Technical Appendix: Comparative Life Cycle Assessment of Hygienic Pads | Review

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I. Description

This study is uses the work of Fourcassier, S. et al. (2022) to establish GHG Emission Factors for single-use & reusable hygienic pads adapted to the humanitarian context, and analyse the environmental impact of the product's life cycle to identify key levers for impact reduction through a comparison between the two products for an extended time period.

Hygienic or sanitary pads are procured in large volumes by humanitarian organization. A standard single-use pad can only be used for up to 4 hours, and therefore creates a large volume of waste due to its use. A reusable pad can be washed and reword repeatedly for up to 2 years. This study compares these products to shed light on impact reductions that can take place in these contexts.

In humanitarian contexts, water supply could be precarious and high-impact, therefore this study takes into account the use of water to formulate the cradle-to-grave factor for these pads. Additionally, the use of soap and water to wash hands in considered during the use phase of the single-use pad, to further reflect its wastefulness.

The functional unit of this study is use of hygienic pads for 12 periods.

II. Methodology

Life Cycle Assessment is a standard methodology used to estimate the potential environmental impacts linked to the entire life cycle of a product or system (ISO 14040, 14044, 14067). The scope in this study is a cradle-to-grave system boundary for the assessment of impact across the complete life cycle named as follows:

- Raw Material

- Production
- Supply & Distribution
- Use
- Waste Management

To perform these studies, data from the Ecoinvent 3.11 cut-off system model is used, which allocates the entire impact of the material to its primary user without any 'rewards' for its potential for being recycled. The results are calculated following the Environmental Footprint 3.1 indicator system in the below categories:

- Climate Change: Global Warming Potential (GWP100)
- Impact on Human Health:
  - Human Toxicity: Carcinogenic and Non-carcinogenic
  - Ionising Radiation
  - Particulate Matter Formation
  - Photochemical Oxidant Formation

The impact on human health results are weighted using the approach detailed in the EF methodology – with a percentage assigned to each sub indicator, as well as normalized for one citizen so as to aggregate and represent as a single score.

III. Key Parameters & Assumptions

The parameters of the pads are as below

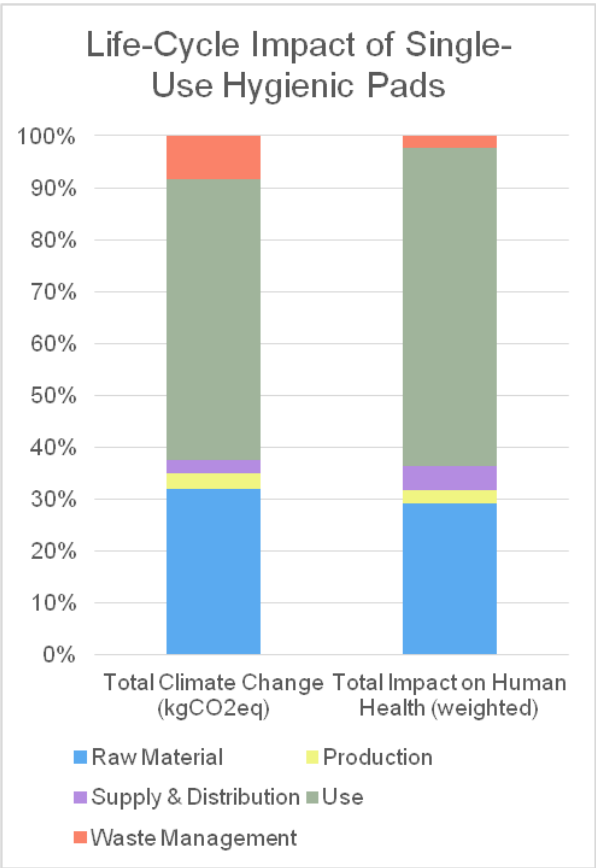
LIFE-CYCLE STAGE	RARAMETE	SINGLE-USE PAD	REUSABLE PAD
Raw Material	Bill of Materials	11g net weight Polyethylene, paper, glue, wood pulp	43g net weight Polyester, cotton

