

Evaluating the impact of Electronic Prescription Services on Carbon Emissions

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Research context



The industrial partner is Digital Health and Care Wales. They are a branch of the NHS that ensure digital services are used effectively to improve healthcare in Wales.



The researcher is a student at UWTSD studying Data and Information Systems, and an employee of DHCW in the Information Services department working as a Data Analyst.



An electronic prescription service (EPS) [1] uses computers to write and manage health prescriptions. These prescriptions can be sent directly to pharmacies for collection.



Research Problem

- ▶ The research problem is that health care has a significant impact on carbon emissions in Wales.
- ▶ The electronic prescription service could be having an impact to reduce these emissions but there is no evidence of this.
- ▶ There needs to be a thorough investigation using data analysis and visualisation techniques to produce a product that is going to inform on this problem.



Aim

- ▶ To analyse and evaluate whether the implementation of the EPS in Wales has had an impact on carbon emissions.

Objective 1

- ▶ To critically evaluate the state of carbon emissions related to healthcare before and after the introduction of the EPS in Wales.

Objective 2

- ▶ To critically compare the impact of introducing an EPS on carbon emissions across different regions/countries.

Objective 3

- ▶ To assess the impact of carbon emissions across different prescribing health boards

Objective 4

- ▶ To investigate the correlation between the adoption rate of the EPS and the levels of carbon emissions across Wales.

Objective 5

- ▶ To identify and evaluate additional factors that may influence the impact of the EPS.

Research Aim & Objectives



Literature Review



[1] Benefits of EPS: reduction of medical errors relating to handwriting, reduction of waiting time for medication, lower carbon emissions.



[2] Implementation in other countries include Canada, [3] Sweden, and [2] Estonia.



[4] Limitations: global implementation of National Council for Prescription Drug Programs coding scheme.



[5] Impact of the healthcare sector on carbon emissions: In 2019, 25 megatons of carbon were produced in England alone because of the NHS.



[6] Visualisation: Drive time analysis, [7] Geographical Information Systems (GIS), [8] Power BI, Arc-GIS, R, Python.

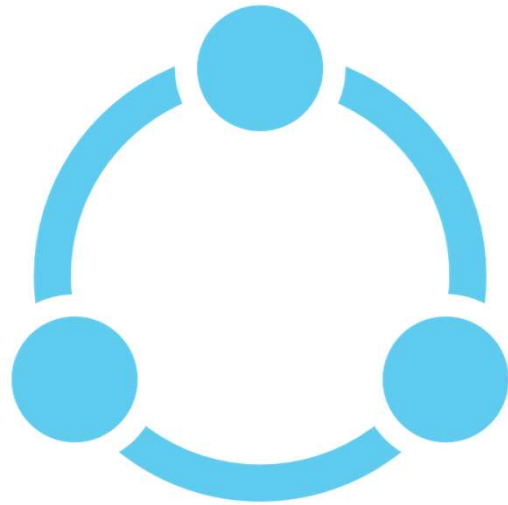




Research Methodologies

- ▶ [9] The philosophy is Positivism. It is the belief that knowledge is based on experiences of real phenomena in the real world.
- ▶ [10] The approach is Deductive. Deductive approaches include having a theory/hypothesis, and then designing a research strategy to prove the hypothesis.
- ▶ [11] The limitations involved with this project include the lack of ArcGIS licenses held by Digital Health and Care Wales. Another limitation is that other departments less involved with the project could miss the deadlines as they aren't considered a priority for them.
- ▶ [12] There are ethical issues involved because personal identifiable information is included in the dataset. There is no risk of physical harm, but the researcher could feel stress.





Development Methodologies

[18] The software development methodology is Feature Driven Development (FDD) which is suitable because it is agile.

The following process will be followed for the methodology

Develop the overall model

Build a feature list

Plan by Feature

Design by Feature

Test and review

Deploy and Integrate



Validity, Reliability, & Generalisability

[13] There could be validity concerns when the researcher is considering the EPS 'impact' on carbon emissions. The use of qualitative data helps validate the findings and the project. The people involved in this project are skilled data analysts with experience using healthcare data which increases validity.

[13] Reliability of this project is high because of the factual and statistical data used. The reproducibility being high also increases the reliability because when data is qualitative then the use of researcher shouldn't vary the results. If the project was repeated it should return the same conclusions.

[13] The project has good generalisability because the findings could apply for other healthcare setting using a similar service, either in Wales or globally. These services could follow the methodology and structure. The project could also encourage other sectors to implement similar services.



Data Collection/Evaluation

[14] Qualitative data: Electronic Prescription Dataset, Carbon emissions dataset, surveys, interviews.

[15] Data Evaluation: Descriptive analysis techniques will be used. Analysis will investigate prescription uptake, travel distances, and carbon emissions across Wales.
[16] Comparisons will also be made. Drive-time analysis will be done using GIS.

