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Research Paper

Utilizing an Implicit Health Analysis Integrated Simulation for Hospital-Nurse Staffing Strategy

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Abstract: This summary presents the application of an integrated simulation platform for the analysis of poor health in practical nursing care. The platform uses advanced techniques to model and analyse the complex health behaviours of nursing home residents. The platform leverages implicit health analysis to capture hidden patterns and subtle changes in people's health to better understand their needs. Through simulation-based evaluation, various aspects of the strategy can be analysed, including employee engagement, community health, and the need for assistance. The platform provides the framework for improving employee decisions by identifying the best strategies to meet the diverse and changing needs of nursing home residents.
Using this new approach, nursing homes can improve care, reduce labour costs and ultimately improve residents' overall quality of life.

Keywords: Skilled Nurse, Registred Nurse,NB,Simulator

1. Introduction

Skilled Care Facilities, also known as Nursing Homes (NHs), provide 24/7 care and support to the elderly and those with a variety of chronic conditions and age-related disabilities. Due to a rapidly ageing population, the United States is expected to experience an increase in the number of people with disabilities. However, despite the high cost of NH care, quality care cannot always be guaranteed. NH has been penalised for many shortcomings for violations, and shortages of staff and public funding continue to hinder the delivery of quality care. Effects of NH staff on community outcomes and quality of care [1]. Currently, NH applications rely on the knowledge of managers or government regulations, without a simulation-based decision support platform with predictive analytics to make decisions for people to do the appropriate work. Current literature on clinical trial modelling mostly focuses on acute care settings such as hospitals and emergency rooms, while neglecting long-term care settings such as NH [2]. To investigate the decisions of NH officials, several challenges need to be addressed. The length of hospital stay (LOS) for NH residents ranges from a few days to months or years and there may be multiple discharges. The assumptions of the LOS model are insufficient due to the complexity caused by the different types of emissions.Therefore, there is a need to develop predictive models that take into account multiple evictions and improve LOS estimates for New Hampshire residents. Additionally, New Hampshire residents suffer from a variety of chronic conditions and functional disabilities that result in the need for a variety of services. Current systems often assume patient consistency while ignoring the individual characteristics and care of NH residents. To overcome this limitation, a simulation model should be developed to capture the heterogeneous service needs of individual NH residents.An integrated computer simulation platform for stealth survival analysis is proposed to solve these investigations [3].The platform aims to identify the real-time needs of New Hampshire residents and evaluate action plans based on various census scenarios. A prediction method based on latent survival analysis improves the NH LOS model by taking into account various emission factors. The simulation model includes individual features to accurately represent the needs of New Hampshire residents [5]. The model supports the assessment of employee entry and recommends the most appropriate staff to NH managers to meet service needs while reducing labour costs. The simulation-based decision support platform developed by combining analytical methods with computer simulations and NH experience to enable NH managers to better understand their career decisions.A proof-of-concept study using randomised clinical trial data from a local NH centre demonstrated the effectiveness and efficiency of the plan. To increase usability, an easy-to-use graphical user interface has been designed that allows administrators to make real-time settings, update employee requirements, and view simulation results, thus supporting the widespread use of this tool in the NH application [1].

By modelling this project, we can clarify the following: -
Improving Patient Satisfaction: This project focuses on increasing patient satisfaction, which is the brand's major goal for the hospital. Hospitals can achieve greater satisfaction by

improving staffing and quality standards of care, ensuring that patients receive the care and support they need [3].

Predictive Modeling and Optimization: Using a combination of modelling and optimization, hospital managers can create effective and efficient future plans [1].
These models help predict the number of nurses needed and provide an effective plan to meet patient needs while reducing hospital costs.

Nursing Staff: A staffing model provides hospital managers with a framework to anticipate nursing needs and make informed hiring decisions. By assessing staffing needs, hospitals can provide adequate coverage to meet patient needs, maintain quality of care, and improve the capital allocation layer.
Comply with Law Changes: Use this model to introduce new thinking in the hospital setting, making necessary adjustments to new regulations and changes in the industry. This change enables hospitals to adapt to evolving medical procedures and quality control regulations [1].

