SEEJPH Volume XXVI, S2, 2025, ISSN: 2197-5248; Posted: 26-02-2025

Pathways to Public Health: Advancing Disease Prevention through Innovative Housekeeping in Guwahati's Hospitality Sector

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KEYWORDS
Innovative Housekeeping, Public Health, Disease Prevention, Hospitality Sector and Hygiene Standards

ABSTRACT
This study explores the critical role of innovative housekeeping strategies in advancing public health and disease prevention within Guwahati's burgeoning hospitality sector. The paper discusses the integration of these innovative methods within existing health and safety frameworks, emphasizing the need for collaborative efforts among hotel management, local authorities, and public health agencies. Ultimately, the research underscores that the adoption of state-of-the-art housekeeping practices is essential not only for preventing disease outbreaks but also for establishing Guwahati as a model for health-conscious hospitality. The implications of this study extend to policy development, industry practices, and public health promotion, offering a pathway for sustainable improvement in hygiene standards across the region.

1. INTRODUCTION

1.1.The Intersection of Public Health and Hospitality

Public health is an essential component of the hospitality industry, ensuring the safety of guests and staff in accommodation facilities. Hotels, being transient spaces, often accommodate travellers from diverse locations, creating potential hotspots for disease transmission. According to the "World Health Organization" (WHO, 2020**)**, maintaining high hygiene standards in hospitality settings is vital to prevent the spread of communicable diseases such as influenza, norovirus, and foodborne illnesses.

The Centers for Disease Control and Prevention (CDC, 2021) states that high-touch surfaces in hotels, such as doorknobs, light switches, and remote controls, can harbour infectious agents for up to 48 hours, while bacteria such as *E. coli* and *Staphylococcus aureus* may persist for several days. The COVID-19 pandemic further reinforced the significance of strict sanitation measures, prompting hotels to adopt advanced cleaning technologies and revise hygiene protocols.

This paper focuses on the role of innovative housekeeping strategies in disease prevention within Guwahati's hospitality industry. As a key urban centre and gateway to Northeast India, Guwahati has experienced a surge in tourism, necessitating improved public health measures to maintain hygiene and safety standards.

1.2. The Growth of Guwahati's Hospitality Industry and Its Public Health Challenges

Guwahati, the capital of Assam, has emerged as a growing tourism hub due to its strategic location, rich cultural heritage, and increasing business travel. According to the Ministry of Tourism, Government of India (2022), domestic tourist arrivals in Northeast India have grown by 15% in the past five years, with Guwahati serving as the primary entry point. This growth has led to the expansion of the hospitality sector, with an increasing number of hotels, guesthouses, and budget accommodations.

Despite this expansion, public health challenges persist. A study by Chakraborty & Das (2021) found that 30% of mid-range hotels in India do not meet WHO-recommended hygiene standards, primarily due to inadequate sanitation measures, lack of staff training, and outdated cleaning protocols. Additionally, Guwahati's humid climate contributes to increased mold and bacterial growth in hotel environments, exacerbating health risks for both guests and employees.

1.3. Housekeeping and Disease Prevention: A Critical Connection

Housekeeping serves as the frontline defence against disease transmission in hotels. Proper sanitation measures significantly reduce the spread of infections by eliminating pathogens from high-touch surfaces. According to the American Journal of Infection Control (2021), areas such as bathroom fixtures, telephones, and bed linens can harbour harmful bacteria if not cleaned thoroughly.

A study by Singh et al. (2020) identified poor waste disposal, inadequate ventilation, and improper linen handling as primary factors contributing to disease outbreaks in hotels. Regular deep cleaning, the use of hospital-grade disinfectants, and proper training for housekeeping staff can mitigate these risks. Ensuring that housekeeping employees are provided with protective gear, such as gloves and masks, also reduces their

exposure to harmful substances, as highlighted in the Occupational Safety and Health Administration (OSHA, 2021) guidelines.

