

GIS Assignment 1

by Runa Bibi

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Beverley Holland

Geodemographic Analysis using GIS Software

Geographical Information Systems

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1. Abstract

This research paper discusses how a Spatial Decision Support System (SDSS) can be established to help notify healthcare professionals on recent uptakes of the MMR vaccination in Wales with a particular focus on Swansea, so as to find any places that may be vulnerable of catching mumps. A GIS will be built in MapInfo to try and find patterns in the spatial data and answer a prove or disprove a hypothesis.

2. Introduction

Geographical Information Systems (GIS) are used for storing, displaying, capturing and checking data linked to locations found on Earth's surface [1]. The beginnings of GIS can be traced back to 1854 when Dr Jon Snow mapped cholera outbreak sites with the boundaries of properties and the roads and water pumps in which he found that the disease was not airborne but being spread through a specific infected water pump [2].

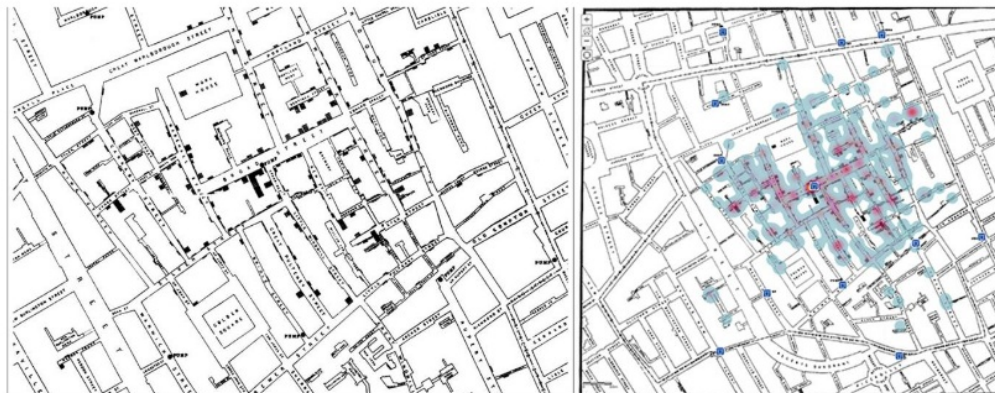


Figure 1 - Dr Jon Snow's original map next to map with heat map analysis [2]

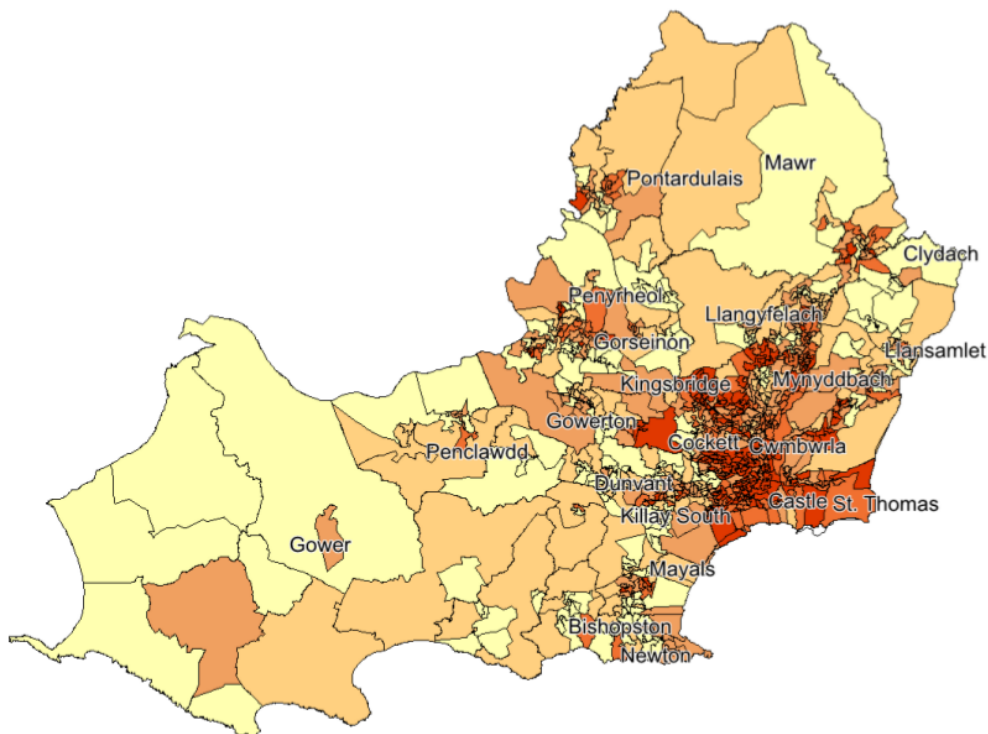
Spatial Decision Support Systems (SDSS) are designed to accompany GIS for solving spatial problems too complex for a GIS alone [3]. SDSS can be used in healthcare to help make decisions and spot high risk locations for disease outbreaks alongside distribution of staff, vaccines and healthcare facilities [4]. By using GIS and SDSS in healthcare it is possible to find patterns in diseases and correlations such as the surrounding environment [5], similar to Dr Jon Snow.