[17] t-tests are a good way of testing hypothesis. The following relates to this project:

Null hypothesis: There implementation of the EPS in Wales has no significant impact on carbon emissions.

Alternative hypothesis: The implementation of the EPS in Wales has a significant impact on carbon emission.



Resources/Planning Materials



The only hardware required is an individual laptop. A monitor would be useful for an extra screen and working quicker.



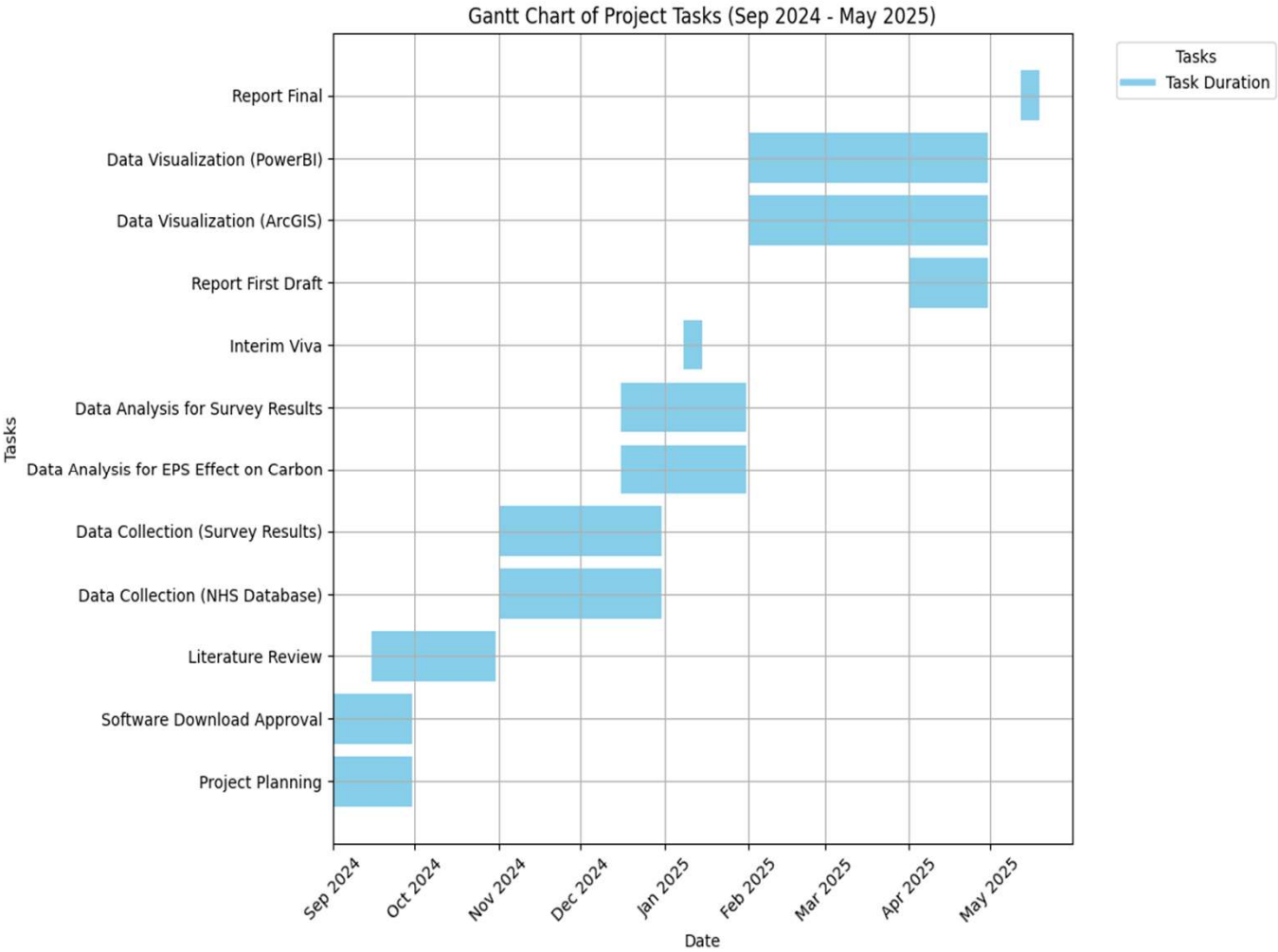
The software essential for the project include SQL Management Studio 2019, Microsoft Power BI, and ArcGIS.



Regarding Human Resources, only the researcher and manager will be involved in the process. A survey will include 100 staff member responses.



Project Plan



References

[1]

“Electronic prescription system requirements: a scoping review,” Rdcu.be, 2024. <https://rdcu.be/dSI54> (accessed Sep. 05, 2024).

