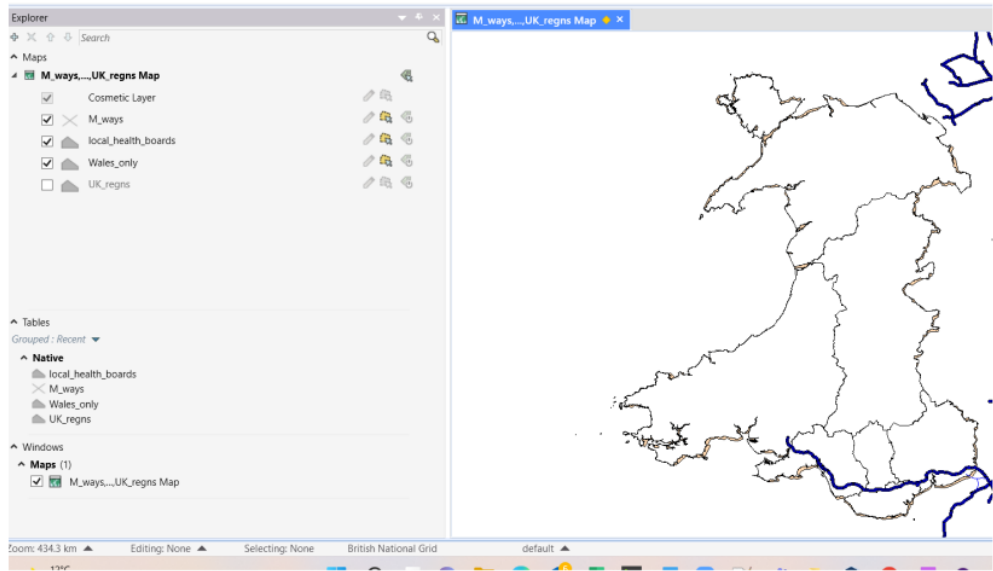
M_ways,Wales_only, regns Map



2.2 Wales Local Health Boards

Figure 4 Wales Local Health Boards

local_health_boards.TAB



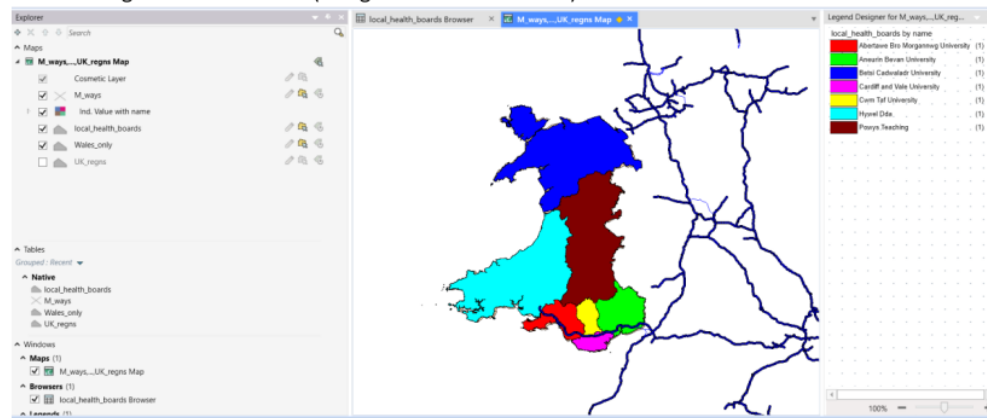
Browser for local_health_boards

Table 1 Browser for Local Health Boards

code	name_welsh	area_description	source	capturedby	capturedate	loa_pop2011	areacode
707	Adlysgu Powys	Local Health Board	NHS Wales: Statutory Instrument 2009 No. 778 (W.66)	Cartographics, WAG	2009/06/05	131,789	W11000024
706	Prifysgol Aneurin Bevan	Local Health Board	NHS Wales: Statutory Instrument 2009 No. 778 (W.66)	Cartographics, WAG	2009/06/05	559,366	W11000028
705	Prifysgol Cwm Taf	Local Health Board	NHS Wales: Statutory Instrument 2009 No. 778 (W.66)	Cartographics, WAG	2009/06/05	289,933	W11000027
704	Prifysgol Ceredigion a'r Fro	Local Health Board	NHS Wales: Statutory Instrument 2009 No. 778 (W.66)	Cartographics, WAG	2009/06/05	452,577	W11000029
703	Prifysgol Abertawe Bro Morgannwg	Local Health Board	NHS Wales: Statutory Instrument 2009 No. 778 (W.66)	Cartographics, WAG	2009/06/05	492,240	W11000026
702	Hywel Dda	Local Health Board	NHS Wales: Statutory Instrument 2009 No. 778 (W.66)	Cartographics, WAG	2009/06/05	367,123	W11000025
701	Prifysgol Betsi Cadwaladr	Local Health Board	NHS Wales: Statutory Instrument 2009 No. 778 (W.66)	Cartographics, WAG	2009/06/05	658,279	W11000023

Figure 5 Wales Local Health Boards with Legend

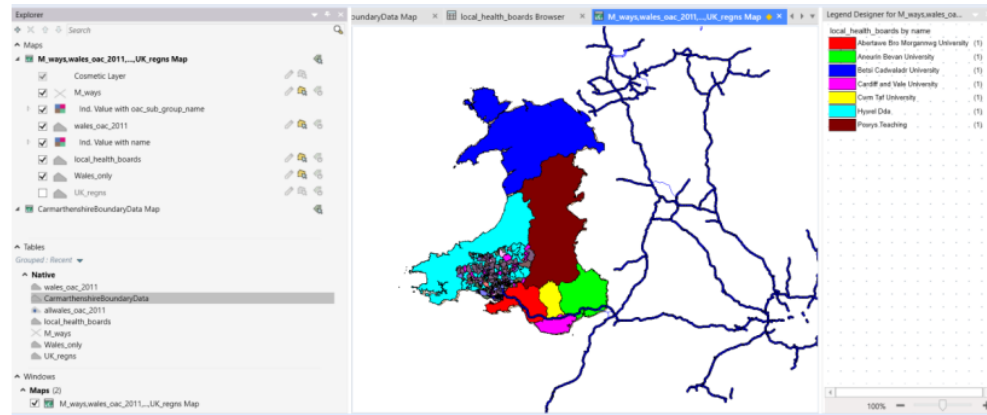
After adding theme for above: (using areacode and name)



2.3 Case Study Carmarthenshire Output Area - Hywel Dda LHB

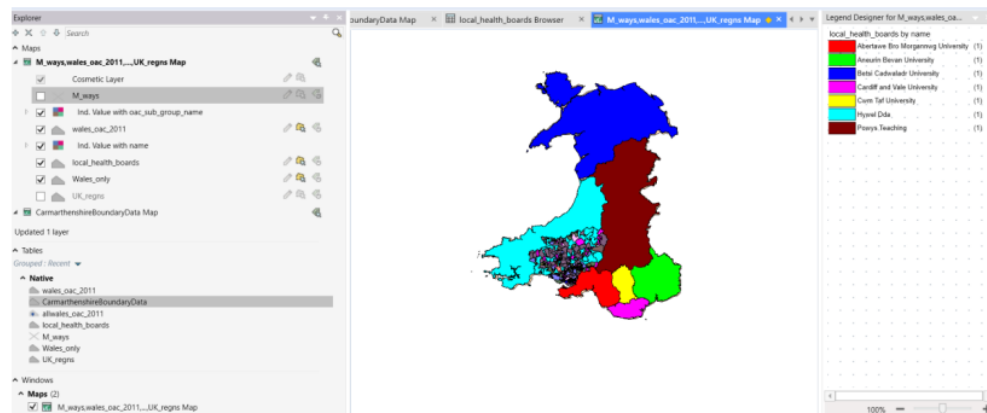
Figure 6 Carmarthenshire Output Area in Hywel Dda

CarmarthenshireBoundaryData.TAB



Turned off motorways view (distracting) CarmarthenshireBoundaryData

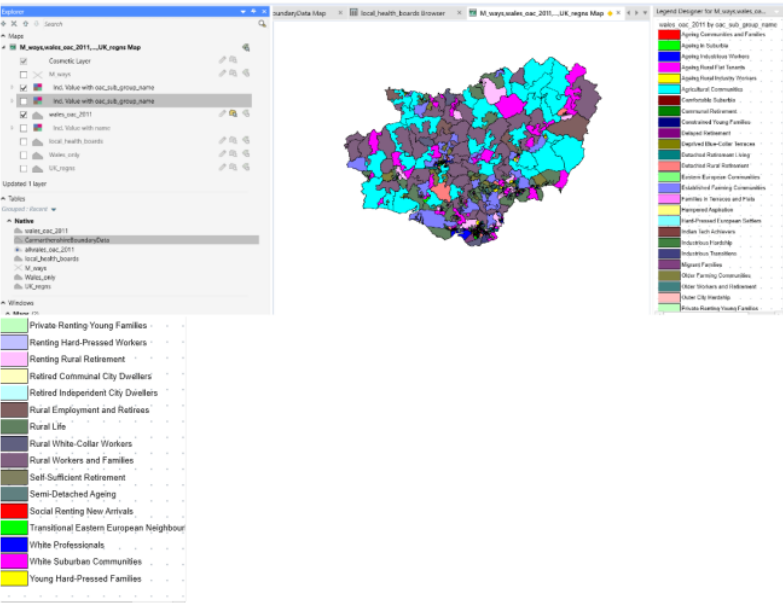
Figure 7 Carmarthenshire OA (without motorways)