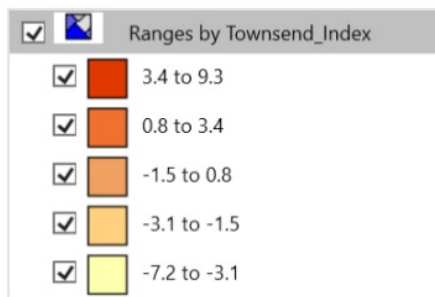
This research paper will discuss and develop a GIS system to find patterns in MMR vaccination uptake in South Wales due to recent reports of mumps at universities in South Wales being investigated by Public Health Wales [6].

3. Discussion and Analysis

To carry out this case study, a hypothesis needs to be brought forward to prove or disprove. My hypothesis is that MMR vaccination uptake by 2 years old increases by 2016-17 compared to 2003-04 and immunisation will have improved. To start to build the GIS, data collection is required in Excel. The data needed includes geocodes which are numerical coordinates derived from text-based information on locations [7]. The first data to collect will be deprivation data. A good way of analysing deprivation data is with the Townsend Index which is a census-based index which is calculated by four variables: households with no car, overcrowded households, households with no owner and unemployed people [8].

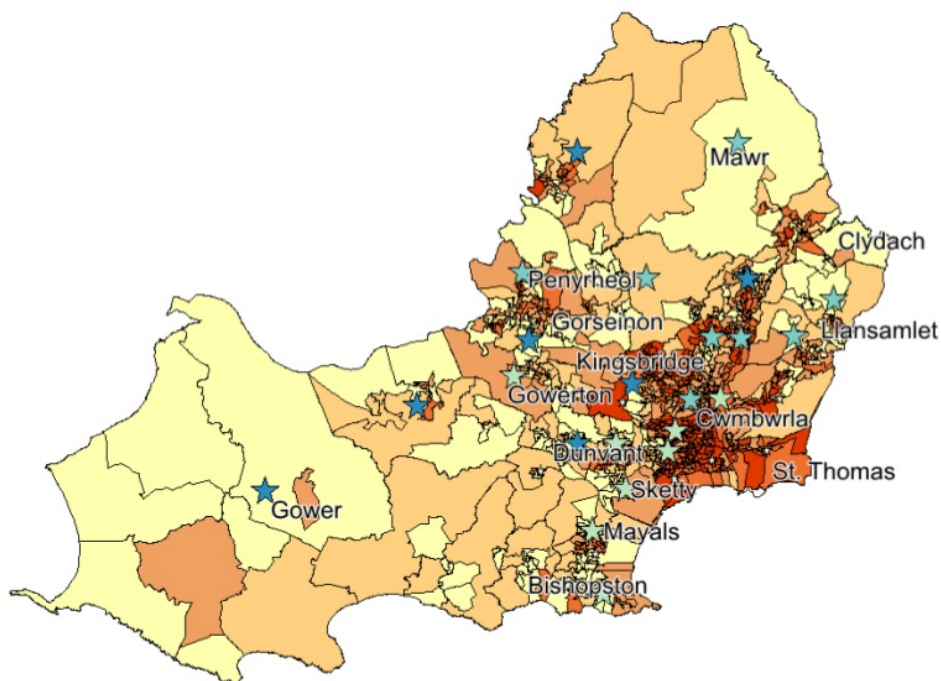
This was the first layer which was put on the Wales Mid Super Output Area (MSOA) along with labels.





