



AN OBSERVATIONAL STUDY OF HAND HYGIENE COMPLIANCE AMONG NURSES AND HEALTHCARE WORKERS IN RESIDENTIAL CARE HOMES IN THE POST-COVID-19 ERA

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Abstract

Background: Five Moments for Hand Hygiene (WHO 5 Moments) and a minimum 20-second hand hygiene duration are critical for preventing transmission in residential care homes (RCHs), where residents are highly vulnerable. Comparing compliance between nurses and other healthcare workers (HCWs) helps identify targeted gaps for intervention. Post-COVID-19 data on hand hygiene compliance in RCHs remain limited.

Objectives: To assess compliance with the WHO 5 Moments and hand hygiene duration (≥ 20 seconds) among nurses and HCWs in RCHs after COVID-19.

Methodology: A non-participant and anonymous observational study was carried out in seven private and subsidized RCHs. The study population included nurses and HCWs (health workers and personal care workers). Two trained research assistants (inter-rater reliability $>80\%$) observed practice across diverse units, using a per-unit stopping threshold of 200 infection control practice episodes. Data were captured using the eRub app, a checklist based on international guidelines. Hand hygiene compliance was defined as compliance with WHO 5 Moments and hand hygiene duration (≥ 20 seconds).

Result(s): From August 2023 to July 2024, 6,208 hand hygiene episodes were recorded. Overall compliance was 3.9%, which was very low. Nurses had significantly higher compliance (6.3%, N=1,625) than HCWs (3.1%, N=4,583), $\chi^2(1, N=6,208)=32.7, p<.001$. The lowest compliance by WHO moment was observed before patient contact (1.9%, N=3,533), after contact with patient surroundings (2.6%, N=269) and after patient contact (6.1%, N=2,174).

Discussion: Hand hygiene compliance in RCHs was markedly low, with significantly lower rates among HCWs compared with nurses and particularly poor adherence before patient contact. These results highlight the urgent need for targeted, role-specific interventions and hand hygiene campaigns to reduce healthcare-associated infections among vulnerable residents. Ongoing longitudinal monitoring is warranted to track trends and evaluate the effectiveness of these measures.

Keywords: Hand hygiene, Infection control practice, Residential care home, Nurse, Healthcare worker, COVID-19, Observational study



ASSOCIATION BETWEEN THE GENERAL HAPPINESS INDEX AND PSYCHOSOCIAL WELL-BEING IN THE CHINESE POPULATION

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Abstract

Background: Happiness is increasingly recognised as a fundamental indicator of population health and quality of life, happiness which also efficiently measures subjective mental well-being. However, limited research investigated the association between happiness and psychosocial well-being in the Chinese population.

Objectives: To investigate the associations among happiness, psychosocial well-being and sociodemographic characteristics.

Methodology: Data were collected in Hong Kong (July–August) of the General Happiness Survey 2025, which included the General Happiness Index (GHI), psychological well-being (assessed by the Patient Health Questionnaire [PHQ-9]), and the Social Well-being Scale (SWB). Spearman's rho assessed associations among GHI, PHQ-9, SWB and age. Mann-Whitney U and Kruskal-Wallis tests were used to investigate the associations between GHI and sociodemographic characteristics.

Result(s): Among 2,622 participants (66% female; mean age 39.5 years, SD = 13.1), mean GHI was 6.1 (SD = 2.1; range 0–10), mean PHQ-9 was 8.3 (SD = 6.5; range 0–27) and mean SWB was 3.1 (SD = 0.4; range 1–5). GHI correlated negatively with PHQ-9 ($\rho = -0.50$, $p < .001$) and positively with SWB ($\rho = 0.10$, $p < .001$) and age ($\rho = 0.10$, $p < .001$). Higher GHI was associated with higher monthly income ($\chi^2 = 63.2$, $p < .001$) and with perceived poorer personal finances ($\chi^2 = 351.9$, $p < .001$). Lower GHI was more common among those with secondary school and non-degree higher education compared with primary or below and degree higher education or above ($\chi^2 = 22.1$, $p < .001$). GHI was not associated with sex or religious faith.

Discussion: Happiness was associated with psychological well-being and sociodemographic characteristics (higher income, perceived poorer personal finances, and specific educational levels), and was weakly associated with social well-being and age. No associations were observed with sex or religious faith. The research findings provided policymakers with an evidence-based reference to organise mental health services for the population. A longitudinal study can be conducted to evaluate effectiveness in the future.

