Last updated on 20/05/2019

**Environment and Health Statistics**

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**1. Introduction**

This paper was written for an EPA-funded research project (INHALE[[1]](#footnote-1)) workshop on 22nd May 2019. The paper is a first CSO look at what microdata sources are most relevant for examining the inter-relationship between the environment and human health. Relevant indicators from the United Nations Sustainable Development Goals provide a reference of what international organisations consider important. The creation of a draft framework for environment and health statistics forms a a more structured approach. An initial list of potential data sources is presented in Section 6 but it needs considerably more work particularly on the health side. Identifying where most added value would be achieved, by combining different microdata sources for statistical purposes, would assist future CSO work.

**2. Background**

The natural and built environment can affect human health in many ways. Low air and water quality have negative impacts whereas experience of nature can relieve stress and provide physical exercise. Human activity can result in a serious deterioration in the quality of the natural environment which in turn can affect human health. The list of pollutants and hazardous substances that can impact on human health is long and varied: e.g. airborne biological pollutants, asbestos, carbon dioxide, carbon monoxide, formaldehyde, ground-level ozone, lead, malaria, mercury, nitrogen dioxide, nitrous oxide, particulate matter, radon, sulphur dioxide, volatile organic compounds, etc.

Policy-makers can reduce negative impacts, for example, by setting pollution thresholds and raising building standards. People spend most of their time indoors so indoor living and working conditions need to be monitored as much as the external environment. Measurement of the impact of the environment on human health is compounded by variations in impact arising from factors such as seasonality (e.g. pollen count), length of exposure, and reducing actual exposure by taking precautionary measures (e.g. avoiding outdoor activity during peak traffic times). Multiple exposures may make it difficult to identify causal factors e.g. living in a poor quality indoor and outdoor environment.

Policy-makers need a better understanding of our responsiveness to improvements in the environment so that they can establish regulatory and building standards where necessary. Some policy initiatives are complementary e.g. moving to electric vehicles should improve air quality and reduce climate change pressures. There is a lack of basic statistical data on the inter-action between the environment and health and this paper is a preliminary review of what kinds of data are needed and available for Ireland. Traditionally statisticians have not collected data on both the environment and on health conditions in the same survey. The possibility of adding value by combining separate microdata sources is touched upon in the review of possible data sources. Working with data at a small spatial scale is likely to correlate better with actual exposure however this requires detailed geocoding of the microdata e.g. capturing the Eircode and identifiers that can be used to connect health data with place of work and residence.

The CSO collects primary data through surveys but has not been very involved in direct collection on health statistics. Exceptions were the 2006 National Disability Survey and some household health modules including the 2015 Irish Health Survey. On the environment side, the CSO conducted a Labour Force Survey module in Quarter 2 2014 which collected information on energy use, waste management, and some general environmental behaviours from a sample of 13,000 households.

Measuring causal relationships between exposure to pollutants in the environment and health outcomes is difficult. While direct monitoring of air and water quality is essential, other approaches may be needed to determine any adverse impact on the health of individuals. Biomonitoring involves measuring the presence of chemical substances in the human body by taking samples e.g. blood, urine, and hair. Statistics Canada undertakes such data collection as part of its Health Measures Survey. The CSO has not engaged in biomonitoring measurement but if such measurements were available from administrative data sources then the CSO could attempt to combine them with survey data to enable health risk to be classified by socio-demographic characteristics.

The CSO is empowered to obtain access to administrative data under the Statistics Act, 1993. Increased usage of common personal and geographical identifiers facilitates combining separate data sources to achieve added value in a cost-efficient manner e.g. combining building energy ratings with socio-demographic characteristics at a household level. While such data matching would be done by the CSO using non-anonymised microdata, the new output could be anonymised and made available for research purposes as a CSO Research Microdata File. Alternatively the CSO could undertake some detailed analyses of the new file if the researcher defined specific analyses.

Within the CSO, the Administrative Data Centre division has primary responsibility for obtaining and managing confidential administrative microdata. The Statistical Support and Coordination Unit division undertake policy-driven analyses of survey and administrative microdata. Subject-matter divisions may undertake specialised analyses of their own data and of their data combined with other microdata.

**3. Sustainable Development Goals**

Table 1 contains the SDG indicators that are of relevance to the inter-action between environment and health. The 24 indicators cover nine of the 17 goals. The indicators selected in the SDG process include: household and ambient air quality; water quality; sanitation; waste and wastewater management; fossil fuel use; living conditions; climate change; ecosystem services; seafood; and biodiversity protection. The SDG indicators provide a reference for the development of a set of environment and health indicators for Ireland, that have international relevance, as countries are already trying to identify data sources and data for these 24 indicators.

