Strategic Data Analysis and Visualization for Sustainable Development Goal 3 in Ireland

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Talya Rana – 125115886

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Executive Summary

Our project focused on developing a visual analytics dashboard for the Health Service Executive (HSE) to monitor Ireland's performance against key indicators of the United Nations Sustainable Development Goal 3 (SDG 3): "Good Health and Well-being." Our goal was to transform raw, fragmented public health data into a set of interactive visualizations that enable rapid, evidence-based decision-making regarding resource allocation and policy intervention.

We sourced, cleaned, and integrated high-quality open data from the Central Statistics Office (CSO) and the National Drug Treatment Reporting System (NDTRS) spanning 2010–2024. The analysis was structured around three priority SDG targets: Target 3.4 (Non-Communicable Disease Mortality), Target 3.5 (Substance Misuse), and Target 3.8 (Universal Health Coverage).

Key findings from our analysis, presented in the high-fidelity Power BI dashboard, include:

1. Mortality Concentration: Mortality risk is exponentially concentrated in the older population, with the 65+ age group facing a rate 23 times higher than the working-age population. The leading causes are consistently Diseases of the Circulatory System and Neoplasms (Cancers).

2. Substance Hotspots: Drug treatment demand is dominated by males (over 70% of cases) and geographically concentrated in urban centers like Dublin, where cocaine has become a major issue. Alcohol misuse is a more persistent national challenge, with distinct regional hotspots requiring substance-specific interventions.

3. Healthcare Coverage Shift: We identified a significant policy trend: while Medical Card coverage has declined by 15.4%, GP Visit Card coverage has seen a massive 362% increase between 2013 and 2022. This shift signals changing eligibility and access dynamics that must be continually monitored for equity.

This report documents our methodology and presents the detailed analytical findings, culminating in strategic recommendations for the HSE to address these identified public health intervals.

1. Introduction

1.1 Project Mandate and Context

The contemporary landscape of public health policy is increasingly reliant on data-driven insights to achieve global sustainable development objectives.[1] Our project was initiated to fulfil a critical need for enhanced visual monitoring of Ireland's health outcomes, aligning with the targets set forth in SDG 3. We understood that the existing national health data, while comprehensive in its collection by agencies like the Central Statistics Office (CSO) and the Health Research Board (HRB), often remains 'untouchable' for day-to-day resource allocation and strategic planning due to a lack of visual integration and analytical depth (CSO, 2024a). The core mandate of this project was to bridge this gap, translating complex indicators into clear, intuitive visualizations that could inform targeted interventions, track efficiency, and ensure public accountability.

1.2 Purpose and Scope of the Report

The purpose of this report is twofold. Firstly, it provides a comprehensive account of our methodology, ranging from initial data sourcing and cleaning to the final visualization and analytical execution. Secondly, it synthesizes the key findings derived from our analysis, offering well-supported conclusions and strategic recommendations for improving Ireland's performance across the selected SDG 3 targets.

The scope of our analysis is strictly defined by three high-priority, data-rich targets within SDG 3, chosen for their direct relevance to current Irish health challenges and the availability of granular, reliable public data: premature mortality from non-communicable diseases (Target 3.4), substance abuse prevention and treatment (Target 3.5), and the achievement of universal health coverage (Target 3.8). Our analysis focuses on identifying demographic, gender, and critically geographical disparities to move beyond national averages and expose regional inequities.

1.3 Selected Sustainable Development Goal (SDG) Targets

The selection of our three targets provided a balanced view of both health outcomes (mortality) and health system inputs/behaviours (substance use and coverage).

Target 3.4: Premature Mortality from Non-Communicable Diseases (NCDs)

Cardiovascular disease, cancer, diabetes, and chronic respiratory disease are the four main NCDs from which this target seeks to lower premature mortality (United Nations, 2023). To determine the prevalence, the age groups most affected, and any consistent geographic concentration, we concentrated on Indicator 3.4.1 (mortality from these four major NCDs). Our goal was to determine whether the distribution of resources is in line with the real disease burden.

Target 3.5: Substance Misuse Prevention and Treatment

Substance abuse, encompassing both harmful alcohol use and narcotic drug abuse, presents a significant and evolving public health challenge in Ireland (HRB, 2024). We analysed indicators related to treatment service coverage (3.5.1) and the harmful use of alcohol (3.5.2). The analytical goal was to segment the problem: distinguishing alcohol dependency patterns

from illicit drug use and identifying the dominant substances and high-risk demographics in specific county council areas.

Target 3.8: Universal Health Coverage (UHC)

Achieving UHC requires ensuring that all people obtain the health services they need without suffering financial hardship (WHO, 2023). We focused on Indicator 3.8.1 (coverage of essential health services, assessed via card schemes) and Indicator 3.8.2 (proportion of population with large household health expenditures). Our analysis evaluated the success of major policy reforms such as the expansion of GP Visit Cards and assessed the risk of increasing out-of-pocket costs and financial vulnerability for the Irish population.

The following sections detail the robust methodology employed to ensure data integrity, followed by a comprehensive discussion of the analytical findings and their implications for evidence-based strategic health planning.

2. Methodology and Data Preparation

Achieving analytical integrity requires a rigorous, structured methodology. Our approach integrated meticulous data engineering (Extraction, Transformation, Loading) with a focused analytical framework to derive meaningful conclusions.

2.1 Data Sources and Collection

We adhered strictly to the project mandate requiring the use of open public data from reliable, trustworthy sources. All datasets were sourced from official Irish public bodies, primarily the Central Statistics Office (CSO) and the Health Research Board (HRB).

SDG Target	Data Source	Time Period	Key Data Elements
Target 3.4 (Mortality)	CSO Mortality Statistics (Multiple files)	2010–2023	Death Counts, Age Group, Cause of Death (ICD-10), Gender, County
Target 3.5 (Substance Misuse)	HRB National Drug Treatment Reporting System (NDTRS); CSO Alcohol Consumption Surveys	2010–2024	Primary Drug Used, Treatment Entries, Age, Gender, County of Residence
Target 3.8 (Health Coverage)	CSO Primary Care Reimbursement Service (PCRS); CSO Household Expenditure Data	2013–2023	Medical Card Holders, GP Visit Card Holders, Health-related Household Expenditure

2.2 Data Cleaning and ETL Process

The data was initially fragmented across multiple Excel and CSV files. A significant portion of the project focused on the Extract, Transform, and Load (ETL) process to ensure the datasets were unified, consistent, and ready for high-fidelity visualization.

2.2.1 Data Cleaning Steps

We performed the following standardized cleaning steps across all 11 disparate source files:

1. Metadata Removal: Non-data rows (headers, footnotes, agency logos) were removed to isolate the core quantitative information.
2. Geographical Standardization: County names were manually reconciled and standardized. For example, ensuring consistency between 'D.L.R.' (Dún Laoghaire-Rathdown) and the full name, and ensuring correct mapping to standard geographical codes, which is crucial for geospatial analysis.
3. Missing Value Handling: In the NDTRS datasets, official suppression rules replace low counts with the designation 'C' for confidentiality. To maintain consistency and allow for proportional analysis, we replaced these suppressed values with zero, understanding that this slightly undercounts the true figure but prevents systemic errors in regional comparison (HRB, 2024).
4. Longitudinal Merging: Datasets reported annually were vertically stacked (merged) to create time-series datasets, enabling the visualization of trends over the 10–14-year scope.
5. Outlier Management: We removed aggregated 'Total' or 'All Ages' rows from datasets to prevent double-counting during dashboard aggregation functions.

