

GIS Assignment 2 Report

by Runa Bibi

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Beverley Holland

Investigating Location Based Services

Geographical Information Services

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1. Introduction

Location Based Services (LBS) provide information to the user on services based on their location [1]. Some examples of this include car navigation systems, emergency services and tourist tour planning [2]. LBS need an entity to trigger the location information such as RFID tracking pallets of groceries [3]. Location Based Services allow for a dynamic information experience which is personal to the user's location e.g. a news application that requests your location and provides you with local news and advertisements from local companies [4]. Compared to traditional GIS applications, LBS receive data from a variety of sources e.g. topographic maps, remote sensing positioning systems and transportation and traffic data sources [5]. So, data in Location Based Services needs to be handled dynamically and simultaneously, which makes them more diverse compared to other GIS applications [5].

This technology can be very useful in the health industry so a GIS and website can be developed to help construct an LBS in order to inform local healthcare professionals and the public of areas that have low immunisation uptake. Additional information on schools, sixth forms and universities will also be useful because they have been known to increase the spread of diseases. Healthcare facilities close to these establishments can also be added to see how accessibility affects the rate of uptake.

2. GIS Construction

To start with a map showing the University of Trinity Saint Wales buildings was constructed for MapInfo2Leaflet. The buildings were selected and saved as a layer.



Figure 1 - Uni Buildings Selection

A new browser was created, and simple information was added including opening times and a web address for the appropriate buildings. Below is a view of the map created in MapInfo2Leaflet which shows the university buildings highlighted.



Figure 2 - MapInfo2Leaflet Uni Buildings Map

Clicking on each building brings up the information from the browser and each web address goes to the webpage on a new tab.

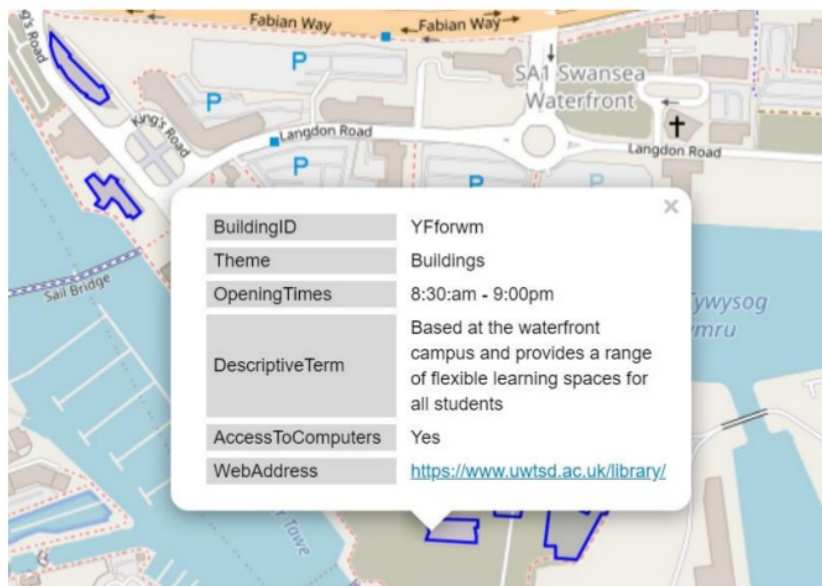


Figure 3 - Uni Buildings Map Popups

Another simple webpage was made in MapInfo2Leaflet showing healthcare locations using postcode data i.e. longitude and latitude coordinates as points which also shows attribute data of each building when you click on each arrow.

