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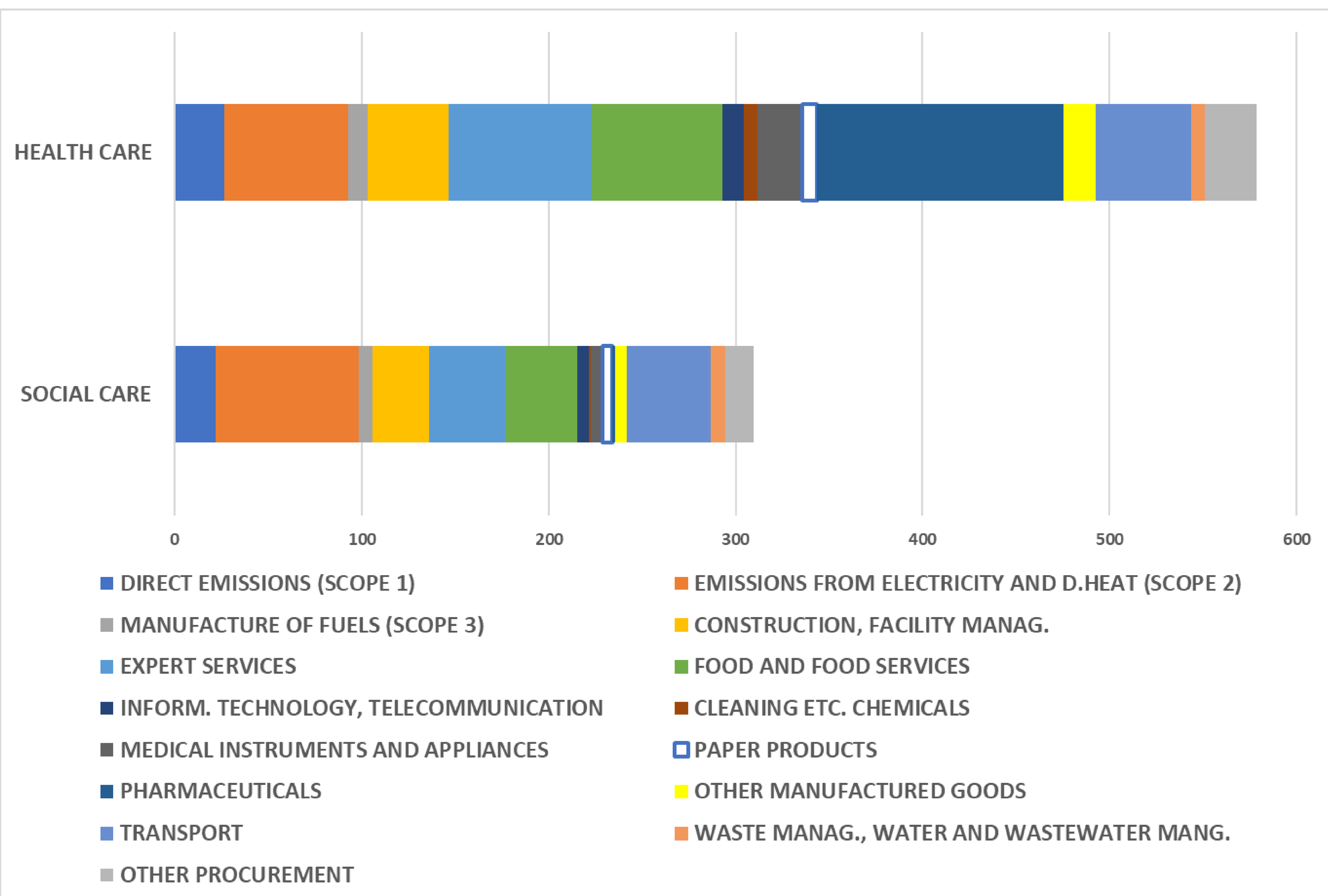
Carbon footprint of digital health technologies

- **Healthcare is responsible for 5% of global GHG emissions, and majority of the emissions stem from the healthcare supply chains.**
- **Digital health technologies have the potential to reduce emissions from, e.g., patient travel but the carbon footprint of digital infrastructure must also be considered.**
- **The study focuses on the carbon footprints of the Finnish healthcare sector and the integration of novel health technologies: case studies about continuous glucose monitoring and point-of-care testing of CRP.**

Healthcare decarbonisation and digitalisation

Healthcare is responsible for 5.2% of the global greenhouse gas (GHG) emissions (Romanello et al., 2022) and for 4.2% of consumption-based GHG emissions of Finland (Pulkki et al., 2023). Majority of the healthcare carbon footprint stems from clinical care and healthcare supply chains (Fig. 1). Efforts for healthcare decarbonisation have been taken, and several national health systems, as for example in the UK, Fiji and Spain, have recently set a net-zero target. In Finland, regional health care providers have set net-zero targets.



Ari Nissinen & Hannu Savolainen, Syke, Eko-Sote and CLISHEAT projects.

Fig. 1. Carbon footprint of health and social care in Finland, kg CO2eq per person and year

Pharmaceuticals have been identified as the highest emitting product group in the Finnish healthcare, followed by catering, heating and electricity, and buildings (Pulkki et al., 2023). Indirect emissions from the supply chains of healthcare products and services (Scope 3 emissions) contribute to 84% of the carbon footprint. A more detailed analysis is done in this project with the environmentally extended input-output model ENVIMAT.

Digital health technologies (DHT) are becoming more common and can provide health and clinical benefits as well as enhance patient convenience compared to the traditional practices they replace. They can also help reduce emissions by reducing travel and the use of single-use medical supplies, but digital infrastructure may also counterbalance these carbon footprint reductions.

