

EPS Framework for Environmental Impact Assessment

Version: 1.0

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1. Summary

This framework outlines the structure and methodology for evaluating the carbon emissions related to the Electronic Prescription Service (EPS) implementation in Wales. This includes data sources, tools, analytical approaches, and outputs used to evaluate the paper and transport related emissions. The framework has been designed with scalability in mind for other GP practices, or other industries with similar data structures.

2. Purpose and scope

This EPS Framework aims to:

- Calculate the carbon savings from the EPS implementation.
- Provide methodology that is reproducible for other practices, health boards, and others who have similar data structures.
- Support the NHS net zero carbon goals by 2030.
- Model for scenarios and evaluate policies.

3. Governance and compliance

In this project correct protocols have been adhered to. There's no patient identifiable information used reducing privacy risks, all data has been sourced from reputable sources including the NHS, emissions stats were gathered from the Government GHG Conversion Factors, and this framework aligns with the DHCW Data Governance policies [1][5].

4. Stakeholders

Digital Health and Care Wales

GP Practices and Health Boards

Welsh Government

Pharmacy contractors

5. Data sources and Licencing

Source	Description
Health Maps Wales (Cadwgan_to_Pharmacies_Edited.csv)	GP and Pharmacy Locations. Cleaned csv file for scenario modelling and Power BI Visualisations [3].
NHS EPS Dashboard (DashboardExtract.xlsx)	EPS and repeat item counts
UK GHG Conversion Factors 2024	CO2 per mile and per paper sheet

6. Methodology

6.1 Data collection and filtering

- Data was filtered for Cadwgan GP Practice and its related pharmacies [3].
- ArcGIS Pro was used to calculate drive-times [4].
- Pharmacies within 1 mile of the GP were removed from the dataset (assumed walking distance).
- EPS data was manually extracted row by row from the NHS Dashboard [2].

6.2 Drive time and transport emissions

- Drive distances were multiplied by 0.2733kg of carbon per mile [1].
- The carbon emissions were normalised per item and scaled nationally.

6.3 Paper savings analysis

- Carbon savings per item were calculated based on 0.225 kg of carbon produced per sheet of paper [1][6].
- Cadwgan's average carbon was scaled to a national level of EPS items.

6.4 Repeat prescription scenario

- eRD Items were taken and multiplied by the average carbon savings per item.

6.5 Forecasting and benchmarking

- Linear regression was used for Cadwgan trends.
- Cadwgan was benchmarked against the other practices using the EPS adoption rates.

6.6 Dashboard Integration

- Power BI was used to visualise the EPS uptake, the carbon savings for both transport and paper, and the pharmacy specific emissions [2].

6.7 Scenario Modelling and Equivalent Analysis

The script EPS_CO2_Equivalence_Scenarios calculates four different scenarios at a national level.

1. EPS carbon savings for all prescriptions
2. Transport related carbon emissions for Wales based on Cadwgan data
3. EPS carbon savings for just the repeat prescriptions
4. Transport carbon savings for just the repeat prescriptions.

The carbon totals were put into perspective based on miles driven (0.2733 kg of carbon per mile), trees planted (21.77 kg carbon per tree per year)[7], and home energy usage metrics (0.038kg of carbon per day) [1][8].

7. Code and automation

The python scripts have been designed to be easily reused and repurposed.

Script Name	Description
Transport_Emissions_Analysis_Cadwgan	Calculated GP to Pharmacy transport emissions
National_Paper_and_Transport_Savings	Scaled Cadwgan Paper and Transport savings to national level
EPS_Trend_Forecasting_and_Benchmarking	Forecasts EPS uptake and benchmarks the Cadwgan GP Practice
Cadwgan_Paper_Savings_Analysis	Visualises the EPS usage and carbon savings for Cadwgan GP Practice
EPS_CO2_Equivalence_Scenarios	Converts carbon savings/emissions into real world equivalents for comparison

8. Outputs and metrics

- Estimated carbon savings from paper across Wales: 57,333,50 kg
- Estimated transport emissions saved across Wales: 2,764,777.29 kg
- Repeat prescription only savings through EPS in Wales: 1,317.47 kg
- Paper sheets saved across Wales: 179,093
- EPS Items: 3,343,646
- Power BI Dashboard showing EPS Trends and carbon information.

