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Healthcare Apps as Tools for Brand Extension and Sustainability

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Abstract

Healthcare apps were previously designed for scheduling appointments and to access patient information. However, due to the rapidly evolving technology, healthcare applications have turned into digital medical platforms. They enable doctors to conduct teleconsultation with the patients and perform remote diagnostics. They also help in chronic disease monitoring and in management of prescriptions. This study examines how health care apps not only improve service access, but also contribute to environmental sustainability. The study employs a comparative quantitative method with conceptual implications that evaluate differences in carbon emissions between telehealth service and conventional in-person health care delivery. The research analyses the carbon footprint drivers such as patient travel and energy consumption in medical facilities. The study suggests that particular apps involving teleconsultation and remote patient monitoring reduce emissions due to travel to a great extent. They also reduce the usage of papers and physical infrastructure. The analysis of this study supports the fact that the digital Health Care apps offer a more sustainable alternative and support hospitals in aligning with ESG (environmental, social and governance) commitments. By achieving the above, healthcare apps act as strategic brand extenders for hospital medical services. This study provides suggestions to

extend the medical services by using healthcare apps and to build competitiveness in sustainable healthcare markets.

Keywords: Telemedicine, Healthcare apps, Carbon footprint, Brand extension, ESG strategy, Sustainable healthcare app.

I. INTRODUCTION

Healthcare apps are internet-based applications. They are designed to support health monitoring and administrative functions in a hospital. These apps connect three stakeholders of a medical service such as patients, doctors and medical institutions through digital platforms. They were initially used to maintain records within a hospital. Due to the advancements in smart phones, the apps were turned into patient interactive platforms. The combination of artificial Intelligence with these apps has improved diagnosis and treatments. There are many types of healthcare apps. They are telemedicine apps, fitness apps, wellness apps, medication reminder apps, electronic health record apps and chronic disease management apps. Healthcare apps help hospitals in promoting their services which increases patient engagement. Healthcare apps enhance service quality and improve competitive advantage.

Public health apps like Asha Connect provide information about preventive care and community health forums. Applications like Sana connect rural medical professional to experts. Lifestyle apps like Joule bag gamifies healthy habits and tracks the amount of carbon dioxide and water saved daily. Nexercise awards points for walking. Preventive care apps like Charity Miles encourages physical activity by donating to health charities for every mile walked. Telemedicine apps like Teladoc provide access to specialists within minutes. Babylon Health uses artificial intelligence for checking symptoms. Even though the research on telemedicine's contributions on sustainability is increasing, only limited studies integrate assessment of environmental impact with brand extension theory. Existing researches evaluate the accessibility, cost and clinical outcome of tele consultation. But the attention given to strategic branding implications is insufficient within literature of marketing and sustainability. Comparative carbon modeling of outpatient visits and services by healthcare apps remain underexplored. This study addresses the above-mentioned gap by integrating carbon estimation with brand extension theory to validate healthcare apps as sustainable brand growth tool.

Literature review

Purohit et al (2021) conducted a Systematic review of telemedicine and its carbon emissions. Thiel et al (2023) compared the virtual and in person visit emissions and proved telemedicine reduce greenhouse gas emissions. They concluded that telemedicine offers clear environmental benefits. Morcillo Serra et al (2022) studied the reduction of carbon dioxide emission through digital appointments and concluded that digital health system reduced emissions due to patients' travel. Muschol et al. (2022) showed that video consultations reduce travel costs, emissions and loss of time in orthopedic follow ups. Faizan et al (2025) systematically reviewed the digital health tools like mHealth and concluded that even though digital tools reduce emissions, they lack standardized environmental metrics.

Umpierre et al. (2025) conducted a cross-sectional study analyzing the reduction of carbon emission through telemedicine. Akinola et al (2023) reviewed the adoption of digital health features and suggested that these innovations must prioritize sustainability. Sun et al (2023) assessed the sustainability of mHealth platforms and stated that high quality of information supports the long-term sustainability of those platforms. Medina Aguerrebere et al (2022) studied how leading hospitals in United States use mobile apps for education and communication. The study concluded that most apps are used for basic services such as appointments. The team also analyzed how hospitals use apps as branding tools. Khurana et al (2019) examined how mhealth apps improve communication, engagement and reputation of the institution. Alahmari & Reddy (2025) analyzed how culture in an organization affects the adoption of healthcare apps and suggested that innovation-friendly environment of an institution increases the usage of the apps. Above studies ensure the environmental benefits of telemedicine, but only few provide cross-system carbon comparisons. Combining sustainability performance with brand extension remain underexplored. Although health care apps consume energy through data transmission and cloud processes, evidence suggests that the emissions remain significantly low, when compared with patient transportation and energy use by medical institution.