2. Related Work

2.1 Real-world case study

It demonstrates the feasibility of a simulation using real-world data from a skilled nurse (NH) representative in the Tampa Bay area. Data from the Minimum Data System (MDS), which provides information on New Hampshire residents [1].

The descriptive statistics in Table 2 provide insight into the characteristics of residents. The data shows that most residents are women, with many aged 65 and over. In addition, more than 90 percent of residents suffer from at least one chronic illness such as cancer, high blood pressure or diabetes [4].

When it comes to help with activities of daily living, about 75% of New Hampshire residents need moderate assistance with Activities of Daily Living (ADLs), which is on the 2 to 10 ADL scale. On the other hand, about 20 percent of residents have an ADL score of 11 to 16, with a higher level of physical disability and needing more assistance.The data also showed that more than 95% of residents received treatment and treatment. treatment. The use of these services varies from person to person, reflecting the different needs of residents.

Using real-world data in simulations, researchers can model and analyse the impact of different strategies on worker and resident needs, resource allocation, and overall NH performance [2].

This validation with real-time data improves the usability and impact of the simulation platform, providing NH managers with insight to make informed decisions to improve the quality of care for their patients.

2.2 Comparative Performance Evaluation Model and Evaluation:

Analysis of NH records, including data from 759 NH residents, focusing on resident daily arrivals and length of stay (LOS). For modern arrivals, different parametric distributions are compared, such as the Poisson and negative binomial (NB) distributions. The goodness of fit of these distributions was evaluated using the chi-square test. The NB distribution (NB(r, p)) has proven to be the best fit for the actual arrival data, and a p-value of 0.38 indicates a good fit.Using the arrival prediction model, the study used the latent survival model to analyse real NH LOS data and evaluate its performance. The data show that the two main discharges for residents are returning to the community (61% of residents) and reading (24% of residents). Other treatments were considered inconclusive and were not included in the analysis.

We compared the predictive performance of the proposed model with two methods: the LOS model, which does not include various emissions wastes, and the LOS model, which groups LOS data into groups based on observed text. The proposed model outperformed the prediction, as demonstrated by the correlation between the estimated Kaplan-Meier (K-M) curve and the actual LOS model [3].

In contrast, other methods show unsatisfactory accuracy of accuracy, resulting in lower LOS. It discusses the limitations of other methods. LOS models that do not include multiple waste releases simplify model assumptions and fail to capture the various types of waste associated with NH assets. Methods that group LOS data into groups by tags ignore the occurrence of output events and the possibility of changes in the output group. Therefore, these options do not fully reflect the complexity of exit events and their relationship to the residents' LOS [6].

The findings highlight the importance of considering multiple discharges and including potential discharge events when modelling NH LOS. The proposed survival model improves the accuracy of the prediction and provides a better understanding of the factors influencing LOS in NH residents.

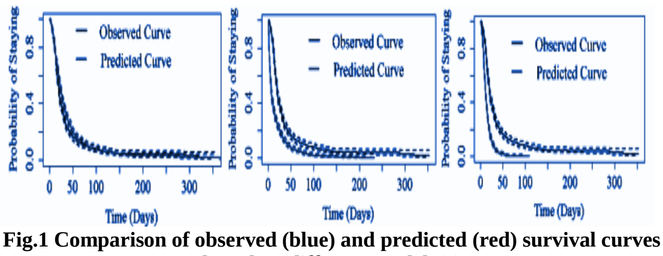

Fig.1 Comparison of observed (blue) and predicted (red) survival curves based on different models(1)

Comparing the LOS model with and without considering various waste emissions further highlights the importance of the predictive analysis method. Figure 1 shows simulated demand, performance and total operating cost under the two models. The LOS model with good prediction performance (recommended model) provides more accurate predictions than the LOS model, which ignores multicasts. The inaccuracy of the LOS model, which does not include many discharges to the field level [4] results in a lower demand in Figure.