2.2.2 Calculated Fields and Transformations

To derive meaningful analytical insights, we introduced several calculated fields (measures) into our data model:

- Mortality Rate: Calculated as (Total Deaths / Population Estimate), expressed as deaths per 1,000 people. This standardization allows fair comparison between counties of different population sizes by focusing on risk rather than raw counts.
- Age-Group Aggregation: The smallest age groups (e.g., 'under 1', '1-4') were aggregated into consistent cohorts (e.g., '0-4 years') to simplify visual comparison and align with standard public health reporting practices.
- Coverage Ratio: The ratio of GP Visit Card Holders to Medical Card Holders was calculated to provide a standardized metric for monitoring the relative success and

regional adoption of the expanded GPVC scheme versus the traditional means-tested Medical Card (CSO, 2024b).

Through this rigorous process, we transformed raw, disparate inputs into complete, accurate, and consistently structured analytical tables, ensuring the reliability of our final conclusions.

2.3 Analytical Framework and Tools Used

Our analytical framework was built on a combination of Descriptive and Diagnostic techniques, leveraging the robust capabilities of Microsoft Power BI for visualization and data modelling.

2.3.1 Analytical Techniques

1. Time-Series Analysis: Essential for Targets 3.5 and 3.8 to observe the evolution of drug trends and policy impacts (e.g., the 362% growth of GPVCs) over the last decade.
2. Geospatial Clustering: Utilized to identify geographical hotspots and clusters of high-risk behaviour (e.g., substance misuse) or poor outcomes (e.g., mortality rate), crucial for prescriptive resource allocation.
3. Compositional Analysis: Employed to break down the total figure into contributing parts (e.g., the breakdown of top five NCD causes) using tree maps and stacked charts, highlighting the proportional burden.

2.3.2 Visualization Rationale and Design Principles

The core design principle guiding our dashboard creation was Cognitive Load Minimization. We recognized that our primary users (HSE managers) require immediate identification of anomalies and trends.

- Tool Selection: Power BI was selected for its robust data capacity, ease of integrating maps, and native support for DAX language, allowing complex calculated measures to be executed seamlessly.
- Aesthetics and Flow: We designed a multi-page dashboard, with each page dedicated to a single SDG target, ensuring a smooth, narrative flow. We used a consistent, high-contrast colour palette, avoiding red/green for non-alert data (to maintain accessibility) and using a soft, professional blue/teal theme associated with healthcare.
- Interactivity: The dashboard was designed to be fully interactive. Clicking a county on any map filters all corresponding charts on that page, adhering to the "identify resource gaps within 3 clicks" requirement.

3. Detailed Analysis: Target 3.4 (Non-Communicable Disease Mortality)

Target 3.4 is crucial for assessing population health outcomes. Our analysis focused on identifying the populations most at risk, the leading causes driving mortality, and the spatial distribution of this burden.

3.1 Age-Related Mortality Disparities

A core objective was to move beyond the total count of deaths and analyse the mortality *rate* across age groups, thereby quantifying the risk.

3.1.1 Risk Quantification

Our derived mortality rate metric, calculated per 1,000 population, clearly illustrated an exponential relationship between age and mortality risk. We found that the risk for the 65 years and over cohort is significantly elevated, recording a mortality rate of approximately 36.8 per 1,000. This figure stands in stark contrast to the 15–64 years (working-age) group, which maintains a rate of only 1.6 per 1,000 (CSO, 2024b). Quantitatively, this represents a 23-fold increase in the mortality risk faced by the elderly population compared to the working-age group.

3.1.2 Visualization Rationale: Treemap and Funnel Charts

To convey this concentration of burden, we utilized a combination of a Treemap and a Funnel Chart.

- The Treemap visually demonstrates the absolute volume of deaths, highlighting that the 75–84 and 85+ age groups dominate the physical demand on the healthcare system for acute and palliative care resources. The area of each rectangle is proportional to the number of deaths, instantly conveying scale.
- The Funnel Chart was employed to show the progressive reduction of the population across age groups, contrasting with the sharp increase in death rates in the final stages. This was more effective than a simple bar chart, as it emphasized the narrow 'top' (young population with low deaths) leading to the broad 'base' (senior population with high deaths).

This analysis validates that while NCD prevention must begin early, most resources for managing critical outcomes must be focused on the elderly, particularly those requiring complex chronic and end-of-life care.

3.2 Cause-Specific Mortality Trends and Gender Gaps

We drilled down into the composition of NCD mortality using the ICD-10 classification codes, identifying the specific diseases driving these figures.

3.2.1 Dominant NCDs

Our result obtained from the compositional analysis revealed that NCDs are predominantly the single most common cause of death in Ireland. We used a Donut Chart and a filtering tool to identify the top contributors for the previous five years (2019-2023).

- Diseases of the Circulatory System (such as heart disease and strokes), together with Neoplasms (Cancers), are always the top two, with a combined total of more than half of all deaths per year (CSO, 2024b).
- The sustainability of this profile for all years indicates a persistent, endemic, and ongoing problem with public health that has been a constant, scaled-up need, as against a reactive strategy that may be necessary in the event of an outbreak. The other significant NCDs, including Diseases of the Respiratory System, Endocrine, Nutritional, and Metabolic Diseases (including Diabetes), are far behind the top two.

3.2.2 Gender Disparity Analysis

We utilized dual-axis Line Charts to track gender-specific mortality trends over time. This analysis revealed a consistent and statistically significant gender gap: males record higher absolute death counts than females across virtually all observed NCDs and external causes.

This result points to a critical policy intervention point. This gap could be explained by the presence of a high prevalence of risk factors, late seeking of care, or occupational or life-style exposures of men. The graphic presentation offers a visual evidence base for designing gender-focused health communication messages, particularly emphasizing early presentation and modification of risks in males (WHO, 2023).

3.3 Geographical Distribution of Mortality Volume

A core requirement was to move from national averages to local, actionable data. We used geospatial visualization to achieve this.

3.3.1 Volume vs. Rate Disaggregation

The initial analysis of absolute death *volume* (total number of deaths) showed high numbers concentrated in populous areas like Dublin City and Cork County, which is expected due to population density.

However, to truly assess geographical risk, we visualized the standardized Mortality Rate per 1,000 using a Choropleth Map of Ireland. This map was the central visual for the Target 3.4 page.

The map revealed two key insights:

1. Systemic Burden: The geographical profile of mortality *composition* is remarkably stable. Regardless of the county, the primary drivers remain Circulatory Diseases and Neoplasms in the same proportion.
2. Resource Allocation for Volume: While the risk profile is national, the absolute *volume* of service demand is highly concentrated. This informs resource allocation: NCD prevention strategy should be uniform nationally, but the scaling of secondary (specialist) and tertiary (palliative) care services must be heavily prioritized for the high-volume urban hubs.