Keywords: General Happiness Index, Patient Health Questionnaire [PHQ-9], Social Well-being Scale, Psychosocial Well-being, Chinese Population, Sociodemographic Characteristics



EFFECTIVENESS OF GAMIFIED INTERVENTION IN MENTAL OUTCOMES AMONG ELDERLY WITH COGNITIVE IMPAIRMENT: LITERATURE REVIEW

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Abstract

Background: Cognitive impairment (CI) shows a growing trend among the elderly and challenges their well-being and daily living. However, traditional cognitive training interventions in a clinical setting have limitations. Recently, gamification has emerged as a trend to improve the cognitive, motor, and mental functioning of the elderly with CI through more interactive, digital approaches. While research in this field is expanding, the overall effectiveness of these interventions remains insufficiently profiled.

Objectives: This review aimed to synthesise the literature on the effectiveness of gamified interventions for cognitive and psychosocial outcomes among older adults with CI.

Methodology: This literature review study was adapted from PRISMA guidelines. CINAHL, EBSCOhost and PubMed databases were searched for quantitative studies in the past ten years (January 2015 to October 2025) on gamified interventions that improve psychological and behavioural outcomes among the elderly with CI.

Result(s): 30 studies were selected after screening 122 searches. Most primary studies (94.7%) examined the cognitive outcomes of gamification, whereas fewer studies (68.4%) examined the mental outcomes. Also, mental outcomes are not covered in existing systematic reviews, for example, neuropsychiatric and behavioural symptoms. This shows a lack of integration of such empirical evidence on mental health despite its interrelation with cognitive functioning.

Discussion: This review highlights the potential of gamification, especially in future research on improving cognitive training for the elderly. Our findings also demonstrate a current trend in the application of gamification, such as the use of social elements, decentralized care, and holistic integration.

Keywords: Gamification, Cognitive Impairment, Elderly, Mental Health



VALUE CREATION IN THAILAND'S HEALTH TOURISM ECONOMY

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Abstract

Background: Thailand is preparing to generate revenue and propel its health economy to prominence as a premier wellness tourism destination. This approach involves highlighting cultural identities combined with local uniqueness, alongside strictly monitoring service standards and product quality to build tourist confidence. Furthermore, supporting business matching for local entrepreneurs to attract investment will serve to integrate and strengthen the wellness tourism industry.

Objectives: This research project aimed to analyze the current state of health tourism in Thailand, identify strategies to bolster the nation's health economy, expand domestic and international health tourism networks, forecast the future landscape of Thailand's health tourism economy, and ultimately generate value within this sector.

Methodology: The research engaged a diverse population, including researchers specializing in health tourism, stakeholders such as entrepreneurs and industry experts, and domestic and international figures involved in health tourism. Data collection involved an international academic conference, in-depth interviews with stakeholders and experts, and consultations with health economics specialists. Data were analyzed using descriptive statistics and regression equations to model and forecast the value of health tourism in Thailand. Secondary data incorporating economic variables and computer science tools were employed for multivariate data management and content analysis.

Result(s): Key findings of this research include:

1. Establishment of collaborative networks: Through an international academic conference and the formalization of collaborative agreements with health organizations, the research facilitated the creation of robust networks with various stakeholders in both public and private sectors for future collaboration.

2. Forecasting the health tourism economic landscape: Utilizing five distinct algorithms – Linear Discriminant Analysis (LDA), Classification and Regression Trees (CART), k-Nearest Neighbors (kNN), Support Vector Machines (SVM), and Random Forest (RF) – the research generated six potential



scenarios for Thailand's health economy between 2025 and 2029. These scenarios, based on varying levels of government support for health tourism policies and global economic performance, include:

Scenario 1: Strong government support and robust global economic growth project a "full growth" trajectory for Thailand's health tourism economy, with an annual growth rate of 5.01% - 10.00%.

Scenario 2: Strong government support coupled with moderate global economic growth also indicate "full growth," maintaining a similar annual growth rate.

Scenario 3: Strong government support amidst a global economic recession predicts a decline in Thailand's health tourism economy, with growth rates ranging from -2.00% to 3.00%.

Scenario 4: No government support with robust global economic growth.

Scenario 5: No government support with moderate global economic growth forecasts a negative trajectory, mirroring Scenario 3's growth rates.

Scenario 6: No government support with a global recession project the most pessimistic outlook, with economic growth between -2.00% and 0.10%.