Thus, this leads to worker shortage as shown in figure (b). Determining the number of workers according to the wrong LOS model ultimately leads to higher labour costs due to poor workers, as shown in figure (c).

Together, the improved design accuracy of the demand forecast simulation model enables operational strategies to be implemented to meet occupant needs while reducing overall labour costs. This comparison highlights the importance of considering multiple discharges in estimating service need, recruiting appropriate staff, and optimising operating costs at NH plants [1]

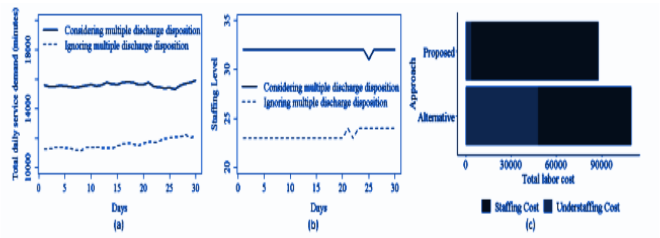

Fig.2 Facility-level performance comparison(1)

The performance of the proposed model to predict LOS is further evaluated by comparing the simulated daily occupancy model for a month with the real observation model. Panel (a) clearly shows that the simulated results have a similar distribution to the real observations. A two-sample Kolmogorov-Smirnov (K-S) also found no difference between simulated and observed data with a p value of 0.52 [3].

In contrast, the simulated output of the conventional method, ignoring various discharges, shows unsatisfactory validation results (panel (b)) with low p-values in the K-S test. The simulated residence based on the LOS model is generally lower than the actual residence. This inconsistency is due to the LOS inconsistency in the model, which, as shown, ignores the effect of multiple discharges [7].

Also simulated numbers in real time (according to plan) are compared with real data for better use of the simulator.Panel (c) shows the 95% confidence interval for the simulated population volume, including the total daily population, and the actual and confidence intervals for the simulated product.

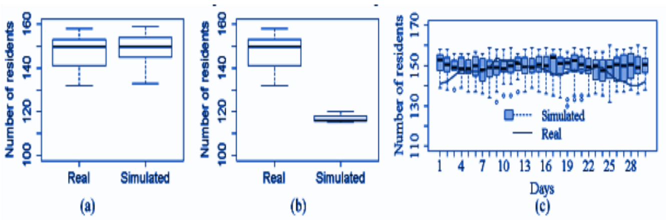

Fig. 3(1)

2.3 Evaluation and Comparison of Employee Strategies:

Once the simulation model has been validated, different employee strategies can be evaluated as the employee-resident (SR) ratio. Three main staff ratios are compared: the minimum SR rate from government regulations (National SR Rate), the current SR rate used by the NH as reference monitoring staff (Plant SR Rate), and the platform-recommended SR rate (Report. SR rate). Total cost of operation during simulation was used as a performance measure to compare these strategies [2].

To evaluate this policy, over- or under-staffing is calculated in minutes using simulated on-time service requests and hourly SR rates at the facility level. Additional temporary care workers may be called in to make up for the shortage, resulting in additional personnel costs [1].

Total labour cost includes planned costs for staff for nursing staff and temporary costs for temporary staff during simulation.CNAs providing direct care to residents were surveyed using census data for NH residents. Three recruitment strategies for CNAs were compared: state SR rate, district SR rate, and demand SR rate [5]. The graph shows that the demand SR ratio provides a more appropriate level of staff allocation to meet service demand than the other two strategies.The state SR ratio results in worker shortages, while the location SR ratio results in worker surplus.Overall, the simulation platform allows for the evaluation of different opinions of employees based on the SR ratio, allowing the necessary employee decision to balance needed help and rewards [1].