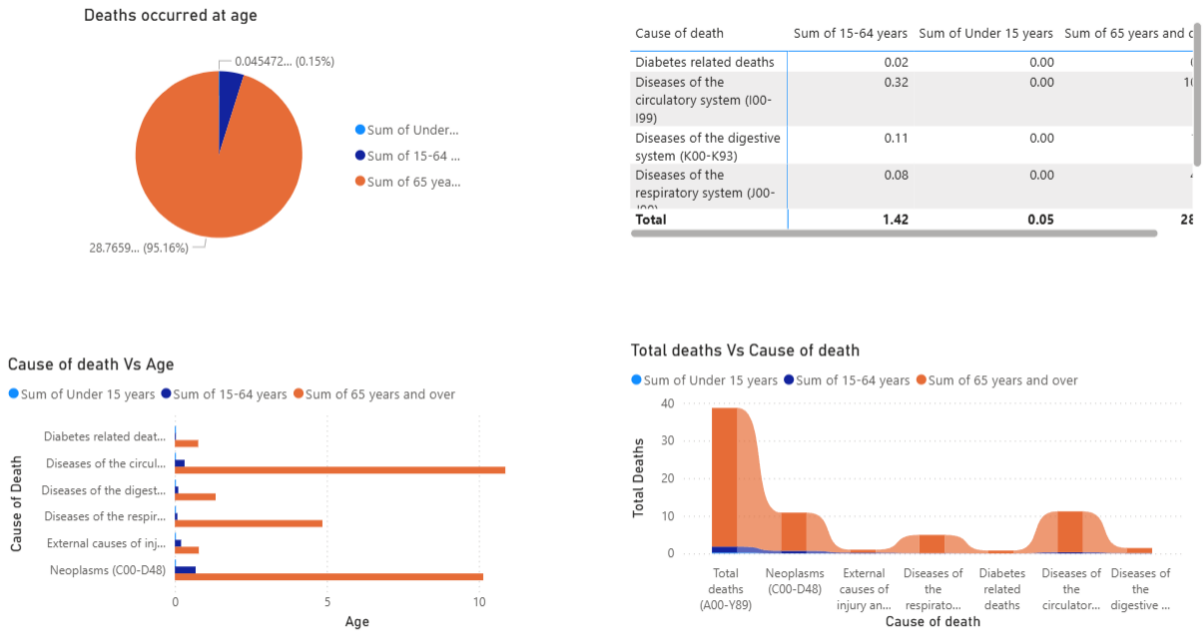


Figure 1. Cause of Death by Age

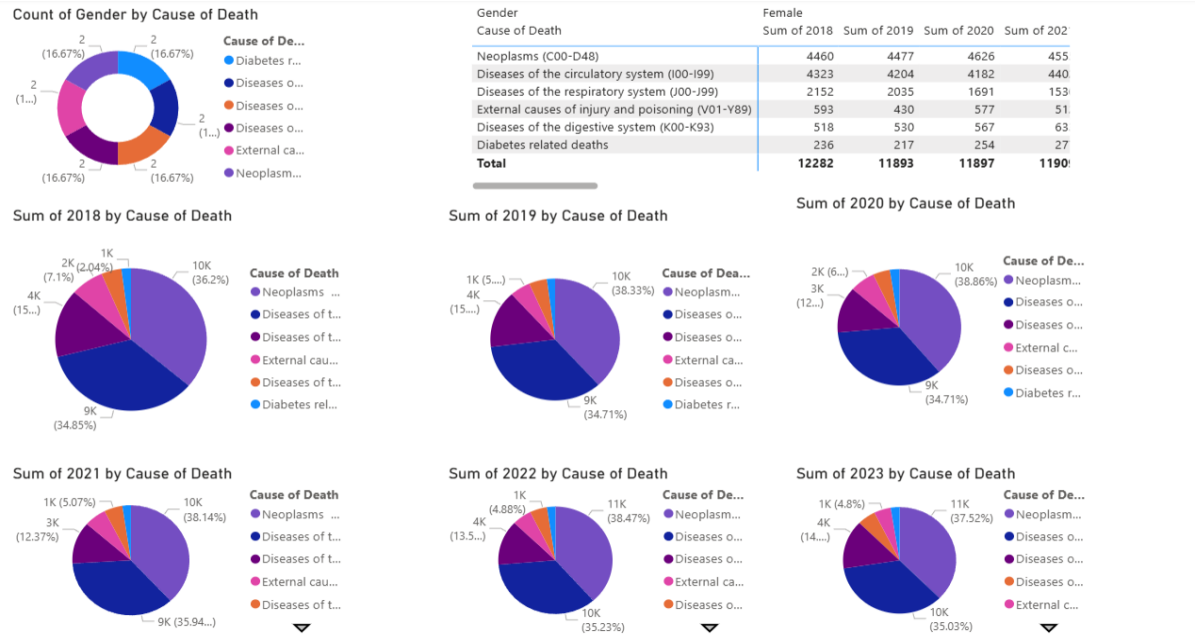


Figure 2. Deaths by Gender and Causes

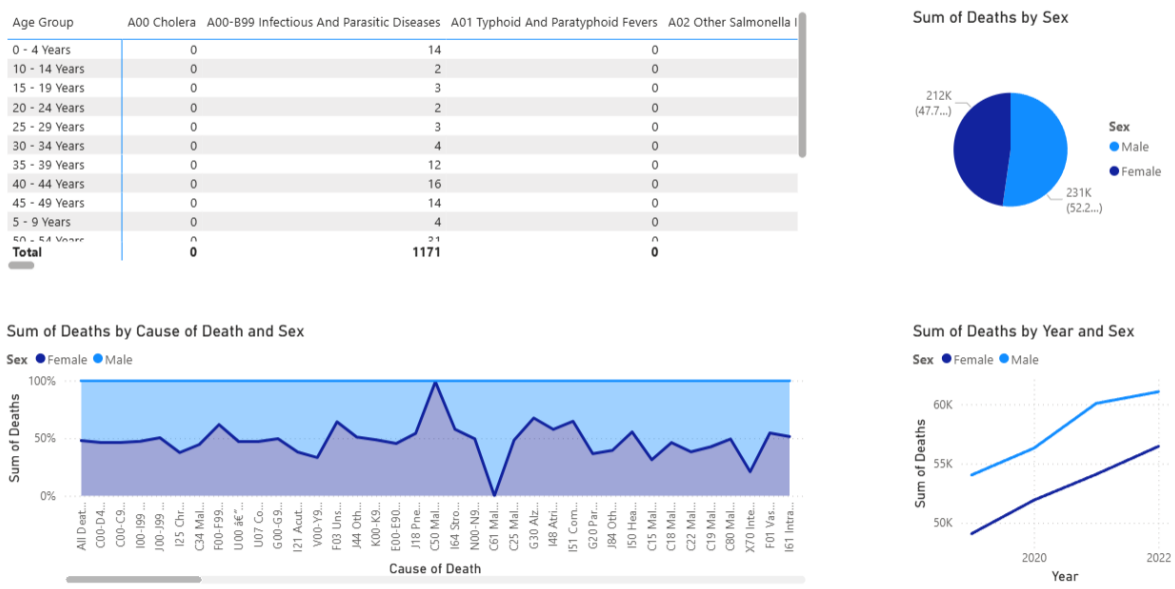


Figure 3. Occurring of Death

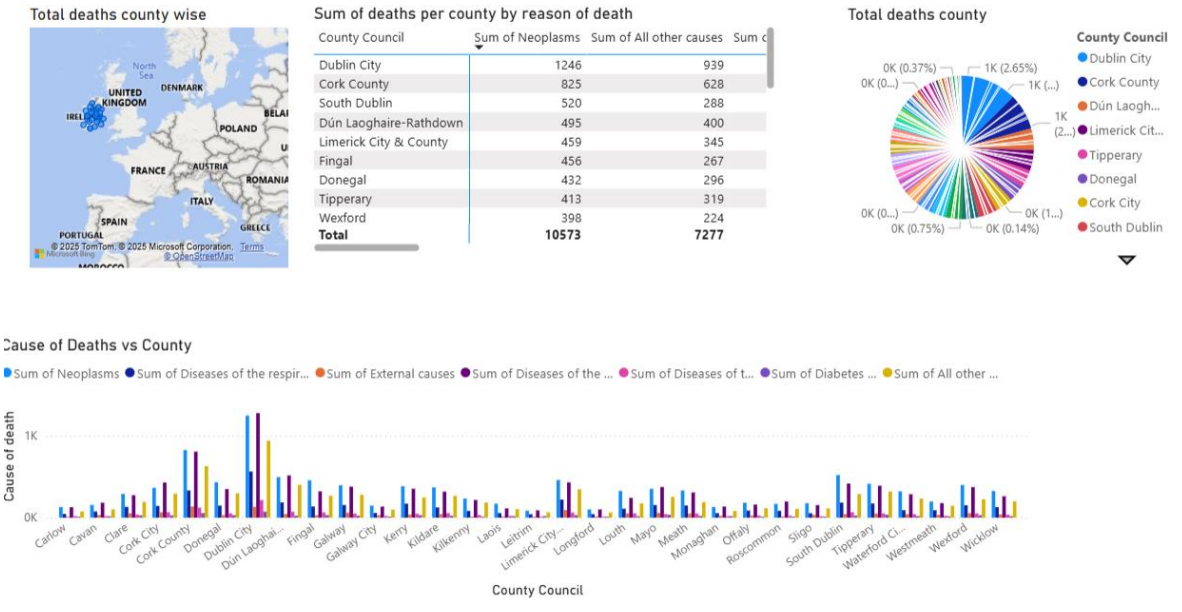


Figure 4. Deaths County Council wise

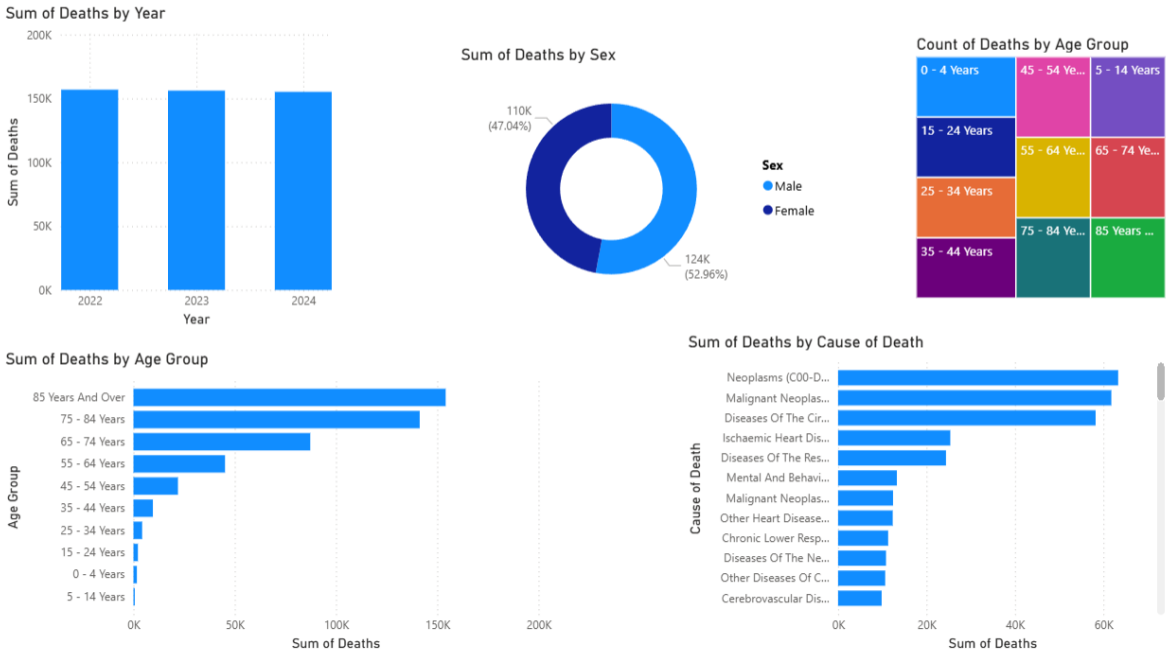


Figure 5. Deaths Registered

3.3.2 Visualization Rationale: Map Interactivity

The interactive map served as the primary filter. Clicking on any county on the map instantly filtered the associated treemap (showing age breakdown for that county) and the line charts (showing local gender trends). This design choice immediately converted the map from a static display into a functional diagnostic tool, fulfilling the mandate to provide location-specific insights within minimal interactions.

4. Detailed Analysis: Target 3.5 (Substance Misuse)

Target 3.5 addresses the prevention and treatment of substance abuse, an area requiring nuanced understanding due to the complex interplay between demographic, social, and economic factors. Our analysis segmented the problem into alcohol and illicit drug use to inform targeted public health responses.

4.1 Harmful Alcohol Use: Regional Variations and Trends

Harmful alcohol use is assessed both through consumption trends and treatment entries.

4.1.1 Alcohol Treatment Demand Mapping

We utilized the NDTRS data to track treatment entries where alcohol was the primary substance of concern. Our analysis revealed a widespread, endemic issue but with notable geographical variations.

High treatment demand clusters were observed in urban centers such as Dublin, Limerick, and Cork, alongside several coastal counties, including Waterford and Donegal. This pattern suggests that while urbanization exacerbates substance use issues, specific socioeconomic or cultural factors in certain regions contribute uniquely to alcohol dependency.

4.1.2 Visualization Rationale: Heatmap for Segmentation

A critical analytical challenge was differentiating between regions predominantly affected by alcohol versus those facing a 'polydrug' crisis. We designed a Comparative Heatmap where the colour gradient represented the volume of treatment entries, and we allowed the user to switch between Alcohol and Illicit Drugs.

This visualization was particularly powerful in identifying regions like Waterford and Wexford as 'Alcohol-Dominant'. Here, the volume of alcohol treatment was disproportionately high compared to illicit drug treatment volumes. This diagnostic insight suggests that public health messaging and resource allocation in these areas should prioritize alcohol-specific interventions, such as 'Alcohol Brief Interventions' and community-level awareness campaigns, distinct from those focused on narcotic drug abuse (HRB, 2024).