3. Interviews with stakeholders across four key groups within Thailand's health tourism industry – policymakers, policy implementers, entrepreneurs, and academics (both domestic and international) – revealed a strong consensus on policy priorities. The most urgent need is to increase and enhance the capacity of the healthcare and social service workforce. This is followed by expanding academic programs focused on health promotion and facilitating health insurance coverage for international tourists through bilateral agreements between governments.

Discussion: A study on health tourism trends in Thailand indicates rapid growth in recent years. Over the next five years, health tourism is expected to develop in line with nine key trends, positively impacting both individuals and the economy. These trends will support the physical and mental well-being of tourists while bolstering local industries, attracting health-conscious travelers seeking immersive cultural experiences. This growth not only generates new revenue for the country but also promotes sustainable economic development within local communities.

Keywords: Health Tourism, Wellness Economy, Future Scenario of Health Tourism



ADMINISTRATIVE STRATEGIES FOR ENHANCING HEALTH TOURISM STANDARDS TO ATTRACT HIGH-QUALITY TOURISTS IN THAILAND (2024)

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Abstract

Background: Thailand aims to advance its health economy by positioning itself as a premier global wellness destination. Despite this ambition, a significant gap exists in structured evaluation and standardized frameworks for health tourism projects. To bridge this gap, a robust administrative plan is required to elevate service quality and product standards, leveraging local cultural assets while fostering tourist trust through stringent quality assurance and investment attraction.

Objectives: This research aims to analyze and estimate the level of achievement of the "Enhancing Health Tourism Standards for High-Quality Tourists" projects in both the completed 2023 and ongoing 2024 projects. This analysis aligns with the goals of Program Management Unit for Competitiveness (PMUC). The research integrates the output of the projects in both years, including monitoring, follow-up, and expediting research projects under the program. This will lead to an evaluation and delivery of research project outcomes.

Methodology: This research employs a program evaluation design using mixed methods. Key variables include project outputs, alignment with PMUC strategic goals, and sustainability indicators. Data were collected via concrete instruments: structured questionnaires for surveys with project teams, semi-structured interviews for in-depth insights, and field notes from operational observations. Quantitative data were analyzed using descriptive statistics, while qualitative data underwent thematic content analysis.

Result(s): The 2023 projects achieved full alignment with PMUC goals, confirming the effectiveness of the administrative plan in delivering well-structured research frameworks and meeting planned objectives. For the 2024 cycle, the integration of eight projects showed ongoing progress, supporting the hypothesis that collaborative frameworks—utilizing the Wellness Destination Competitiveness framework and PEST analysis—enhance sustainability across seven dimensions. Monitoring results confirmed that 100% of 2023 projects reached completion, while 2024 projects are progressing on schedule, indicating efficient administrative oversight and multi-sectoral synergy.

Discussion: This research anticipates fostering collaboration among public, private, local, and community sectors. The research outputs will serve as a foundation for developing health tourism standards, elevating tourism quality, and promoting long-term sustainability across economic, social, and environmental dimensions.

Keywords: Wellness Tourism, Administrative Plan, Health Tourism Standards, High-quality Tourists



TRANSFORMING HEALTH SPA BUSINESS INTO CARBON FREE INDUSTRY

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Abstract

Background: Health spa services are resource-intensive, requiring continuous energy and water inputs to run equipment, service processes, and hygiene standards. High energy consumption, often reliant on fossil fuels, contributes to carbon emissions through water heating, product steaming, room temperature control, as well as equipment cleansing. Therefore, spa operational procedures are closely linked to environmental and health impacts. Integrating carbon-reduction strategies, including renewable energy, energy-efficient technologies, and sustainable water management, can mitigate these effects while promoting safer, healthier, and environmentally responsible spa services.

Objectives: This study aimed to 1) develop prototype models of carbon-free spa business and 2) evaluate the reduction in carbon emissions achievement in the prototype.

Methodology: This study employed research and development (R&D) approach by Richey & Klein (2007) and was conducted between February 2023 and January 2024. The processes involved iterative phases, including model design, development, and pilot implementation. Data were collected using structured questionnaires to assess key indicators related to energy and water consumption, operational practices, and carbon emission outcomes.