Statement of the problem

Healthcare applications have emerged due to the increased advancement of mobile technology in recent years. The COVID-19 pandemic has accelerated the adoption of healthcare apps globally. It has become common to seek and access virtual medical care through these apps. The growing conventional healthcare systems contribute significantly to global net carbon emissions. This emission is forecasted to increase in following years. The emissions in the conventional healthcare systems are due to travel to and from the hospitals,

intensive use of energy, production of paper and medical wastes. Hospitals and pharmaceutical companies face pressure to demonstrate their measurable sustainability outcomes. Traditional healthcare delivery increases greenhouse gas emissions by frequent travel of the patients, physical documentation of their records, congestion near the hospital area and environmental degradation. Although healthcare apps reduce travel and paper documentation, the reduction of carbon emissions due to them is a question. The elements needed for the app to work such as data centers, mobile networks and manufacturing units also generate carbon emissions. Many hospitals do not use healthcare apps to extend their brand. Healthcare apps are only used for appointments and teleconsultations.

Objectives

- To examine healthcare apps as brand extension tool hospital medical services
- To analyze the potential of healthcare apps in reducing carbon footprint
- To compare traditional health care services with digital health care platforms
- To propose managerial recommendations for innovative marketing of hospital services through apps

Research methodology

This study employs a secondary-data-based comparative carbon modeling approach grounded in Life Cycle Assessment (LCA) principles and conceptual brand theory integration. This study is based on secondary data from academic literature and healthcare system audits. The data regarding carbon emissions are drawn from sustainability reports. Existing evidence shows that the telemedicine apps reduce carbon footprint more than any other health care app since it cuts the patient's travel and record management. The environmental impact of healthcare apps varies depending on regions and their adoption levels. The study synthesizes the quantitative data from secondary sources to compare the carbon emission of healthcare apps and conventional medical service methods. Future empirical research is recommended to assess the longitudinal impact of carbon emission and long-term sustainability outcome of the apps. The research uses an exploratory method to suggest innovative ideas to extend the brand of hospital medical services. The analysis of functional unit is defined as one outpatient consultation episode. To ensure consistency of the methodology, all carbon emissions are standardized to the above unit. Through operational phase boundary approach, the study analyses emissions from

1. Patient travel
2. Network transmission
3. Cloud processes
4. Emissions due to usage of the electronic device
5. Energy consumption of hospital facility

Emissions due to manufacturing of the device and construction of hospital infrastructure are excluded to maintain boundary symmetry. The study relies on secondary data of emission estimates from published literature and sustainability reports. Actual emissions may be influenced by geography, carbon intensity and the distance travelled by the patients. Hence, the results calculated are represented as indications rather than absolute inference.

In-Person Outpatient Visit

According to JAMA Network Open (Heller et al, 2023):

- **Average patient travel emission per healthcare trip is** ~10 kg of CO_2

According to The Lancet Planetary Health (Tennison et al, 2021):

- **Emissions due to outpatient hospital visits** are ~76 kg of CO_2 per visit

So, Total emissions due to In-Person Visits = 10+76

=86 kg of CO_2

Healthcare App energy consumption

Digital components that contribute major energy consumption are use of the electronic device such as mobile, data transmission, data center process.

Based on ICT energy intensity literature (IEA, Malmodin, Andrae):

Estimated total:

Carbon emission due to the apps ≈ 0.02–0.03 kg CO_2,

which means the emissions must be ≈ 20–30 grams of CO_2.