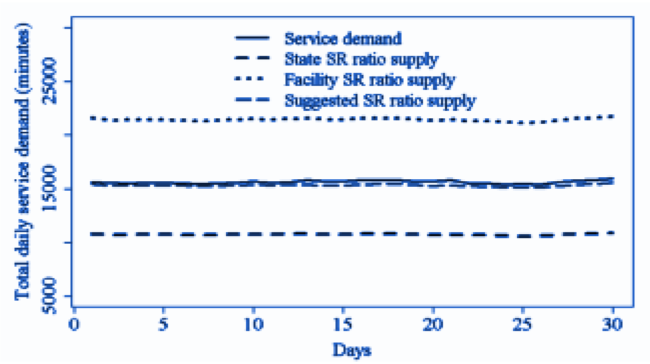

Fig. 4 Compare CNA services and requests by SR variable(1)

Table– Taken from Reference(1)

Total labor cost of CNAs under different staffing ratios with 20 replications

Staffing strategy (SR ratio)	Total labor cost (thousand $)	95% CI (thousand $)	Staffing cost (thousand $)	Avg. daily overstaffing (minutes)	Avg. daily understaffing (minutes)
State SR ratio (1/20)	110.2	(107.3, 112.9)	58.1	0	2366.6
Facility SR ratio (1/10)	116.2	(114.4, 117.9)	116.2	2914.4	0
Suggested SR ratio (1/14)	85.9	(83.8, 88.1)	82.9	32	135.3

2.4 Census-based conditions variations:

The census population of NH may change over time and between different NHs, so the SR ratio needs to be adjusted. The simulation model allowed the creation of "what if" scenarios and other calculations to evaluate the SR value in each scenario. In the base case, between 75% and 95% of the population should seek medical care and have an average level of physical dependence [3] Three other scenarios are considered:

"More Physically Independent" Scenario (S1): In this scenario, 70% of the population is less dependent, generating Activity of Daily Living (ADL) scores compared to baseline conditions [1].

"Less Physical Independence" Scenario (S2): In this scenario, 70% of residents are highly physically dependent, resulting in a 60% increase in ADL scores over the baseline scenario."Reduced need for treatment" scenario (S3): In this scenario, the ADL level is the same as in the baseline scenario, but the percentage of treatment pain for residents is reduced by 50%.graphs showing simulated demand and performance for each scenario with different SR [4] Volume models based on service demand models do not take into account individual differences and cannot capture service demand changes between different situations with different statistical calculations. In contrast, simulation models suggested the needs of NH residents based on their characteristics.The results in Figure show significant differences in service requirements across conditions [1]. A one-size-fits-all staffing strategy based on the SR firm model cannot meet the needs of different situations. For example, the state SR rate (20 residents in 1 CNA) is better to meet the needs of the service in case of S1, where residents are more independent. However, in Scenario S2, where residents are more dependent, the local SR rate (10 residents in 1 CNA) is better for solving more needs while the state SR rate is not sufficient [6].

These findings highlight the importance of tailoring staffing strategies to the unique characteristics and needs of the New Hampshire population in a variety of situations, rather than relying on a competitive SR. The simulation model is designed to provide evaluation and optimization of staffing strategies to meet the needs of NH residents.

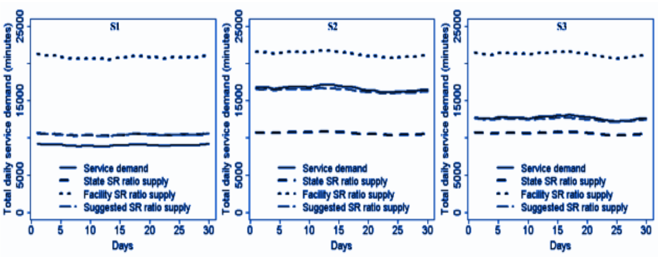

Fig. 5 Comparison of service demand under different composition scenarios and staffing supply based on staffing strategies with different SR ratios(1)

In this study, 20 iterations were made and the average total operating cost was calculated according to the SR ratio determined for each counting scenario. Recommended SR rates vary from count to count due to changing needs. This simulation model has captured many service needs, including different scenarios, resulting in staffing needs in each scenario [1].