2.3.1 Categorisation of Residents

Figure 8 Carmarthenshire Residents Status and Legend

Turned off other maps so just Carmarthenshire and Residents Status with a Legend



2.3.2 Deprivation Index

Opened New Browser with Carmarthenshire Deprivation

Table 2 Carmarthenshire Deprivation Browser

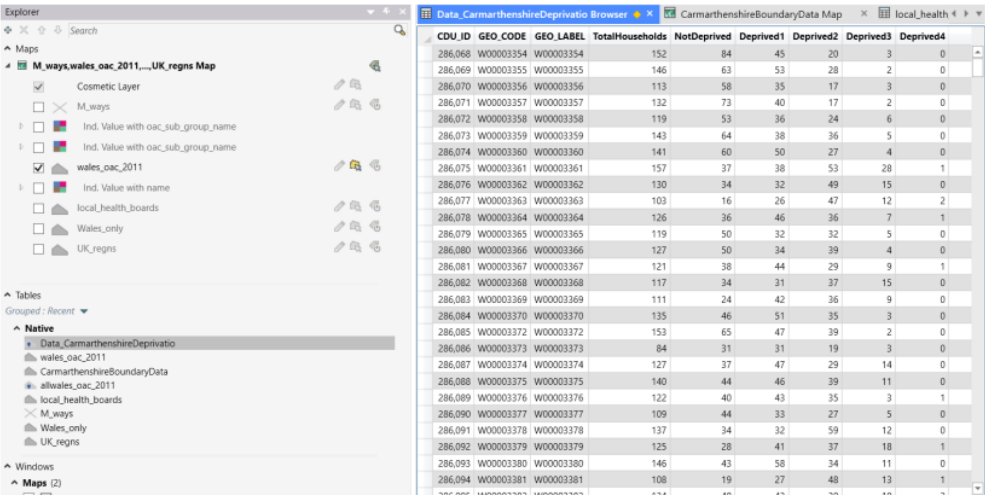
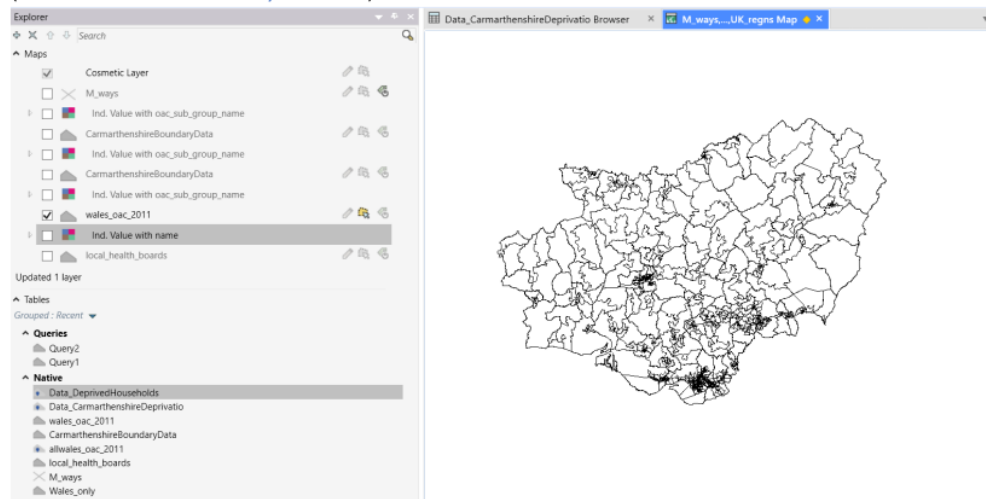


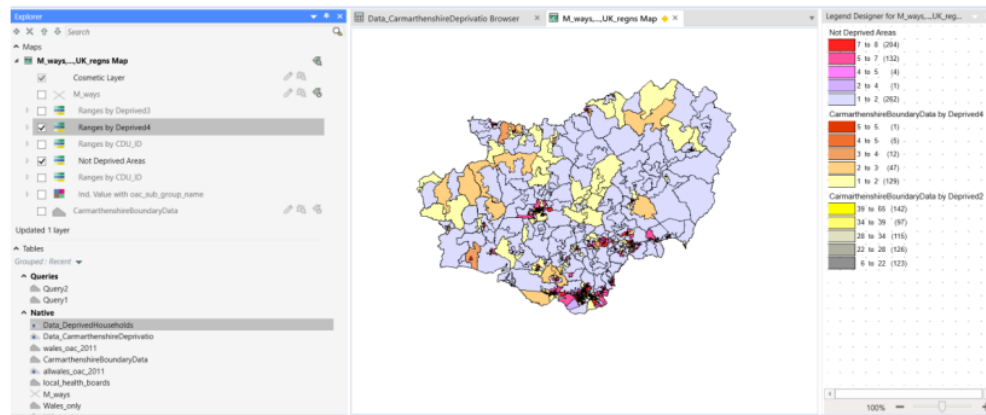
Figure 9 Carmarthenshire Output Area (Blank)

Get the Basic Carmarthen map back on screen to layer with Carmarthen Deprivation (CarmarthenshireBoundaryData.TAB)



Add the levels of Deprivation so can compare (by joining Carmarthenshire blank as above to Deprivation)

Figure 10 Carmarthenshire Levels of Deprivation



2.3.3 Levels of Health

Add Levels of Health in so can compare those in deprived areas and those in not deprived areas

Data_HealthCarms.xls

Table 3 Data Health Carms Browser

The screenshot displays the QGIS desktop environment. The main map area shows a geographical view of Carmarthenshire, Wales, with various colored regions representing different deprivation levels. The left sidebar contains the 'Explorer' panel, which lists the loaded layers: 'M_ways..._uk_regs Map', 'Cosmetic Layer', 'M_ways', 'Ranges by Deprived4', 'Ranges by Deprived3', 'Not Deprived Areas', 'Ranges by CDU_ID', 'Ind. Value with oac_sub_group_name', 'CarmarthenshireBoundaryData', and 'Ranges by Deprived2'. Below the Explorer is the 'Tables' panel, showing a list of queries and native data sources. The right sidebar features the 'Data Browser' panel, which lists several data sources, including 'Data_HealthCarms', 'Data_CarmarthenshireDeprivatio', 'wales_oac_2011', 'CarmarthenshireBoundaryData', 'allwales_oac_2011', 'local_health_boards', 'M_ways', and 'Wales_only'. The 'Data Browser' panel is currently expanded, showing a table of data for 'Data_HealthCarms' with columns: 'CDU_ID', 'GEO_CODE', 'GEO_LABEL', 'VGHHealth', 'GoodHealth', 'FairHealth', 'BadHealth', and 'VBadHealth'. The table contains 20 rows of data, showing various health metrics for different CDUs in Carmarthenshire.

CDU_ID	GEO_CODE	GEO_LABEL	VGHHealth	GoodHealth	FairHealth	BadHealth	VBadHealth
286.068	W00003354	W00003354	223	114	35	11	4
286.069	W00003355	W00003355	165	106	61	11	15
286.070	W00003356	W00003356	150	77	42	5	4
286.071	W00003357	W00003357	175	94	48	9	4
286.072	W00003358	W00003358	126	76	44	11	2
286.073	W00003359	W00003359	162	125	53	12	5
286.074	W00003360	W00003360	151	122	50	18	5
286.075	W00003361	W00003361	122	97	57	37	15
286.076	W00003362	W00003362	78	51	52	23	8
286.077	W00003363	W00003363	66	54	55	25	7
286.078	W00003364	W00003364	163	80	56	22	6
286.079	W00003365	W00003365	124	83	41	14	4
286.080	W00003366	W00003366	115	74	66	16	5
286.081	W00003367	W00003367	132	74	40	23	7
286.082	W00003368	W00003368	76	59	39	27	6
286.083	W00003369	W00003369	93	63	41	25	3
286.084	W00003370	W00003370	145	105	59	18	11
286.085	W00003372	W00003372	153	114	76	39	14
286.086	W00003373	W00003373	107	64	25	14	5
286.087	W00003374	W00003374	121	113	49	23	6
286.088	W00003375	W00003375	117	86	44	30	9
286.089	W00003376	W00003376	125	97	38	15	5
286.090	W00003377	W00003377	117	100	50	13	8
286.091	W00003378	W00003378	95	85	53	26	11
286.092	W00003379	W00003379	129	92	48	24	5
286.093	W00003380	W00003380	182	98	44	20	4
286.094	W00003381	W00003381	53	60	46	16	8

Figure 11 Carmarthenshire Levels of Health 0-4

see if the Deprivation relates to Health
Deprivation Levels = from 0 to 4 (0 is darker and 4 is lighter)