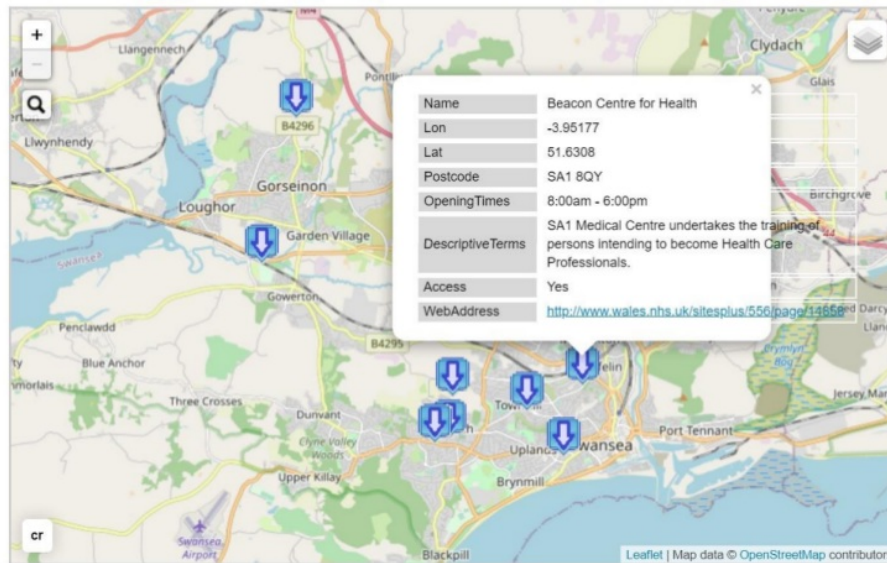


Figure 4 - HealthCare Coordinates Map

A similar html page was built showing the university buildings which led to back pages showing attribute information of each building.

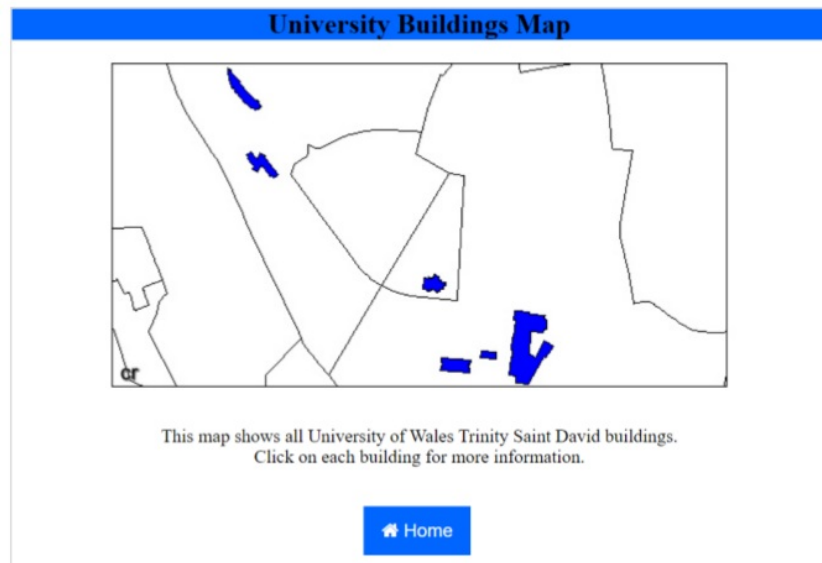


Figure 5 - Uni Buildings HTML page

Clicking on the buildings leads to pages like this one for the IQ building:

IQ Building	
BuildingID	IQBuilding
Theme	Buildings
OpeningTimes	24 hours
DescriptiveTerm	Carries most of the lecture rooms for students of UWTSD SA1
AccessToComputers	Yes
WebAddress	https://www.uwtsd.ac.uk/

Go Back

Figure 6 - IQ Building Back Page

A page showing the schools, colleges and universities around Swansea with the Townsend Index in the background was also added which is an index that measures material deprivation using four census variables [6].

