IJITCE

ISSN 2347- 3657

International Journal of Information Technology & Computer Engineering

Email : ijitce.editor@gmail.com or editor@ijitce.com

International Journal of Information Technology & Computer Engineering

ISSN 2347–3657

Volume 13, Issue 2, 2025

Comprehensive Health care ecosystem optimizing health operations and patient care

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Abstract:

The **LRO-S encryption method** not only addresses the critical need for secure data handling in healthcare but also optimizes the encryption process by reducing the time required for both encryption and decryption. By leveraging the fitness functions of lion and remora in key generation, the method ensures that encryption keys are sufficiently randomized and unique, making them more resistant to hacking attempts and unauthorized access. This enhances the privacy standards of hospital management systems and ensures that sensitive patient data remains protected even as it is stored and transmitted across cloud platforms. On the operational front, the deployment of modern frontend technologies like AJAX and Bootstrap significantly improves the usability and accessibility of hospital management systems. AJAX facilitates real-time data synchronization, allowing healthcare professionals to view and update patient information instantly without page reloads, thereby reducing response times during critical moments. Bootstrap's responsive design capabilities ensure that the system adapts seamlessly to different screen sizes, enabling doctors, nurses, and administrators to access the system from desktops, tablets, or smartphones with ease. By reducing training time and simplifying user interaction, these frontend technologies help increase the self-efficacy of healthcare workers, enabling them to interact with the system more intuitively and efficiently. This dual approach not only improves data security but also enhances the speed, adaptability, and overall quality of healthcare operations, making hospital management systems more robust and future-ready.

Keywords:

LRO-S Encryption, Metaheuristic Optimization, Serpent Algorithm, HTML, CSS, JavaScript, Bootstrap, Real-time Data, Hospital Management System, Security, Usability, Efficiency, Self-efficacy, Cloud Storage.

1.Introduction

Hospital administration is pivotal in the healthcare ecosystem, serving as the cornerstone of healthcare institutions worldwide. The management and organization of hospitals are critical components in ensuring the effective delivery of healthcare services. Hospital administrators oversee various aspects of hospital operations, from financial management and resource allocation to quality improvement and patient safety Over the years, the field of hospital administration has evolved significantly, adapting to the changing dynamics of the healthcare industry. Traditionally, it focused primarily on administrative and logistical functions. Still, recently, it has expanded its scope to encompass a broader spectrum of responsibilities, including patient-centered care, data-driven decision-making, and strategic planning The overarching goal of any healthcare system is to provide high-quality care that results in positive patient outcomes. Patient outcomes measure the effectiveness and success of healthcare interventions

and services. These outcomes encompass a wide range of factors, including the patient's overall health, satisfaction with care, recovery, and, notably, the prevention of adverse events specific to their treatment or condition Improving patient outcomes is a moral imperative and a critical component of healthcare quality and performance evaluation. Hospitals and healthcare institutions are continually working to enhance patient outcomes, recognizing that they are intrinsically connected to the reputation and success of the institution, as well as the well-being of the community it serves This comprehensive review aims to delve into the multifaceted realm of hospital administration and its profound impact on patient outcomes. We aim to explore the intricate interplay between effective hospital administration practices and patient care quality. By examining various dimensions of hospital administration, we intend to provide a holistic view of how administrative decisions and strategies can influence patient health, safety, and overall satisfaction.

2.Literature review

O'Brien et al [1]., systematically reviewed studies measuring ecosystem health, analyzed these studies' temporal and spatial distributions, and examined the assessment methods evaluating ecosystem health in freshwater and estuarine ecosystems [2]. Li et al., provided us with views of ecosystem health assessment using remote sensing in dynamic temporal and spatial scales, and presented future perspectives, current opportunities and challenges [3]. Su et al., guided us to understand the development vein of urban ecosystem health assessment [4]. Despite these studies, most analyses are still incomplete, and now out of date. Generally speaking, research analyzing the current state and the development trends of this area is rare. Scientometrics is quantitative analysis about a process, and the inputs and outputs of scientific and technological activities, to understand the knowledge mapping of scientific fields, and the developing status in relevant scientific and technological domains based on the methods of computing technology and social statistics [5]. In the past few years, it has become a universal phenomenon, and many researchers are enthusiastic about using the scientometric method to find out about hot topics and the evolving development trends in a relevant domain. Information visualization software CiteSpace is playing an increasingly important role in knowledge management activities [6]. Contrasting with other common types of information visualization software, for instance, ArnetMiner, PaperLens, and TDA, CiteSpace uses integration that can achieve cluster analysis, social-network analysis, and multidimensional scaling. In addition, CiteSpace has advantages in detecting emerging trends of a research frontier, and analyzing the relationship between a research frontier and the knowledge basis, and the internal relationship between different research frontiers [7]. In view of this series of advantages, CiteSpace is now applied in a wide range of fields and has basically been accepted by users who want to have a general understanding of their research area [8]. Yu et al., adopted types of the scientometric-analysis methods, such as cluster analysis and burst analysis, to analyze the current state and explore the development tendencies of the carbon-emission trading domain [9]. Chen made a scientometric review of the literature concerning major aspects of science mapping to identify major areas, intellectual milestones, evolutionary stages of major specialties, and transition dynamics from one specialty to another [10]. Jiang et al., applied the scientometric method, cluster analysis, and the document-sorting method to identify the hot topics and dynamic developing stages of urban-planning research under the influence of climate change [12]. Huang et al., developed an assessment-index system to analyze the relationship between rural resilience and land-use policy based on a co-citation network and research clusters [13].