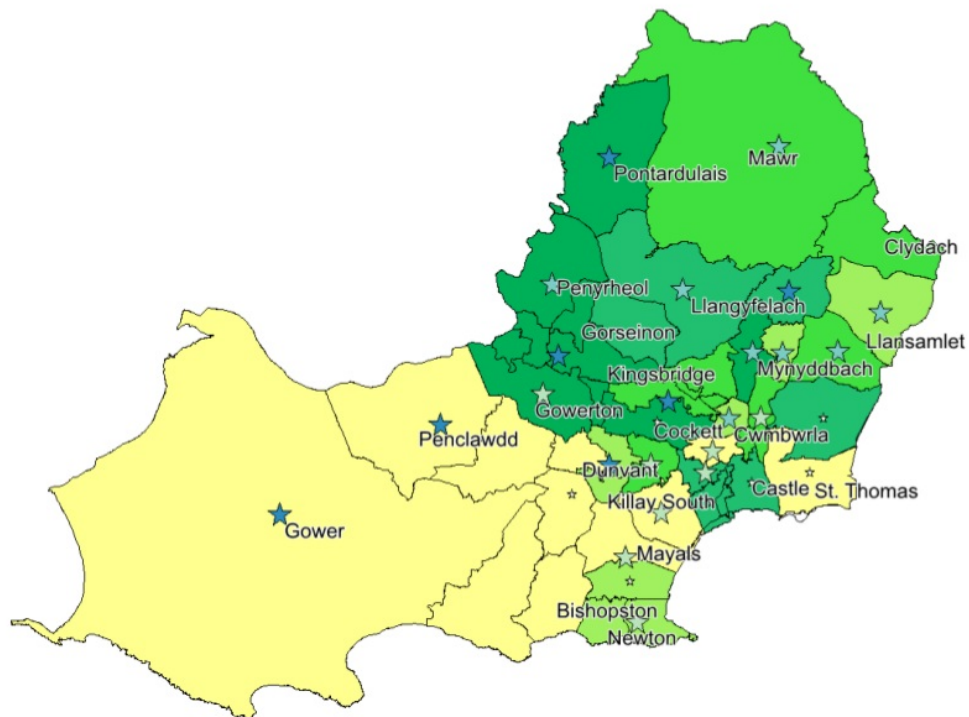
To create this visualisation, the Wales MSOA map needed to be downloaded and then the Townsend Index data needed to be linked via geocodes.

MMR data of the first dose by age 2 was then collected for the most recent years available i.e. 14-15, 16-17, 17-18 and placed over the map as a second layer using graduating symbols, which not only increased in size but also had a changing colour gradient.



MMR_data by First_dose_by_age_2__17_18			
	97.1 to 100	(7)	
	96 to 97.1	(8)	
	91.3 to 96	(8)	
	79.3 to 91.3	(8)	

In order to find answers to my hypothesis, I created a map with the most recent data on first MMR vaccination by age 2 for 2017-18 as the top layer and the same data for 2003-04.



MMR_data by First_dose_by_age_2__17_18			
★	97.1 to 100	(7)	
★	96 to 97.1	(8)	
★	91.3 to 96	(8)	
★	79.3 to 91.3	(8)	
wales_msoa_2011 by _1st_dose_by_age_2_03_04			
	76 to 81.6	(6)	
	71.4 to 76	(6)	
	67.2 to 71.4	(6)	
	64.4 to 67.2	(6)	
	51.4 to 64.4	(7)	

From this map, you can see the majority of places that were 51.4-64.6% increased their uptake 91.3% upwards. While it may seem like Castle St. Thomas has not improved due to the size of the star, if you look at the legend you can see they have increased from 51.4-64.4% to 79.3-91.3% which is why the legend is so important. A

lot of the areas that had low MMR vaccination uptake in 2003-04 were in the same surrounding areas which may have led to low immunity there.

4. Conclusion

Overall, the map is a very useful visual information system, provided there is a bit more information available to see. Patterns are more clearly seen with the use of colour and size, so when using graduated symbols, they should also increase in size. My hypothesis has been proven right as shown by the significant increase in MMR vaccination uptake compared to 2003-04.