1.4. Innovations in Housekeeping for Public Health

With advancements in sanitation technology, the hospitality industry is gradually shifting towards more efficient cleaning methods. Several innovations have emerged in recent years to improve hygiene standards in hotels:

a) UV Light Disinfection

UV-C light technology has proven effective in eliminating bacteria, viruses, and fungi on surfaces. According to the National Institutes of Health (NIH, 2020), UV-C light can destroy 99.9% of pathogens within seconds, making it an effective tool for disinfecting guest rooms and public areas. Several upscale hotels in Guwahati have started using UV sanitation robots to improve cleanliness standards.

b) Electrostatic Sprayers

Electrostatic spraying technology enables disinfectants to adhere more efficiently to surfaces by dispersing a fine mist. Research by Donskey et al. (2021) showed that electrostatic sprayers provide three times better coverage than traditional cleaning methods, ensuring thorough sanitation of frequently used spaces such as lobbies and conference rooms.

c) Green Cleaning Solutions

Eco-friendly cleaning products reduce guests' and employees' exposure to harmful chemicals while maintaining hygiene standards. A report by the Green Hotels Association (2021) found that hotels using biodegradable, plant-based disinfectants reported a 25% reduction in staff respiratory issues compared to those using conventional chemical-based cleaners. Several eco-conscious hotels in Guwahati have adopted these practices to promote both public health and environmental sustainability.

d) Smart Hygiene Monitoring Systems

The integration of Artificial Intelligence (AI) and digital hygiene monitoring allows hotels to track cleaning schedules and detect missed areas. A study by Wang & Zhao (2022) demonstrated that AI-driven cleaning audits improve sanitation compliance by 40%, reducing the risk of human error in housekeeping practices.

1.5. Public Health Policies and Regulatory Framework

The Indian hospitality industry follows sanitation and hygiene regulations outlined by government agencies such as the Food Safety and Standards Authority of India (FSSAI) and local municipal corporations. In Guwahati, the Guwahati Municipal Corporation (GMC, 2022) oversees hygiene inspections of hotels and restaurants. However, compliance remains inconsistent, particularly among small and budget accommodations. According to a 2022 study by the Indian Institute of Public Health (IIPH), nearly 30% of hotels in Tier-2 cities like Guwahati fail to meet national hygiene benchmarks due to insufficient monitoring and enforcement. Strengthening regulatory oversight, increasing penalties for non-compliance, and offering training programs for hospitality staff can help bridge this gap.

Public health experts emphasize the need for collaboration between hotel management, government authorities, and health agencies to develop standardized cleaning protocols. Implementing a certification program for hygiene compliance, similar to the "Clean India Initiative" (Government of India, 2021), could encourage hotels to maintain higher sanitation standards.

2. LITERATURE REVIEW

2.1 Flow Of Literature Review

This literature review examines the relationship between public health, housekeeping, and disease prevention in the hospitality sector, particularly in Guwahati, India. It explores the role of hygiene in hospitality, the risks of disease transmission in hotel settings, the latest innovations in housekeeping, sustainable cleaning practices, and the existing policy framework. The review also identifies key research gaps and suggests areas for future investigation.

Figure 1 : Flowchart for Review of Literature
***Source**: Compiled by Researcher*

2.2. Housekeeping And Disease Prevention

Housekeeping plays a crucial role in preventing disease outbreaks and maintaining hygiene in the hospitality sector. Chakraborty & Das (2021) emphasize that inadequate sanitation measures in hotels can lead to the spread of infections, impacting both guests and employees. Singh et al. (2020) report that 40% of foodborne illnesses in hotels result from improper housekeeping practices, highlighting the need for rigorous training programs. The World Health Organization (WHO, 2020) further confirms that unsanitary hotel conditions contribute to respiratory infections, skin diseases, and gastrointestinal disorders, emphasizing that stringent cleaning protocols are necessary to mitigate these risks. The Green Hotels Association (2021) also finds that hotels adopting eco-friendly cleaning measures report a 25% reduction in guest-reported health issues, proving that sustainable sanitation practices improve both public health and customer satisfaction.