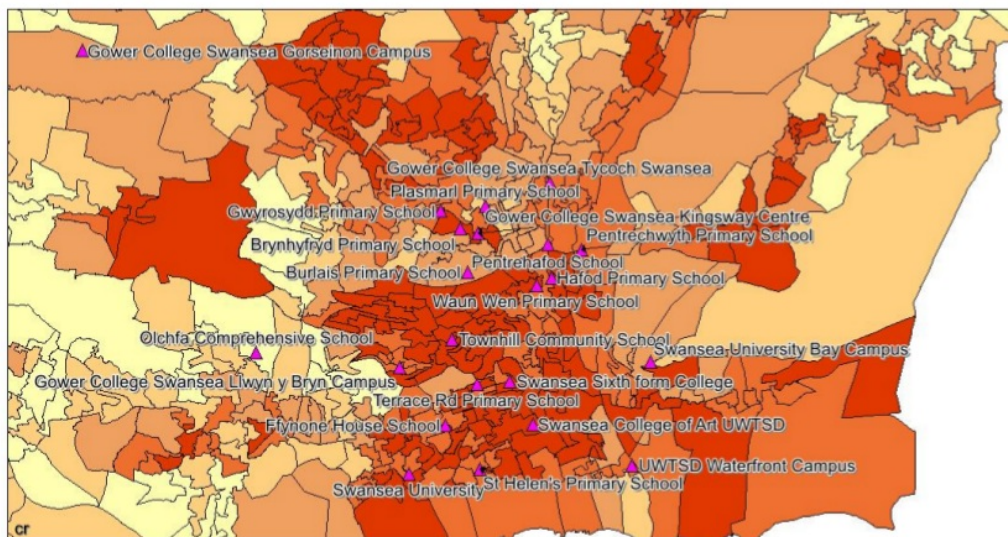


Figure 7 - Townsend Index Map with Educational Buildings Points

☒  Ranges by Townsend_Index

- ☒  3.4 to 9.3
- ☒  0.8 to 3.4
- ☒  -1.5 to 0.8
- ☒  -3.1 to -1.5
- ☒  -7.2 to -3.1
- ☒  all others

Figure 8 - Townsend Index Range

This map shows that most of the educational buildings fall within the top two range of the townsend index, so they are in prosperous neighbourhoods and the expectation is that the MMR vaccine will have a better uptake in 14 to 16 year olds i.e. where secondary schools are found. Clicking on each associated triangle brings up pages with attribute details of each building.

Pentrehafod School

Name_of_institute	Pentrehafod School
OpeningTimes	8:00am - 3:00pm
DescriptiveTerms	A school which promotes a positive and nurturing environment in which all pupils are able to thrive and become the best they can be.
AccessToComputers	Yes
WebAddress	https://pentrehafod.school/

Figure 9 - Education Buildings Attributes Page

Another page with the Townsend Index as a background layer and the available healthcare facilities in Swansea on a map as points was created. Clicking on each square also leads to attribute details on the healthcare facilities.

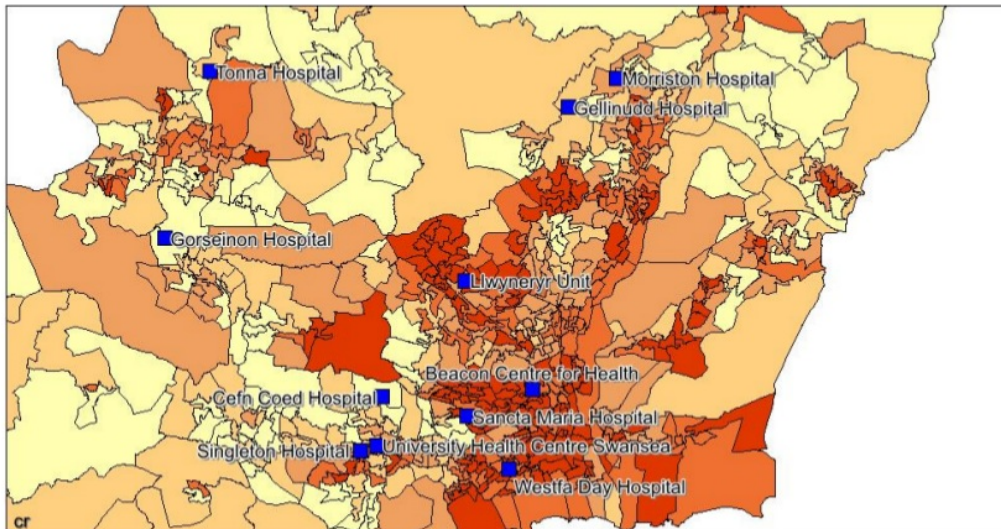


Figure 10 - Townsend Index Map with Healthcare Facilities Points

Gellinudd Hospital

Name	Gellinudd Hospital
OpeningTimes	24 hours
DescriptiveTerms	Gellinudd Recovery Centre provides a unique and progressive in-patient service for people recovering from a mental illness in a state-of-the-art Centre based in the heart of beautiful South West Wales.
Access	Yes
WebAddress	https://www.gellinudd.org.uk/

Figure 11 - Healthcare Facilities Attributes Page

There are many healthcare facilities which are accessible to places of study i.e. in proximity and most are in prosperous neighbourhoods. The next stage was to see the relationship between areas of low immunisation uptake for MMR and educational buildings.

