The Environmental Impact of Telemedicine Preoperative Evaluations for Benign Foregut Clinic

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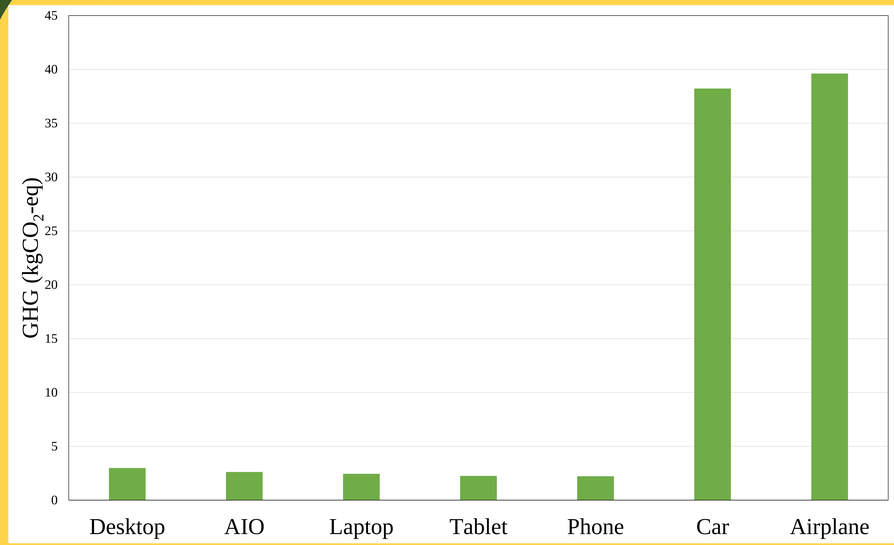
Introduction

- Healthcare accounts for 10% of the US carbon footprint
- This is estimated to result in a loss of 470,000 disability-adjusted life years due to the impact of environment on health.
- Telemedicine has the potential to decrease greenhouse gas (GHG) emissions
- Benign foregut preoperative evaluation relies on a thorough history and diagnostic work up and physical exam is rarely contributory. Therefore, most clinic visits can be virtual

Methods

- Retrospective data from 3rd quarter of 2020
  - Patient distances to clinic fit to a log-normal distribution. It is assumed that travel occurred by car if <300 miles and by plane if ≥ 300 miles.
  - A car produces 0.5 $kgCO_2$-eq per mile while air travel produces 0.0245 $kgCO_2$-eq
  - Telemedicine inputs
  - Internet connection, devices, length of visit
- Monte Carlo simulation and life cycle assessment (LCA) were used to calculate GHG emissions for visits
- The Monte Carlo method ran 10,000 simulations based on a fit distribution of our known data to understand our system on a larger scale.

Results



Device	GHG ($kgCO_2$-eq)
Desktop	2.99
AIO	2.62
Laptop	2.45
Tablet	2.26
Phone	2.22
Car	38.22
Airplane	39.61

For in-person visits, 145 travel distances were recorded with a median [IQR] travel distance of 29.5 [13.7, 85.1] miles; these were fit to a log-normal distribution. Eighty-five (59%) were conducted via telemedicine representing 28 tons of CO_2 saved in 1 year. For telemedicine visits, prospective data from 10 visits were recorded and fit to a normal distribution, the mean (SD) was 40.6 (17.1) minutes. The GHG emissions from telemedicine visits and from in-person visits were determined after running 10,000 simulations using Monte Carlo method. For telemedicine, GHG emissions ranged from 2.26 $kgCO_2$-eq to 2.99 $kgCO_2$-eq depending on the type of device used. For in-person visits, car travel emitted 38.22 $kgCO_2$-eq and plane travel emitted 39.61 $kgCO_2$-eq. A telemedicine visit resulted in less GHG emissions than an in-person visit ($p<.001$).

Discussion

- Telemedicine has a smaller carbon footprint than in-person visits.
- The Monte Carlo simulation and LCA are rigorous methods to carbon footprint. There's increasing awareness of using LCA in the healthcare sector to as we can develop a reasonable range of estimates for emissions while accounting for variability in patient interactions and travel distances
- While there are certain assumptions that must be made to define inputs, a benefit of the Monte Carlo method is that we can create a range from lowest carbon emissions to highest for our inputs and account for variability.
- There are patient populations with limited access to telemedicine. Our healthcare system needs to incorporate inclusive language, increase telemedicine interpreter access, and provide training for providers on facilitating telemedicine use in vulnerable populations
- In just 1 year, we saved 28 tons of CO_2, this equals 14 roundtrip distances driven from Seattle to Bangkok

Conclusion

- **Using telemedicine evaluations in select surgical populations is a purposeful step towards addressing our role in healthcare's large carbon footprint.**
- **We need increased, reliable access to broadband internet for our patients in rural areas or with lower socioeconomic status to have access to telemedicine options**

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