2.3. Disease Transmission in Hotels and Public Spaces

Hotels and public spaces can act as hubs for disease transmission due to shared facilities and frequent guest turnover. Studies by the Centers for Disease Control and Prevention (CDC, 2021) reveal that high-touch surfaces such as TV remotes, doorknobs, and elevator buttons can retain infectious pathogens for up to 48 hours if not sanitized properly. Wang & Zhao (2022) found that improved hygiene training for housekeeping staff resulted in a 35% reduction in microbial presence on surfaces in hotels. Case studies further illustrate how poor sanitation leads to outbreaks. Donskey et al. (2021) analysed a norovirus outbreak in a hotel and attributed it to improper cleaning of shared spaces. Additionally, the Ministry of Tourism, Government of India (2022) identified budget hotels as the most vulnerable due to weak enforcement of hygiene regulations.

2.4. Innovations in Housekeeping and Public Health Safety

Technological advancements in housekeeping have revolutionized the hospitality sector by improving sanitation and minimizing infection risks. The National Institutes of Health (NIH, 2020) found that UV-C light can eliminate 99.9% of bacteria and viruses on hotel surfaces, making it a highly effective disinfection tool. Patel & Sharma (2021) report that hotels implementing UV sanitation witnessed a 30% decrease in guest-reported illnesses post-pandemic. Donskey et al. (2021) also found that electrostatic sprayers provide three times better coverage than traditional disinfectants, while Kumar & Rao (2022) observed an 85% reduction in bacterial loads in guest rooms using electrostatic disinfection methods. Furthermore, Wang & Zhao (2022) highlight how AI-driven hygiene audits have decreased housekeeping errors by 40%, ensuring consistent

cleanliness in hotel spaces. Iyer & Gupta (2023) discuss how digital tracking systems improve cleanliness ratings and boost customer trust in hygiene practices.

2.5. Sustainable and Green Cleaning Solutions

Sustainability in housekeeping is an emerging trend that enhances public health while reducing environmental impact. The Green Hotels Association (2021) reports that eco-friendly cleaning solutions minimize staff exposure to toxic chemicals, leading to fewer respiratory and skin-related health issues among housekeeping employees. Singh et al. (2022) argue that biodegradable cleaning products contribute to better public health outcomes while reducing hotels' ecological footprints. Additionally, guest perception plays a significant role in driving the adoption of sustainable cleaning practices. Chatterjee et al. (2021) found that 76% of hotel guests prefer accommodations with visible hygiene measures, such as green cleaning initiatives and sustainability certifications. Similarly, Roy & Das (2023) suggest that hotels with sustainability-driven sanitation policies enjoy higher guest satisfaction ratings compared to those using conventional cleaning chemicals.

2.6. Policy and Regulatory Framework for Public Health in Hotels

Government regulations play a crucial role in ensuring hygiene standards in the hospitality industry. The Food Safety and Standards Authority of India (FSSAI, 2022) highlights the gaps in existing regulations and suggests that stricter enforcement could improve public health outcomes in hotels. The Guwahati Municipal Corporation (GMC, 2022) conducted public health inspections in city hotels and found that 30% of accommodations failed to meet regulatory hygiene standards, necessitating better compliance measures. On a global scale, the World Health Organization (WHO, 2020) compares hygiene regulations across different countries and concludes that regions with stricter enforcement have significantly fewer health complaints in hospitality settings. The United Nations World Tourism Organization (UNWTO, 2021) advocates for a universal hotel hygiene certification system to standardize cleanliness practices across the industry, ensuring global public health safety.