MMR requires two doses, one after the child turns one and the next before they enter school [7]. The latest MMR data from 2017/18 shows the MMR uptake for the first dose by age 2 in Wales was just below the target 95% [8], which is what is required to reach herd immunity [7]. This data based on the Swansea map shows around 45% of schools were in an area where 90.9% - 93% had their first dose by age 2. 18% of schools were in an area where only 79.3% - 90.9% had their first dose by age 2. This may account for the low immunisation uptake as schools are said to spread diseases easier due to students being in proximity for long periods of time.

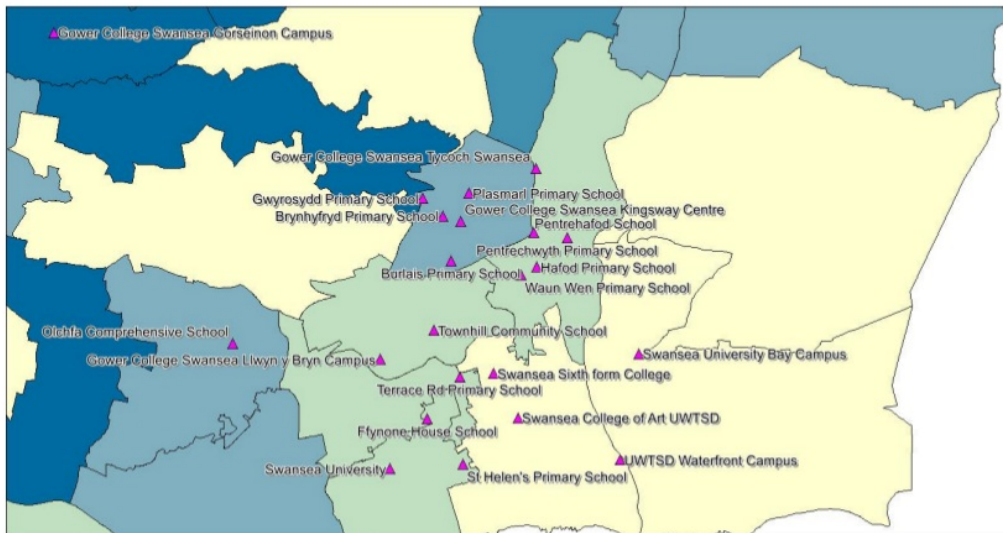


Figure 12 - MMR first dose by age 2 17/18

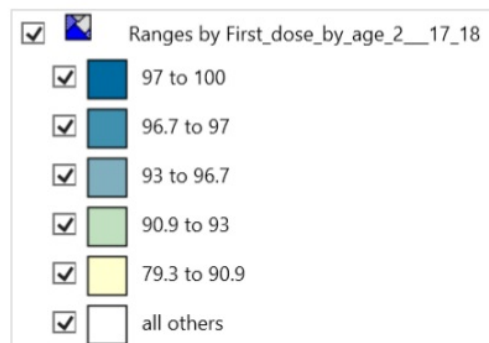


Figure 13 - MMR first dose by age 2 17/18 range

By age 16, this does not seem to have improved with the highest percentage of those with 2 doses of the MMR vaccination only reaching 92.1% overall. The schools

in areas which previously had their first dose by age 2 at 79.3% - 90.9% only reached 81.7% - 84.8% uptake.