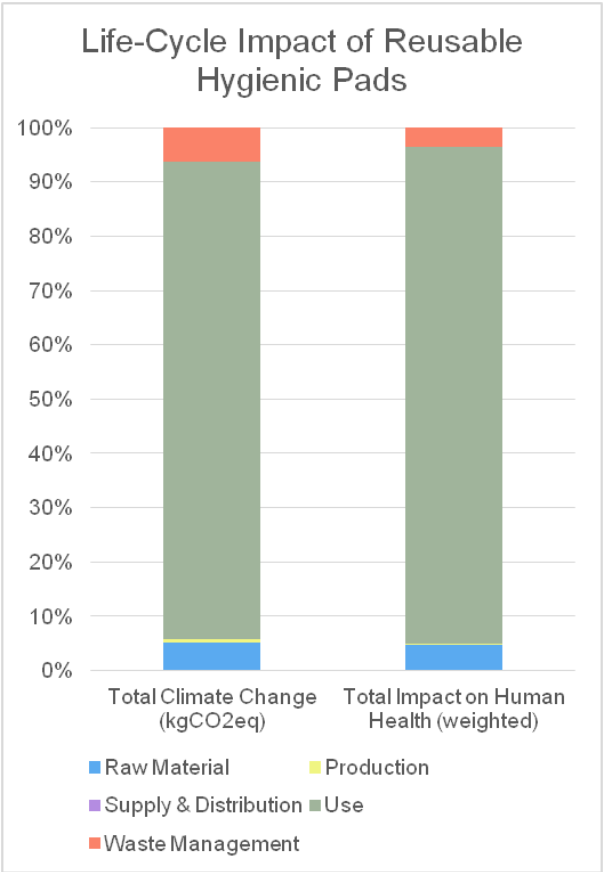
	Packaging	LDPE Film	LDPE Film
Production	Manufacturing Location	Local to warehouse and distribution location (i.e. within 1,500 km)	India
	Manufacturing Processes	Modelled using energy and water use	Modelled using energy use
Supply & Distribution	Transport Chain	TRUCK for procurement of materials (500 km) TRUCK to warehouse (1,500 km) & distribution (1,500 km)	TRUCK for procurement of materials (500 km) TRAIN to port (1,500 km), SEA to final location (10,000 km) TRUCK to warehouse (1,500 km) & distribution (1,500 km)
Use	Lifespan	10 pads per period (modelled low to represent scarcity)	2 pads per year used interchangeably (5 times per period)
	Usage Processes	Washing of hands after use of each pad (2L water & soap)	Washing of pad after each use (5L water + soap)
Waste Management	Product Disposal Method	Open Dumping + Wastewater	Open Dumping + Wastewater
	Packaging Disposal Method	Open Dumping + Wastewater	Open Dumping + Wastewater

IV. Results & Discussion

For both types of pads, the largest share of impact is caused by the water consumption during the use of the pads, consisting of handwashing for single-use pads and laundry for reusable pads

For disposable hygienic pads it is 54%/61% of GHG Emissions/impact on human health. For reusable pads it is 88%/91% of GHG Emissions/impact on human health



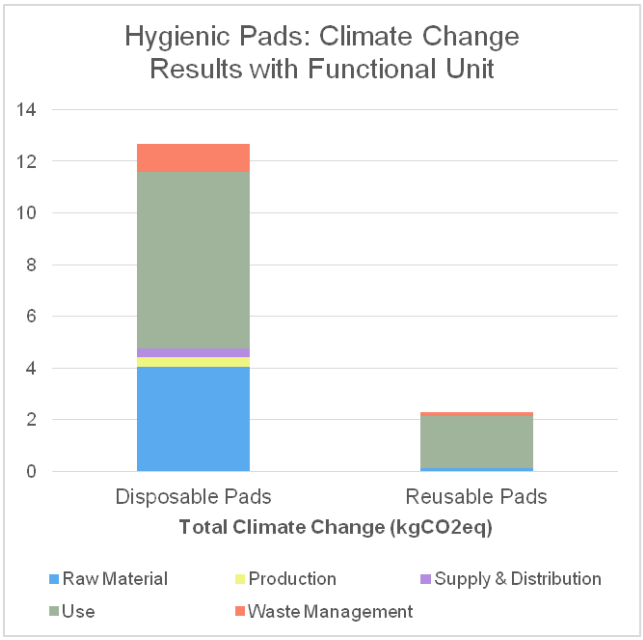


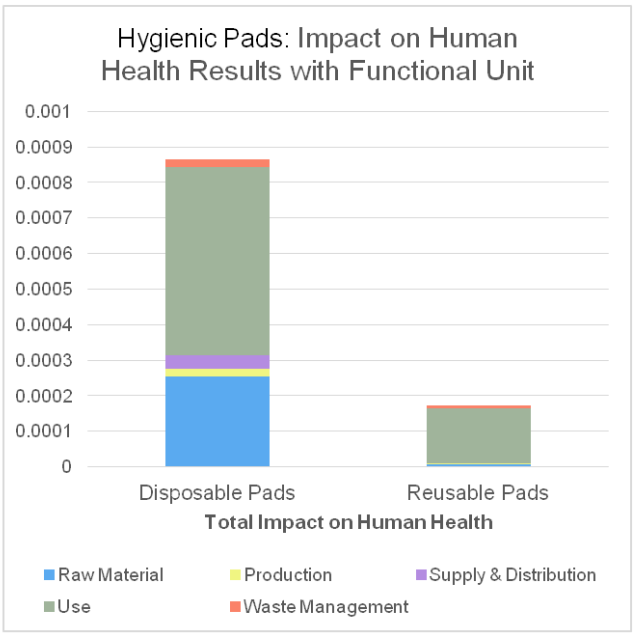
Greenhouse Gas (GHG) Emission Factors: Single-Use Pads