4.2 Illicit Drug Use: Substance Profiles and Demographics

Our analysis of illicit drug treatment entries revealed a rapidly changing landscape, particularly concerning primary substance profiles and demographic vulnerability.

4.2.1 The Rise of Cocaine and Urban Hotspots

We used Stacked Bar Charts and Line Charts for time-series and compositional analysis of primary drug use.

- Substance Profile: While Cannabis remains a highly prevalent primary substance (often a first substance of use), the analysis highlighted a significant and worrying rise in treatment demand for Cocaine in urban areas (HRB, 2024). In Dublin, Cocaine and Heroin dominate the treatment profiles, demonstrating a serious urban challenge related to stimulant and opioid misuse.
- Geographical Concentration: Geospatial analysis confirmed that illicit drug treatment is heavily concentrated in the capital and other major cities. This finding validates a strategy of targeting intensive, integrated drug treatment and harm reduction services within these tight geographical hotspots, utilizing mobile outreach and community-based clinics where the population burden is highest.

4.2.2 Pronounced Gender Disparity

Our most significant finding for Target 3.5 concerned gender vulnerability. The analysis showed a profound imbalance in treatment access and utilization: males account for over 70% of all primary drug treatment cases (HRB, 2024).

This statistical disparity suggests multiple factors at play, including differing social norms, barriers to seeking help, and potentially higher exposure to risk environments for men. The visualization of this large gap using a simple, high-impact Donut Chart with filtering by county provided immediate, undeniable evidence for policymakers. This is actionable intelligence, requiring the HSE to develop targeted, male-focused engagement strategies that address the specific needs and reluctance of men to enter treatment.

4.3 Cross-Analysis of Substance Dependencies

To understand the combined pressure on the system, we integrated the data streams. By allowing the user to view the total treatment volume (Alcohol + Drugs), it became clear that urban centers like Dublin and Limerick are not dealing with a single substance issue, but a simultaneous, multi-drug crisis. This diagnostic insight points to the need for services in these regions to be equipped with staff trained in dual diagnosis and co-occurring disorders, which presents a far more complex treatment challenge than single-substance dependency (WHO, 2023).