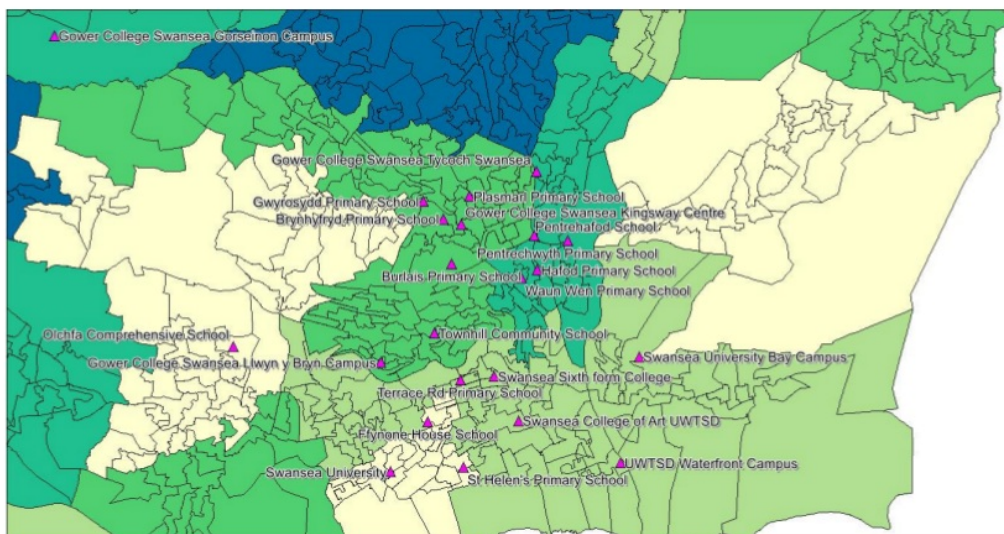


Figure 14 - MMR 2 doses by age 16 17/18

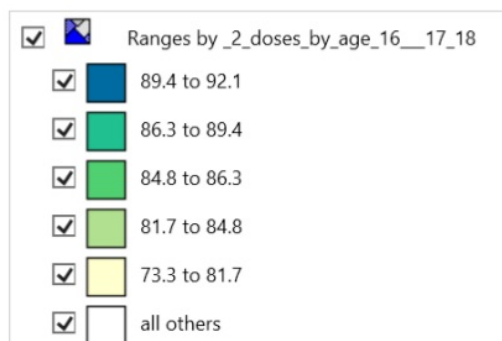


Figure 15 - MMR 2 doses by age 16 range

Those that have not received the full course of MMR vaccines, may mean they are still vulnerable to diseases which can be prevented with vaccines e.g. mumps [9]. This may explain why cases for mumps were seven times higher in Swansea in 2019 compared to 2018, at 385 cases [10].

These maps have been included in the website so the public can be aware of locations where there is low immunisation uptake. This may be vital in helping them decide on schooling for their children and highlight the importance of completing the course of vaccinations for your child.