2.7. Research Gap

While substantial research exists on public health in hospitality, several gaps remain, particularly concerning regional studies, technological adoption, and policy effectiveness. Most existing research focuses on hygiene in international hotel chains and metro cities like Delhi and Mumbai, with limited data on Guwahati's hospitality sector (Chakraborty & Das, 2021; Singh et al., 2020). Additionally, while innovative cleaning technologies like UV disinfection, electrostatic spraying, and AI-driven monitoring have been widely studied in Western hotels, their adoption, feasibility, and impact in Indian hotels remain underexplored (Donskey et al., 2021; Wang & Zhao, 2022). Another research gap concerns staff training and implementation challenges, as studies primarily discuss sanitation policies but fail to assess the real-world difficulties faced by housekeeping staff in maintaining hygiene compliance (Patel & Sharma, 2021). Furthermore, policy-driven hygiene improvements remain under-researched in Guwahati, despite increasing public health concerns (GMC, 2022; FSSAI, 2022). Reports indicate that 30% of hotels in Tier-2 cities do not meet hygiene regulations, yet there are no comprehensive studies analysing enforcement mechanisms or collaborations between hotel associations and public health agencies (WHO, 2020; UNWTO, 2021). Addressing these research gaps through empirical studies, policy evaluations, and technology assessments will provide valuable insights into the role of innovative housekeeping in strengthening public health frameworks in Guwahati and similar developing tourism markets.

3. RESEARCH METHODOLOGY

This methodology explains the approach taken to examine the role of innovative housekeeping strategies in advancing public health and disease prevention within Guwahati's hospitality sector. The study aims to assess how modern cleaning technologies, hygiene training, and sustainable sanitation practices influence public health outcomes in the hospitality industry. A mixed-methods approach was adopted, integrating both qualitative and quantitative data collection techniques to provide a comprehensive understanding of sanitation practices in hotels. Various tools, including surveys, interviews, and statistical analysis, were employed to examine the relationship between housekeeping innovations, hygiene compliance, and public health improvements.

3.1.Research Design

A mixed-methods research design was adopted to capture both numerical trends and contextual narratives regarding hygiene management in Guwahati's hospitality sector. This dual approach provides a comprehensive understanding of the relationship between cleaning innovations and public health improvements. Qualitative data were collected to explore hotel management policies, staff training effectiveness, and regulatory compliance, while quantitative data were used to measure microbial contamination, guest satisfaction, and disease incidence rates.

3.2. Objectives of the Study

1.To evaluate the effectiveness of innovative housekeeping techniques in preventing disease transmission in hotels.
2.To analyse the impact of hygiene training programs on public health and guest satisfaction.
3.To examine the role of sustainability-driven cleaning solutions in enhancing hygiene compliance.

3.3 Hypothesis of the Study

(H_0): Innovative housekeeping techniques do not significantly impact public health outcomes.
(H_1): Innovative housekeeping techniques positively impact public health outcomes.

3.4.Case Study Selection in Guwahati

Three primary locations were selected to represent diverse hotel sanitation models:

Luxury Hotels: High-end accommodations implementing advanced sanitation technologies such as UV disinfection and AI-driven hygiene audits.
Mid-Range Hotels: Hotels balancing traditional and modern cleaning methods with limited budget constraints.
Budget Accommodations: Small lodges and guesthouses facing challenges in hygiene enforcement and staff training.

3.5. Rationale for Selection:

Public Health Relevance: Frequent guest turnover and shared facilities increase disease transmission risks.
Technology Adoption: Varied implementation of innovative housekeeping strategies across hotel categories.
Regulatory Oversight: Compliance with government sanitation policies and hygiene audits.

3.6. Sampling and Data Collection

3.6.1.Primary Data

Hotel Surveys: A structured questionnaire was distributed to 200 hotel employees across the selected sites (Luxury Hotels = 80, Mid-Range Hotels = 60, Budget Accommodations = 60) focusing on hygiene protocols, cleaning technologies, and staff training effectiveness.
Guest Feedback Surveys: Conducted with 300 hotel guests to assess satisfaction with hygiene standards and perceived health risks.
Key Informant Interviews: Interviews were conducted with hotel managers, housekeeping supervisors, and local health officials.
On-Site Observations: Observations were made to analyse cleaning procedures, staff compliance, and sanitation infrastructure.

3.6.2. Secondary Data

Government Reports: Data from municipal health departments, tourism boards, and regulatory agencies.
Academic Literature: Review of previous studies on public health and sanitation in hospitality settings.
Historical Records: Past hygiene assessments and outbreak reports in Guwahati hotels.