The results summarised in Table 4 show that the recommended SR ratio consistently reduces the total cost in all cases. In contrast, using a one-size-fits-all staffing strategy, such as state or office SR, results in higher labor costs.This higher cost is attributable to unskilled workers due to under- or over-staffing. Finding highlights the importance of tailoring staffing strategies to specific census situations and considering the unique characteristics and needs of New Hampshire residents. By optimising the SR ratio according to the consensus model, NH plants can reduce energy costs while continuing to meet different needs.

2.5 Employee assessment of other groups of NH nursing staff:

This study expanded the simulation platform to evaluate work strategies for different types of nursing in NH, particularly registered nurses (RNs) and licensed practical nurses (LPNs). RNs are responsible for advanced patient care such as administering medications and implementing plans, while LPNs provide clinical and nursing care.(3) The needs of each type of caregiver vary according to their individual roles and responsibilities. Figures (a) and (b) show the evaluation and comparison of career strategies for RNs and LPNs. The suggested input is the state SR rate, the position SR rate, and the specified SR rate is recommended by the simulation platform.(4)The results showed that state and federal SR rates for RNs and LPNs contributed to poor performance. This finding highlights the importance of using a more targeted and flexible approach to staffing NH institutions. The platform is proposed in such a way that it can meet the needs of different services according to individual characteristics and needs, by recommending the appropriate SR compared to both RN and LPN. Using the SR ratio guide, facilities can optimise staffing levels with the specific needs of high performance monitoring, and expanding the simulation platform to evaluate the work strategy for different employees of supervisors shows the benefits for employees in different fields. roles Flexibility and usability. To configuration issues on the NH kit [1].

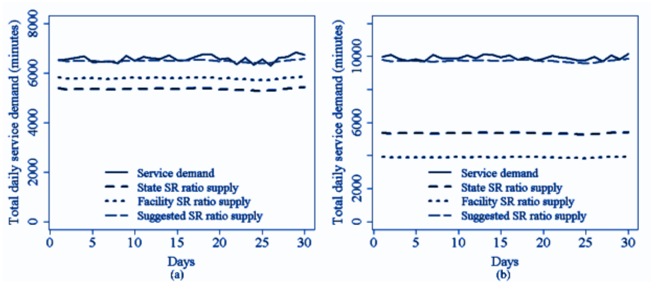

Fig 6 Match service requests and supplies with (a) RN and (b) LPN in different SRs(1)

3. Proposed Methods

An integrated simulation platform for predictive modelling for NH quality assessment was built from the ground up and consists of several key modules. The platform has several key features, including a separate NH residence time (LOS) estimator, a separate operator routine simulator, and a graphical user interface.

Personal NH LOS Predictor is a handy module that uses predictive values to predict each person in a nursing home. The estimator improves the accuracy of the LOS model for New Hampshire residents by considering multiple evictions. The Employee Daily Work Simulator is another feature that simulates daily employee needs based on the unique characteristics and care of each resident.This example provides a better representation of workforce needs, taking into account the diversity of service needs among New Hampshire residents.

The platform includes a graphical user interface to increase usability and simplify decision making. The interface allows NH administrators to edit real-time settings, update employee policies, and view simulation results. The user-friendly interface makes this platform widely used in real NH environments. Details are as follows.

3.1 Personal NH LOS Predictor

Personal NH LOS Predictor is an integral part of an integrated simulation platform for predictive modelling for NH personnel quality control. It is designed to estimate the length of stay (LOS) in skilled nursing facilities (NH) for each resident. Unlike acute care hospitals, where patient length of stay tends to be consistent, hospital stays for NH residents can range from days to months or years. This variable estimate includes the complexity of the many discharges New Hampshire residents may be discharged from, such as being discharged into their community or transported to the hospital due to an emergency. The Predictor uses previous forecasting methods, specifically Hidden Survival Analysis, to improve the accuracy of the LOS model for New Hampshire residents.