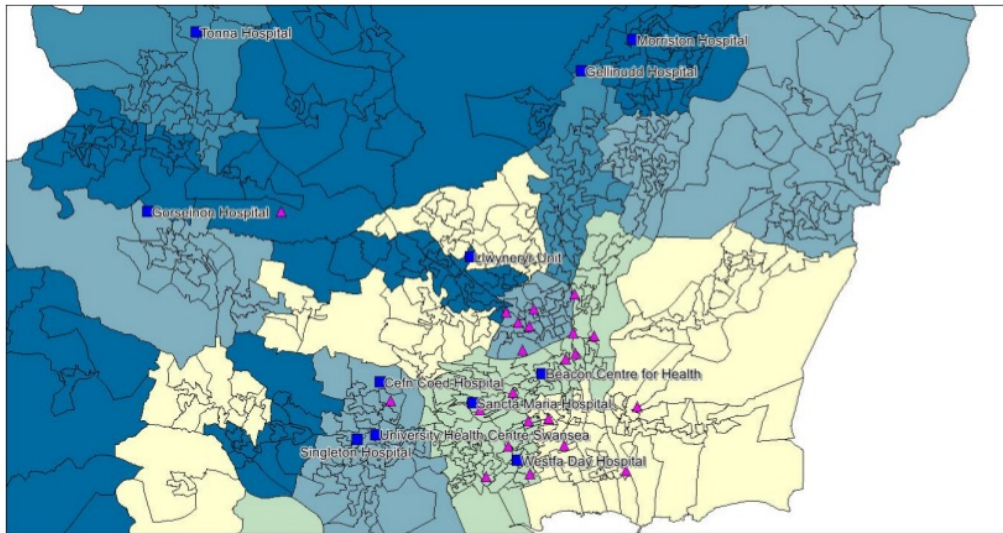


Figure 16 - MMR first dose by age 2 with healthcare points 17/18

The healthcare facilities points were added over the same map to see if there was any type of relationship between the low immunisation uptake and access to healthcare facilities. While there seem to be many healthcare facilities available in the local area, a lot of them close to educational buildings, 27% of them are in an area with only 90.3% - 93% uptake. Compared to the locations of the educational buildings, around 73% of the healthcare facilities are in areas within the ranges from 93% up to 100% uptake.

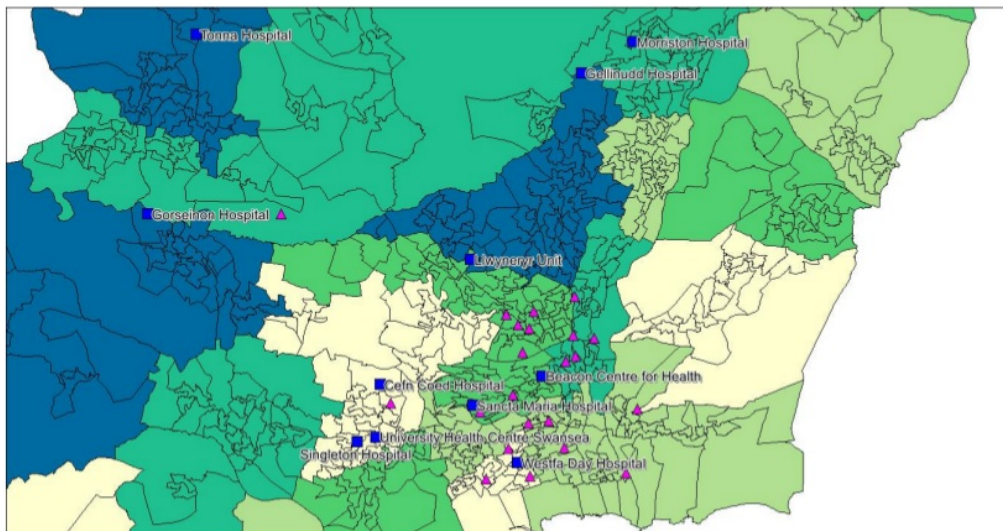


Figure 17 - MMR 2 doses by age 16 17/18 with healthcare points

As discussed previously, the full course of MMR vaccinations by age 16 in 2017/18 did not improve for many areas, including in areas with 3 healthcare facilities where uptake went from 93% - 96.7% down to 73.3% - 81.7%. The areas with healthcare facilities which had the highest uptake previously of 97% - 100% went down to 84.8% - 86.3% and 86.3% - 89.4%. In fact, every area shown has decreased in uptake.

A report from the Royal Society of Public Health in 2018 stated that accessibility to vaccination services may be a very important factor to vaccine uptake, especially for parents who are wary of vaccinations [11]. The survey found the most frequent barriers to vaccination were appointment times (49%), childcare responsibilities (29%) and appointment availability (46%) [12]. One way to help improve vaccination uptake is diversify the locations where vaccines can be given which can give parents more opportunities to get their children vaccinated [13]. Local healthcare organisations and GP practices should keep up-to-date and accurate information on all children and young people in patient records, the child health information system and the personal child health record [14]. They should also record any circumstances which could affect a child or young person to keep up with vaccinations [14].

The deprivation (Townsend index) maps on the website can help provide information on what areas may need the most attention from local health care providers. Although, it does appear that deprivation does not have a major effect on MMR uptake, as those areas with the least percentage of deprivation still had a lower percentage of uptake in their MMR vaccinations. Nevertheless, NHS Wales found that deprivation produced inequalities in vaccine uptake and the gap increased between locations of high and low deprivation in vaccines for older ages [15]. The key to narrowing this gap is maintaining routine vaccination checks and offering vaccinations for teenagers and older children [15].