5. References

- [1] National Geographic, "GIS (Geographic Information System)," [Online]. Available: <https://www.nationalgeographic.org/encyclopedia/geographic-information-system-gis/>. [Accessed 9 December 2019].
- [2] R. Steenson, "The history of Geographic Information Systems (GIS)," BCS, 25 April 2019. [Online]. Available: <https://www.bcs.org/content-hub/the-history-of-geographic-information-systems-gis/>. [Accessed 9 December 2019].
- [3] P. J. Densham, "Spatial decision support systems," in *Geographical information systems: principles and applications*, London, Longman Publishing Group, 1993, pp. 403-412.
- [4] R. Beard, E. Wentz and M. Scotch, "A systematic review of spatial decision support systems in public health informatics supporting the identification of high risk areas for zoonotic disease outbreaks," *International Journal of Health Geographics*, vol. 18, 2018.
- [5] F. B. Abdullahi, M. Lawal and J. Agushika, "Design and Implementation of a Web-based GIS for Public Healthcare Decision Support System in Zaria Metropolis," *International Journal of Research and Reviews in Applied Sciences*, vol. 4, no. 4, pp. 435-439, 2010.
- [6] M. Lloyd, "Suspected mumps among south Wales university students," BBC, 18 October 2019. [Online]. Available: <https://www.bbc.co.uk/news/uk-wales-50086801>. [Accessed 9 December 2019].
- [7] C. Owusu, M. Zheng, Y. Lan and W. Tang, "Geocoding Fundamentals and Associated Challenges," in *Geospatial Data Science Techniques and Applications*, Boca Raton, CRC Press, 2017, pp. 41-62.
- [8] Geographical Referencing Learning Resources, "Townsend Deprivation Index," [Online]. Available: <http://www.restore.ac.uk/geo-refer/36229dtuks00y19810000.php>. [Accessed 9 December 2019].

GIS Assignment 1

GRADEMARK REPORT

FINAL GRADE

40/100

GENERAL COMMENTS

Instructor

Generic Assessment Criteria Runa Bibi	Marks available	Marks awarded
1. Engagement with Literature Skills		
<i>Investigating the fundamentals of visual perception, cartographic visualisation and the map as a visual information system. Explore the origins of GIS and cartographic representation.</i> A suitable well-structured introduction stating your intended study. Your review of the literature provides some insight on GIS with a historical overview but it is a little brief. Our word count is less than 1000 For a research paper you would be expected to provide a far more detailed literature review.	25	12
2. Knowledge and Understanding Skills		

<i>Discuss the principles of thematic mapping and data visualisation within a software environment. Use the evidence that you have collected and exerts from the GIS system that you have developed to help with your discussion and analysis. You will be measured on good use of case study data.</i> For this section you should discuss your hypothesis – which you have done – but then you should expand and compare your primary data – i.e. all your maps and layers with secondary research and discus visualisation of the data. At level 6 you should write all your assessments – reports in the 3rd person – don't use I my. I know you had lots of data and that you examined different thematic views why not use then t discusses the benefits of GIS data analysis	35	8
3. Cognitive and Intellectual Skills		

<i>Provide a description of suitable additional case study data that may enhance your study and research paper (to be discussed with to Module tutor prior to assignment completion)</i> You have discussed how you will use your datasets and you have provided evidence of some very good research with this data by looking at the MSOA represented with stars and the theme underneath. However why not add more maps explore other year of data and discuss in more detail	15	7
4. Practical Application Skills		
<i>Identify types of data involved in Geo-information systems. Briefly describe the use of Excel to gather data. Use of GIS to analyse data that you have collected for the study.</i> A brief discussion and some screen shots of your excel data would have helped here. You could have looked at your chosen years and suggested why you wanted to review this data. This is where you demonstrate your practical knowledge.	15	9

5. Transferable Skills for Life and Professional Practice		
<i>All work suitably presented and referenced and concluded</i> Although correct this is a very simplistic conclusion. You should provide a more detailed commentary on your data analysis. I know you explored your datasets in more detail so why not reflect in them compare excel and Mapinfo. TOTAL 40%	10	4

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