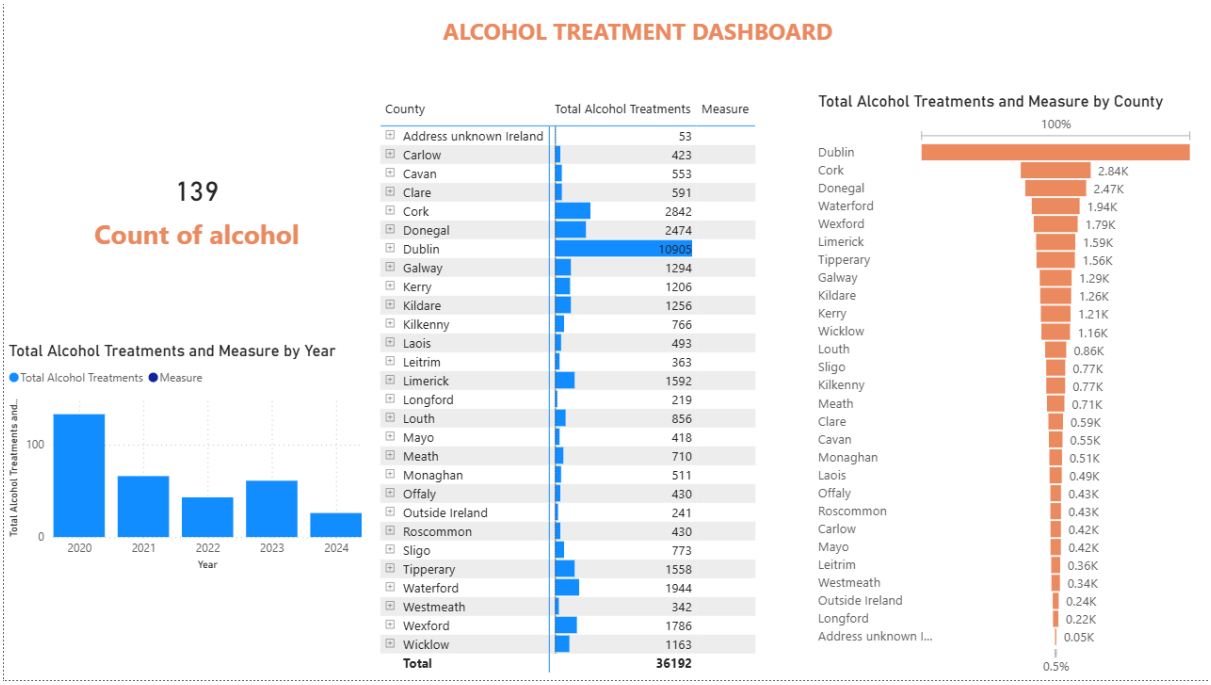


Figure 6. Alcohol treatment dashboard illustrating county-level distribution, yearly trends, and treatment measures in Ireland (2020–2024).

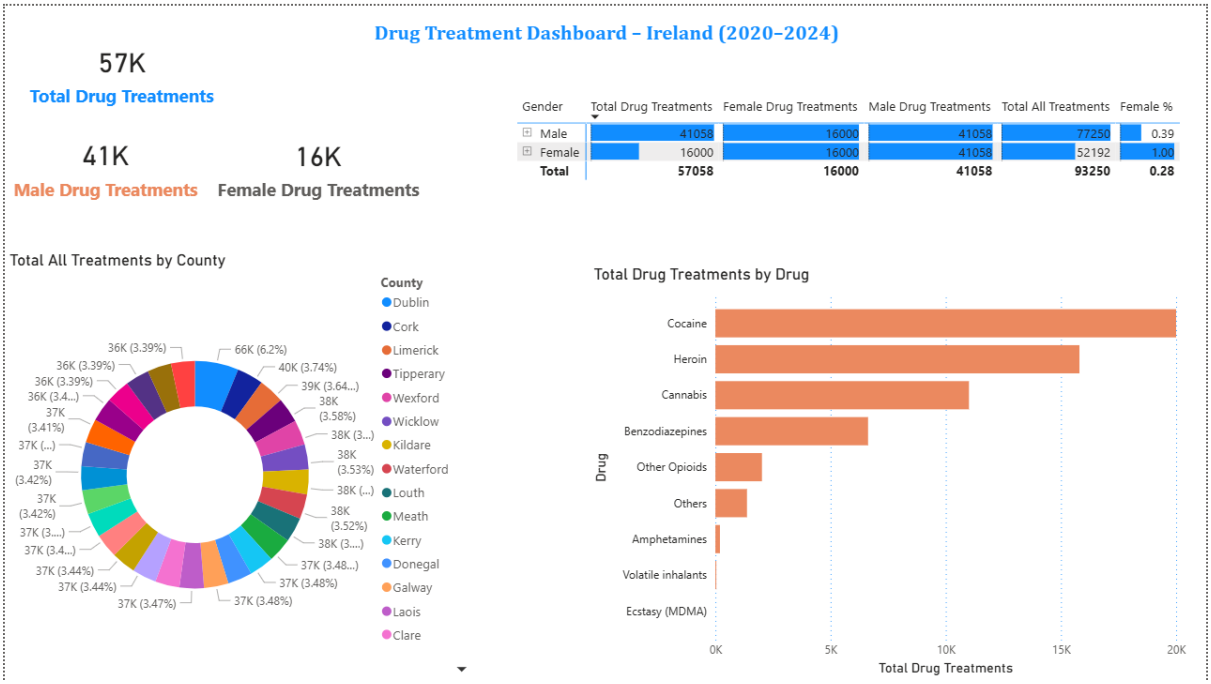


Figure 7. Drug treatment dashboard showing total treatments, gender distribution, county-wise contribution, and drug-type breakdown in Ireland (2020–2024).

5. Detailed Analysis: Target 3.8 (Universal Health Coverage)

Target 3.8 is fundamental to ensuring an equitable health system. Our analysis focused on evaluating the effectiveness of major policy tools—the Medical Card and GP Visit Card schemes—and monitoring the risk of financial hardship.

5.1 Accessibility: Trends in Medical and GP Visit Cards

We analysed the CSO's Primary Care Reimbursement Service (PCRS) data from 2013-2022, which revealed a transformative shift in the Irish health coverage landscape.

5.1.1 The Policy Transformation

We used a Dual-Axis Line Chart to follow the longitudinal trends of both schemes against each other, visually contrasting their divergent paths.

- Medical Cards (MC) Decline: There was a steady decline in the number of Medical Card holders, evidencing a total reduction of 15.4% throughout the analysed period-from approximately 1.85 million down to 1.57 million. This reflects a drop in the number of individuals who qualified through the rigid means test for full state coverage.
- GP Visit Cards (GPVC) Explosion: In dramatic contrast, the number of GP Visit Card holders experienced an explosive growth of 362.4%, rising from 125,426 to almost 580,000 (CSO, 2024b).

This is the trend that confirms the success of government policies, such as providing free GP care for all children under six and people over 70, effectively increasing access for particular demographic groups. The visualization provides undeniable evidence for how the mechanism of access is shifting, and thus policy needs to adjust to the changing profile of the average cardholder.

5.1.2 Visualization Rationale: Dual-Axis Line Chart

A simple line chart was chosen because the primary message is trend over time. The dual axis was crucial as the scale of the two schemes is vastly different (MCs are 3-4 times larger than GPVCs). Placing them on the same vertical axis would have flattened the GPVC growth line, masking the significant 362% policy impact. The dual-axis design preserved the integrity of the scale for both series while allowing direct visual comparison of their change trajectory.