However, factors such as not having a car can also greatly affect people's access to healthcare facilities to receive their vaccinations. The map below shows the percentage of the population of each area who had no cars. There seems to be more of a relationship between lack of a car and low immunisation uptake i.e. the higher the percentage of people who did not have cars the lower the MMR immunisation

uptake. This could explain why lack of accessibility to vaccination services prevents people from keeping up with the recommended course.

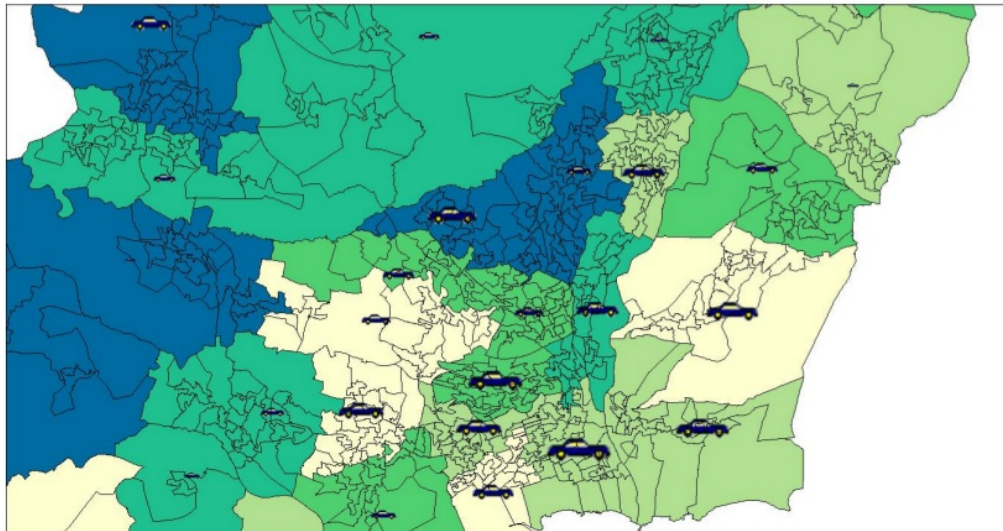


Figure 18 - % No cars on 2 doses by age 16 17/18

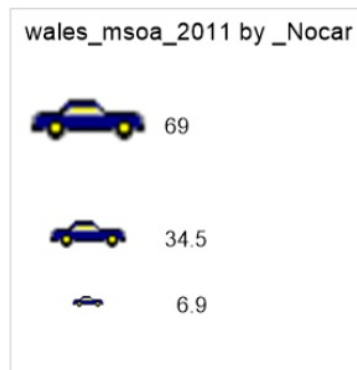


Figure 19 - % No cars legend

A study done by Stone et al. determined different approaches which can help improve adult immunisation which can be applied here in helping parents keep their children immunised also [16]. The most effective intervention was changes in clinical procedures and staffing e.g. an elected nurse to administer the vaccination and a vaccine-only clinic [17]. Patient reminders and GP recommendations to high-priority patients in target groups were also found to be effective interventions [17].

NHS Wales created an action plan for 2019-2021 against measles and rubella as the UK lost its measles-free status in 2019 [18], and recommended catch up activities for

young people who have not received two doses of the MMR vaccination such as: offering secondary school pupils catch up MMR vaccines, actively bringing in 16-24 year olds missing MMR vaccines and finding local vulnerable groups and targeting them with additional interventions [15]. 16-24 year olds in Wales in 2019 were found to be the most susceptible to MMR which is why the action plan had specific targets to reach them [15]. 2 doses of the MMR vaccine are crucial as it protects 99% of people against measles and rubella and 88% of people against mumps [19]. Anyone who still catches mumps when they are vaccinated are less likely to be hospitalised or have serious complications [19].

Despite all the benefits of vaccinations they are not yet compulsory in Wales [20] and so the public should work hard to keep themselves and their children vaccinated for the better of the whole community as the higher proportion of people who are immunised, the better chance for herd immunity. Herd immunity is when a large percentage of people in a population are immunised to a disease so there is less chance of someone who is infected encountering a vulnerable individual [21]. The more unvaccinated individuals that gather, the higher the risk of bigger outbreaks [15].