Result(s): In pilot testing, eight spa businesses served as prototype models of carbon-free health spas. A total of 80 clients participated in pilot testing and reported high satisfaction with both personnel and service quality. The prototype also incorporated seven carbon-free spa product formulations, developed from locally sourced natural ingredients certified by ECOCERT. In addition, service packages were designed based on the 4R principles (Reduce, Reuse, Recycle, and Repair). The results of the carbon footprint assessment for health spa services indicated levels of greenhouse gas emissions across each stage of service delivery. Emissions were quantified for pre-service preparation, reception, treatment program, post-service care, and cleaning processes, with values of 0.05, 0.51, 2.39, 0.45, and 0.02 kgCO₂ equivalent, respectively. Overall, the total greenhouse gas emissions generated throughout the Thai massage service amounted to 3.42 kgCO₂ equivalent.

Discussion: The study findings can be applied by health spa business and related organizations to enhance environmentally sustainable services. Furthermore, governmental support is recommended



to promote carbon-free health spa services, strengthen production capacity of carbon-free spa businesses, and support sustainability in health and wellness tourism.

Keywords: Health Spa, Carbon Free, Prototype Model, Nurses, Health Providers



URBAN BLOCK THERMAL ENVIRONMENT SIMULATION AND OPTIMIZATION METHOD BASED ON CONTROL UNIT

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Abstract

Introduction: The prolonged duration of high temperatures and frequent heat wave events in hot-summer and warm-winter cities not only threaten human comfort and health but also significantly impact building energy consumption. Under the current national strategy of developing “livable, resilient, and smart” cities, systematically optimizing urban block thermal environments during the urban design and regulatory planning stage has become particularly important.

Research Objective(s): This study aims to systematically elucidate how to closely couple thermal environmental assessments with block planning.

Literature Review: Urban microclimates are significantly influenced by key parameters such as building morphology and underlying surface characteristics. However, traditional urban planning often lacks quantitative tools to bridge environmental sensing with performance evaluation. To address this, this study aims to systematically elucidate how to closely couple thermal environment assessments with block planning by establishing thermal environment control units for quantitative management at the neighborhood scale.

Methodology: A complete simulation-based technical pathway from environmental sensing to performance evaluation was constructed. The study investigated 234 thermal environment control units across a 100 km² study area in Guangzhou, China. Control units were delineated based on Local Climate Zone (LCZ) classifications overlaid with block-scale street networks. Utilizing an improved Urban Weather Generator (UWG) model—validated via field meteorological station data—we simulated microclimate conditions. Key evaluation metrics included Urban Heat Island (UHI) intensity (defined as the urban-rural canopy temperature difference), thermal comfort evaluated via Universal thermal comfort index (UTCI), and building energy consumption measured by cooling energy demand (W/m²).



Results: Compared to the baseline scenario of the existing unoptimized urban morphology, the optimized control unit planning demonstrated significant improvements, even under an increased urban development intensity (such as an increase in Floor Area Ratio (FAR)). Quantitatively, the optimized morphological interventions reduced average UHI intensity by 27.9% decreased UTCI by 4.3%, and building cooling energy consumption was reduced by 8.0%.

Discussion and Conclusion: This approach successfully reveals the complex mechanisms of how building morphology and surface characteristics influence the local thermal environment. The findings provide robust theoretical foundations and practical decision-support tools for urban planners, municipal decision-makers, and real estate developers to balance high-density development with climate resilience. Future work will focus on extensive field validation across varied urban typologies within the hot-summer and warm-winter climate zone.

Funding: This work was supported by Yunnan Fundamental Research Projects (grant NO. 202501CF070061) and Yunnan Provincial Science and Technology Department-Applied Basic Research Joint Special Funds of Chinese Medicine (grant NO.202501AZ070001-195).

Keywords: Thermal Environment Control Unit, Urban Microclimate, Urban Heat Island Mitigation, Urban Block Planning, Performance Assessment



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Keywords: Thermal Environment Control Unit, Urban Microclimate, Urban Heat Island Mitigation, Urban Block Planning, Performance Assessment

MACHINE-LEARNING-BASED IDENTIFICATION OF KEY FACTORS AFFECTING A DUAL-PRESSURE EVAPORATION ORGANIC RANKINE CYCLE (DPORC)

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Abstract

Introduction: Low-grade waste heat recovery is an important approach to improving energy efficiency and reducing carbon emissions. A dual-pressure evaporation organic Rankine cycle (DPORC) offers better thermal matching and greater performance potential than a conventional organic Rankine cycle (ORC). However, strong nonlinear coupling among evaporation pressures, heat-exchanger temperature differences, and component efficiencies makes it difficult to identify the key factors governing system performance. Therefore, an interpretable framework is needed to identify the dominant parameters governing DPORC performance and to quantify their interaction effects.