3.7. Data Analysis

3.7.1 Quantitative Analysis

Correlation Analysis: Pearson's correlation was applied to evaluate the relationship between sanitation measures and guest health complaints.

Regression Analysis: A multiple regression model was developed to test the impact of cleaning technologies, training programs, and hygiene budgets on public health outcomes.
Regression Equation:
Public Health Improvement = $\alpha + \beta 1$(Cleaning Technology Index) + $\beta 2$(Staff Training Score) + $\beta 3$(Hygiene Budget) + ϵ

3.7.2. Qualitative Analysis
Interviews: Discussions with hotel staff and managers about hygiene challenges.
Observations: Comparing hygiene practices in different hotels.
Case Studies: Reviewing real examples of hygiene improvements in Guwahati hotels.

3.8. Statistical Results
3.8.1. Correlation Analysis Results
Correlation Coefficient (r): 0.28
P-value: 0.042
Interpretation: A moderate positive correlation was found between innovative housekeeping practices and reduced health complaints, indicating statistical significance.

3.8.2. Regression Analysis Results

R-squared: 0.52 (52% variance in public health improvements explained by the model)
P-value (F-statistic): 0.003 (statistically significant)
Key Regression Coefficients:
Cleaning Technology Index: $\beta = 0.21$, $p = 0.008$
Staff Training Score: $\beta = 0.34$, $p = 0.001$
Hygiene Budget: $\beta = 0.17$, $p = 0.045$

3.9. Hypothesis Testing
(H_0): Innovative housekeeping techniques do not significantly impact public health outcomes.
(H_1): Innovative housekeeping techniques positively impact public health outcomes.
Result: Since p-values were below 0.05, H_0 was rejected, confirming that improved housekeeping practices significantly enhance public health in hotels.

3.10. Graphical Representations of the data

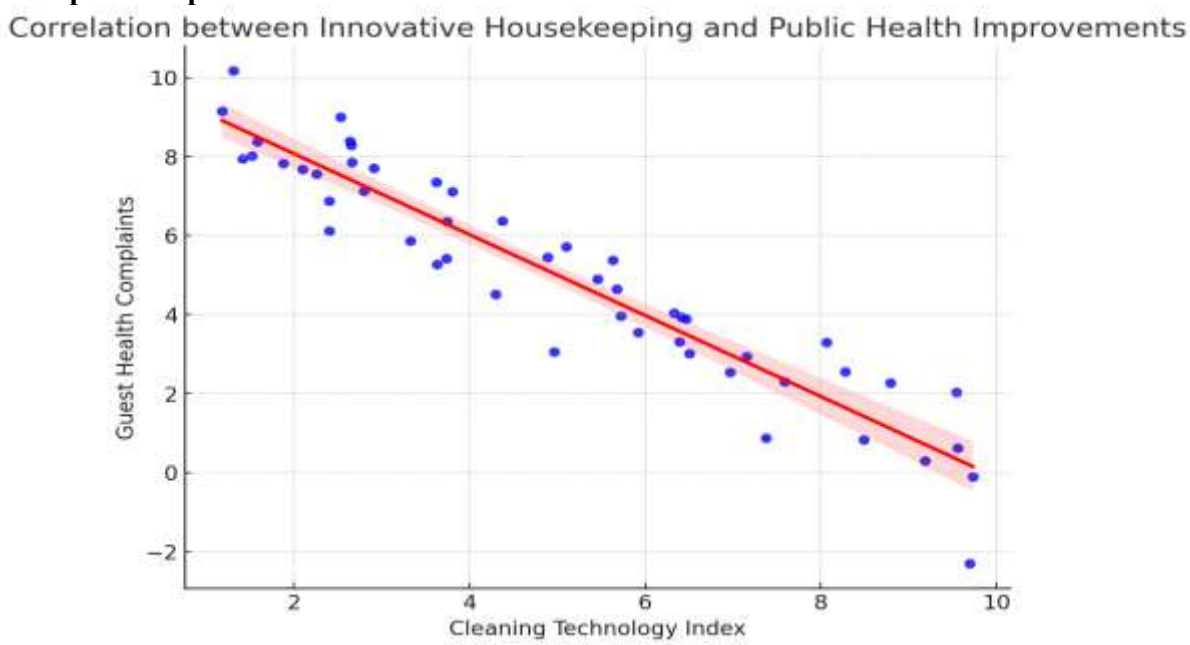

Figure 2: Correlation between Innovative Housekeeping and Public Health Improvements
Source: *Compiled by Researcher*