If the public were more aware of the possible ramifications of low immunisation and which areas have it, they may be more likely to ensure their children have their full course of vaccines, hence the importance of building this GIS and website. Below shows a part of the homepage of the website which shows all the information that is available to the public.

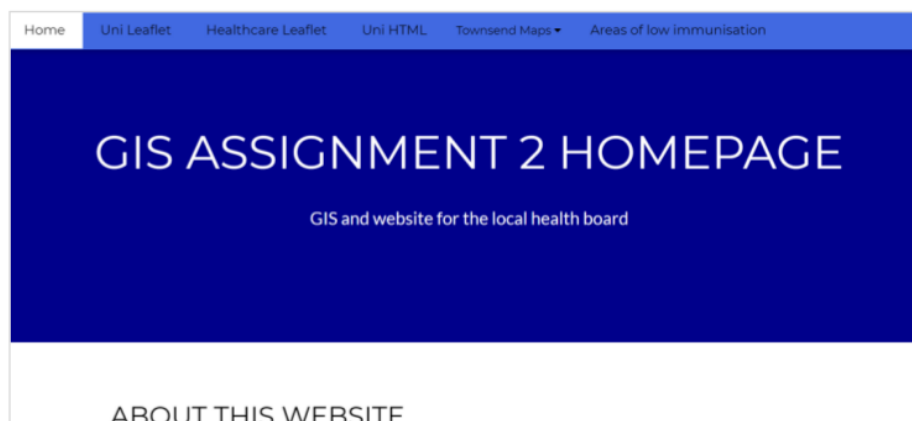


Figure 20 - Website Homepage

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GIS Assignment 2 Report

GRADEMARK REPORT

FINAL GRADE

85/100

GENERAL COMMENTS

Instructor

Generic Assessment Criteria	Marks available	Marks awarded
1. Engagement with Literature Skills		
<i>Discussion and present a brief report on LBS in relation to the provision of health care related information.</i> You have presented relevant and focused research on LBS and you have reflected on location data as required for this type of study. You demonstrate as sound understanding of the use of GIS software and you have discussed the requirement of such systems in the context of the epidemiology study.	20	16
2. Knowledge and Understanding Skills		

<i>Demonstrate how you have collected and cleansed the data. Provide evidence and discuss how new data has been used in the system. What have you included in your data that will enhance that users experience with the GIS/LBS. Your report should discuss the data that you used to build this application and should reflect on the concept of LBS.</i> In this section you have discussed and demonstrated many differing methods for data acquisition. You have justified your choice and discussed the relevance of each set when constructing an LBS using GIS software.	20	17
3. Cognitive and Intellectual Skills		

<i>Describe in detail all the of the spatial data sets that you have included. Why were they necessary and what added detail have they given to the dataset.</i> You have used and demonstrated an understanding of several different processes for data collection. Your dataset and therefore map layers demonstrate sound judgement of the data requirement for such a study. You have compared the available healthcare facilities and looked at the mumps immunisation statistics thus looking for possible correlation. You have discussed relevant findings and made suitable policy suggestions.	20	17
4. Practical Application Skills		

<i>How you developed the layers within the system. Functionality of system GIS and Website. You must submit a working GIS/ LBS environment developed with MapInfo and any additional software add-ons that will enhance the build of a working website.</i> This work demonstrates excellent use of the software. A very professional website has been produces which has explored the use of mapping software in the context of location-based services. You have developed a comprehensive workspace and a thorough investigation of the many datasets available and methods for adding data to the workspace have been explored. Your workspace works well and you demonstrate an in-depth knowledge of data requirements. Good use of visualisation of the data through the various layers and searches. This demonstrate a very good understanding of the datasets and the ability to look for correlations within the data. The practical outcomes form you LBS have been developed to a veryhigh standard.	35	30
5. Transferable Skills for Life and Professional Practice		

<i>All work suitably presented and referenced and concluded</i> Your work has been presented to a very high standard well throughout practical solutions and a well-documented report of you work	5	5
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