# Appraisal of Environmental Impact of Hospital Activities

## ULS Matosinhos
## Portugal

AstraZeneca

Sustainable Healthcare Coalition

| Title | Emergency department visit at ULS Matosinhos – Hospital Pedro Hispano, Portugal |
|---|---|
| Organisation | AstraZeneca UK Limited |
| Organisation's role | AstraZeneca UK Limited initiated and funded this work, but it was not involved in collecting and analysing the hospital data. AstraZeneca saw only the final output. |
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| Completion date | September 2023 |
| Assurance | Internal assurance |
| Supporting information | Operational data from Unidade Local de Saúde (ULS) Matosinhos – Hospital Pedro Hispano, Portugal |
| Data gathering and analysis contact | Michael Collins, Partner, ERM (michael.collins@erm.com) |
| Hospital contact | Pedro Machado (pedro.machado@ulsm.min-saude.pt) |
| Conformance with Care Pathways: Guidance on Appraising Sustainability[1] | Adheres to the principles of the Guidance |
| Care pathway description | Emergency department visit at ULS Matosinhos |
| Environmental issues appraised | Global warming potential (IPCC, $CO_2$ eq, 100-year), water use, waste |


Google Maps. (2025). Hospital Pedro Hispano/Portugal. Satellite Map. Retrieved April 2025

[1] Care Pathways: Guidance on Appraising Sustainability. (SHC, 2023). https://shcoalition.org/sustainable-care-pathways-guidance/

## Study overview

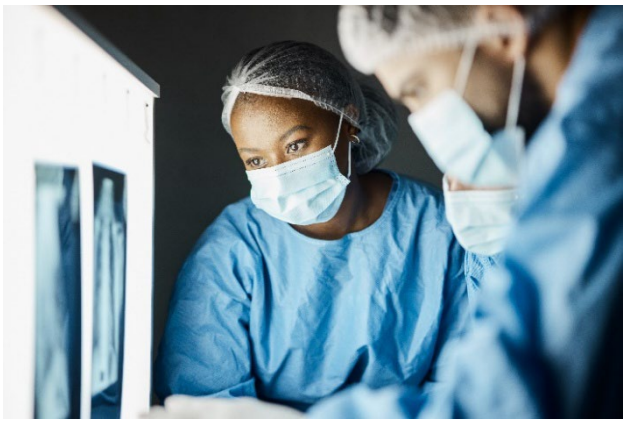
It is recognised that health and care systems are undergoing transformative global change to adapt to the needs of patients and communities, with increasing pressure to be financially, socially and environmentally sustainable. Appraising the sustainability of care pathways is seen as a crucial step to enabling a more sustainable health system[1]. To facilitate the completion of care pathway assessments, it is necessary to generate data that characterises the impact of the common care pathways activities. In generating these data, valuable insight is provided into the environmental hotspots associated with each activity.

AstraZeneca UK Limited sponsored this environmental assessment of ULS Matosinhos for the purpose of facilitating care pathway assessments and to assist ULS Matosinhos in understanding its environmental impact.

Data collection and analysis were completed by Environmental Resource Management (ERM). AstraZeneca had no involvement in the data collection and analysis of the hospital data and only saw the final output.

## Conclusions

This study appraised the environmental impact of activities undertaken by five clinical departments in ULS Matosinhos, located in Senhora de Hora, Portugal: emergency department, primary healthcare, general ward, intensive care ward and surgery.



Across the departments, staff travel (commuting) and electricity use were identified as the main hotspots, with anaesthetic gases and consumable product use being specific hotspots for surgical procedures.

These high-level findings, as well as the underlying data, will be used by ULS Matosinhos to focus activities to reduce environmental impacts. The results will also be used to inform future care pathway assessments and care pathway innovation for patients in Portugal.

## Study Limitations

There are challenges associated with generating the data required for a comprehensive care pathway assessment and data generated in this study can be improved in the future. In particular, more detailed descriptions of consumables and pharmaceutical products consumed for hospital activities would enable more accurate assignment of material emission factors. Several of the impact values for consumables and pharmaceutical products rely on spend-based emission factors, which results in a higher degree of uncertainty then results generated using material and activity-based emission factors. These limitations should be considered when applying results elsewhere. The results may not accurately characterise the activities and associated emissions at another hospital. However, the scale of impact contributions, the learnings and insight into impact drivers will have wider resonance and applicability.