**Table 1: SDG Indicators of relevance to Environment and Health**

| **Goal** | **Indicator** |
| --- | --- |
| 3 | 3.4.1 Mortality rate attributed to cardiovascular disease, cancer, diabetes or chronic respiratory disease 3.9.1 Mortality rate attributed to household and ambient air pollution 3.9.2 Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (exposure to unsafe Water, Sanitation and Hygiene for All (WASH) services)  |
| 6 | 6.1.1 Proportion of population using safely managed drinking water services 6.2.1 Proportion of population using (a) safely managed sanitation services and (b) a hand-washing facility with soap and water 6.3.1 Proportion of wastewater safely treated 6.3.2 Proportion of bodies of water with good ambient water quality  |
| 7 | 7.1.2 Proportion of population with primary reliance on clean fuels and technology  |
| 9 | 9.4.1 CO2 emission per unit of value added  |
| 11 | 11.1.1 Proportion of urban population living in slums, informal settlements or inadequate housing 11.5.1 Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population 11.5.2 Direct economic loss in relation to global GDP, damage to critical infrastructure and number of disruptions to basic services, attributed to disasters 11.6.1 Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities 11.6.2 Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population weighted) 11.7.1 Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities  |
| 12 | 12.4.2 Hazardous waste generated per capita and proportion of hazardous waste treated, by type of treatment 12.c.1 Amount of fossil-fuel subsidies per unit of GDP (production and consumption) and as a proportion of total national expenditure on fossil fuels  |
| 13 | 13.1.1 Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population |
| 14 | 14.1.1 Index of coastal eutrophication and floating plastic debris density 14.2.1 Proportion of national exclusive economic zones managed using ecosystem-based approaches 14.3.1 Average marine acidity (pH) measured at agreed suite of representative sampling stations 14.4.1 Proportion of fish stocks within biologically sustainable levels |
| 15 | 15.1.2 Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type 15.3.1 Proportion of land that is degraded over total land area  |

**4. Draft Environment and Health Statistical Framework**

The statistical area covered by the inter-action between the environment and health needs to be defined to facilitate data collection. The framework should include both indicators that reflect deterioration in the environment and initiatives with an environmental purpose.

A draft framework is given in Table 2. This framework can be used to more sharply define the scope of the area. The domains serve as pointers towards what data sources are relevant and towards the creation of indicators.

**Table 2: Draft Environment and Health Statistical Framework**

|  |  |  |
| --- | --- | --- |
| **No.** | **Domain** | **Example Indicators** |
| 1 | Energy poverty | Heating source, energy rating, health condition |
| 2 | Outdoor air quality | Air pollutants from transport, industry, and agriculture |
| 3 | Water quality | Pollution incidents, farm run-off, regulation of septic tanks, nutrient effluents from wastewater and agriculture, micro-pollutants from product use |
| 4 | Housing conditions | Biological (bacteria, mould, dust mites), Chemical pollutants from combustion and products (carbon monoxide, particulate matter, formaldehyde, VOCs) and Radiological (radon) |
| 5 | Hazardous chemical use | Sales and use of pesticides, herbicides, fungicides |
| 6 | Climate | Extreme temperatures, invasive plants and insects, skin cancer, droughts |
| 7 | Waste and Sanitation | General waste management, hazardous waste, dust in carpets, germs |
| 8 | Energy | Trends in use of fossil and renewable fuels |
| 9 | Transport | Trends in vehicle engine type, kilometres travelled, and use of public transport |
| 10 | Ecosystem services | Non-material benefits from blue and green spaces (cultural services), Pollution removal by non-food plants and trees - PM2.5, sulphur dioxide, nitrogen dioxide, ground-level ozone (Regulating services), Wind dispersion of air pollutants, Protected areas, Medicinal plants |
| 11 | Work conditions | Air quality, building quality, adequate heating, use of hazardous substances, exposure to carbon monoxide |
| 12 | Fiscal measures | Environmental taxes, environmental subsidies, Emissions Trading Scheme, Green innovation, Energy labelling, Environmentally harmful subsidies. |

**5. Example Success Stories**

There are many examples of previous policy initiatives. These examples show behaviours that became unacceptable. In many instances, legislation had a very important role in improving the situation.