By determining the number of discharges, the technician can give a rough estimate of how long each resident will spend at the facility.

Development of a specialist NH LOS that includes review of unidentified clinical trial data from local NH facilities. Using this information, the predictor can take into account many factors that can affect the length of stay, including the resident's workload, diagnosis, nursing care received, and treatment.

The accuracy of individual NH LOS estimates is important for assessing the quality of NH staff. It allows NH managers to estimate the length of each resident, which helps determine appropriate staffing and resource allocation.Armed with this information, managers can improve staffing decisions to ensure NH can meet people's needs while reducing labour costs. The Personal NH LOS Predictor is an essential tool for NH managers, enabling them to make informed decisions and manage the entire office. By incorporating this forecast into an integrated predictive simulation platform, managers can understand the occupants' LOS and use this information to improve the performance, quality, and effectiveness of NHs' operational strategies.

3.2 Personal Worker Time Simulator

Personal Worker Time Simulator is a major project envisioning an integrated simulation platform for evaluating work strategies in NH. This simulator aims to estimate the daily staff required to care for each resident in a nursing home (NH). In NHs, residents suffer from a multitude of chronic diseases, functional limitations, and changing care needs. Therefore, it is important to understand the different needs of New Hampshire residents in order to provide the right staff. The Daily Worker Hours Simulator overcomes this challenge by simulating the daily hours required for maintenance based on the unique characteristics and views of each resident.

The simulator includes many personal factors that affect the care needed, such as the assistant's occupation, diagnosis and specialist services received. For example, different residents may need different levels of assistance with activities of daily living (ADL), such as eating, dressing, bathing, and getting around. By combining these individual characteristics, the simulator can more accurately predict the number of staff hours that residents need each day. Historical data and observations from NH were analysed to develop a personal daily work simulator. This information includes information about the type and cost of care for residents, and the time spent by different caregivers, such as nurses and aides, in specialised nursing jobs.

By analysing this data, the simulator can understand patterns and relationships between individual characteristics of residents and social workers when care is needed.
Simulator uses simulation models to create realistic scenarios and simulate nursing home operations in NH. It dynamically represents employees who need timely assistance, taking into account the characteristics of the residents. This enables NH managers to understand how staff should allocate time to residents and to make informed decisions about staffing levels and budget allocations. The accuracy and efficiency of the Personal Daily Worker Time Simulator is critical to optimising NH operations and service management.

By providing a reliable estimate of the staffing hours needed for each resident, managers can ensure that NH has enough staff to meet people with different needs. This not only improves the quality of care, but also helps to improve labour costs and resource allocation.The simulators also contribute to the overall assessment of staff entry in NHs. It allows managers to assess the impact of different staff and organisation on residents' overall service needs and outcomes. By tracking status and analysing simulation results, managers can decide on staffing strategies that reduce labour costs and maintain quality care while meeting service needs.