Conservative midpoint: Carbon emission due to the apps =0.025 kg CO_2

Table 1

Direct Comparison of Carbon emissions per Visit

Mode	**Emissions (kg CO_2)**
In-person outpatient	**86 kg**
Carbon emission due to the apps	**0.025 kg**

Emission Reduction per Visit: 86−0.025

=85.975 kg CO_2 saved

Percentage Reduction: (85.975/86) ×100

If 10,000 outpatient visits used services through healthcare apps,

Then, 85.975×10,000 = 859,750 kg CO_2

~ 860 metric tons CO_2 are avoided annually

$CE_{In\ Patient\ visit} = CE_{Travel} + CE_{Facility}$

$CE_{Health\ care\ app} = CE_{Device} + CE_{Network} + CE_{Cloud}$

$Net\ Reduction = CE_{In\ Patient\ app} - CE_{Health\ care\ app}$

Where, $CE_{In\ patient\ visit} > CE_{Health\ care\ app}$

Sustainable healthcare apps lower carbon emissions by reducing patient transport. They reduce emissions indirectly by lowering medical facility's energy utilization. Therefore, healthcare digital platforms function as brand extenders, aligning to the ESG goals.

Brand growth and extension

In alignment with Aaker's Brand Extension Theory, Healthcare apps help hospitals to launch new services under their already established brand app. Example: A hospital is popularly known for cardiac care, it can extend service by providing teleconsultation for other medical treatments. Patients using the cardiac services of the hospital are more likely to try new other services provided. The apps can be integrated with pharmaceutical, diagnostic and fitness features, making the brand a comprehensive healthcare provider. Hospitals can use these apps to educate patients with articles, videos and tips.

Clinical Institution's Environmental Performance Improvement

By reducing carbon emissions

↓

Improved ESG Credibility

↓

Perceived Medical Institution's Responsibility

↓

Increased Brand Trust

↓

Strengthened Brand Loyalty

When a hospital provides this service, it positions itself as a trusted healthcare advisor. This helps the patient to associate the hospital with knowledge and reliability. Hospitals can design personalized health programs for its patients such as medication reminders and fitness tracking for post-hospital care. According to Keller's Customer-Based Brand Equity (CBBE) Model, this improves the loyalty of the patient towards the hospital through the health care app. Being present in patient's daily routine, a hospital can extend its brand beyond clinical visits. Innovative inclusion of artificial intelligence in apps like AI symptom checkers and mental health support help hospitals reinforce their image as technologically advanced and patient-centered facility.

Novelty of the research

While digital healthcare apps are widely used for convenience, there is only limited comparison between in-person care and digital telehealth care on the basis of carbon emission. There is an insufficient integration of the life cycle assessment to evaluate the carbon emission due to health care apps. Many organizations lack the way of using healthcare apps as sustainable brand extenders, rather than using them as service tools. Many health care apps are studied based on the engagement of the user, cost and clinical outcomes. But this study addresses this by suggesting the addition of carbon emission to performance metrics of the apps. There is a limited exploration of brand extension ideas of healthcare apps. Research on using healthcare apps to market the brand is limited.

Discussion

The findings indicate that the use of healthcare apps produce carbon emissions lower than traditional healthcare service methods. Reduction of travel is the major factor that reduce significant emission. E-records and remote monitoring decreases the paper usage and congestion near hospital surroundings. By using healthcare apps, hospitals can enhance credibility of the brand and can align with ESG goals. The study indicates that healthcare apps can reduce carbon emissions related to healthcare service and serve as a sustainability tool. They help in brand positioning and extension of the medical institution and provide competitive advantage in the markets prioritizing environmental safety. Launching a health Care app is a hospital's practical and effective way of extending its brand. Medical Institutions can strengthen their reputation by gaining loyalty of its patients through these apps. The rebound effect may influence the sustainability of the apps. Healthcare apps function as sustainable brand extensions by reducing carbon emitting healthcare activities and thereby enhance ESG alignment and competitive positioning of the hospitals.

II. CONCLUSION

As brand extension tools, healthcare apps strengthen an organization's goodwill by increasing accessibility to medical service, reducing emissions and increasing loyalty and engagement of the patients. Healthcare institutions should address problems like internet unavailability to avoid service inequality. Future empirical research should identify carbon emissions reduction across different geographic contexts. The rebound effect and app usage pattern may provide deep insights towards the net environmental impact of the apps. Future research on equal digital access methods may ensure inclusion. Overall, healthcare apps offer a sustainable pathway towards responsible healthcare delivery. It also enhances brand extension and competitiveness in a sustainability-driven economy.

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