| **Topic** | **Timing** | **Description** |
| --- | --- | --- |
| Lead water supply pipes | 1970s | Lead in drinking water is a recognised health concern. There are no lead water mains in Ireland, however, service connections within properties may contain traces of lead. Most lead pipes are contained within properties built up to and including the 1970s. |
| Sewage sludge | 1986 | The Sewage Sludge [Directive 86/278/EEC](http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31986L0278:EN:HTML) on the protection of the environment sets controls on the use of sewage sludge in agriculture. |
| Hazardous waste | 1996 | The PCB/PCT [Directive 96/59/EC](http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31996L0059:EN:HTML) on the disposal of polychlorinated biphenyls and polychlorinated terphenyls) deals with the disposal of certain hazardous chemicals that represent a particular threat to the environment and to human health. |
| Landfills | 1999 | Landfill [Directive 1999/31/EC](http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31999L0031:EN:HTML) set out detailed rules on waste landfills. |
| Leaded petrol | 2000 | All sales of leaded petrol were phased out by January 1st, 2000. As part of the EU Auto Oil Programme to reduce vehicle emissions, the use of leaded petrol was banned throughout the Community by 2005. |
| Waste incineration | 2000 | The Directive on the incineration of waste ([Directive 2000/76/EC](http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32000L0076:EN:HTML) of 4 December 2000) aimed to prevent or limit the negative effects of the incineration of waste. |
| Asbestos | 2003 | Up until 1999, asbestos was commonly used in building materials, mainly for insulation and fireproofing, and in some consumer goods. However, under the [European Communities (Dangerous Substances and Preparations) (Marketing and Use) Regulations 2003](http://www.irishstatutebook.ie/2003/en/si/0220.html), it became illegal to place asbestos or asbestos-containing products on the market. |
| Ban on smoking in public places | 2004 | <http://www.irishstatutebook.ie/eli/2003/si/481/made/en/> |
| Bathing water quality | 2006 | The objective of the Bathing Water Directive (2006/7/EC) was to improve the protection of bather’s health and introduced stricter standards for water quality and a new method of assessment. |
| Low sulphur marked gas oil | * 2011
 | * <http://www.irishstatutebook.ie/eli/2011/si/155/made/en/pdf>
* Gas oil marketed for use in non-road mobile machinery (NRMM) must contain no more than 10 milligrams of sulphur per kilogram of fuel.
* Gas oil used for home heating purposes, stationary equipment, or marine fuel will continue to have a specification of 1,000 ppm sulphur.
 |
| Solid fuels | 2012 | S.I. No. 326 of 2012 prohibits the placing on the market, sale or distribution of solid fuels for residential use within the State unless;* The sulphur content of the bituminous coal is less than 0.7% by weight on a dry ash-free basis
* The sulphur content of low smoke solid fuels and low smoke biomass products is less than 2% by weight on a dry ash-free basis.
* The solid fuels are supplied in sealed bags.
 |
| Septic tanks | 2012 | The Department of Environment, Community and Local Government published the Water Services (Amendment) Act 2012 to regulate wastewater discharges from all homes that are not connected to the public sewer network. |
| Drinking water quality | 2014 | Irish Water is responsible for the monitoring of public water supplies. Local Authorities are responsible for monitoring of group water schemes and regulated small private supplies. Private wells are not covered by the Drinking Water Regulations. |
| Coal powered electricity | 2015 | The EPA prosecuted ESB Moneypoint at Dublin Metropolitan Court. The company pleaded guilty to:* Exceeding the ELV for ammonia to water on 16th September 2015
* Failure to divert for collection and safe disposal on the 12th of April 2016
* Failure to maintain records of integrity tests on site on 12th April 2016
* Failure to maintain records of weekly inspections of the drainage system, bunds, silt traps and oil separators on 12th April 2016.
* Failure to carry out analysis, measurements, examinations and calibrations from 25th September 2015 to 12th April 2016
 |
| Plant protection products | 2015 | A farmer can buy pesticides after November 26, 2015 but cannot apply the spray with their own sprayer unless they have completed the following:* Registered with the DAFM (See below) as a professional user; and
* Have completed the Pesticide Application module.
 |

The Department of Environment, Community and Local Government published the Water Services (Amendment) Act 2012 to regulate wastewater discharges from all homes that are not connected to the public sewer network.

**6. Microdata Sources**

The list of data sources below is the result of a quick preliminary search. It needs to be reviewed and improved. More specific information on data linkage possibilities is also needed. The main idea of this inventory is to identify relevant microdata. The next steps are to identify the most important information within each data source and whether added value would be achieved by linking the file with other microdata. The list is not exhaustive and important microdata may well have been inadvertently omitted particularly on the health side. The accompanying presentation gives a specific example of how data sources relevant to energy poverty could be combined using various unique identifiers.