Integrating a personal staff routine simulator into a predictive analytics integrated simulation platform provides a better understanding of staffing needs in NHs. By integrating this model with other products such as the Individual NH LOS Predictor and GUI, managers can better understand residential care needs and make decisions about employee information. Overall, the Personal Daily Staff Time Simulator helps NH managers understand the various care needs of residents and develop effective strategies for these people. The simulator increases the accuracy and efficiency of NH staff's decisions by using the best simulation techniques and incorporating individual characteristics of residents. In the submodule Distribution of Needs above, we categorise NH residents according to their specific needs.We use the personnel design submodule to determine the service needs of people in each service need group. Because we don't have actual working hours from the state of New Hampshire where we work, we included the STRIVE project, which provides data on the average number of people working in New Hampshire each day. Project STRIVE is a comprehensive study collecting data on more than 97,000 NH residents in more than 200 representative NHs in various states. It leverages digital assistants to capture raw employee data over time. This program provides the national average of the number of daily workers required by residents in each group.Employee hours measured by STRIVE include direct employee audit hours and indirect audit hours. Direct caregiver time includes activities such as feeding, dressing, administering medication, teaching, and doctor consultation. Indirect caregiver time includes activities such as medication, administration, education, rest, and meals.To determine the number of day labourers needed for each resident, we determined a distribution with a measure to model direct and indirect care workers. For direct care and indirect care, we assume that employees are independent. This model was chosen for its simplicity and efficiency. Using data from the STRIVE project and modelling worker hours using these distributions, we were able to estimate the number of daily workers needed by New Hampshire residents in each industry. These estimates will help inform staffing decisions and allocate resources at NH facilities, ensuring residents receive care based on their unique needs.

3.3 Simulation and Development Application in Graphical User Interface:

The simulation application and Graphical User Interface (GUI) development are products of the integrated simulation platform for NH operators to forecast for quality assessment studies.Implementation of simulation involves transforming concepts and models into operational simulations. It requires the development of algorithms and programming codes to simulate various processes and interactions in a nursing home (NH). This includes modelling occupants' movements, allocating staffing resources, and establishing daily staffing needs based on occupant characteristics. The Simulation application also includes predictive models developed in previous versions, such as the Personal NH LOS Estimator and the Personal Daily Uptime Simulator.These models provide input and parameters for simulations, enabling them to create real situations and outcomes based on the differing opinions of employees and people in the mix.

Additionally, the use of simulation includes data management and integration. It may be necessary to access and integrate relevant information such as historical NH records, spreadsheets, and built-in features. Simulation systems need to efficiently generate and process this information to support accurate and timely simulations. The Graphical User Interface (GUI) development focused on creating an intuitive and user-friendly interface for NH administrators to interact with the simulation platform. The GUI is a tool for administrators to enter parameters, set operator rights, view simulation results and perform analysis. The GUI should provide administrators with options to adapt to the real environment, change employee policies, and test different scenarios. It should present the simulation results in a clear and understandable way, such as visualisations, graphs, and reports. This enables managers to make informed decisions about staffing levels, resource allocation and overall OH management based on simulation results.

Additionally, the GUI should provide easy modifications and customizations to suit NH's differences and needs.
It should allow administrators to customise the simulation platform for their specific needs, such as defining the group's needs, adjusting staffing ratios, and including special restrictions or rules. The development of the GUI effectively improves the usability and usability of the simulation platform, making it more useful in the decision-making process of NH managers. It allows managers to explore various employee activities, evaluate their impact on service needs, residency outcomes and labour costs, and select the most appropriate working method based on simulation results. In general, the use of simulation and GUI development is essential to transform predictive modelling into practical and user-friendly simulations. It allows NH managers to interact with the platform, run simulations, and make informed staffing decisions that improve resource allocation and improve quality of care for NH residents.

4. Conclusion

In conclusion, this article provides a data-driven simulation tool to evaluate operational strategies and inform the needs of NH residents. The tool includes a LOS prediction model that takes into account various waste emissions to accurately predict how long residents live. It also uses predictive analytics to generate heterogeneous service needs based on individual characteristics.In conclusion, the development of data simulation tools for the evaluation of nursing staff has important implications for improving patient care and improving the quality of work in hospitals. Taking into account individual characteristics and service needs, the tool provides information on employee strategies that meet specific needs while reducing labour costs.