9. Reusability and scalability

- Scripts are easily changeable through altering the source, and table names. They are not hardcoded.
- Methodology is available for replication.
- Power BI Dashboards can be easily refreshed from the excel table from within the Power BI App.
- Feedback from stakeholders confirmed that the framework has been well-organised, is reproducible, and adaptable.

10. Limitations and Risks

- Manual data extraction limited scalability.
- Assumed that distances under 1 mile would encourage people to walk from GP to pharmacy.
- EPS adoption will vary by practice.
- Drive-length estimates depend on the accuracy of the routing calculations.

11. Recommendations

The recommendations from this project are as follows:

- Promote the EPS and at least the repeat prescriptions on EPS Nationally.
- Automate the data extraction process from NHS Dashboards.
- Integrate EPS statistics into NHS digital reporting tools for further exposure.
- Expand the framework to other practices.
- Maintain and update the Power BI dashboard regularly.

12. Glossary

EPS: Electronic Prescription Service

eRD: Electronic Repeat Dispensing

GHG: Greenhouse Gas

CO2: Carbon Dioxide

DHCW: Digital Health and Care Wales

NHS: National Health Service

13. References

[1] Department for Energy Security and Net Zero, “Greenhouse gas reporting: conversion factors 2024,” GOV.UK, Jul. 2024. [Online]. Available: <https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2024> □cite□turn3search26□

[2] NHS Business Services Authority, “EPS and eRD utilisation dashboard,” NHSBSA, 2025. [Online]. Available: <https://www.nhsbsa.nhs.uk/pharmacies-gp-practices-and-appliance-contractors/prescribing-and-dispensing/electronic-repeat-dispensing-erd/erd-resources-gp-practices> [1](<https://www.nhsbsa.nhs.uk/pharmacies-gp-practices-and-appliance-contractors/prescribing-and-dispensing/electronic-repeat-dispensing-erd/erd-resources-gp-practices>)

[3] Esri UK, “Health Maps Wales,” ArcGIS Hub, 2025. [Online]. Available: <https://health-demo-hub-esriuklg.hub.arcgis.com/datasets/health-maps-wales-1> [2](<https://health-demo-hub-esriuklg.hub.arcgis.com/datasets/health-maps-wales-1>)

[4] Esri, “ArcGIS Pro: An Introduction,” Esri Proceedings, 2025. [Online]. Available: https://proceedings.esri.com/library/userconf/proc17/tech-workshops/tw_685-108.pdf [3](https://proceedings.esri.com/library/userconf/proc17/tech-workshops/tw_685-108.pdf)

[5] Digital Health and Care Wales, “Information Governance,” DHCW, 2025. [Online]. Available: <https://dhcw.nhs.wales/about-us/key-documents/policies/information-governance/> [4](<https://dhcw.nhs.wales/about-us/key-documents/policies/information-governance/>)

[6] King’s College London, “Carbon Accounting Methodology,” KCL, 2025. [Online]. Available: <https://www.kcl.ac.uk/assets/sustainability/pdf/carbon-accounting-methodology.pdf>

[7] Forest Research, “Provisional Woodland Statistics 2025,” Forest Research, 2025. [Online]. Available: <https://www.forestresearch.gov.uk/news/provisional-woodland-statistics/>

[8] Department for Energy Security and Net Zero, “Household Energy Efficiency Statistics, headline release July 2025,” GOV.UK, 2025. [Online]. Available: <https://www.gov.uk/government/statistics/household-energy-efficiency-statistics-headline-release-july-2025>