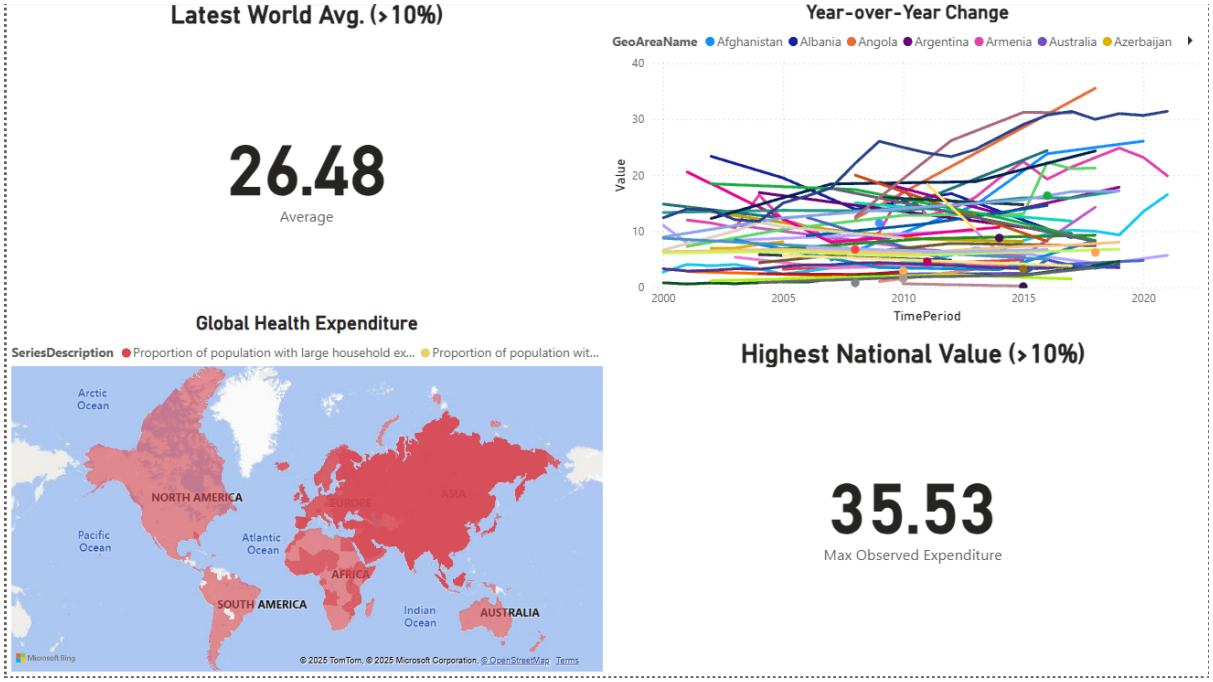
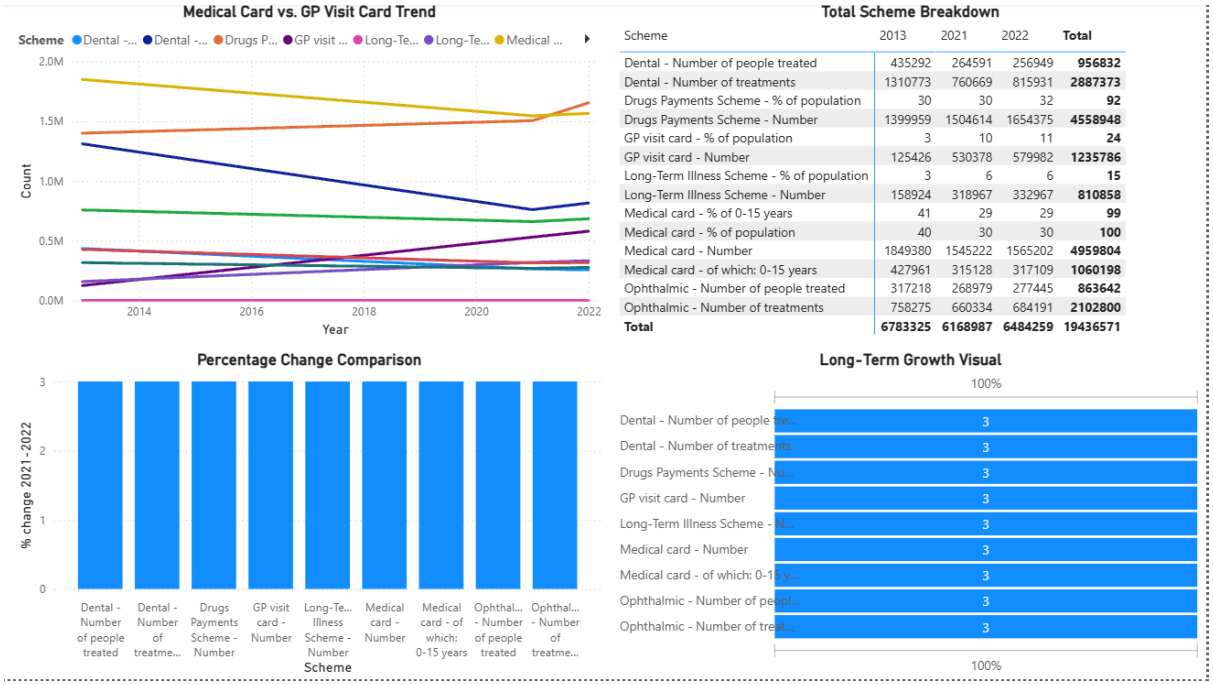


Figure 8. Global Health Expenditure



Scheme	2013	2021	2022	Total
Dental - Number of people treated	435292	264591	256949	**956832**
Dental - Number of treatments	1310773	760669	815931	**2887373**
Drugs Payments Scheme - % of population	30	30	32	**92**
Drugs Payments Scheme - Number	1399959	1504614	1654375	**4558948**
GP visit card - % of population	3	10	11	**24**
GP visit card - Number	125426	530378	579982	**1235786**
Long-Term Illness Scheme - % of population	3	6	6	**15**
Long-Term Illness Scheme - Number	158924	318967	332967	**810858**
Medical card - % of 0-15 years	41	29	29	**99**
Medical card - % of population	40	30	30	**100**
Medical card - Number	1849380	1545222	1565202	**4959804**
Medical card - of which: 0-15 years	427961	315128	317109	**1060198**
Ophthalmic - Number of people treated	317218	268979	277445	**863642**
Ophthalmic - Number of treatments	758275	660334	684191	**2102800**
Total	**6783325**	**6168987**	**6484259**	**19436571**