The simulation platform concept demonstrates that it is simple and practical to connect various situations and types of caregivers, such as certified practical nurses (CNAs), nurse registered nurses (RNs), and licensed practical nurses (LPNs). Examining the different strategies used by each type of caregiver highlights the limitations of a one-size-fits-all approach, such as the government or agency SR ratio, which often results in under- or unnecessary over-staffing. In contrast, the recommended rate of SR generated by the simulated device showed a reasonable level of adherence and reduced energy. Integration of Predictive Analytics and

Latent Survival Analysis into the simulation model improves the accuracy of the prediction and provides better estimation of survival time and need for assistance . However, it is important to remember that admission criteria such as LOS numbers and arrival criteria should be re-evaluated for nursing homes with different characteristics.Future research should focus on local data collection to improve simulation tools and resolve uncertainties. Collaboration with nursing homes can provide detailed information on staffing time, allowing better modelling of service requests. In addition, investigating individual decisions in capacity management, time transitions, and interactions between caregivers in the community can improve the capacity of simulation tools.A strategic simulation tool provides nursing managers and policy makers with an important decision-making framework. It allows them to evaluate operational strategies, optimise resource allocation, and improve patient care.The property provides business planning and adjustments to ensure adequate staffing, taking into account the specific needs of residents and the needs of services.

Finally, the aim of this study is to improve the general health of nursing home residents by supporting the effective and productive work of staff. Using data-driven visualisation and advanced simulation techniques, this simulation tool is useful for decision makers in the nursing industry [1].As the tool continues to be developed and improved through collaboration and research, its impact on patient care and efficiency should increase, ultimately beneficial for residents and caregivers in nursing homes around the world.

References

[1] Xuxue Sun , Nan Kong , Nazmus Sakib , Chao Meng , Kathryn Hyer , Hongdao Meng , Chris Masterson , Mingyang Li, " A Latent Survival Analysis Enabled Simulation Platform For Nursing Home Staffing Strategy Evaluation".

[2] Ridong Wanga,, Karmel S. Shehadehb,, Xiaolei Xiea,, Lefei Lia, "Integrated optimization approaches for nursing home staffing strategy evaluation",https://arxiv.org/pdf/2203.14430.pdf.

[3] U.S. Centers for Medicare and Medicaid Services, 2014. Nursing Home Penalty Data 2014. Baltimore, MD: CMS; 2014.https://data.medicare.gov/Nursing-Home-Compare/Penalty-Counts/t8q7-k6ku

[4] C. Harrington, H. Carrillo and R. Garfield, 2015. "Nursing facilities, staffing, residents and facility deficiencies, 2009 Through 2014". Menlo Park: The Henry J. Kaiser Family Foundation.

[5]Xuxue Sun , Nan Kong , Youbing Zhao , Nazmus Sakib , Chao Meng , Hongdao Meng , Kathryn Hyer , Ying Li f, Chris Masterson , Mingy ang Li, "A latent survival analysis integrated simulation platform for nursing home staffing strategy evaluation",Computers & Industrial Engineering, Volume 177, March 2023, 109074.

[6] Janiszewski Goodin, H., 2003. "The nursing shortage in the United States of America: an integrative review of the literature". Journal of advanced nursing, 43(4), pp.335-343.

[7] R Tamara Konetzka, S Clark Stearns and J Park, 2008. "The staffing-outcomes relationship in nursing homes". Health services research, 43(3), pp.1025-1042.

[8] K. Spilsbury, C. Hewitt, L. Stirk and C. Bowman, 2011. "The relationship between nurse staffing and quality of care in nursing homes: a systematic review". International journal of nursing studies, 48(6), pp.732-750.

[9] C. Mueller, G. Arling, R. Kane, J. Bershadsky,D., Holland, & A.Joy (2006). Nursing home staffing standards: Their relationship to nurse staffing levels. The Gerontologist, 46(1), 74-80.

[10] J.R. Bowblis, 2011. Staffing ratios and quality: An analysis of minimum direct care staffing requirements for nursing homes. Health services research, 46(5), pp.1495-1516.

[11] X. Zhang, S. Barnes, B. Golden, M. Myers and P. Smith, 2019. Lognormal-based mixture models for robust fitting of hospital length of stay distributions. Operations Research for Health Care, 22, p.100184.

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