Chapter 16
Green Theatre Index: Measuring the Effectiveness of Climate-Smart Approaches and Benchmarking

Ronald Ma
University of Melbourne, Australia

Lily Clements
https://orcid.org/0000-0001-8864-0552
IDEMS International, UK

ABSTRACT

The effectiveness of climate-smart approaches is of significant concern because theatres contribute up to 33% of the hospital carbon footprint and 42% of revenue. Despite overwhelming advancements in climate-smart green theatre research, benchmarking remains a challenge. A single index representing their improvements has significant potential to increase control over and to promote their approaches. That is, this study does not stop at an inquiry about climate-smart approaches but also moves a step further and explores a possible outcome measure for the evolution of magnitudes, particularly in favour of the green theatre index (GTI). A function (clinical_theatre_emissions) was created in the R package Carbonr to calculate carbon emission. A time series emission data by theatre were consolidated as GTI using Fisher ideal index. The GTI proves a feasible and accurate consolidated outcome measure for carbon emissions to track and benchmark climate-smart strategies and could be applied in the real-world settings.

INTRODUCTION

One-hundred and ninety-two countries are currently implementing the Kyoto Protocol to reduce carbon emissions in accordance with agreed targets for our planetary wellbeing. Australia is no exception. The Protocol holds parties to account for rigorous monitoring and transparent reporting. Healthcare itself contributes to a significant source of pollution, which has a high cost on the environment, and subsequently the detriment of patient wellbeing due to its carbon footprint. Australian hospitals have been

DOI: 10.4018/979-8-3693-1210-0.ch016

placed second to the food industry in terms of waste by seven percent of the country's overall carbon footprint (Shum et al., 2020).

Climate-smart strategies for operating theatres (green theatre approaches) are of significant concern around the world, because theatres contribute twenty to seventy percent of the hospital carbon footprint and 42% of hospital revenue (Babu et al., 2019; Shum et al., 2020; Wu & Cerceo, 2021).

Carbon emissions have broader environmental and health implications, because they could potentially reverse decades of our health progress by changing climate patterns, temperature, precipitations, drought, floods and rising sea levels. Climate-related mortality is increasing due to cardiovascular diseases and asthma from coal power, and pandemics from altered habitats. All social determinants of health will be affected by climate change, from clean air, water and soil to food systems, sanitation and healthcare workforce.

Incineration alone could produce three kilograms of carbon dioxide for every kilogram of clinical waste (T. Southorn, A. Norrish, K. Gardner, & R. Baxandall, 2013; K. H. Wyssusek, Keys, & van Zundert, 2019). Although representing only a relatively limited physical portion of a hospital, theatres usually consume three to six times the energy of other rooms to incinerate high volumes of waste (Novosel et al., 2022). The majority of ozone-depleting anaesthetic gases, which have a global warming potential of over 2000 times that of carbon dioxide, are released into the atmosphere and significantly affect climate change. Therefore, climate-smart strategies targeting the operating theatre have the highest impact on the health of the patient within the healthcare industry.

Until now, benchmarking of green theatre approaches has not received sufficient attention. Previous research done on this subject overlooked a measure to track the progress and comparison analyses. The literature has been much more reticent in investigating ways of benchmarking and reporting frameworks. Therefore, the benchmarking of green approaches and a consensus on clear protocols remain a challenge despite overwhelming enthusiasm and advancements in green theatre research.

A single statistical index to benchmark their improvements has a significant potential to increase control over and to promote planetary wellbeing. That is, this study does not stop at an inquiry about green theatre approaches but also moves a step further and explores a possible standardised outcome measure for the evolution of magnitudes, particularly in favour of the "Green Theatre Index (GTI)" to track and benchmark the effectiveness of climate-smart strategies in operating theatres.

GTI is a weighted index inspired by Consumer Price Index (CPI) comprising two criteria: quantities of the different theatre wastes (clinical waste in kilograms and electricity in Kilowatts Hours) and corresponding tCO2e (tonnes of carbon dioxide equivalent) to find the percent change over a period of time. The GTI will serve as an indicator of the rate of the green theatre progress for tracking and benchmarking purposes.

STRUCTURE OF THE CHAPTER

This chapter proceeds with the introduction followed by a brief literature review on the green theatre approaches with a summary of the current knowledge gap of lacking a benchmarking measure. The methodology section will explain the study design, the source of data and the structure of the dataset. The data analysis section is the heart of the paper where the development of the carbonr R package to calculate CO2 emissions for the different types of theatre waste such as clinical waste and anaesthetic