Research Objective(s): This study aims to identify the key parameters governing DPORC thermodynamic performance and to quantify their individual and interactive effects by integrating thermodynamic simulation, machine-learning-based surrogate modeling, and global sensitivity analysis.

Literature Review: Previous studies have shown that ORC performance is jointly affected by working-fluid selection, evaporation conditions, condensation conditions, and component efficiencies. For DPORC, the coupling between high-pressure (HP) evaporation and low-pressure (LP) evaporation further increases the complexity of heat-source matching, power generation, and irreversibility distribution. Although thermodynamic analysis and parametric optimization have been widely applied to ORC systems, quantitative identification of dominant factors and their interaction effects in high-dimensional parameter spaces remains limited. Machine-learning-based surrogate modeling combined with Sobol' global sensitivity analysis provides an effective approach for characterizing nonlinear input-output relationships and parameter importance.

Methodology: An integrated framework combining thermodynamic simulation, machine-learning-based surrogate modeling, and global sensitivity analysis was developed. Sobol sampling was used to generate input combinations for nine working fluids: R600a, R600, R601, R1224yd(Z), R1233zd(E), R1336mzz(Z), R1234yf, R1234ze(E), and R1234ze(Z). The input variables included HP



evaporation pressure, LP evaporation pressure, HP superheating degree, LP superheating degree, subcooling degree, evaporator pinch-point temperature difference, condenser pinch-point temperature difference, HP pump efficiency, LP pump efficiency, HP turbine efficiency, LP turbine efficiency, and cooling-water pump efficiency. Net power output, thermal efficiency, and exergy efficiency were used as the performance indicators. The common sampling ranges were 0-20 K for the superheating and subcooling degrees, 3-20 K for the pinch-point temperature differences, and 0.5-0.9 for the efficiency parameters, while the HP and LP evaporation pressures were constrained between the condensation pressure plus 100 kPa and 0.9 times the critical pressure. After data filtering, normalization, and dataset splitting, polynomial chaos expansion surrogate models were optimized and validated using independent test data. The surrogate model accuracy was evaluated by R^2 , MAE , MSE , and $RMSE$. Total-order, first-order, and second-order Sobol' indices were then derived from the surrogate models to quantify the individual and interactive effects of the input parameters on system performance.

Results: The independent validation results demonstrated good predictive performance of the surrogate models, with overall R^2 values ranging from 0.978 to 0.997 across the three performance indicators. Exergy efficiency and net power output displayed highly similar sensitivity structures. Based on the average results across all nine working fluids, the combined first-order contribution of LP evaporation pressure, evaporator pinch-point temperature difference, and condenser pinch-point temperature difference was approximately 51.7% for both exergy efficiency and net power output. In both cases, the strongest average second-order interaction was observed between the HP evaporation pressure and LP evaporation pressure. By contrast, thermal efficiency was primarily governed by LP evaporation pressure and LP turbine efficiency, whose average combined first-order contribution reached 55.87%. Regarding working-fluid-dependent behavior, R600a, R1234ze(E), and R1234ze(Z) exhibited stronger pressure-coupling characteristics; R601 and R1336mzz(Z) were more strongly influenced by LP turbine efficiency; and R1234yf was more sensitive to the condenser pinch-point temperature difference.

Discussion and Conclusion: The proposed framework achieved the objective of identifying the dominant parameters governing DPORC performance and quantifying their interaction effects. The results indicate that the key controlling factors vary with the selected performance indicator and working fluid, highlighting the need to coordinate working-fluid selection with parameter matching in DPORC design and optimization. Overall, integrating thermodynamic simulation, machine-learning-based surrogate modeling, and Sobol' global sensitivity analysis offers a robust basis for parameter



screening, structural optimization, and performance-oriented design of low-temperature waste-heat recovery systems, and it can support future studies on broader operating conditions and multi-objective optimization.

Funding: This work was supported by the Yunnan Provincial Natural Science Foundation (Grant No. 202501AT070200) and Yunnan Provincial Science and Technology Department-Applied Basic Research Joint Special Funds of Chinese Medicine (Grant No. 202501AZ070001-195).

Keywords: Dual-pressure Evaporation Organic Rankine Cycle, Machine Learning, Global Sensitivity Analysis, Sobol' Indices, Thermodynamic Performance