**6.1 CENTRAL STATISTICS OFFICE**

**6.1.1 Cause of death**

**Web link**: <https://www.cso.ie/en/releasesandpublications/ep/p-vsar/vitalstatisticsannualreport2016/technicalnotes2016/#d.en.161799>

**Intrinsic value**: Facilitate studies examining link between air pollution and cause of death e.g. diabetes mellitus, pregnancy-induced hypertensive disorders, etc.

**Added value**: Could be linked with air quality and other data.

**Reservations**: Difficult to identify an environmental cause.

**6.1.2 Domestic central heating fuels**

**Web link** (Table 12): <https://www.cso.ie/en/releasesandpublications/er/q-env/qnhsenvironmentmoduleq22014/>

**Intrinsic value**: Identifies the type of heating used at dwelling level.

**Added value**: Could be combined with meter and socio-economic data.

**Reservations**: Lack of data on amount of solid fuel and kerosene consumed.

**6.1.3 Ecosystem benefits**

**Web link**: <http://www.epa.ie/pubs/reports/research/health/Research_Report_264.pdf>

**Intrinsic value**: Possible to measure distance to public parks, coast walks etc. from a dwelling

**Added value**: Could contribute to the compilation of ecosystem accounts.

**Reservations**: Valuation concepts

**6.1.4 Forecourt sales of unleaded petrol and road diesel**

**Web link**: <https://www.cso.ie/en/statistics/climateandenergy/>

**Intrinsic value**: Microdata file contains volume of sales by geocoded forecourt. The data provide an indication of the levels of road traffic, vehicle emissions, and trends in oil volumes.

**Added value**: Indicator of road fuel purchases at local area level.

**Reservations**: Purchased fuel may be used on motorway journeys and cross-border fuel tourism.

**6.1.5 Building Energy Ratings**

**Web link**: <https://www.cso.ie/en/statistics/climateandenergy/domesticbuildingenergyratings/>

**Intrinsic value**: Profile of housing stock using variables such as period of construction, building type, main central heating fuel, floor area, and energy rating.

**Added value**: It may be possible to link around 45% of dwellings with a BER rating to the Census of Population to analyse the socio-economic circumstances of households with a low energy rating.

**Reservations**: The BER database is not representative as newer urban dwellings are over-represented e.g. apartments for rent need a BER audit done.

**6.1.6 Septic Tanks Register**

**Web link**: <https://www.protectourwater.ie/default.aspx>

**Intrinsic value**: Location of septic tanks

**Added value**: Proximity to water courses.

**Reservations**: Annual re-registration is not required so register may not be fully up-to-date.

**6.2 DEPARTMENT of AGRICULTURE, FOOD and the MARINE**

**6.2.1 Agri-chemical sales**

**Web link**: <http://www.pcs.agriculture.gov.ie/sud/pesticidestatistics/>

**Intrinsic value**: Use of chemicals can affect food safety.

**Added value**:

**Reservations**:

**6.3 DEPARTMENT of TRANSPORT, TOURISM and SPORT**

**6.3.1 Road vehicles by engine type**

**Web link**: <https://www.cso.ie/multiquicktables/quickTables.aspx?id=tea03>

**Intrinsic value**: Move away from fossil fuels and away from most polluting fuels.

**Added value**: Could be linked with changes in air quality if addresses of owners are geocoded and with NCT/CVRT vehicle kilometres data.

**Reservations**:

**6.3.2 End of life vehicles**

**Web link**: <http://www.irishstatutebook.ie/eli/2014/si/281/made/en/print>

**Intrinsic value**: Controlled management of disposal of vehicles and their hazardous components

**Added value**: Could be linked with driver and vehicle files to identify replacement vehicle

**Reservations**:

**6.4 ENVIRONMENTAL PROTECTION AGENCY**

**6.4.1 Radon**

**Web link**: <http://www.epa.ie/radiation/radonmap/>

**Intrinsic value**: EPA did survey collecting data at household level.

**Added value**: Link with health-related data.

**Reservations**: EPA may have stopped its direct involvement in radon measurement.

**6.4.2 Air quality monitoring**

**Web link**: <http://www.epa.ie/air/quality/>

**Intrinsic value**: Direct measurement of air quality.

**Added value**: Can be combined with local area population figures, commuting patterns, and weather-related data.

**Reservations**: Dispersion of air pollution may reduce actual exposure.

**6.4.3 Water quality monitoring**

**Web link**: <http://www.epa.ie/pubs/advice/water/quality/>

**Intrinsic value**: Direct and regular measurement by Irish Water, local authorities, and EPA.

**Added value**:

**Reservations**:

**6.4.4 Waste landfills**

**Web link**: <http://www.epa.ie/nationalwastestatistics/municipal/>

**Intrinsic value**: Waste sent to landfill reflects how the economy is being managed in terms of consumption, recycling, circular economy, etc. Hazardous waste is much smaller in quantity but needs to be very carefully managed.