[2]

B. Aldughayfiq and S. Sampalli, “Digital Health in Physicians’ and Pharmacists’ Office: A Comparative Study of e-Prescription Systems’ Architecture and Digital Security in Eight Countries,” OMICS: A Journal of Integrative Biology, vol. 25, no. 2, Sep. 2020, doi: <https://doi.org/10.1089/omi.2020.0085>.

[3]

U. Deetjen, “European E-Prescriptions: Benefits and Success Factors www.politics.ox.ac.uk/centre/cyber-studies-programme.html European E-Prescriptions: Benefits and Success Factors Working Paper Series -No. 5 2,” 2016. Accessed: Sep. 05, 2024. [Online]. Available: <https://ora.ox.ac.uk/objects/uuid:440a8fe6-6421-4b62-9e5e-cb0f559667d6/files/m24832b33b1957c84ccbf148903f9033d>

[4]

A. Hahn and A. Lovett, “Electronic Prescribing: An Examination of Cost Effectiveness, Clinician Adoption and Limitations,” Universal Journal of Clinical Medicine, vol. 2, no. 1, pp. 1–24, Jan. 2014, doi: <https://doi.org/10.13189/ujcm.2014.020101>.



References

[5]

A. Meng et al., “Health care’s response to climate change: a carbon footprint assessment of the NHS in England,” *Articles Lancet Planet Health*, vol. 5, pp. 84–92, 2021, Available: <https://www.thelancet.com/action/showPdf?pii=S2542-5196%2820%2930271-0>

[6]

E. Szimba, “Assessing travel time savings and user benefits of automated driving – A case study for a commuting relation,” *Transport Policy*, vol. 98, pp. 229–237, Nov. 2020, doi: <https://doi.org/10.1016/j.tranpol.2020.03.007>.

[7]

A. J. Kent and P. Vujakovic, Eds., *The Routledge Handbook of Mapping and Cartography*. Milton Park, Abingdon, Oxon ; New York, NY : Routledge, 2018.: Routledge, 2017. doi: <https://doi.org/10.4324/9781315736822>.

[8]

D. Dietrich and H. Myrntinen, “Data Visualisation,” 2012. Available: https://data.europa.eu/sites/default/files/report/2012_data_visualisation.pdf

References

[[9]

A. Vostovska and I. Siregar, "Epistemological Analysis: Comparison Between Positivism and Phenomenological Approaches," *Contrastive Pragmatics*, vol. 1, no. 2023 -, 2023, Accessed: Sep. 05, 2024. [Online]. Available: <https://contrastivepragmatics.com/index.php/cp/article/view/39#:~:text=While%20positivism%20emphasizes%20objectivity%20and>

[10]

J. Dudovskiy, "Deductive approach," *Business Research Methodology*, 2019. <https://research-methodology.net/research-methodology/research-approach/deductive-approach-2/>

[11]

Team Asana, "7 Common Project Risks and How to Prevent Them," Asana, Jan. 19, 2024. <https://asana.com/resources/project-risks>

[12]

IABAC®, "The Dark Side of Data Analytics: Ethical Dilemmas and Solutions," IABAC®, Oct. 04, 2023. <https://iabac.org/blog/the-dark-side-of-data-analytics-ethical-dilemmas-and-solutions#:~:text=Bias%20and%20Fairness%3A%20Data%20analytics>

References

[13]

L. Leung, "Validity, Reliability, and Generalizability in Qualitative Research," *Journal of Family Medicine and Primary Care*, vol. 4, no. 3, pp. 324–327, 2015, doi: <https://doi.org/10.4103/2249-4863.161306>.

[14]

SurveyCTO, "A Guide to Data Collection: Methods, Process, and Tools," SurveyCTO, 2024.
<https://www.surveyccto.com/resources/guides/data-collection-methods-guide/>

[15]

C. Cote, "What Is Descriptive Analytics? 5 Examples | HBS Online," *Business Insights - Blog*, Nov. 09, 2021.
<https://online.hbs.edu/blog/post/descriptive-analytics>

[16]

L. Costello, "What is drive time analysis & how can it help your business?," *Espatial.com*, Feb. 27, 2024.
<https://www.espatial.com/blog/drive-time-analysis#show-chat>

References

[17]

A. Robb, "Experimental Hypothesis | Importance, Features & Examples," Study.com. <https://study.com/academy/lesson/identifying-experimental-designs-to-test-a-given-hypothesis.html#:~:text=A%20hypothesis%20is%20a%20prediction,background%20research%20on%20the%20topic>.

[18]

"Feature-Driven Development: A Brief Overview - LaunchDarkly," LaunchDarkly. <https://launchdarkly.com/blog/feature-driven-development-a-brief-overview/>



Thank you for watching this presentation

► <https://youtu.be/KLLJcZiyaeQ>