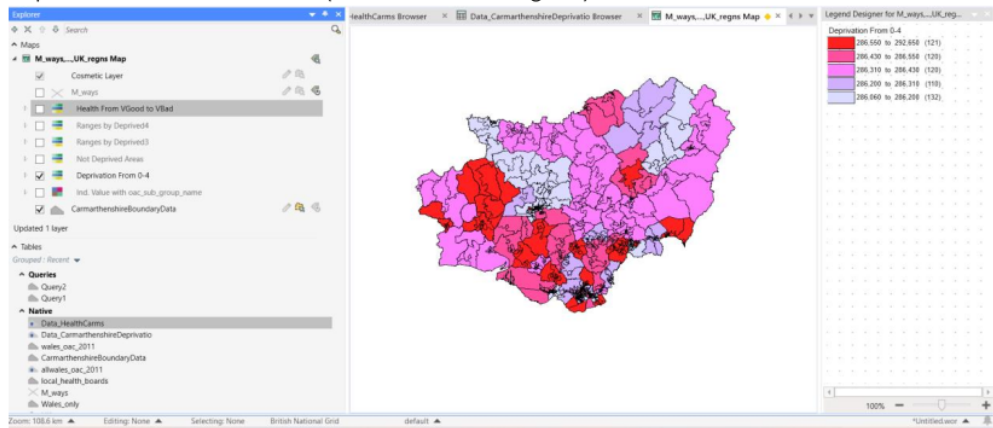


Figure 12 Carmarthenshire Health Levels Very Good to Very Bad

Health levels

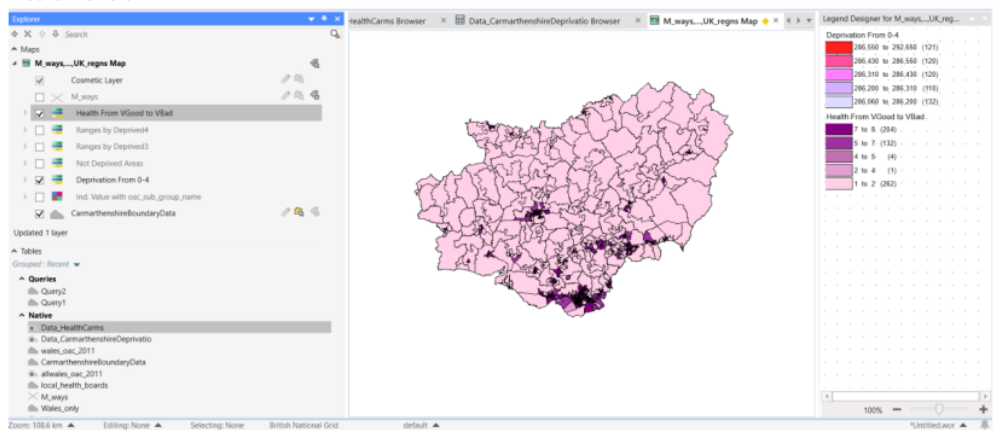
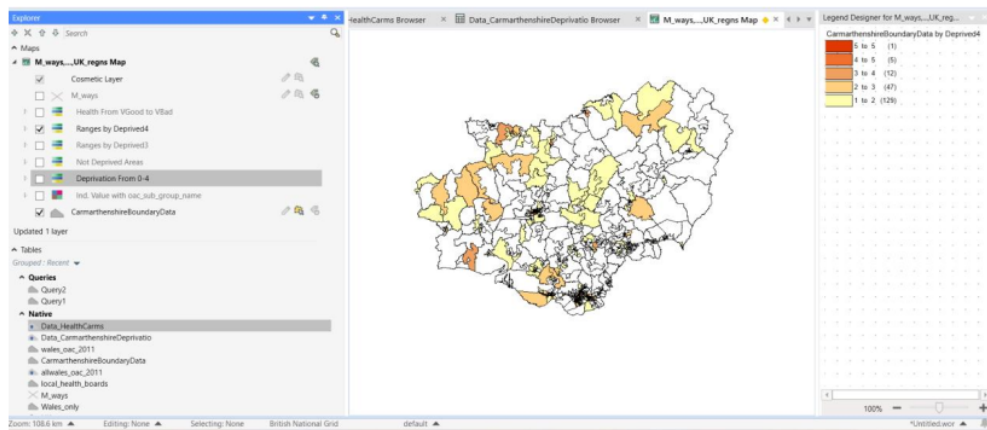


Figure 13 Carmarthenshire Residents Deprived in all 4 Areas

Those Deprived in all 4 Areas:



2.3.4 Covid Cases Just Carmarthenshire Area

Load Covid Cases (Browser) CarmsCovidCasesByLocation

Table 4 Covid Cases Browser CarmsCovidCasesByLocation

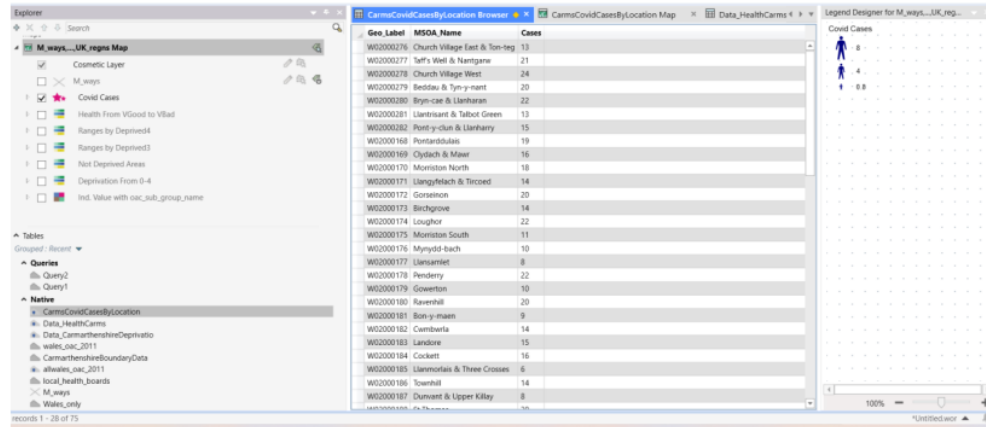
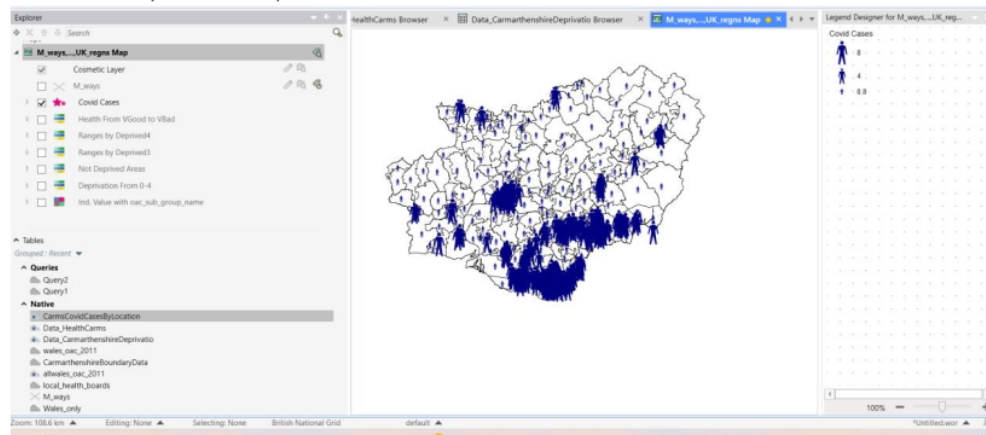


Figure 14 Carmarthenshire Covid Cases

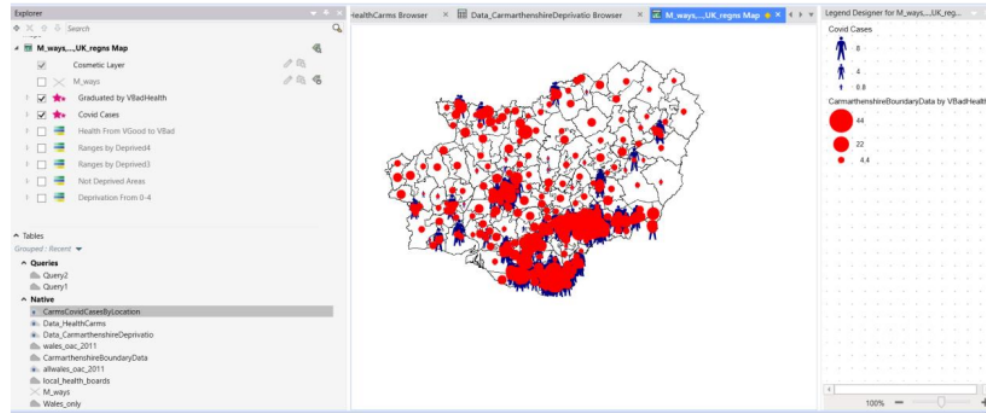
And see mainly in urban deprived areas



2.3.5 Overlaid with Very Bad Health

And see those in Very Bad Health Overlaid on top

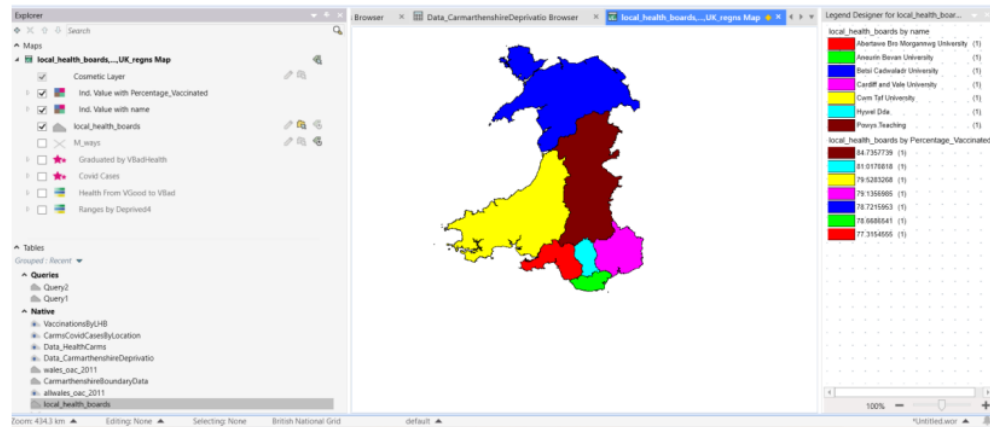
Figure 15 Carmarthenshire Covid Cases Overlaid with Very Bad Health



2.4 Covid Data for Wales by Local Health Board (LHB)

To categorise the **% Vaccination levels** for all 7 Wales Local Health Boards
local_health_boards and overlay with 7 different boards with Legend:

Figure 16 Covid Vaccination Percentages for Wales by Local Health Board



2.4.1 Covid Deaths in Wales

Show the Deaths by Local Health Board (WalesLHBDeathsAll.xls)