[1] Care Pathways: Guidance on Appraising Sustainability. (SHC, 2023). https://shcoalition.org/sustainable-care-pathways-guidance/

## Scope

This assessment appraises the environmental impacts of five hospital activities at ULS Matosinhos.

| Care pathway module | Hospital activity | Reference unit |
|---|---|---|
| GP Consultation | Attendance at a primary healthcare facility by the patient for consultation with a clinician | per patient contact |
| Emergency Department | Attendance at the Emergency Department by the patient for consultation with a clinician | per patient contact |
| Surgical Procedure | Patient undergoing a surgical procedure | per hour of surgery |
| Inpatient Bed Day (low-intensity) | Patient hospitalisation in a General Ward | per inpatient bed day (24 hours) |
| Intensive Bed Day (high-intensity) | Patient hospitalisation in an Intensive Care Ward | per inpatient bed day (24 hours) |

## Approach

The appraisal of each hospital activity accounts for clinical activity in 2021 and includes utilities; waste management; manufacture and use of consumables, equipment, pharmaceutical products, medical gases and anaesthetic gases; and staff commuting journeys. Under the definitions of the Care Pathways Guidance[1], patient travel is a standalone activity and was not included in the scope of this assessment.

Data were sourced from ULS Matosinhos relating to the included consumptions, plus data for the hospital estate (building layout and floor area) and hospital staff numbers, broken down by hospital activity. ULS Matosinhos also provided data on patient throughput numbers for each hospital activity. Emissions for staff commutes were sourced from secondary data for an average commuting journey in the UK, based on an average commuting distance of 16.1 km, undertaken in a passenger car.

Utilities and waste management data were allocated to each hospital activity based on the floor area occupied. Procurement data on consumables, equipment, pharmaceutical products, medical gases and anaesthetic gases were categorised by cost centres linked to each hospital activity.

Greenhouse gas (GHG) emissions, water consumption and waste generated have been considered in this appraisal using the approach set out in the "Care Pathways: Guidance on Appraising Sustainability" guidance document[1]. As specified by the guidance, water use includes direct and indirect, and waste includes hazardous and non-hazardous direct waste. The environmental impact was calculated by multiplying the consumption and waste data with a relevant emission factors for GHG emissions, water consumption and waste. For consumables, equipment, pharmaceutical products & medical gases and anaesthetic gases, material-based life cycle emission factors were applied where possible. Where sufficient detail was not available in the data to assign a material-based emission factor, a spend-based approach was taken, estimating the impact based on the expenditure associated with the consumed item. Material-based emission factors were primarily sourced from the ecoinvent[2] database. Spend-based emission factors were sourced from the US Input-Output Database[3]. Patient throughput numbers for each hospital activity were used to scale the environmental impact to the defined reference unit.

Further detail for each care pathway module is available as supplementary material, available at https://shcoalition.org/appraisal-of-environmental-impact-of-hospital-activities-at-uls-matosinhos-portugal/

[1] Care Pathways: Guidance on Appraising Sustainability. (SHC, 2023). https://shcoalition.org/sustainable-care-pathways-guidance/
[2] Ecoinvent. 2024, ecoinvent.org/.
[3] United States Environmental Protection Agency. "US Environmentally-Extended Input-Output (USEEIO) Models." Www.epa.gov, 5 May 2020, www.epa.gov/land-research/us-environmentally-extended-input-output-useeio-models.