3. Methodology

The CE team at HealthPartners consisted of two CTNs, a social worker, an RN, a program coordinator, and a behavioral neurologist. Intake forms were developed to collect demographic, baseline, and annual data at one year related to dementia severity and caregiver status. Experience surveys were completed at 6 and 12 months by participating caregivers. All data was entered into REDCap.

Implementation and design

The CE intervention was incorporated into a neurology-based memory clinic-HealthPartners Center for Memory and Aging (HP-CMA) and was approved by the department chair. An integrated, fee-for-service, healthcare system, HP is an insurance provider to 1.8 million insurance members and provides care delivery to 1.2 million patients. The HP-CMA CE team consisted of two CTNs, a social worker, an RN, a project coordinator, and a behavioral neurologist. Two CTNs functioned as case managers and had the most direct contact with PWDs and caregivers, providing telephonic support mainly to the caregivers. One CTN had immigrated from Venezuela, obtained an MPH, and participated in prior dementia clinical support services for the Latinx community whereas the other CTN had previously worked as an administrative assistant with little experience working with PWDs. A social worker advised CTNs and provided consultation for more complex patients. An RN assisted with any questions related to prescription medications and side-effects as well as facilitated direct communications with the neurologist caring for patients and caregivers. The CE coordinator was responsible for training CTNs, coordinating meetings, organizing patient-centered materials, and ensuring data integrity. The behavioral neurologist provided oversight and clinical guidance related to the CE team. Due to resource limitations, the HP-CMA CE lacked having the pharmacist as included in the UCSF CE

Overview of Information Systems

An information system is a combination of software, hardware, and communication networks designed to collect, process, store, and distribute data for use in workflows and to facilitate decision making and process optimization. Data become information when processed to support decision making. Information systems can vary widely in complexity and functionality, ranging from simple systems like personal spreadsheets to complex enterprise systems like Customer Relationship Management (CRM) software or Enterprise Resource Planning (ERP) systems.

International Journal of Information Technology & Computer Engineering
ISSN 2347–3657
Volume 13, Issue 2, 2025

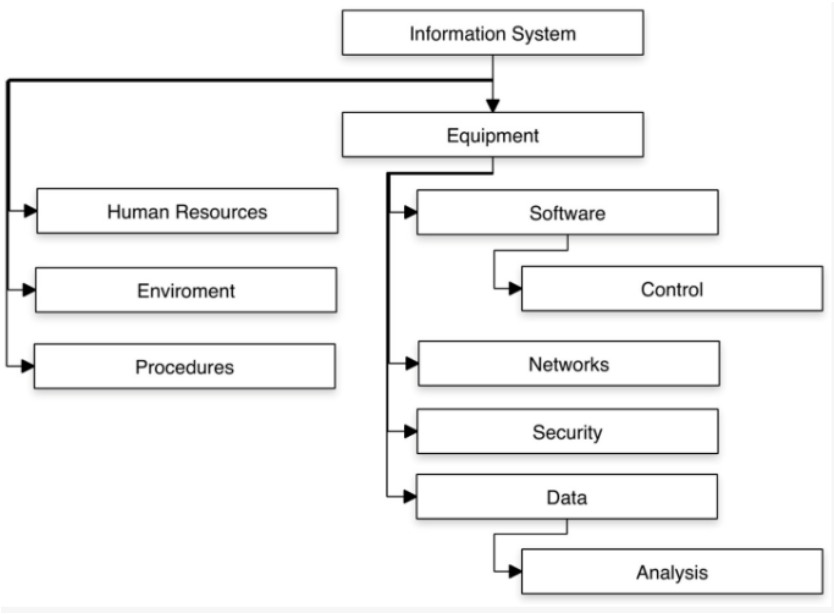


Figure: Components of an information system.