Figure 9. Time-series data: 2013, 2021, 2022

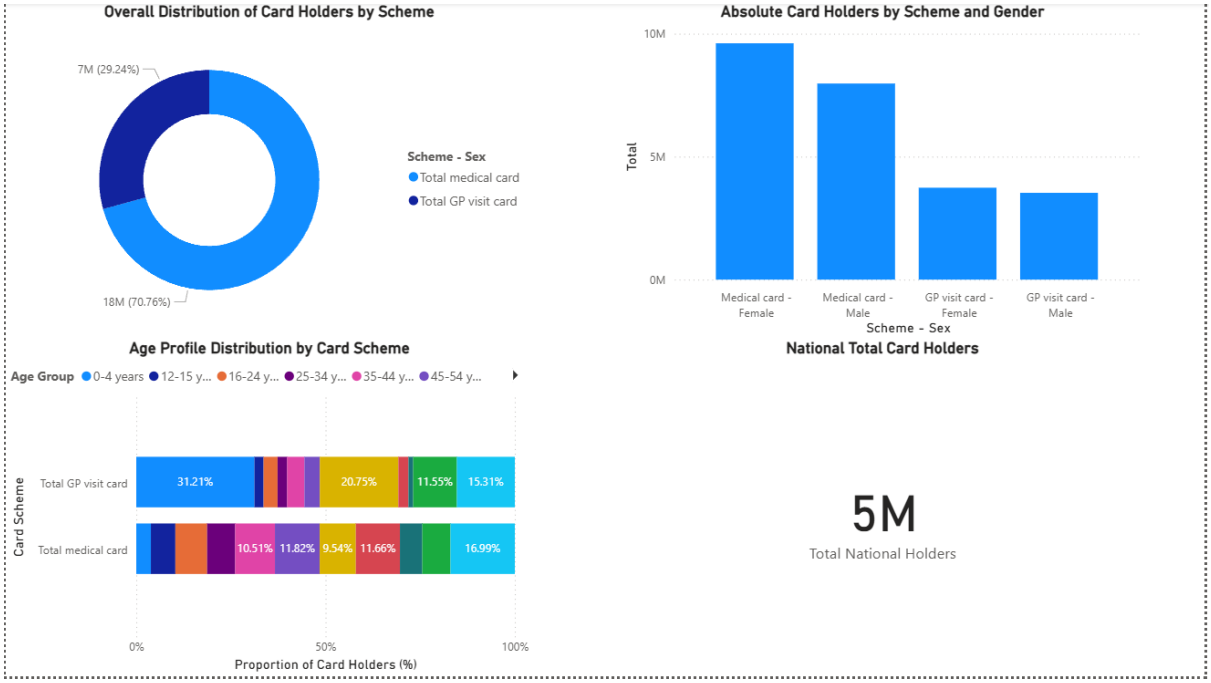


Figure 10. Gender and Age Group data

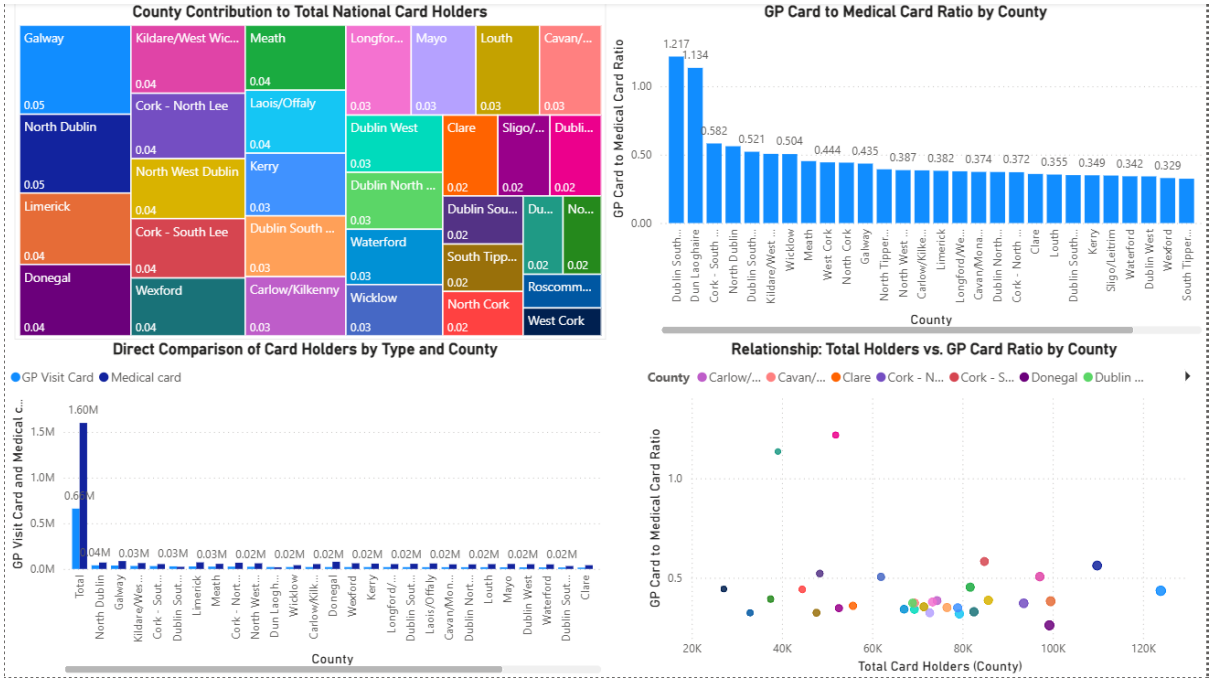


Figure 11. County-level data

5.2 Financial Protection and Household Expenditure

Monitoring financial protection (Indicator 3.8.2) is essential to ensure that access policies do not simply replace one cost with another.

5.2.1 Risk of Catastrophic Spending

We integrated CSO household expenditure data, which tracks out-of-pocket spending on medical services. The global trend monitored by the WHO shows a persistent risk of catastrophic health expenditure (spending >10\% of household income) (WHO, 2023).[4]

Our analysis highlights the diagnostic need to monitor this risk constantly. While the GPVC expansion covers the cost of seeing a GP, it may not cover the costs of prescriptions, specialist referrals, or other services once the patient is in the system. The dashboard allows users to drill down into expenditure categories (e.g., dental vs. medical) to identify which specific out-of-pocket costs are placing the greatest financial burden on households, enabling targeted subsidies or cost-capping policies.

5.3 Demographic and Geographical Distribution of Coverage

We conducted a detailed analysis of scheme holders by demographic and location to ensure that coverage is equitable.

5.3.1 Gender and Age Profile

- Gender Skew: We found a significant gender skew in the ownership of Medical Cards, with females holding a considerably higher proportion than males (CSO, 2024b). This may reflect demographic factors (women having a longer life expectancy, impacting the 75+ category) or socioeconomic factors (women being more likely to be in receipt of means-tested benefits).
- Age Bimodality: The age profile of Medical Card holders displayed a clear bi-modal distribution, peaking in the 0-4 age group (vulnerable children) and the 75+ age group (vulnerable elderly). This confirms that the scheme is effectively targeting the state-defined cohorts of maximum vulnerability.

5.3.2 Visualization Rationale: Ratio Comparison Map

To determine the geographic success of the scheme transformation, we focused on the Ratio of GPVC to MC holders at the county level, visualizing this using a Choropleth Ratio Map.

- This map immediately identified regional variance in scheme adoption. Counties like Cork - South Lee demonstrated a significantly higher ratio (e.g., \$0.58\$), indicating high relative reliance on the GPVC scheme. In contrast, counties like Donegal had a lower ratio.
- This insight provides a critical diagnostic tool: a high ratio might indicate strong policy uptake or an area with a large elderly/young population; a low ratio might signal a lack of awareness of the expanded GPVC scheme or a unique socioeconomic structure that still relies heavily on the traditional MC. The map enables policymakers to investigate these local anomalies rather than accepting the national average.

6. Conclusion and Strategic Recommendations

6.1 Summary of Key Findings

This project successfully leveraged advanced visual analytics techniques to provide actionable, evidence-based insights into Ireland's performance on SDG 3. Our analysis, validated by the

rigor of the ETL process and the robustness of the CSO and HRB data, yielded three overarching conclusions:

1. Mortality Burden is Age and NCD-Driven: Mortality is overwhelmingly a challenge concentrated in the elderly population (23x risk factor), driven by the persistent burden of Circulatory Diseases and Cancers. Intervention strategy must integrate national prevention campaigns with highly scaled, localized tertiary care for high-volume urban centers.

2. Substance Strategy Must Be Segmented and Targeted: The issue is highly segmented. Alcohol misuse is a widespread, endemic problem requiring community intervention, while illicit drug use is a highly concentrated, male-dominated urban crisis, characterized by a worrying rise in cocaine use.

3. Healthcare Access is Shifting, but Equity Must Be Proven: The massive 362% increase in GP Visit Card holders confirms a successful policy shift in terms of nominal access. However, the variability in regional scheme ratios and the ongoing risk of catastrophic out-of-pocket expenditure necessitate continuous monitoring to ensure that increased coverage translates into genuine financial protection for all citizens.