14. Appendices

Appendix A: Screenshots of ArcGIS, Power BI and Excel

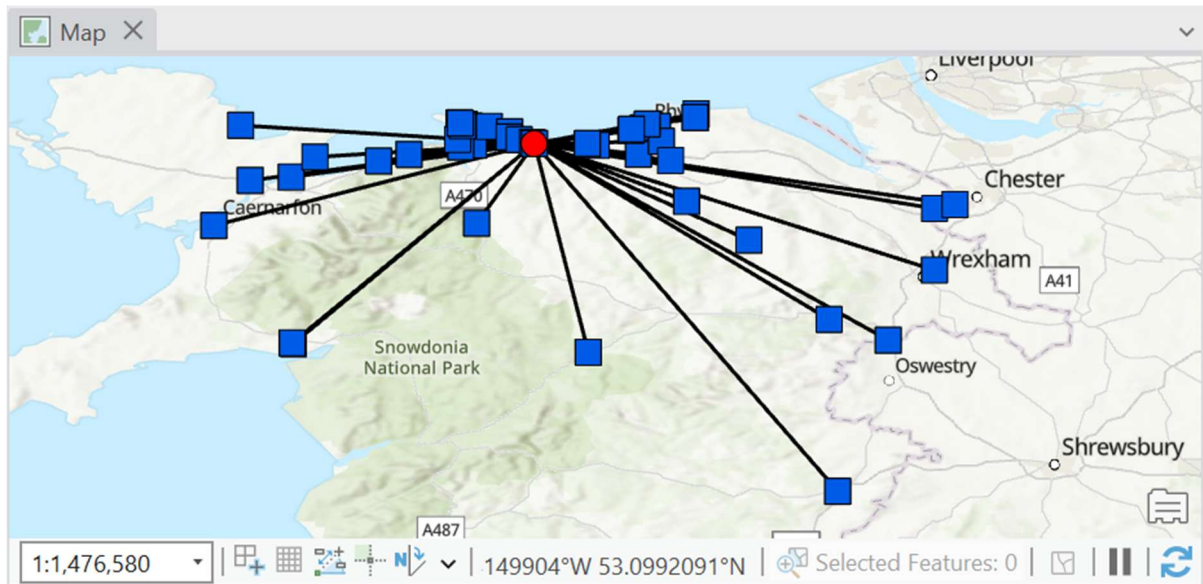


Figure 1 - ArcGIS Pro visual showing Cadwgan to Pharmacy routes

Lines_ExportTable			
Field: Selection: Rows:			
ObjectID *	Name	Total_Drive_Length	
1	1	W91007 - FWT68	0.027911
2	2	W91007 - FWD84	0.255299
3	3	W91007 - FWQ96	1.562904
4	4	W91007 - FWH18	2.301589
5	5	W91007 - FWP29	3.070932
6	6	W91007 - FWV63	4.209907
7	7	W91007 - FEF11	4.941344

Figure 2 - ArcGIS Pro table showing the Cadwgan to Pharmacy drive length (miles)