Name	GHG Protocol Category	kgCO2eq/unit
Cradle-to-grave	N/A	0.11
Cradle-to-gate	3.1 Purchased Goods	0.04

Greenhouse Gas (GHG) Emission Factors: Reusable Pads

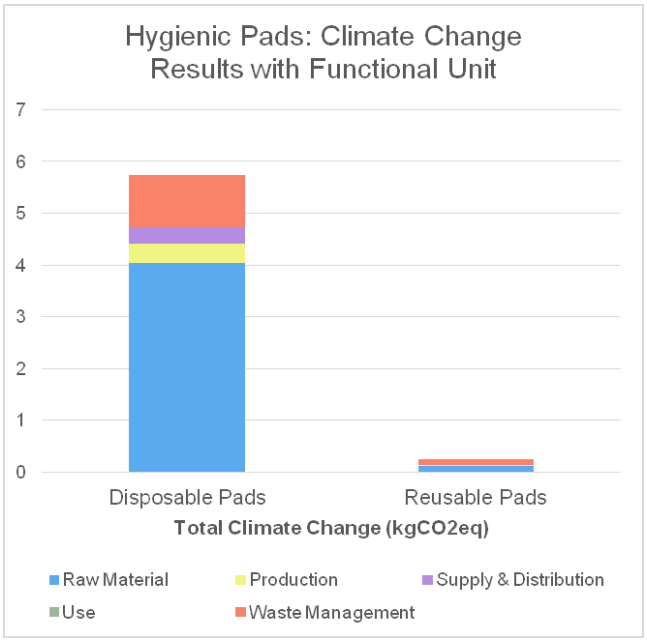
Cradle-to-grave	N/A	1.15
Cradle-to-gate	3.1 Purchased Goods	0.07

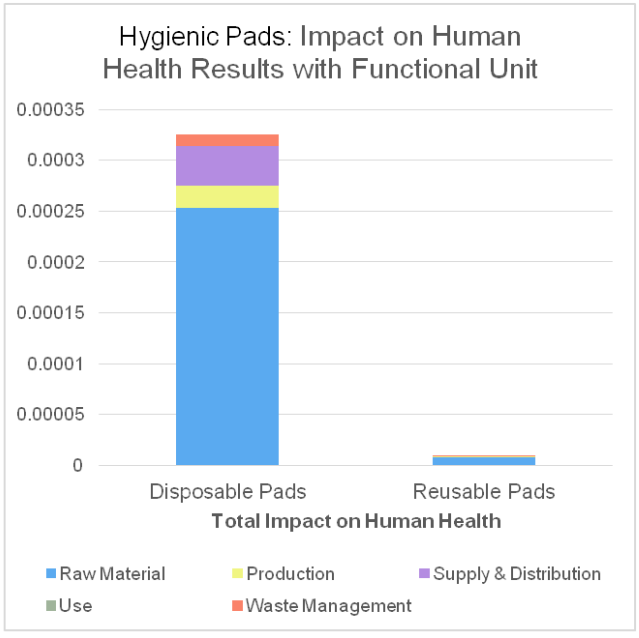




The functional unit of this study is 12 periods. It was assumed that 120 disposable pads and 2 reusable pads are needed to fulfil this function.

As a result, the comparative impact for 12 periods is significantly lower for reusable pads due to the lower amount of items needed, reducing the climate change impact by 82% and impact on human health by 80% for one year, primarily due to the water use.





If water was not considered, the reduction would be even higher, amounting to a net 96% reduction in both categories due to a switch from 120 single-use pads to only 2 reusable pads

V. Conclusion

Changing the type of hygienic pad used can significantly lower the impact of the item, when assuming effective reuse of the pad, in this case for 12 periods:

- 82% climate change
- 80% impact on human health

The impacts to local ecosystems and water systems must be studied to expand on this result.

VI. Bibliography

Rajput, A., Tobin Greene, C. and Schmid, S. (no date) 'Life Cycle Assessment (LCA) Methodology'. Available at: https://climateactionaccelerator.org/wp-content/uploads/2025/06/EPFL_LCA_methodology_v1.0.pdf.

Fourcassier, S. et al. (2022) 'Menstrual products: A comparable Life Cycle Assessment', Cleaner Environmental Systems, 7, p. 100096. Available at: https://doi.org/10.1016/j.cesys.2022.100096.