Figure 17 Covid Death in Wales Categorised by Percentage of LHB

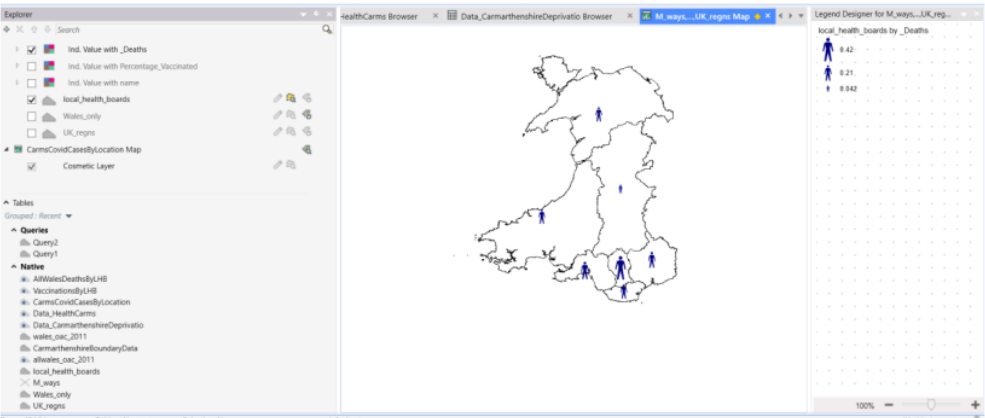


Table 5 AllWalesDeathsByLHB Browser

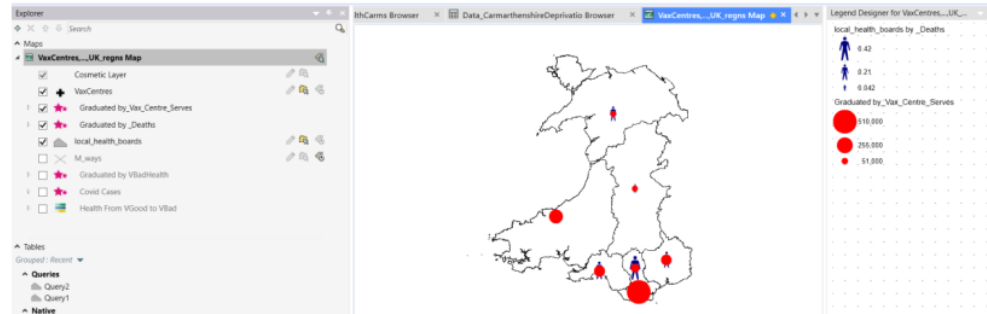
The screenshot shows a GIS application window with a table view. The table is titled 'AllWalesDeathsByLHB Browser' and contains the following data:

Local Health Board	Deaths	Geo. Code	Ranking
Annuar Benau University Health Board	1193	W11000028	5
Betsi Cadwaladr University Health Board	1259	W11000023	6
Cardiff and Vale University Health Board	924	W11000029	3
Cwm Taf Morgannwg University Health Board	1071	W11000027	7
Hypwel Dda University Health Board	707	W11000025	2
Powys Teaching Health Board	89	W11000024	1
Swansea Bay University Health Board	976	W11000026	4

2.4.2 Covid Vaccination Centres in Wales

show Vaccinations Centres per head of population (Deaths underneath)

Figure 18 Covid Vaccination Centres per head of Population by LHB



Browser: VaxCentres

Table 6 VaxCentres Browser

Local Health Board	Geo Code	Vaccination Centres	Population	Serves	Ranking
Betsi Cadwaladr	W11000023	16	703,361	43,960	1
Powys	W11000024	3	133,030	44,343	2
Cwm Taf Morgannwg	W11000027	5	449,836	89,967	3
Aneurin Bevan	W11000028	5	598,194	119,639	4
Swansea Bay	W11000026	3	390,949	130,316	5
Hywel Dda	W11000025	2	389,719	194,860	6
Cardiff & Vale	W11000029	1	504,497	504,497	7

VaxCentres.xls

Cardiff & Vale only had one to cater to whole 504,497

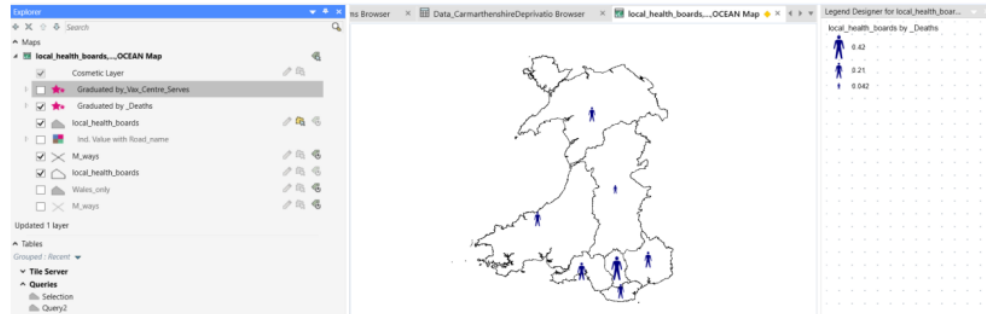
Betsi Cadwaladr had 16 to cater for 703,361

Table 7 Excel Chart Showing How Many Each Vaccination Centre Serves per LHB

	A	B	C	D	E	F
1	Local Health Board	Geo_Code	Vaccination_Centres	Population	Serves	Ranking
2	Betsi Cadwaladr	W11000023	16	703,361	43,960	1
3	Powys	W11000024	3	133,030	44,343	2
4	Cwm Taf Morgannwg	W11000027	5	449,836	89,967	3
5	Aneurin Bevan	W11000028	5	598,194	119,639	4
6	Swansea Bay	W11000026	3	390,949	130,316	5
7	Hywel Dda	W11000025	2	389,719	194,860	6
8	Cardiff & Vale	W11000029	1	504,497	504,497	7
9						

Reminder of the previous layer of Death percentages (underneath Vax Centres)
WalesLHBDeathsAll.xls

Figure 19 Reminder of the Deaths (underneath previous map)



show the number of Vaccination Centres per LHB
Added in Ocean layer (last) with labelling

- Powys has largest area and smallest population.
- It is more likely that the more **densely populated** areas suffered due to high transmission.
- Ranking by **percentage of population who died/vaccinations** given shows **more accurate** picture (hence these figures used):

[3]

Table 8 All Wales Population By Local Health Board

Area		Area Code	Mid-year 2009	Mid-year 2010	Mid-year 2011	Mid-year 2012	Mid-year 2013	Mid-year 2014	Mid-year 2015	Mid-year 2016	Mid-year 2017	Mid-year 2018	Mid-year 2019	Mid-year 2020
Wales			3,038,872	3,049,971	3,063,758	3,074,067	3,082,412	3,092,036	3,099,086	3,113,150	3,125,165	3,138,631	3,152,879	3,169,586
Wales	Betsi Cadwaladr University Health Board	W11000023	684,575	685,911	688,417	689,924	691,180	693,067	693,360	694,826	696,284	698,369	699,559	703,361
	Powys Teaching Health Board	W11000024	133,090	132,878	133,071	133,015	132,786	132,777	132,730	132,337	132,515	132,447	132,435	133,030
	Hywel Dda University Health Board	W11000025	379,051	380,195	381,867	383,399	383,833	383,927	383,129	383,656	384,239	385,615	387,284	389,719
	Swansea Bay University Health Board	W11000031	375,138	376,949	378,571	379,541	379,975	381,419	383,262	386,140	387,570	389,372	390,308	390,949
	Cwm Taf Morgannwg University Health Board	W11000030	430,682	431,423	432,634	434,288	435,710	437,214	438,884	441,301	443,368	445,190	448,639	449,836
	Aneurin Bevan University Health Board	W11000028	572,518	574,778	577,077	578,178	579,346	580,794	582,245	584,831	587,743	591,225	594,164	598,194
	Cardiff and Vale University Health Board	W11000029	463,818	467,837	472,121	475,722	479,582	482,838	485,476	490,059	493,446	496,413	500,490	504,497

Table 9 All Wales Covid Deaths Ranked Proportionate to Population of Local Health Board

Local Health Boards - Deaths Ranked Least to Most Proportionate to Population

Local_Health_Board	Deaths	Geo_Code	Raw_Ranking	Population	% Deaths	Placed (Low to High)
Powys	89	W11000024	1	133030	0.07	1
Hywel Dda	707	W11000025	2	389719	0.18	2
Cardiff and Vale	924	W11000029	3	504497	0.18	3
Betsi Cadwaladr	1259	W11000023	6	703361	0.18	4
Aneurin Bevan	1193	W11000028	5	598194	0.20	5
Swansea Bay	976	W11000026	4	390949	0.25	6
Cwm Taf Morgannwg	1871	W11000027	7	449836	0.42	7

2.5 Data, File Types and Reasons Used

2.5.1 Data Sets

Workspace saved in **GISExamination.WOR**

Data Sets Used

- Total **Vaccinations** given by organisations in Wales
- Total **Covid Cases** in Carmarthenshire
- **Deaths** by Local Health Board
- **Lle** website to show the **Local Health Boards**
- **.gov** website used to show **Population by Welsh Local Health Boards**
- Carmarthenshire Boundary Data
- Carmarthenshire Deprivation in 5 Areas (Not Deprived, Deprived in 1 aspect, 2 aspects, 3 aspects and 4 aspects)

2.5.2 File Types

- .WOR (for whole Map Info Pro Project)
- .xls (93-2007 Excel)
- Bing Hybrid (for terrain with town names)
- Bing Aerial (for terrain)
- Maps
- Browsers
- Legends
- The various other file types listed over page

2.5.3 Reasons

The following **data sets** were chosen out of all the **Covid Data**, as they were **specific** to Local Health Boards/County (Carmarthenshire).

- Total **Vaccinations** given by organisations in Wales
- Total **Covid Cases** in **Carmarthenshire**
- **Deaths** by Local Health Board

Also chosen:

- **Lle** website to show the **Local Health Boards**
- **.gov** website used to show **Population by Welsh Local Health Boards**

Summary of Files used and reasons in table over

Table 10 Summary of Files Used and Why

	Description	Thumbnail	Fig	Reason
1	UK Regions Map UK_regns Map		1	Show UK Regions
2	Wales LHB's (with Legend) and Motorways overlaid Local_health_boards Map		5	Separate into 7 LHB's with Motorways overlaid
3	Wales LHB's with Carmarthenshire Overlaid As above		7	Show Carmarthenshire location
4	Carmarthenshire Categorised by Population CarmarthenshireBoundaryData.TAB		8	Classification of Carmarthenshire residents
5	Carmarthenshire Categorised by Deprivation Data_CarmarthenshireDeprivation.xls		10	Separate Level of deprivation maps 0,3,4
6	Carmarthenshire Categorised by Deprivation 0-4 As above		11	Show Levels of deprivation 0—4 (Overall)
7	Carmarthenshire Categorised by Very Good Health to Very Bad Health Data_HealthCarms.xls		12	Categorise Health by Very Good to Very Bad Health locations
8	Carmarthenshire Residents Deprived in all 4 Areas Data_CarmarthenshireDeprivation.xls		13	Show just those Deprived in all 4 Areas
9	Carmarthenshire OA – No of Covid Cases in Carmarthenshire by MSOA 10 Jan 21 to 27 Feb 2022 CarmsCovidCasesByLocation.xls		14	Show spread of Covid Areas
10	Carmarthenshire OA – Correlation of VBad Health Overlaid onto Covid Cases by Area Data_HealthCarms.xls		15	Above overlaid with those with Very Bad Health
11	Wales Vaccination Percentages by LHB VaxCentres.xls		16	Proportionate to Population % Vaccinated by LHB
12	Wales Covid Deaths Percentages by LHB DeathsRankedByWalesLHBAndPopulation.xls		17	Proportionate to Population % Covid Deaths by LHB
13	Wales Vaccination Centres per head of Population As above 2 (Deaths per LHB underneath)		18	Proportionate to Population % Vaccination Centres by LHB

3.0 TASK 2 – RESULTS OF GEOGRAPHICAL INFORMATION SYSTEMS BUILD

When identifying factors involved, in assessing each region's efficacy, i.e.:

- Deaths
- Vaccinations
- Vaccination Centres

considered the population of each Local Health Board, to rank the Health Boards proportionately.