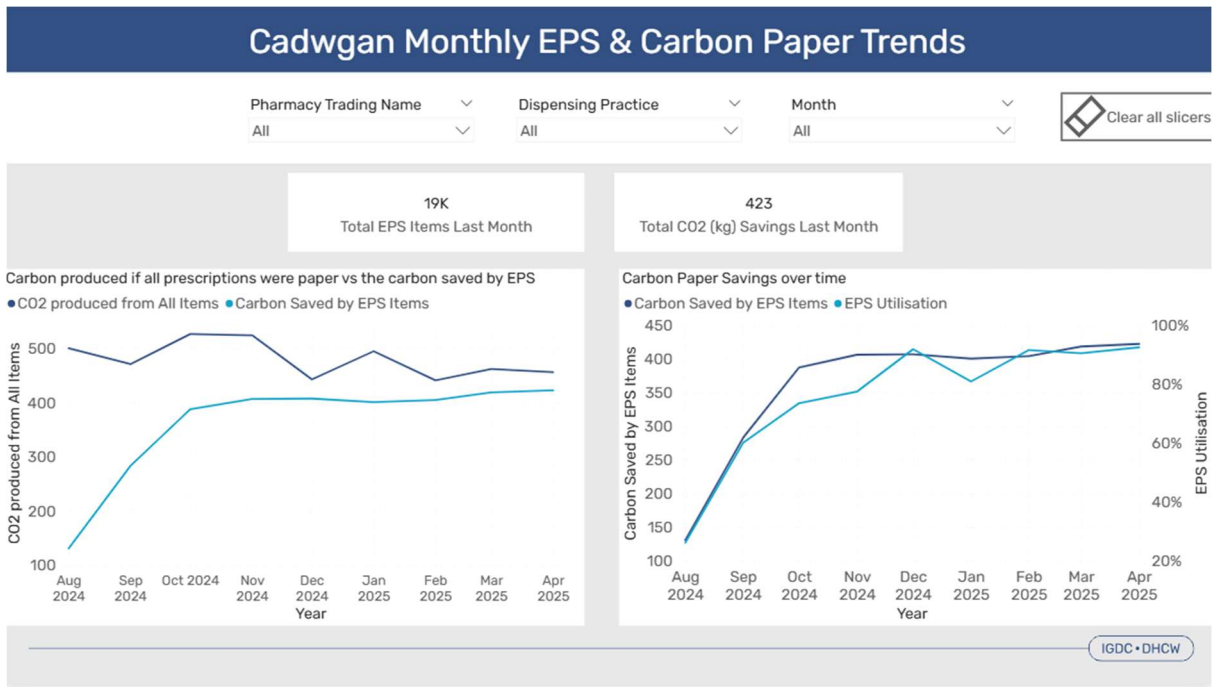


Figure 3 - Cadwgan Monthly EPS & Carbon Paper Trends

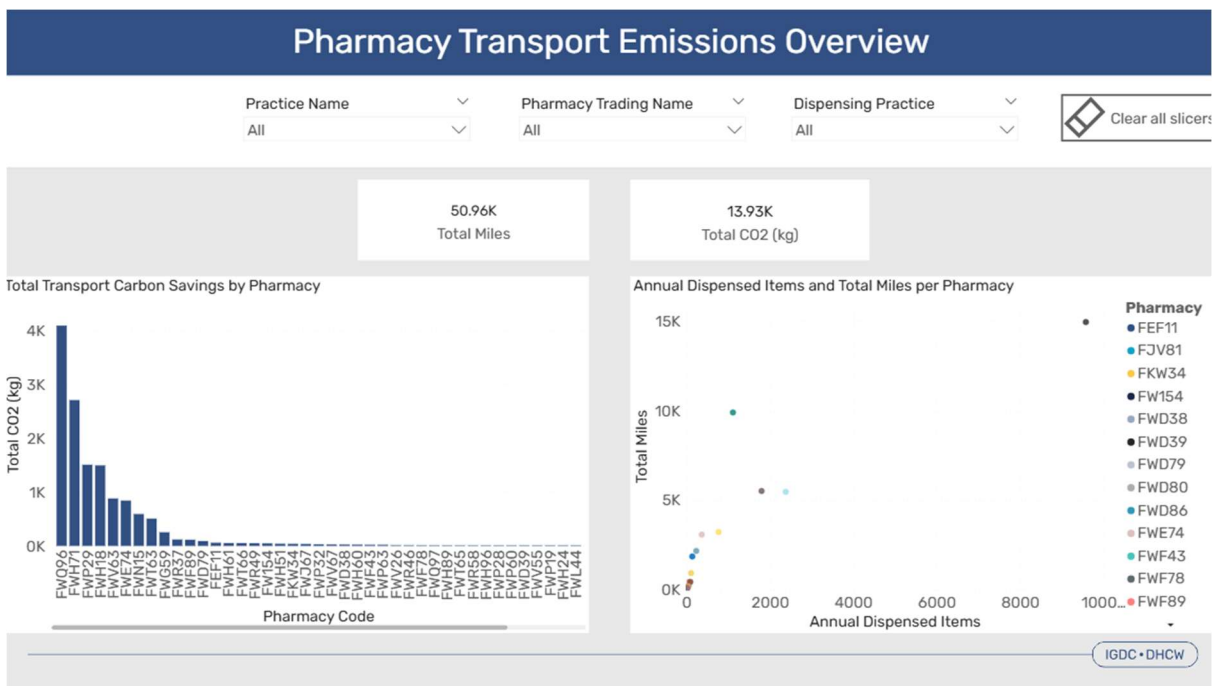


Figure 4 - Pharmacy Transport Emissions Overview

Pharmacy Efficiency - Transport Emissions

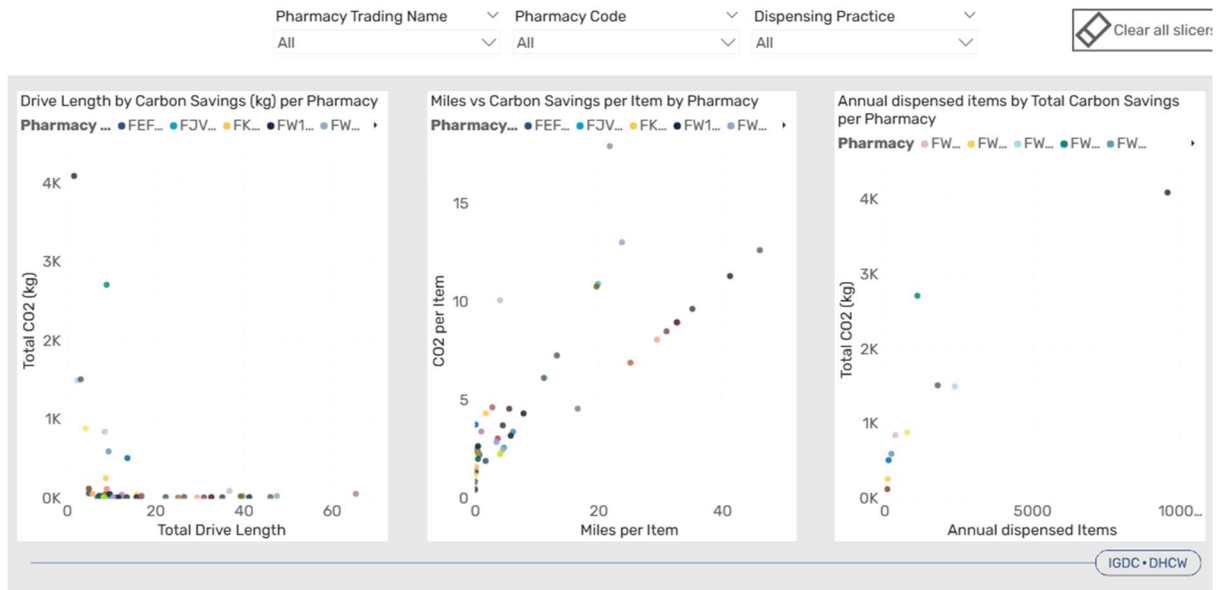


Figure 5 - Pharmacy Efficiency - Transport Emissions

Appendix B: Python Scripts

```
[4]: import pandas as pd

[6]: # Load Cadwgan monthly data to calculate average EPS CO2 saving per item
cadwgan_df = pd.read_excel("DashboardExtract.xlsx", sheet_name="Cadwgan", engine="openpyxl")
cadwgan_df["co2_saving_per_item"] = cadwgan_df["co2 savings from EPS Items"] / cadwgan_df["All Items "]
avg_eps_saving_per_item = cadwgan_df["co2_saving_per_item"].mean()

[8]: # Load EPS data for all Welsh practices
eps_df = pd.read_excel("DashboardExtract.xlsx", sheet_name="EPS Data", engine="openpyxl")
total_eps_items = eps_df["EPS Items"].sum()
total_repeat_items = eps_df["eRD Items"].sum()

[10]: # Load Cadwgan transport data to calculate average transport CO2 per item
transport_df = pd.read_csv("Cadwgan_to_pharmacies_Edited.csv")
total_transport_co2 = transport_df["Total kg co2 "].sum()
total_dispensed_items = transport_df["Annual dispensed items"].sum()
avg_transport_co2_per_item = total_transport_co2 / total_dispensed_items

[12]: # --- Scenario 1: EPS CO2 savings across all prescriptions ---
eps_total_savings = total_eps_items * avg_eps_saving_per_item

[14]: # --- Scenario 2: Transport CO2 emissions if all practices matched Cadwgan ---
transport_total_emissions = total_eps_items * avg_transport_co2_per_item

[16]: # --- Scenario 3: EPS CO2 savings for repeat prescriptions only ---
eps_repeat_savings = total_repeat_items * avg_eps_saving_per_item
transport_repeat_emissions = total_repeat_items * avg_transport_co2_per_item

[24]: # --- Real-world equivalents ---

def miles_driven(kg_co2): return kg_co2 / 0.2733 # Correct UK GHG factor
def trees_planted(kg_co2): return kg_co2 / 21.77 # 21.77 kg CO2 per tree per year
def home_days(kg_co2): return kg_co2 / 0.038 # 0.038 kg CO2 per home per day
```