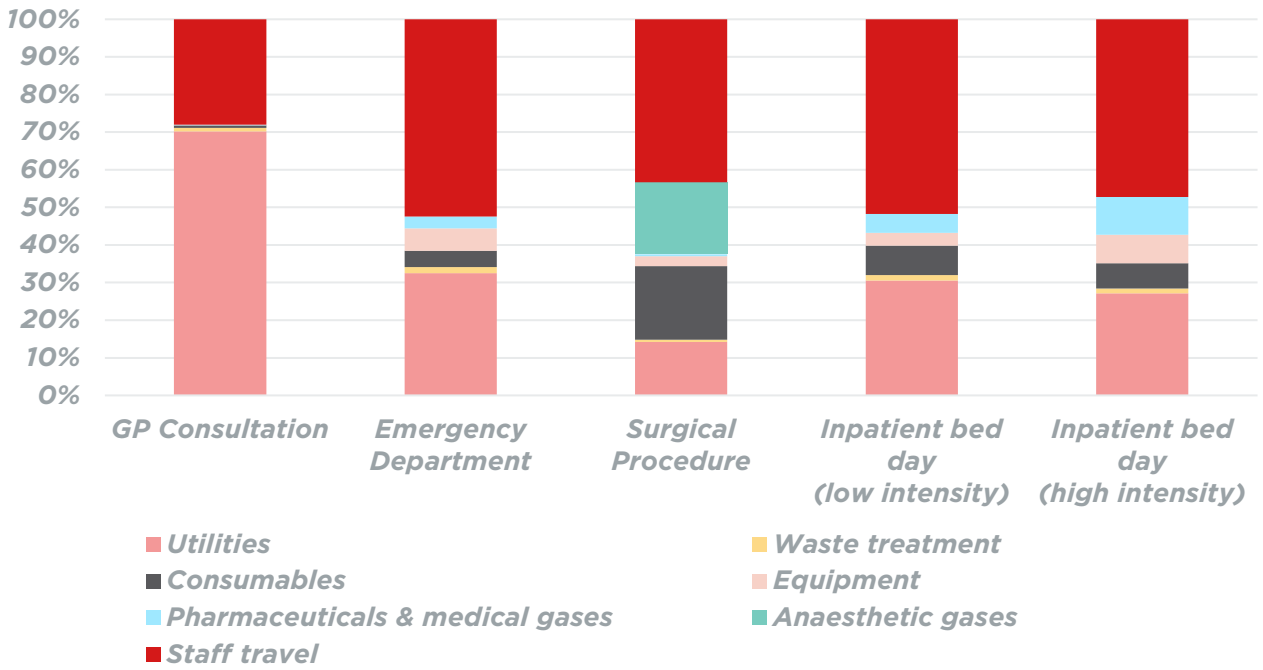
## Results

| Module | GHG kg $CO_2$ eq | Water $m^3$ | Waste kg | Reference unit |
|---|---|---|---|---|
| GP Consultation | 4.05 | 2.52 | 0.1 | per patient contact |
| Emergency Department | 13.7 | 43.2 | 0.6 | per patient contact |
| Surgical Procedure | 93.2 | 183 | 1.7 | per hour of surgery |
| Inpatient Bed Day (low intensity) | 21.5 | 65.7 | 0.9 | per inpatient bed day |
| Inpatient Bed Day (high intensity) | 99.2 | 269 | 3.7 | per inpatient bed day |

## GHG emissions per hospital activity

Staff travel, to the hospital from their homes, is a key driver across all hospital activities. This is related to the number of staff members associated with each hospital activity.

For the GP Consultation, grid electricity consumption is the main contributor to the impact, accounting for heating, lighting and operation of equipment at the primary healthcare facilities. For the Emergency Department, staff travel is the main contributor, followed by grid electricity consumption. For the Surgical Procedure, staff travel is the main contributor, followed by anaesthetic gases and consumables. For the Inpatient Bed Day (low intensity), staff travel is the main contributor, followed by grid electricity consumption. For the Inpatient Bed Day (high intensity), staff travel is the main contributor, followed grid electricity consumption. The contribution from pharmaceuticals and medical gases is also a key contribution, notably higher than for the low intensity bed day, reflecting the nature of care provided in the intensive care ward.




## Acknowledgements

This document has been developed collaboratively with ULS Matosinhos and the Sustainable Healthcare Coalition. The coalition comprises a range of organisations within the healthcare sector, including pharmaceutical and medical device companies, trade bodies, procurement, government organisations and other stakeholders. The Sustainable Healthcare Coalition operates with the aim of facilitating the journey towards good health and wellbeing on a finite planet, through open-minded collaboration across public and private healthcare.