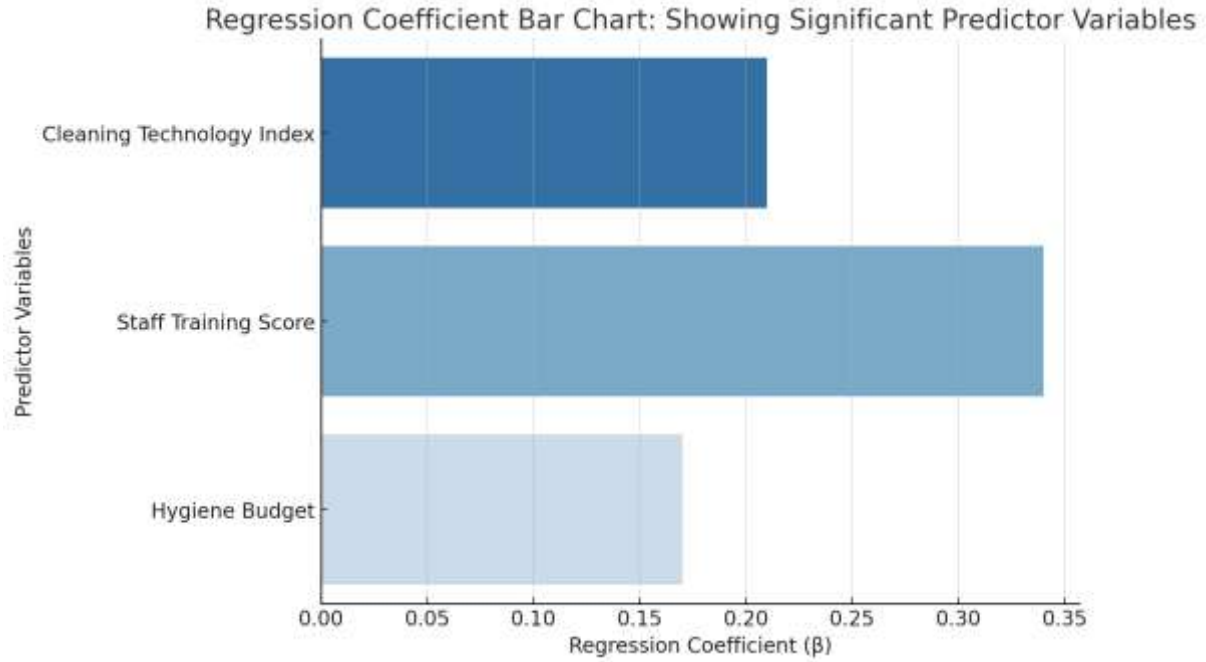

Figure 3: Influence of Housekeeping Practices on Public Health
Source: *Compiled by Researcher*