References

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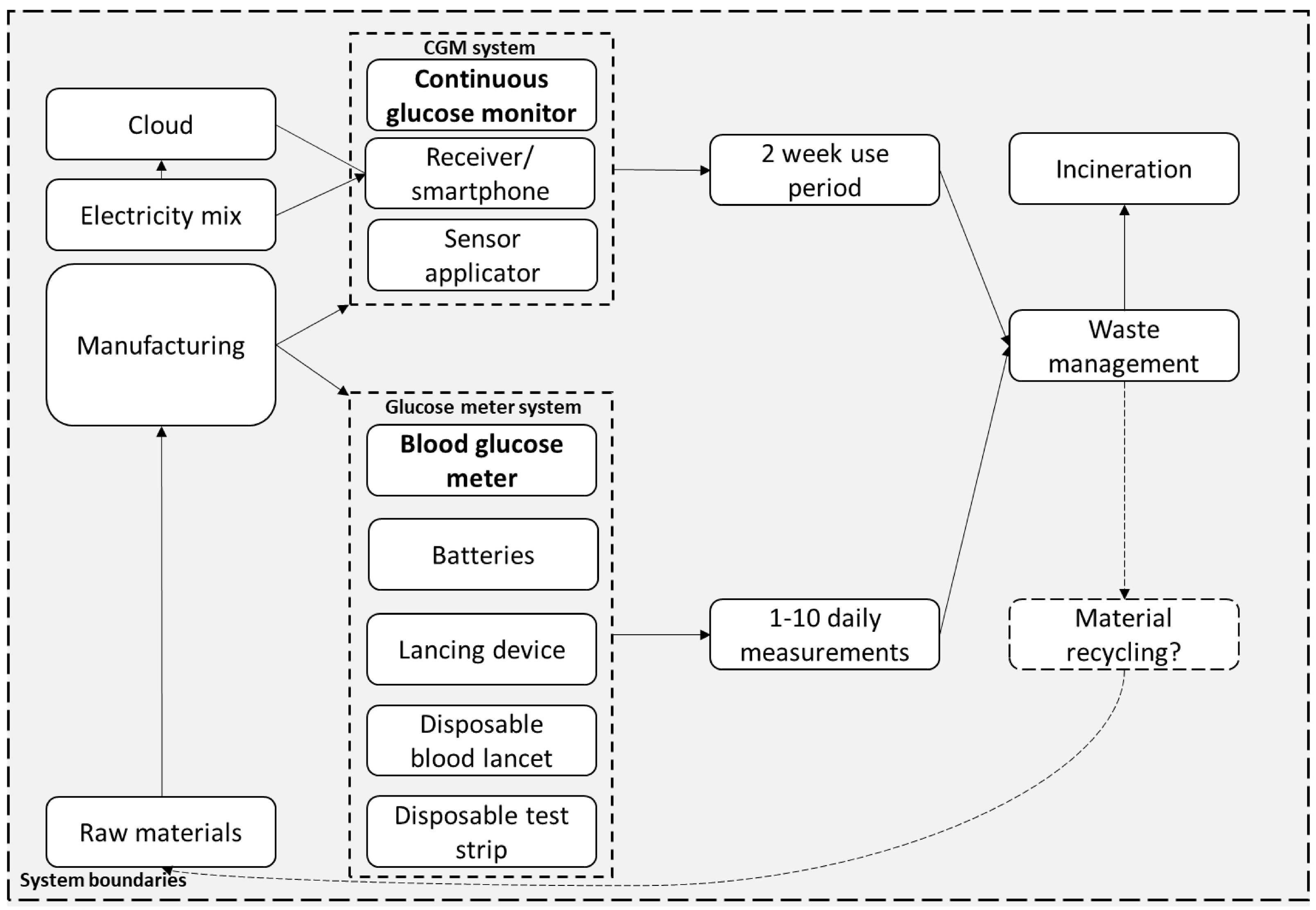
Romanello M, Di Napoli C, Drummond P, Green C, Kennard H, Lampard P, ... & Costello A (2022). The 2022 report of the Lancet Countdown on health and climate change: health at the mercy of fossil fuels. The Lancet, 400(10363), 1619-1654.

Carbon footprint case studies: glucose monitoring and point-of-care testing of CRP

The aim of this study is to compare new digital healthcare services with prevailing common services. Two topical examples are 1) continuous glucose monitoring (CGM) devices for diabetes patients, gradually replacing self-monitoring of blood glucose, and 2) point-of-care testing for common pathology tests, such as C-reactive protein (CRP), traditionally conducted in a laboratory setting. Globally, around half a billion adults have diabetes and billions of pathology tests are performed annually.

Life cycle assessment (LCA) is used as a method to analyse the carbon footprints of the two DHTs and their preceding reference systems. For example, the lifetime of CGM devices and the required digital infrastructure are some important factors affecting its carbon footprint (Fig. 2), while point-of-care testing could decrease the emissions from disposable medical consumables and laboratory infrastructure.



Atte Pitkänen, Syke, CLISHEAT project

Fig. 2. Comparative carbon footprint assessment of continuous glucose monitoring and self-monitoring of blood glucose, system boundary

The hospital infrastructure and patient/staff travel required for the care processes are considered in the carbon footprint analysis. Functional unit for diabetes treatment stems from the care pathway, e.g., the annual use of CGM sensors. For CRP testing, it is the collection and analysis of a single test. Primary product data from manufacturers, process data from healthcare providers and secondary data from literature and databases are needed for LCA of the healthcare product systems.

Our results can support the decarbonisation of healthcare, by guiding the research and development of climate-smart health technologies and practices without compromising people's and planetary health.

The whole CLISHEAT project:
https://www.utu.fi/en/university/faculty-of-technology/mechanical-and-materials-engineering/research/materials-in-health-technology