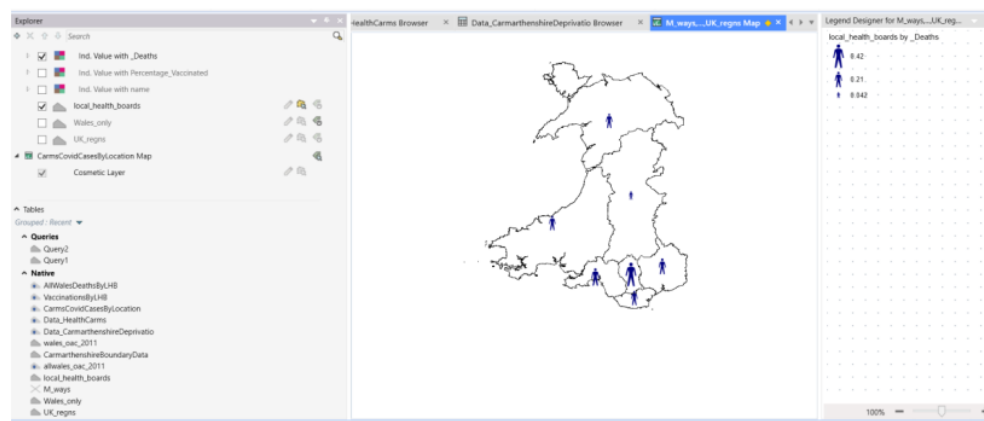
3.1 Wales LHB Deaths Proportionate to Population

Table 11 All Wales Covid Deaths Ranked by LHB Proportionate to Population

Local Health Boards - Deaths Ranked Least to Most, Proportionate to Population

Local_Health_Board	Deaths	Geo_Code	Raw_Ranking	Population	% Deaths	Placed (Low to High)
Powys	89	W11000024	1	133030	0.07	1
Hywel Dda	707	W11000025	2	389719	0.18	2
Cardiff and Vale	924	W11000029	3	504497	0.18	3
Betsi Cadwaladr	1259	W11000023	6	703361	0.18	4
Aneurin Bevan	1193	W11000028	5	598194	0.20	5
Swansea Bay	976	W11000026	4	390949	0.25	6
Cwm Taf Morgannwg	1871	W11000027	7	449836	0.42	7

Figure 20 Deaths by LHB Ranked in Proportion to Population



3.2 Wales LHB Vaccinations Proportionate to Population

Table 12 All Wales Vaccinations Ranked Proportionate to LHB Population

NB: **one** Vaccination considered to be vaccinated

Local_Health_Board	Geo_Code	First_Vaccination	Total_Population	Percentage_Vaccinated
Powys Teaching Health Board	W11000024	112724	133030	85
Cwm Taf Morgannwg University Health Board	W11000027	364444	449836	81
Hywel Dda University Health Board	W11000025	309937	389719	80
Aneurin Bevan University Health Board	W11000028	473385	598194	79
Betsi Cadwaladr University Health Board	W11000023	553697	703361	79
Cardiff and Vale University Health Board	W11000029	396881	504497	79
Swansea Bay University Health Board	W11000026	302264	390949	77

Figure 21 Vaccinations by Local Health Board (Percentages)

local_health_boards Map/local_health_boards by Percentage_Vaccinated

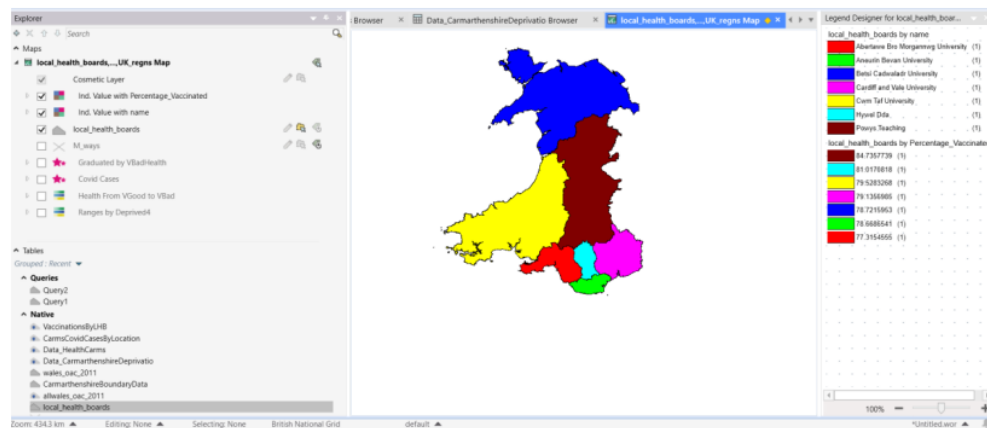


Table 13 Vaccinations by LHB Browser

Local_Health_Board	Geo_Code	First_Vaccination	Total_Population	Percentage_Vaccinated
Powys Teaching Health Board	W11000024	112,724	133,030	84.7358
Cwm Taf Morgannwg University Health Board	W11000027	364,444	449,836	81.0171
Hywel Dda University Health Board	W11000025	309,937	389,719	79.5283
Aneurin Bevan University Health Board	W11000028	473,385	598,194	79.1357
Betsi Cadwaladr University Health Board	W11000023	553,697	703,361	78.7216
Cardiff and Vale University Health Board	W11000029	396,881	504,497	78.6687
Swansea Bay University Health Board	W11000026	302,264	390,949	77.3155

3.2.1 Herd Immunity

^[4] According to the World Health Organisation, although herd immunity of 80% is needed for measles, and for polio it is 80%, the percentage needed to achieve herd immunity for Covid 19, remains unclear.

^[5] The analysis of the population in Wales:

Table 14 Wales Immunity If Immunity Wanes After 2+ years/2 Years % of Immunity

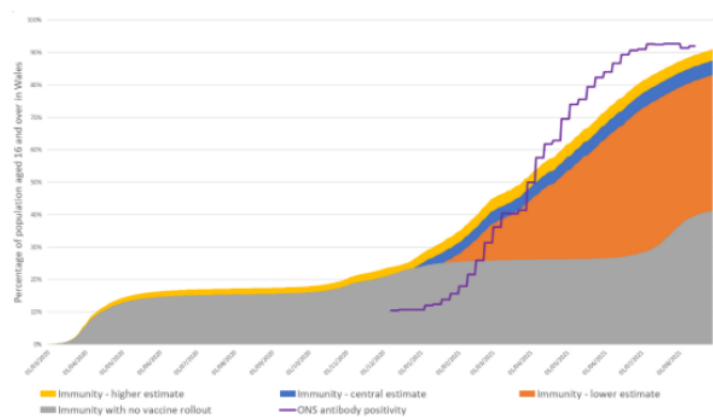
If immunity wanes after	Age Group	Will have some immunity
2+ years	16+	88%
2 years	All	75%

Table 15 Highest and Lowest Immunity in Wales by Age Group

Highest/Lowest Immunity	Age Group	Percentage immunity
Highest Immunity	80+	97%
Lowest Immunity	16-17	53%

Although immunity levels are increased by use of vaccines, **if none** had been administered, 41% (39% of the population) 16+ would have had **some immunity against Covid 19**.

Figure 22 Levels of Immunity - Best, Worst and If No Vaccines Administered



^[6] Health professionals **estimate 70-90%** of the population need immunity to achieve herd immunity.

However, some cannot take the vaccine:

- Those with weak immune systems
- If going through chemotherapy treatments
- New born babies and elderly persons

- Those living with HIV
- Vaccination refusers

Table 16 Vaccinations Ranked Proportionate to LHB Population

	Vaccinations Proportionate to Population	%	Herd Immunity Achieved
1.	Powys	85	✓
2.	Cwm Taf Morgannwg	81	✓
3.	Hywel Dda	79	1% short
4.	Aneurin Bevan	79	"
5.	Betsi Cadwaladr	79	"
6.	Cardiff & Vale	79	"
7.	Swansea Bay	77	3% short

Herd Immunity: If it is assumed the middle ground between 70-90% is 80% (similar to measles), to achieve the above then:

- Achieved: Powys and Cwm Taf Morgannwg have surpassed the benchmark
- 1% short
 - Hywel Dda
 - Aneurin Bevan
 - Betsi Cadwaladr
 - Cardiff and Vale
- Swansea Bay being the lowest at 77% are only 3% away.