Figure 6 - Python Script for real-world equivalents

```

=== Scenario 1: EPS CO2 Savings Across All Prescriptions ===
Average CO2 saving per item: 0.017147 kg
Total EPS items: 3343646
Estimated total CO2 savings: 57332.68 kg
Equivalent to driving 209,779 miles
Equivalent to planting 2,634 trees
Equivalent to powering a home for 1,508,755 days
# Caveat: Assumes all practices achieve Cadwgan's EPS efficiency.

=== Scenario 2: Transport CO2 Emissions if All Practices Matched Cadwgan ===
Average transport CO2 per item: 0.826875 kg
Estimated total transport CO2 emissions: 2764775.77 kg
Equivalent to driving 10,116,267 miles
Equivalent to planting 126,999 trees
Equivalent to powering a home for 72,757,257 days
# Caveat: Assumes transport patterns are similar across all practices.

=== Scenario 3: EPS CO2 Savings for Repeat Prescriptions Only ===
Total repeat prescriptions (eRD Items): 76834.0
Estimated CO2 savings: 1317.45 kg
Equivalent to driving 4,821 miles
Equivalent to planting 61 trees
Equivalent to powering a home for 34,670 days
# Caveat: Assumes repeat prescriptions have the same EPS efficiency as all items.

=== Scenario 4: Transport CO2 Emissions for Repeat Prescriptions Only ===
Estimated transport CO2 emissions: 63532.08 kg
Equivalent to driving 232,463 miles
Equivalent to planting 2,918 trees
Equivalent to powering a home for 1,671,897 days
# Caveat: Assumes repeat prescriptions have the same transport profile as all items.

```

Figure 7 - Python Output for real-world equivalents


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```
[104]: import pandas as pd
```

Paper Savings all Wales

```

[107]: # Load the Cadwgan monthly data from the Excel file
cadwgan_df = pd.read_excel("DashboardExtract.xlsx", sheet_name="Cadwgan", engine="openpyxl")

[109]: # Calculate CO2 saving per item for each month
cadwgan_df["co2_saving_per_item"] = cadwgan_df["co2 savings from EPS Items"] / cadwgan_df["All Items "]

[111]: # Compute the average CO2 saving per item
avg_saving_per_item = cadwgan_df["co2_saving_per_item"].mean()

[113]: # Load the EPS data from the Excel file
eps_data_df = pd.read_excel("DashboardExtract.xlsx", sheet_name="EPS Data", engine="openpyxl")

[115]: # Sum the total EPS items across all practices
total_eps_items = eps_data_df["EPS Items"].sum()

[85]: # Estimate the total CO2 savings if all practices operated like Cadwgan
estimated_total_savings = total_eps_items * avg_saving_per_item

[87]: # Print the results
print(f"Average CO2 saving per item at Cadwgan: {avg_saving_per_item:.6f} kg")
print(f"Total EPS items across all Welsh practices: {total_eps_items}")
print(f"Estimated total CO2 savings if all practices operated like Cadwgan: {estimated_total_savings:.2f} kg")