**Added value**:

**Reservations**:

**6.4.5 Emissions trading scheme**

**Web link**: <http://www.irishstatutebook.ie/eli/2012/si/490/made/en/pdf>

**Intrinsic value**: Permit system for monitoring emissions of carbon dioxide.

**Added value**:

**Reservations**:

**6.4.6 Pollutant release and transfer register**

**Web link**: <http://www.epa.ie/pubs/advice/licensee/prtr/sino649of2011.html>

**Intrinsic value**: Mechanism for monitoring emissions and generation of hazardous waste by industrial installations.

**Added value**:

**Reservations**:

**6.5 HEALTH and SAFETY AUTHORITY**

**6.5.1 Use of asbestos**

**Web link**: <https://www.hsa.ie/eng/Your_Industry/Chemicals/Legislation_Enforcement/Asbestos/Asbestos_Notifications/>

**Intrinsic value**:

**Added value**:

**Reservations**:

**6.6 Health Service Executive**

**6.6.1 Hospital Inpatient Enquiry**

**Web link**: <https://www.hse.ie/eng/services/list/3/acutehospitals/hospitals/portiuncula/hospital-inpatient-enquiry-hipe-department-.html>

**Intrinsic value**:

**Added value**:

**Reservations**:

**6.6.2 Primary Care Reimbursement System**

**Web link**: <https://www.hse.ie/eng/staff/pcrs/online-services/>

**Intrinsic value**:

**Added value**:

**Reservations**:

**6.6.3 Sales of environment-related drugs**

**Web link**: <https://www2.hse.ie/services/drugs-payment-scheme/drugs-payment-scheme-card.html>

**Intrinsic value**: Drugs for breathing difficulties etc.

**Added value**: The microdata could be linked with air quality data.

**Reservations**: Causal factor is difficult to determine.

**6.7 IRISH WATER**

**6.7.1 Drinking water quality**

**Web link**: <https://www.water.ie/water-supply/water-quality/parameters/>

**Intrinsic value**: Monitoring of drinking water quality.

**Added value**: If the cause of contamination of drinking water supplies can be identified, the degree of management of these causes can be evaluated by policy-makers.

**Reservations**:

**6.8 MET EIREANN**

**6.8.1 Extreme weather frequency**

**Web link**: <https://www.met.ie/climate/available-data/historical-data>

**Intrinsic value**: Detailed data on weather parameters such as temperature and rainfall.

**Added value**: Can be used to derive indicators such as heatwaves and droughts.

**Reservations**: There is a strong natural variability in our weather which makes it difficult to distinguish change caused by human activity. The CSO is working with Met Eireann to increase the length of the time period that daily data are available for from around 60 years to around 140 years.

**6.9 NATIONAL ROADS AUTHORITY**

**6.9.1 Road traffic counter data**

**Web link**: <https://www.nratrafficdata.ie/c2/gmapbasic.asp?sgid=ZvyVmXU8jBt9PJE$c7UXt6>

**Intrinsic value**: Reliable data on traffic flows by location and time of day.

**Added value**: Links with air quality.

**PM2.5**: Respiratory infections, ischaemic heart disease (heart attacks), chronic obstructive pulmonary disease (COPD), cerebrovascular disease (strokes) and lung cancer.

**Reservations**:

**6.10 ROAD SAFETY AUTHORITY**

**6.10.1 Vehicle Test Data**

**Web link**: <http://www.rsa.ie/en/RSA/Your-Vehicle/Your-Vehicle-/NCT-Statistics-/>

**Web link:** <https://www.cvrt.ie/en/Pages/CVRT-Statistics-.aspx>

**Intrinsic value**: Odometer readings can be linked with vehicle characteristics e.g. fuel type.

**Added value**:

**Reservations**:

1. Irish Nationwide Health and Air Quality Linkage [↑](#footnote-ref-1)