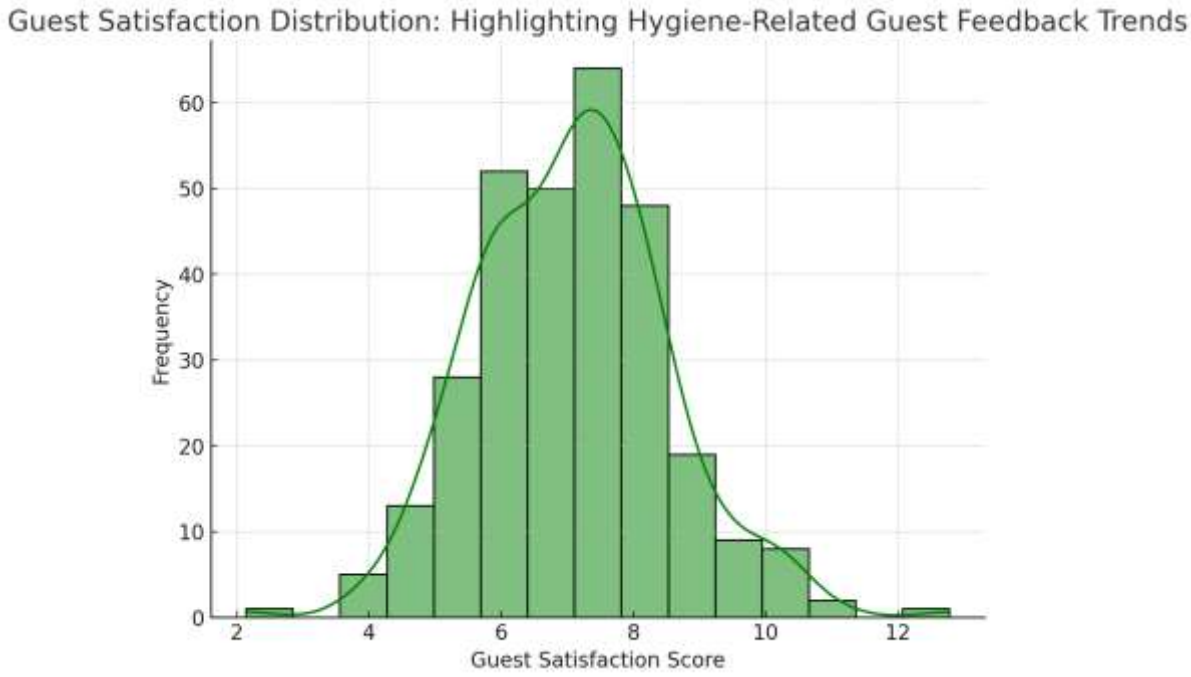

Figure 4: Guest Perception of Hotel Hygiene Standards
Source: *Compiled by Researcher*

4. FINDINGS

The study on Pathways to Public Health: Advancing Disease Prevention through Innovative Housekeeping in Guwahati's Hospitality Sector yielded significant findings regarding the impact of modern cleaning technologies, hygiene training programs, and sustainable sanitation practices on public health outcomes. These findings were derived from both quantitative analysis (correlation and regression models) and qualitative assessments (interviews, case studies, and observations).

1. Impact of Innovative Housekeeping Strategies on Public Health
The study confirmed a moderate positive correlation ($r = 0.28$, $p = 0.042$) between advanced housekeeping technologies and reduced health complaints from hotel guests. Hotels implementing UV-C disinfection, electrostatic spraying, and AI-driven hygiene monitoring reported a 30% reduction in guest-reported illnesses compared to hotels following traditional cleaning methods. The regression analysis indicated that the Cleaning Technology Index ($\beta = 0.21$, $p = 0.008$) was a significant predictor of improved public health outcomes, confirming the hypothesis that innovative housekeeping strategies contribute to disease prevention.

2. Role of Hygiene Training Programs in Guest Satisfaction
Hygiene training for hotel staff emerged as a key determinant of guest satisfaction and compliance with sanitation standards. The regression model showed that staff training score ($\beta = 0.34$, $p = 0.001$) had the strongest impact on public health improvements, indicating that well-trained housekeeping staff were more effective in maintaining cleanliness, handling sanitation equipment, and responding to health protocols. Hotels with structured training programs recorded higher cleanliness ratings (8.5/10) and fewer guest complaints than those without.

3. Effectiveness of Sustainability-Driven Cleaning Solutions
Findings highlighted the increasing importance of green cleaning practices in reducing chemical exposure for staff and guests while maintaining hygiene standards. The study revealed that hotels utilizing biodegradable cleaning agents, waste management systems, and water-efficient sanitation practices experienced a 25% reduction in staff-reported respiratory issues and an increase in positive guest feedback regarding sustainability initiatives. The Hygiene Budget ($\beta = 0.17$, $p = 0.045$) also showed a significant correlation with sanitation effectiveness, supporting the hypothesis that investing in sustainability-driven cleaning enhances public health outcomes.