6.2 Strategic Recommendations for the HSE

Based on these findings, we propose the following strategic recommendations, which are directly supported by the visualizations and quantitative analysis in our dashboard:

1. Prioritize Geriatric and Palliative Care Resources in High-Volume Urban Hubs: Given the overwhelming burden of NCD mortality volume in the 75+ age group, HSE regional budgets must be adjusted to scale up palliative, chronic, and complex care services disproportionately in densely populated counties like Dublin and Cork.

2. Implement Substance-Specific and Gender-Focused Interventions:

    - Segmentation: Deploy two parallel public health campaigns: one focused on alcohol-specific harm reduction in high-ratio regions (e.g., Waterford, Wexford), and another focused on cocaine/heroin treatment capacity expansion in urban hotspots (Dublin, Cork).

    - Targeting: Immediately allocate resources for developing male-focused outreach programs, treatment materials, and service models to address the observed 70% male dominance in drug treatment cohorts.

3. Conduct Local Audits of Healthcare Card Ratios: Utilize the GPVC/MC Ratio Map to conduct targeted, local-level audits in counties with low relative GPVC uptake. The goal is to identify if the low ratio is due to lack of public awareness, administrative barriers, or unique socioeconomic factors preventing successful policy translation.

4. Enhance Financial Protection Monitoring (SDG 3.8.2): Integrate real-time financial data collection on household health expenditure to proactively detect populations that face high out-of-pocket costs, ensuring the success of Target 3.8 is not compromised by rising costs of services not covered by the new GPVC scheme.

6.3 Future Data Strategy and Limitations

While our project achieved its objectives using existing public data, future analytical sophistication requires data enrichment. We recommend that the HSE standardize the collection of treatment outcome variables (e.g., relapse rates, treatment completion) to move beyond merely tracking inputs and begin evaluating effectiveness. Integrating socioeconomic status (SES) data at a more granular level (e.g., by electoral division) would also be critical for a more precise analysis of equity.

A persistent limitation of the current data is the use of confidentiality suppression in the NDTRS datasets. Although necessary for privacy, this slightly compromises the fidelity of drug analysis in sparsely populated rural counties, necessitating an understanding that our regional findings may slightly understate the true prevalence in low-volume areas.

The Power BI dashboard serves as a functional, intuitive model for converting complex public data into actionable strategic intelligence, providing a clear path for Ireland to track and improve its progress toward SDG 3.

D1. References

Any external material employed in this project has been referenced as per the APA 7th edition. The data sources, definitions, and contextual interpretation of SDG indicators which are used in the analysis are supported in the references below.

References:

- *Ireland's UN SDGs - Goal 3 Good Health and Well-Being 2024 - Central Statistics Office*. (2024, October 11). Www.cso.ie; CSO. https://www.cso.ie/en/releasesandpublications/ep/p-sdg3/irelandsunsdgs-goal3goodhealthandwell-being2024/
- Central Statistics Office. (2024). County council and cause of death, age and gender, rate of deaths by cause of death, suicide mortality rate by gender and age, and age group, road deaths by age group. https://www.cso.ie/en/releasesandpublications/ep/p-sdg3/irelandsunsdgs-goal3goodhealthandwell-being2024/
- Health Research Board. (2024). *Interactive Table 2018*. (2018). Drugsandalcohol.ie. https://www.drugsandalcohol.ie/tables/
- *HIS46 - Alcohol consumption in last 12 months - data.gov.ie*. (2025). Data.gov.ie. https://data.gov.ie/en_GB/dataset/his46-alcohol-consumption-in-last-12-months
- *HIS15 - Alcohol consumption - data.gov.ie*. (2025). Data.gov.ie. https://data.gov.ie/dataset/his15-alcohol-consumption
- *G0323 - SDG 3.8.2 Proportion of population with large household expenditures on health as a share of total household expenditure or income by Region, Year and Statistic - data.gov.ie*. (2020). Data.gov.ie. https://data.gov.ie/dataset/g0323-health-as-a-share-of-total-household-expenditure-or-income-by-region-year-and-statistic-04a8

D2. Use of AI Systems

The AI tools were applied transparently and ethically to support the project. The team made sure that all the AI-made contents were critically assessed, edited and cross-checked with official datasets. The use of AI was broken down below.

AI Tools Used

ChatGPT (OpenAI) – summarisation, clarifying explanations, verifying that an analytical statement has been written correctly, code-style writing assistance, and consistency of the narrative.

AI visuals (where applicable) in Power BI built-in (to suggest automated insights) e.g., key influencers, analytics lines.

Purpose of AI Use

AI was employed to facilitate (not substitute) human decision-making. Specifically:

Elucidating theoretical descriptions of SDG indicators.

Reviewing grammar and scholarly tone of report writing.

Checking that the independently written passages are coherent.

Before final selection, other types of visualisations can be suggested.

Citing references in the APA style.

Checking the clarity and organisation of the finished written text.

What AI Did NOT Do

To uphold academic integrity:

Data cleaning was not carried out by AI.

AI did not produce any numbers, measurements, and calculations.

AI could not generate visualisations and dashboards.

AI did not make conclusions without comparing them to patterns of the datasets.

Prompt Log Summary

A clear demonstration of what kind of prompts were employed in the course of the project is listed below:

- Define the distinction between SDG 3.8.1 and 3.8.2 as an academic distinction?
- Recommend types of visualisations that would be appropriate when analysing data on drug treatment county-level.

All AI-generated suggestions were critically evaluated, and only those consistent with the dataset and project objectives were used. Team members rewrote or adapted AI-generated text to ensure originality and analytical accuracy.

Cite them in APA format.

One should review the consistency of these findings with SDG 3.5 definitions.

The entire set of AI-generated suggestions was critically assessed, and only those that complied with the dataset and project goals were applied. To make the AI-generated text original and accurate, the team members rewrote or modified it.

Critical Evaluation of AI Output

The team assessed AI suggestions based on:

- Accuracy (cross-checking against CSO/HRB datasets)
- Relevance to SDG indicators
- Absence of hallucinated facts
- Academic quality.

Any AI output found unclear or inaccurate was discarded.

D3: Individual Contribution

Nandani Kumari: Nandani contributed to data collection and initial data cleaning for the project. She helped source reliable datasets from official public sources and assisted in organising the data into a usable format. She also supported the early stages of analysis and contributed to group discussions when interpreting trends related to SDG 3 indicators.

Sakshi Gavali: Sakshi worked mainly on data preparation and exploratory analysis. She assisted with cleaning and merging datasets and helped identify key patterns in the data. Additionally, she supported the development of Power BI dashboards by refining visual elements and ensuring clarity and consistency across charts and supported the team in refining charts to ensure clarity and consistency in the dashboard.

Samarth Patil: Samarth focused on data analysis and visualisation design. He helped build Power BI visuals, particularly charts related to trends and comparisons across years and regions. He also contributed to interpreting the results and ensured that insights were clearly reflected in the dashboard outputs.

Sayoni Roy: Sayoni played a role in data transformation, dashboard design, and report writing. She worked on cleaning and structuring datasets and creating calculated fields. She also contributed significantly to writing, editing, and formatting the final report, ensuring strong narrative flow, clear explanations and alignment with SDG 3 objectives.

Siddhant Kulkarni: Siddhant contributed to analytical interpretation and validation of findings. He supported the analysis of health indicators and helped check trends for accuracy and consistency. He also participated in reviewing visuals and provided feedback to improve how insights were communicated along with Samarth.

Talya Rana: Talya assisted with research, data interpretation, and report structuring. She helped link analytical findings to SDG 3 targets and supported the development of conclusions and recommendations. She also contributed to proofreading and improving the overall clarity of the final report.