3.3 Combined Rankings for Low Deaths and High Vaccination Rates by LHB

Table 17 Combined Rankings for Low Death/High Vaccination per % of LHB Population

	Ranked by <u>Least</u> Deaths	Population	%		Ranked by <u>Highest</u> % of Vaccination Using 1 dose as standard	%	Population
1	Powys	133,030	0.07	1	Powys	85	133,030
2	Hywel Dda	389,719	0.18	2	Cwm Taf Morgannwg	81	449,836
2	Cardiff and Vale	504,497	0.18	3	Hywel Dda	79	389,719
2	Betsi Cadwaladr	703,361	0.18	3	Aneurin Bevan	79	598,194
3	Aneurin Bevan	598,194	0.20	3	Betsi Cadwaladr	79	703,361
4	Swansea Bay	390,949	0.25	3	Cardiff & Vale	79	504,497
5	Cwm Taf Morgannwg	449,836	0.42	4	Swansea Bay	77	302,264

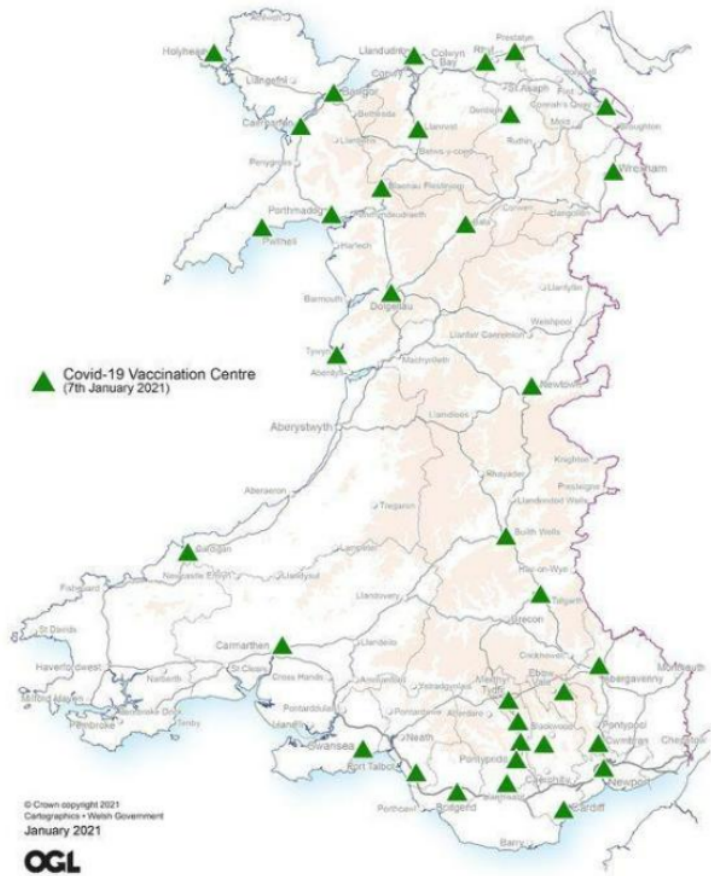
Cardiff and Vale being part of Hywel Dda:

- Came Joint 2nd in the Least Deaths with 0.18% (with 2 other LHB's)
- Came Joint 3rd in the Highest Vaccination Percentage with 79% (with 3 other LHB's)

3.4 Vaccination Centres

Figure 23 Locations of Vaccination Centres in Wales

[4]



3.4.1 Locations of Vaccination Centres - Categorised by LHB

Table 18 Locations of Vaccination Centres by LHB

[7-29]

	[5-26] Latitude	[5-26] Longitude	Local Health Board	[4] No. of Vaccination Centres
Newport	41.490101	-71.312828	Aneurin Bevan	
Bargoed	51.683552	-3.229210	Aneurin Bevan	
Cwmbran	51.653	-3.021	Aneurin Bevan	
Pontypool	51.70111	-3.04444	Aneurin Bevan	
Abergavenny	51.825366	-3.019423	Aneurin Bevan	5
Tywyn	52.586113	-4.0551	Betsi Cadwaladr	
Dolgellau	52.7391137102	-3.883579799	Betsi Cadwaladr	
Bala	52.9111100	-3.5972200	Betsi Cadwaladr	
Wrexham	53.04664	-2.99132	Betsi Cadwaladr	
Pwllhelli	52.8899	-4.41451	Betsi Cadwaladr	
Porthmadog	52.925266	-4.130193	Betsi Cadwaladr	
Blaenau Ffestiniog	52.998337	-3.944894	Betsi Cadwaladr	
Caernarfon	53.14126	-4.27016	Betsi Cadwaladr	
Llanrwst	53.14021	-3.79527	Betsi Cadwaladr	
Denbigh	53.18333	-3.41667	Betsi Cadwaladr	
Connah's Quay	53.21839	-3.05496	Betsi Cadwaladr	
Holyhead	53.31281	-4.63281	Betsi Cadwaladr	
Bangor	53.227390	-4.129263	Betsi Cadwaladr	
Llandudno	53.32498	-3.83148	Betsi Cadwaladr	
Rhyl	53.31929	-3.49228	Betsi Cadwaladr	
Prestatyn	53.33748	-3.40776	Betsi Cadwaladr	16
Cardiff	51.483707	-3.1680962	Cardiff & Vale	1
Llantrisant	51.5429188	-3.3749525	Cwm Taf	
Pontypridd	51.601151	-3.349900	Cwm Taf	
Rhondda	51.650661	-3.493790	Cwm Taf	
Mountain Ash	51.683521	-3.379690	Cwm Taf	
Merthyr Tydfil	51.74794	-3.37779	Cwm Taf	5
Cardigan	52.0681917	-4.6574333	Hywel Dda	
Carmarthen	51.8561996	-4.3051558	Hywel Dda	2
Talgarth	51.99557	-3.23288	Powys	
Builth Wells	52.14911	-3.40208	Powys	
Newtown	52.5121120	-3.3131060	Powys	3
Swansea	51.6210919	-3.9438179	Swansea Bay	
Port Talbot	51.5953016	-3.7829294	Swansea Bay	
Bridgend	51.504286	-3.576945	Swansea Bay	3

NB: As Long/Lat subscription only could not map

3.4.2 Number of Vaccination Centres Categorised by LHB with Population Alphabetically Sorted

Table 19 No. of Vaccination Centres by LHB with Population in Alphabetical Order

	Local Health Board	Vaccination Centres	Population
1	Aneurin Bevan	5	598,194
2	Betsi Cadwaladr	16	703,361
3	Cardiff	1	504,497
4	Cwm Taf	5	449,836
5	Hywel Dda	2	389,719
6	Powys	3	133,030
7	Swansea	3	390,949

3.4.3 Number of Vaccination Centres Categorised by LHB with Population in Size Order

Table 20 No. of Vaccination Centres by LHB with Population Size Order

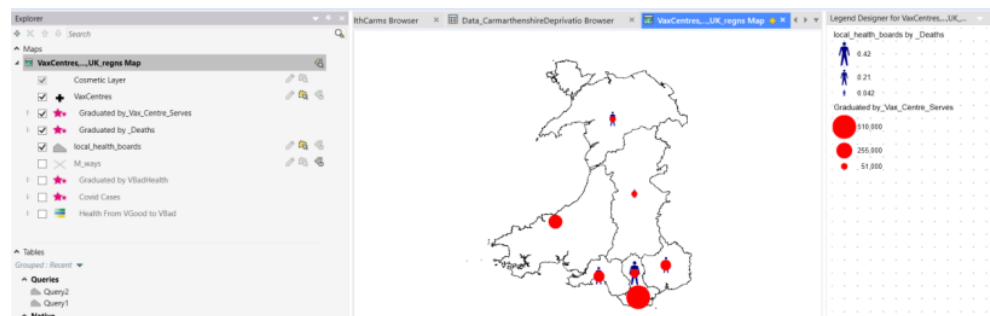
	Local Health Board	Vaccination Centres	Population
6	Powys	3	133,030
5	Hywel Dda	2	389,719
7	Swansea	3	390,949
4	Cwm Taf	5	449,836
3	Cardiff	1	504,497
1	Aneurin Bevan	5	598,194
2	Betsi Cadwaladr	16	703,361

3.4.4 Vaccination Centres Categorised by LHB – Ranked by which Serving Least/Most

Table 21 Vaccination Centres by LHB Ranked by which Serving Least to Most

Local Health Board	Geo_Code	Vaccination_Centres	Population	Serves	Ranking
Betsi Cadwaladr	W11000023	16	703,361	43,960	1
Powys	W11000024	3	133,030	44,343	2
Cwm Taf Morgannwg	W11000027	5	449,836	89,967	3
Aneurin Bevan	W11000028	5	598,194	119,639	4
Swansea Bay	W11000026	3	390,949	130,316	5
Hywel Dda	W11000025	2	389,719	194,860	6
Cardiff & Vale	W11000029	1	504,497	504,497	7

Figure 24 Vaccination Centres per head of Population by LHB



3.5 Possible Reasons for Individual LHB's Success or Failure

Table 22 Possible Reasons for LHB's Success/Failure

Good Performance		Poor Performance	
Least Deaths	Possible Reasons	Most Deaths	Possible Reasons
Powys	Smaller Aged Population? More Rural so less transmission?	Cwm Taf Morgannwg	Larger Aged Population? More Care Homes? More urban so more transmission? High Deprivation: - no access to transport/car - overcrowded households - unemployment - lack of education
Most Vaccinations	Possible Reasons	Least Vaccinations	Possible Reasons
Powys	Less People to Vaccinate	Swansea Bay	Younger Student Population (not prioritized for vaccines) Students may have been counted, but left to study remotely from home Smaller Aged Population (more employment) More Urban (crowded)
Most Vaccination Centres per head		Least Vaccination Centres per head	
Betsi Cadwaladr	16 Most Well catered for Rural Sparsely Populated	Cardiff & Vale	1 Least Well Catered for Urban Highly Populated

3.5.1 Powys' Success with Both High Vaccination and Low Death Rate

- Powys coped well on **both** fronts as highest Percentage of population vaccinated and the lowest deaths.

Possible Reasons for Powys Success:

- Powys has **smallest population** so less to vaccinate
- Powys populace is **spread over wide area** and mostly rural (**less transmission**)
- With 3 vaccination centres it came 2nd in Vaccination Centres per head – Population spread over wide area.