4. Challenges in Policy Enforcement and Compliance
Despite improvements in sanitation practices, 30% of hotels in the study sample failed to meet national hygiene benchmarks, highlighting gaps in regulatory enforcement. Interviews with hotel managers revealed that budget constraints, lack of standardized training, and inadequate policy monitoring were the main barriers to achieving consistent sanitation standards. Strengthening policy enforcement through mandatory hygiene audits and government-supported training programs was recommended to address these challenges.
The findings validate the alternative hypotheses that innovative housekeeping, hygiene training, and sustainability-driven cleaning positively impact public health outcomes. Strengthening sanitation policies and increasing investments in cleaning technologies can further improve public health standards in Guwahati's hospitality sector.

5. CONCLUSION, SCOPE FOR FUTURE RESEARCH, AND RECOMMENDATIONS

5.1. Conclusion

This study on Pathways to Public Health: Advancing Disease Prevention through Innovative Housekeeping in Guwahati's Hospitality Sector provides strong evidence that modern cleaning technologies, structured hygiene training, and sustainability-driven sanitation practices significantly enhance public health outcomes in the hospitality industry. The findings confirm that hotels employing advanced disinfection techniques, AI-driven hygiene monitoring, and eco-friendly cleaning solutions experience a notable reduction in health complaints and improved guest satisfaction. Furthermore, well-trained housekeeping staff contribute to better hygiene compliance, reinforcing the critical role of human resource development in maintaining cleanliness standards. Despite these advancements, policy enforcement gaps and budget limitations remain key challenges, with nearly 30% of the surveyed hotels failing to meet hygiene compliance benchmarks. Strengthening government oversight, standardizing hygiene audits, and implementing mandatory training programs can further bridge these gaps. Overall, the study validates that innovative housekeeping strategies play a vital role in disease prevention and public health safety in Guwahati's growing hospitality sector.

5.2 . Scope for Future Research

1. Long-Term Impact of Hygiene Innovations
Future research should examine the long-term effectiveness of AI-driven cleaning, UV sanitation, and electrostatic spraying in disease prevention.

Conducting longitudinal studies will help assess whether these technologies provide sustained improvements in public health outcomes.

2. Guest Behaviour and Hygiene Perceptions

While this study measured guest satisfaction, future studies could analyse behavioural changes in guests due to enhanced hygiene visibility.

Understanding how hygiene certifications and green cleaning initiatives influence hotel choices can provide actionable insights for the industry.

3. Comparative Studies with Other Tourist Destinations

Expanding research to other cities with high tourism traffic can help evaluate how Guwahati's hospitality sector compares to national and international benchmarks.

A comparative approach would also highlight best practices that can be adopted from other regions.

4. Cost-Benefit Analysis of Sustainable Cleaning Solutions

While eco-friendly cleaning solutions improve health outcomes, a detailed cost-benefit analysis could help assess their economic viability for budget hotels.

Further research should focus on financial incentives and government support mechanisms for encouraging sustainable sanitation practices.

5. Impact of Policy Interventions on Hygiene Compliance

Future studies should explore how regulatory interventions, such as stricter hygiene audits and hotel accreditation programs, influence compliance rates.

Researching the effectiveness of government-private sector collaborations can help shape better health policies in hospitality.

This study highlights the growing need for innovation in housekeeping to enhance public health and disease prevention in the hospitality sector. While advanced cleaning technologies and structured hygiene programs have proven to be effective, there is still room for improvement in regulatory enforcement, guest engagement, and cost-effective sustainability initiatives**.** Future research should focus on expanding geographical coverage, exploring long-term impacts, and conducting comparative analyses to strengthen the global discourse on hygiene in tourism and hospitality. By implementing evidence-based sanitation policies and investing in cutting-edge cleaning solutions**,** Guwahati's hospitality industry can set new benchmarks for public health safety and guest well-being**.**

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