Average CO2 saving per item at Cadwgan: 0.017147 kg
Total EPS items across all Welsh practices: 3343646
Estimated total CO2 savings if all practices operated like Cadwgan: 57332.68 kg

```

Figure 8 - Paper Savings for All Wales

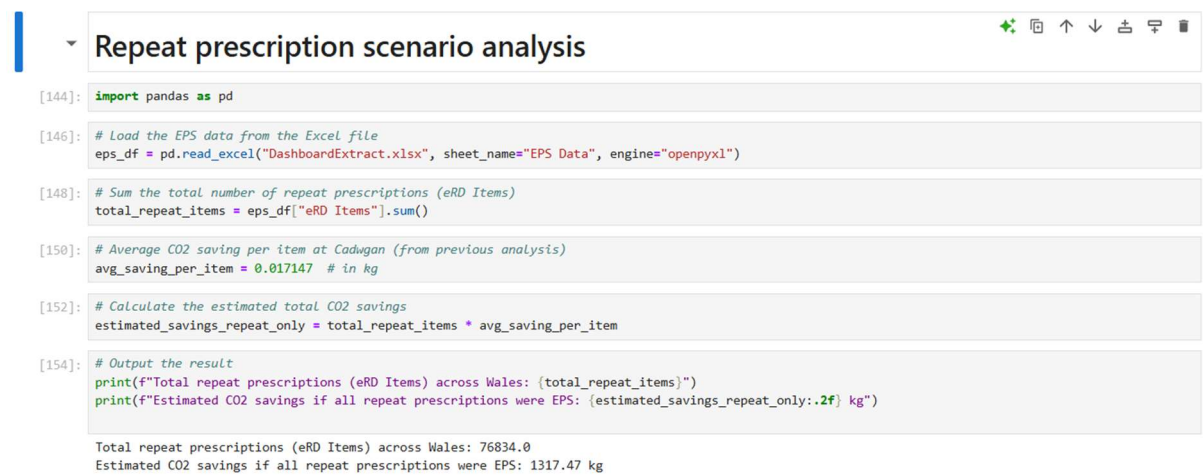


Figure 9 - Repeat prescription scenario analysis

Appendix C: Sample Data Tables

1	GP	Pharmacy	Total_Drive_Length	Annual dispensed items	kg co2	Total Miles	Total kg co2
2	W91007	FWQ96	1.562903910511887	9577	0.273315663	14967.93075	4090.969918
3	W91007	FWH18	2.301588543824114	2377	0.273315663	5470.875969	1495.276093
4	W91007	FWP29	3.070932375626782	1797	0.273315663	5518.465479	1508.283052
5	W91007	FWV63	4.209906763821661	766	0.273315663	3224.788581	881.3852294
6	W91007	FEF11	4.941343533674496	44	0.273315663	217.4191155	59.42404972
7	W91007	FWT66	5.730179573023990	34	0.273315663	194.8261055	53.24902621
8	W91007	FWL44	6.905223352800882	4	0.273315663	27.62089341	7.549222798
9	W91007	FWP32	7.264261763748499	15	0.273315663	108.9639265	29.78154781
10	W91007	FWN15	9.378710133276044	231	0.273315663	2166.482041	592.1334755
11	W91007	FWE74	8.491361770671588	363	0.273315663	3082.364323	842.4584487
12	W91007	FWR37	4.909130525138306	89	0.273315663	436.9126167	119.4150616
13	W91007	FWJ67	8.379355014463197	16	0.273315663	134.0696802	36.64334355
14	W91007	FW154	8.643685417102350	20	0.273315663	172.8737083	47.24909223
15	W91007	FWG59	8.753814927972588	106	0.273315663	927.9043824	253.6108015
16	W91007	FWH96	11.084505915973766	3	0.273315663	33.25351775	9.088707253
17	W91007	FWH71	8.927873845404783	1110	0.273315663	9909.939968	2708.541814
18	W91007	FWH60	8.042514271866816	11	0.273315663	88.46765699	24.17959633
19	W91007	FWF89	8.979230880963131	47	0.273315663	422.0238514	115.3457288
20	W91007	FWV55	10.410846899260230	3	0.273315663	31.2325407	8.536342571

Figure 10 - Cadwgan to Pharmaices data (Drive-length)

	A	B	C	D	E	F
1	Practice	Dispensing	EPS Items	EPS Forms	eRD Items	eRD Utilis
2	W00067 - ARGYLE MEDICAL	No	181,876	78,295	7,839	0.01%
3	W91007 - CADWGAN SURG	No	179,093	83,851	8	0.00%
4	W91009 - HEALTHY PRESTA	No	67,747	28,815	314	0.00%
5	W91010 - CANOLFAN IECH	No	7,080	3,458	10	0.00%
6	W91014 - KINMEL BAY MED	No	34,870	14,465	269	0.00%
7	W91019 - GARDDEN ROAD	No	7,468	3,356		
8	W91024 - CHIRK SURGERY	No	31,753	13,959	47	0.00%
9	W91025 - ALYN FAMILY DO	No	130,891	64,713		
10	W91028 - PARK HOUSE SUF	No	18,776	9,104	7	0.00%
11	W91043 - RUABON MEDICA	No	38,832	17,866	785	0.00%
12	W91047 - CORWEN FAMILY	No	1,553	898	1	0.00%
13	W91048 - RYSSELDENE SUF	No	29,139	13,362		
14	W91059 - BEECH AVENUE F	No	12,751	5,947	1	0.00%
15	W91614 - CRANE MEDICAL	No	10,882	5,290	311	0.00%
16	W91615 - LAKESIDE MEDIC	No	23,584	9,863	93	0.00%
17	W92008 - BARLOW HOUSE	No	32,782	16,440		
18	W92018 - MEDDYGFA EMLY	No	92,708	42,169	12	0.00%
19	W92031 - MEDDYGFA TYW	No	18,975	8,927		

Figure 11 - DataExtract.xlsx on the EPS Data Page