3.5.2 Highest Death Rate - Cwm Taf Morgannwg

- Cwm Taf Morgannwg had worst Deaths per Population than all the rest

Possible Reasons:

- There may be larger proportion of aged population (care homes?)
- There may be more urban (overcrowded) areas

3.5.3 Lowest Vaccinations - Swansea Bay

Most of the rest of Local Health Boards had 77-79% of population Vaccinated

- There was marginal difference in percentages vaccinated

3.6 Carmarthenshire Case Study – Hywel Dda's Ranking on LHB's

Carmarthenshire being part of Hywel Dda Local Health Board:

3.6.1 Least Deaths and Most Vaccinations

Hywel Dda was 2nd least populated Local Health Board and:

Table 23 Least Deaths/Most Vaccinations by % Population of LHB

	Ranked by <u>Least Deaths</u>	Population	%		Ranked by <u>Highest % of Vaccination</u> Using 1 dose as standard	%	Population
1	Powys	133,030	0.07	1	Powys	85	133,030
2	Hywel Dda	389,719	0.18	2	Cwm Taf Morgannwg	81	449,836
2	Cardiff and Vale	504,497	0.18	3	Hywel Dda	79	389,719
2	Betsi Cadwaladr	703,361	0.18	3	Aneurin Bevan	79	598,194
3	Aneurin Bevan	598,194	0.20	3	Betsi Cadwaladr	79	703,361
4	Swansea Bay	390,949	0.25	3	Cardiff & Vale	79	504,497
5	Cwm Taf Morgannwg	449,836	0.42	4	Swansea Bay	77	302,264

- For Covid **Deaths** placed Joint 2nd **Least Deaths** at 0.18%
- For Covid **Vaccinations** placed Joint 3rd at 79%
- For Vaccination Centres placed 6th for the most population served with just 2 centres.

3.6.2 Vaccination Centres

- For **Vaccination Centres** per head of population, Hywel Dda came 6th with 2 Vaccination Centres to serve 194,860 people

Table 24 – See the Ranking of Hywel Dda (Carmarthenshire)

Local Health Board	Geo_Code	Vaccination_Centres	Population	Serves	Ranking
Betsi Cadwaladr	W11000023	16	703,361	43,960	1
Powys	W11000024	3	133,030	44,343	2
Cwm Taf Morgannwg	W11000027	5	449,836	89,967	3
Aneurin Bevan	W11000028	5	598,194	119,639	4
Swansea Bay	W11000026	3	390,949	130,316	5
Hywel Dda	W11000025	2	389,719	194,860	6
Cardiff & Vale	W11000029	1	504,497	504,497	7

3.7 What the Carmarthenshire Case Study Revealed

Insights revealed:

3.7.1 Urban and Crowded = More Covid Cases

- it highlighted the more **urban and crowded**, the **more covid cases** there were.

3.7.3 Countryside and Least Populated = Less Covid Cases

- The Farming community, on the other hand, **being more spread out** were **less afflicted**.

3.7.4 The More Deprived and Bad Health Areas = More Covid Cases

- The **more deprived** areas suffered Covid infections possibly due to **overcrowding and poor health**.

3.8 Summary of Whole of Wales LHB Performance

Table 25 Summary of Whole of Wales Local Health Boards Performance (Rankings)

Ranked by <u>Least</u> % Deaths	Population	%	Ranked by <u>Highest</u> % of Vaccination Using 1 dose as standard	%	Population	Raw Rank Population Highest to Lowest		No of Vaccination Centres (VC)	VC's Serving the Least to the Most
1 Powys	133,030	0.07	1 Powys	85	133,030	1	Betsi Cadwaladr	16	1 Betsi Cadwaladr
2 Hywel Dda	389,719	0.18	2 Cwm Taf Morgannwg	81	449,836	2	Aneurin Bevan	5	2 Powys
2 Cardiff and Vale	504,497	0.18	3 Hywel Dda	79	389,719	3	Cardiff & Vale	1	3 Cwm Taf
2 Betsi Cadwaladr	703,361	0.18	3 Aneurin Bevan	79	598,194	4	Cwm Taff	5	4 Aneurin Bevan
3 Aneurin Bevan	598,194	0.20	3 Betsi Cadwaladr	79	703,361	5	Hywel Dda	2	5 Swansea Bay
4 Swansea Bay	390,949	0.25	3 Cardiff & Vale	79	504,497	6	Swansea Bay	3	6 Hywel Dda
5 Cwm Taf Morgannwg	449,836	0.42	4 Swansea Bay	77	302,264	7	Powys	3	7 Cardiff & Vale

The mostly rural area of Betsi Cadwaladr got the most vaccination centres whilst Cardiff & Vale, the capital, got the least. The reasoning seems to be because of the sizes.

- Betsi Cadwaladr much larger area,
- although Cardiff has 3rd largest population – and denser.
- Cardiff being the capital has more transient population being the capital of Wales and therefore a hub of activity (and transmission).

Table 26 Vaccination Centre Rankings

Local Health Board	Geo_Code	Vaccination_Centres	Population	Serves	Ranking
Betsi Cadwaladr	W11000023	16	703,361	43,960	1
Powys	W11000024	3	133,030	44,343	2
Cwm Taf Morgannwg	W11000027	5	449,836	89,967	3
Aneurin Bevan	W11000028	5	598,194	119,639	4
Swansea Bay	W11000026	3	390,949	130,316	5
Hywel Dda	W11000025	2	389,719	194,860	6
Cardiff & Vale	W11000029	1	504,497	504,497	7

3.9 Thematic Maps Used to Highlight Findings

Table 27 Thematic Maps Used to Highlight Findings

	Map to Show:	Thumbnail	Fig	Shows
1	UK Regions Map		1	UK Regions
2	Wales LHB's (with Legend) and Motorways overlaid		5	The 7 LHB's with Motorways overlaid
3	Wales LHB's with Carmarthenshire Overlaid		7	Carmarthenshire location
4	Carmarthenshire Categorised by Population		8	Carmarthenshire residents
5	Carmarthenshire Categorised by Deprivation		10	Separate Level of deprivation maps 0,3,4
6	Carmarthenshire Categorised by Deprivation 0-4		11	Levels of deprivation 0—4 (Overall)
7	Carmarthenshire Categorised by Very Good Health to Very Bad Health		12	Those with Very Good Health locations
8	Carmarthenshire Residents Deprived in all 4 Areas		13	Those Deprived in all 4 Areas
9	Carmarthenshire OA – No of Covid Cases in Carmarthenshire by MSOA 10 Jan 21 to 27 Feb 2022		14	Spread of Covid Areas
10	Carmarthenshire OA – Correlation of VBad Health Overlaid onto Covid Cases by Area		15	Above overlaid with those with Very Bad Health
11	Wales Vaccination Percentages by LHB		16	Proportionate to Population % Vaccinated by LHB
12	Wales Covid Deaths Percentages by LHB		17	Proportionate to Population % Covid Deaths by LHB
13	Wales Vaccination Centres per head of Population (Deaths per LHB underneath)		18	Proportionate to Population % Vaccination Centres by LHB

4.0 CONCLUSION

4.1 Best LHB For Least Deaths and Most Vaccinations - Powys

- Deaths were fewer as low transmission rate, as area mainly rural
- Vaccinations highest as has smallest population, which is easier to manage
- Achieved over 80% Vaccination so Herd Immunity reached

4.2 Worst LHB for Deaths – Cwm Taf Morgannwg

- Area urban, so likely had a high transmission rate
- Could have been because it has large percentage of older people/those in bad health and/or crowded deprived conditions
- 1% away from assumed 80% target to Herd Immunity having achieved 79%

4.3 Worst LHB for Vaccinations – Swansea Bay

- Large Town with outskirts crowded suburbs housing workers and students
- Students may have left to go back to parents, but been counted as residents
- Insufficient Vaccination Centres
- 3% away from the assumed target threshold of herd immunity of 80% having achieved 77%

4.4 Most Vaccination Centres Per Head of Population – Betsi Cadwaladr

- Betsi Cadwaladr had by far the most Vaccination Centres in Wales at 16, each centre catered for the least (43,960), but still only came joint 3rd in the Vaccination Ranking.
- Betsi Cadwaladr had the highest population at 703,361
- 1% away from the assumed target threshold of herd immunity of 80% having achieved 79%

4.5 Least Vaccination Centres Per Head of Population – Cardiff & Vale

- Cardiff & Vale had the least Vaccination Centres (by far) in Wales at 1 Vaccination centre, which catered for the most (504,497) but still came joint 3rd in the Vaccination Ranking.
- 1% away from the assumed target threshold of herd immunity of 80% having achieved 79%

4.6 Recommendations

There was little difference in percentages vaccinated and death rates, however, the number of Vaccination Centres differed widely.

Maximum efficacy could be achieved if Vaccination Centres were provided proportionate to:

- Population, appropriately weighted for:
 - Amount in crowded Urban Areas
 - Amount with Deprivation
 - Amount in Very Bad Health
 - Amount of transient visitors

Table 28 Recommendations by Areas of Concern

	Area of Concern	Recommendation...because
1	Deaths	Prioritize Vaccinations for those in: • Crowded accommodation • deprived areas • very bad health
2	Cases	More prevalent in crowded areas so more preventative measures needed in highly populated areas (more Vaccination Centres)
3	Vaccinations	Prioritize Vaccinations: • according to highest population of LHB's allowing for: ○ those in urban areas ○ those in deprived areas ○ those in very bad health
4	Vaccination Centres	Provide more Vaccination Centres • Insufficient in densely populated areas where deprivation and very bad health high • Insufficient in high traffic areas (i.e., capital Cardiff and Swansea – near M4 motorway)

5.0 REFERENCES

[1]	GIS Is Being Applied Around the World Stock Photo Adobe Stock – Free image [Online] Available: https://GIS Is Being Applied Around the World Stock Photo Adobe Stock [Accessed 29 April 2022]
[2]	Lle – Local Health Boards (gov.wales) [Online] Available: https://Lle - Local Health Boards (gov.wales) [Accessed 6 May 2022]
[3]	Population estimates by local health boards and year (gov.wales) [Online] Available: https://Population estimates by local health boards and year (gov.wales) [Accessed 6 May 2022]
[4]	30 Dec 2020, Coronavirus disease (COVID-19): Herd immunity, lockdowns and COVID-19 (who.int) [Online] Available: https://Coronavirus disease (COVID-19): Herd immunity, lockdowns and COVID-19 (who.int) [Accessed 14 May 2022]
[5]	Welsh Government Technical Advisory Cell (TAG), 8 Sept 2021, Advice from tag for the 17 september restriction review.pdf(gov.wales) [Online] Available: https://advice-from-tag-for-the-17-september-restriction-review.pdf (gov.wales) [Accessed 14 May 2022]
[6]	9 Apr 2021, The Relationship Between Vaccines and Herd Immunity, Columbia Public Health [Online] Available: https://The Relationship Between Vaccines and Herd Immunity Columbia Public Health
[7]	J. Hill, 12 Jan 2021, Why Welsh Government will not reveal Covid vaccination sites, South Wales Argus [Online] Available: https://Why Welsh Government will not reveal Covid vaccination sites South Wales Argus [Accessed 6 May 2022]
[8]	Latitude and Longitude Finder on Map Get Coordinates(latlong.net) [Online] Available: https://Latitude and Longitude Finder on Map Get Coordinates (latlong.net) [Accessed 7 May 2022]
[9]	Latitude, Longitude and GPS coordinates of Cwmbran (gps-latitude-longitude.com) [Online] Available: https://Latitude, Longitude and GPS coordinates of Cwmbran (gps-latitude-longitude.com) [Accessed 7 May 2022]
[10]	GPS coordinates of Merthyr Tydfil, United Kingdom. Latitude 51.7479 Longitude -3.3778 [Online] Available: https://GPS coordinates of Merthyr Tydfil, United Kingdom. Latitude: 51.7479 Longitude: -3.3778 [Accessed 7 May 2022]
[11]	GPS coordinates of Pontypool, United Kingdom, Latitude: 51.7011 Longitude: -3.0444 [Online] Available: https://GPS coordinates of Pontypool, United Kingdom. Latitude: 51.7011 Longitude: -3.0444 [Accessed 7 May 2022]
[12]	GPS coordinates of Abergavenny, United Kingdom, DMS, UTM, GeoHash – CountryCoordinate.com [Online] Available: https://GPS coordinates of Abergavenny, United Kingdom, DMS, UTM, GeoHash - CountryCoordinate.com [Accessed 7 May 2022]

[13]	Where is Talgarth? Talgarth on a map (getthedata.com) [Online] Available: https://Where is Talgarth? Talgarth on a map (getthedata.com) [Accessed 7 May 2022]
[14]	Where is Builth Wells? Builth Wells on a map (getthedata.com) [Online] Available: https://Where is Builth Wells? Builth Wells on a map (getthedata.com) [Accessed 7 May 2022]
[15]	Where is Newtown Powys, Wales United Kingdom (roadonmap.com) [Online] Available: https://Where is Newtown Powys, Wales United Kingdom (roadonmap.com) [Accessed 7 May 2022]
[16]	Tywyn Map Great Britain Latitude & Longitude: Free Wales Maps (freecountrymaps.com) [Online] Available: https://Tywyn Map Great Britain Latitude & Longitude: Free Wales Maps (freecountrymaps.com) [Accessed 7 May 2022]
[17]	GPS coordinates of Dolgellau, United Kingdom. Latitude: 52.7391 Longitude: -3.8836 [Online] Available: https://GPS coordinates of Dolgellau, United Kingdom. Latitude: 52.7391 Longitude: -3.8836 [Accessed 7 May 2022]
[18]	Geographic coordinates of Bala, Latitude, longitude, and elevation above sea level of Bala, United Kingdom (dateandtime.info) [Online] Available: https://Geographic coordinates of Bala. Latitude, longitude, and elevation above sea level of Bala, United Kingdom (dateandtime.info) [Accessed 7 May 2022]
[19]	GPS coordinates of Wrexham, United Kingdom. Latitude: 53.0466 Longitude: -2.9913 [Online] Available: https://GPS coordinates of Wrexham, United Kingdom. Latitude: 53.0466 Longitude: -2.9913 [Accessed 7 May 2022]
[20]	GPS coordinates of Pwllheli, United Kingdom, Latitude: 52.8899 Longitude: -4.4145 [Online] Available: https://GPS coordinates of Pwllheli, United Kingdom. Latitude: 52.8899 Longitude: -4.4145 [Accessed 7 May 2022]
[21]	GPS coordinates of Caernarfon, United Kingdom. Latitude: 53.1413 Longitude: -4.2702 [Online] Available: https://GPS coordinates of Caernarfon, United Kingdom. Latitude: 53.1413 Longitude: -4.2702 [Accessed 7 May 2022]
[22]	GPS coordinates of Llanrwst, United Kingdom. Latitude: 53.1402 Longitude: -3.7953 [Online] Available: https://GPS coordinates of Llanrwst, United Kingdom. Latitude: 53.1402 Longitude: -3.7953 [Accessed 7 May 2022]
[23]	GPS coordinates of Denbigh, United Kingdom. Latitude: 53.1833 Longitude: -3.4167 [Online] Available: https://GPS coordinates of Denbigh, United Kingdom. Latitude: 53.1833 Longitude: -3.4167 [Accessed 7 May 2022]
[24]	Where is Connah's Quay? Connah's Quay on a map (getthedata.com) [Online] Available: https://Where is Connah's Quay? Connah's Quay on a map (getthedata.com) [Accessed 7 May 2022]

[25]	Latitude and longitude of Holyhead wales – Yahoo Search Results [Online] Available: https://latitude and longitude of Holyhead wales - Yahoo Search Results [Accessed 7 May 2022]
[26]	Latitude, Longitude and GPS coordinates of Bangor, Wales (gps-latitude-longitude.com) [Online] Available: https://Latitude, Longitude and GPS coordinates of Bangor, Wales (gps-latitude-longitude.com) [Accessed 7 May 2022]
[27]	GPS coordinates of Llandudno, United Kingdom. Latitude: 53.3250 Longitude: -3.8315 [Online] Available: https://GPS coordinates of Llandudno, United Kingdom. Latitude: 53.3250 Longitude: -3.8315 [Accessed 7 May 2022]
[28]	GPS coordinates of Rhyl, United Kingdom. Latitude: 53.3193 Longitude: -3.4923 [Online] Available: //GPS coordinates of Rhyl, United Kingdom. Latitude: 53.3193 Longitude: -3.4923 [Accessed 7 May 2022]
[29]	Latitude.to map gb united kingdom cities Prestatyn [Online] Available: https://latitude.to/map/gb/united-kingdom/cities/prestatyn [Accessed 7 May 2022]

- Word Count of Tables of Figures 603
- Word count 3,937- 603 = total net of 3,334
- 4,000 allowed.

Geodemographic Analysis using GIS Software

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

Instructor

57 / 100

Generic Assessment Criteria	Marks available	Marks awarded
1. Engagement with Literature Skills		
2. Knowledge and Understanding Skills		
You have provided a detailed log of your expert exploration of the GIS software. You have thought about the data available and looked for opportunities within the functionality of the software to explore said data using different thematic mapping tools.	25	14

3. Cognitive and Intellectual Skills		
Whilst looking for a path through the software you have provided some thoughtful choices on your data types and how you are then going to match the sad data types within your workspace you demonstrate good planning and again thoughtful analysis of the data required to provide answers as requested in the assignment remit. Within your data log I very much like the table where you show the imagery and your reasoning for choice offset data sets.	25	16
4. Practical Application Skills		
This is difficult software and at times I felt there would have been easier ways for you to present your data. For example you gave me lots of screenshots of the whole package and maybe you could have made use of the image saving tool. Also make sure that when you're deciding on colour codes, for example if we look at the Wales health	40	20

board map, what are you doing with the data and what do you want to portray have a think about the data behind the scenes. That said you have most definitely explored the software and used it well to present a data set on Wales and a data set within your chosen study area of Carmarthen. Good use has been made of all the different available tools to present themes and visualise the data and again the table provides good justification of your choice.		
5. Transferable Skills for Life and Professional Practice		
Generally because of the large screen prints and well appointed information this section was a little messy. The message you were trying to present was sometimes lost. However again I would like to emphasise that the table where you showed small snippets of your images and the reasons behind your choices was very good and I enjoyed that.	10	7

--	--	--

Generic Assessment Criteria	Marks available	Marks awarded
1. Engagement with Literature Skills		
Throughout your second task you have reflected on the data you've analysed in your report but I do feel you haven't engaged with the literature perhaps some references to why GIS is good for epidemiology type studies and some references to case studies of GIS used for vaccine uptake analysis.	25	11
2. Knowledge and Understanding Skills		
you have worked well with your data and looked at different aspects of vaccine uptake and the reasons behind the poor uptake - looking at the population of several communities and making some great observations and comparisons. Some thoughtful discussions throughout	20	12

3. Cognitive and Intellectual Skills		
Thoughtful interpretation of your data and some good comparisons between different data sets population for example and the number of vaccine centres provided a good argument and discussion point on the possible achievement of herd immunity	25	17
4. Practical Application Skills		
in this section you needed to reflect on some of your maps and imagery that you created in the first part of this assessment I E bringing some map images as you are discussing them.	20	10

5. Transferable Skills for Life and Professional Practice		
generally a good layout however I think I would have liked a conclusion at the end of Part 2 you have put in a table where you have thought about solutions but perhaps a concluding paragraph would have helped.	10	6

PAGE 1
PAGE 2
PAGE 3
PAGE 4
PAGE 5
PAGE 6
PAGE 7
PAGE 8
PAGE 9

PAGE 10

PAGE 11

PAGE 12

PAGE 13

PAGE 14

PAGE 15

PAGE 16

PAGE 17

PAGE 18

PAGE 19

PAGE 20

PAGE 21

PAGE 22

PAGE 23

PAGE 24

PAGE 25

PAGE 26

PAGE 27

PAGE 28

PAGE 29

PAGE 30

PAGE 31

PAGE 32

PAGE 33

PAGE 34

PAGE 35

PAGE 36

PAGE 37

PAGE 38

PAGE 39

PAGE 40

PAGE 41

PAGE 42

PAGE 43

PAGE 44