4. Data were collected through mailed or online intake

forms at baseline and then repeat questionnaires at 12-months by a subset participating caregivers (n=173). Dyads were contacted by phone if surveys went uncompleted. Caregivers were responsible for completion of intake forms. Once the intake form was completed, the dyad was officially enrolled and contributed to the total enrollment number, which represented adoption of the CE program. The data captured was modeled after outcomes described by Possin and colleagues. These outcomes included frequency of ED visits/hospitalization for PWD, caregiver depression score on the Patient Health Questionnaire (PHQ)-9 (minimal depression 0–4; mild moderate 5–14; severe>14) and caregiver burden score using the 12 item Zarit burden score, a subjective evaluation of caregiver burden that been translated into multiple languages All of the above scales were include in the baseline and 12 month follow-up sent to caregivers.

Healthcare utilization and medical care

Longitudinal outcomes related to hospitalizations and ED visits showed that the % of total participants presenting to the ED significantly increased from 36→59, $p<0.05$ (Fig. 3) over one year whereas the number of hospitalizations did not significantly change over this time. Approximately, 2.6% of acute care events were related to neuropsychiatric symptoms whereas the majority of events were related to internal medicine-related chief complaints. Healthcare utilization outcomes did not differ between rural and non-rural populations. There was no relationship between the mean call duration/# of calls with the CTN and the number of ED visits/ hospitalizations. Of the 570 dyads enrolled, the number of participants using a pillbox to assist with medication compliance dropped from 132 at baseline to 123. In addition, 37 individuals were taking 10 or more medications at baseline as compared to 33 after 1 year. The number of PWD prescribed blood thinners increased from 26 to 34. None of these changes were found to reach statistical significance.

International Journal of Information Technology & Computer Engineering

ISSN 2347–3657

Volume 13, Issue 2, 2025

Table: Care Ecosystem Participant Demographics

	Total Enrolled N = 570	Completed Intake and Year 1 N = 173
Enrollment Type		
Full	477 (83.7%)	154 (89%)
Lite	93 (16.3%)	19 (11%)
Location		
Urban	463 (81.2%)	141 (81.5%)
Rural	107 (18.8%)	32 (18.5%)
Persons Living with Dementia		
Age in Years (Mean ± Standard Deviation) [a]	75.15 ± 9.43	72.17 ± 9.18
Gender		
Male	301 (46.7%)	87 (50.3%)
Female	344 (53.4%)	85 (49.1%)
Other	1 (0.6%)	2 (0.4%)
Race[b]		
White-Non-Hispanic	410 (71.9%)	155 (89.6%)
White Hispanic	32 (5.6%)	9 (5.2%)
Asian	13 (2.3%)	3 (1.7%)
Black or African American	17 (3%)	4 (2.3%)
Native Hawaiian or Other Pacific Islander	1 (0.2%)	0 (0%)
American Indian or Alaska Native	1 (0.2%)	0 (0%)
Two or more races	3 (0.5%)	1 (0.6%)
Other	9 (1.6%)	1 (0.6%)

Discussion and implications

We found that the CE program was feasible in a highvolume neurology clinic over a 34-month enrolment period., and there was acceptability by caregivers based on survey data. The CTNs, despite carrying a relatively larger number of dyads compared to prior studies, were valued by dyads with 87–92% of participants rating their experiences as being favorable. These numbers are similar to what has been documented in the past for CTNs and suggest that PWDs and caregivers appreciate this service regardless of whether the healthcare setting is academic or non-academic

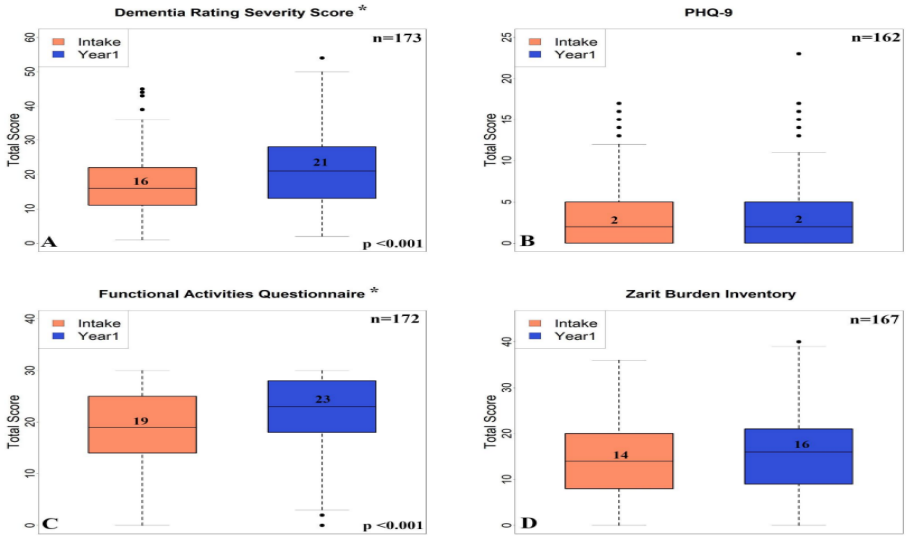
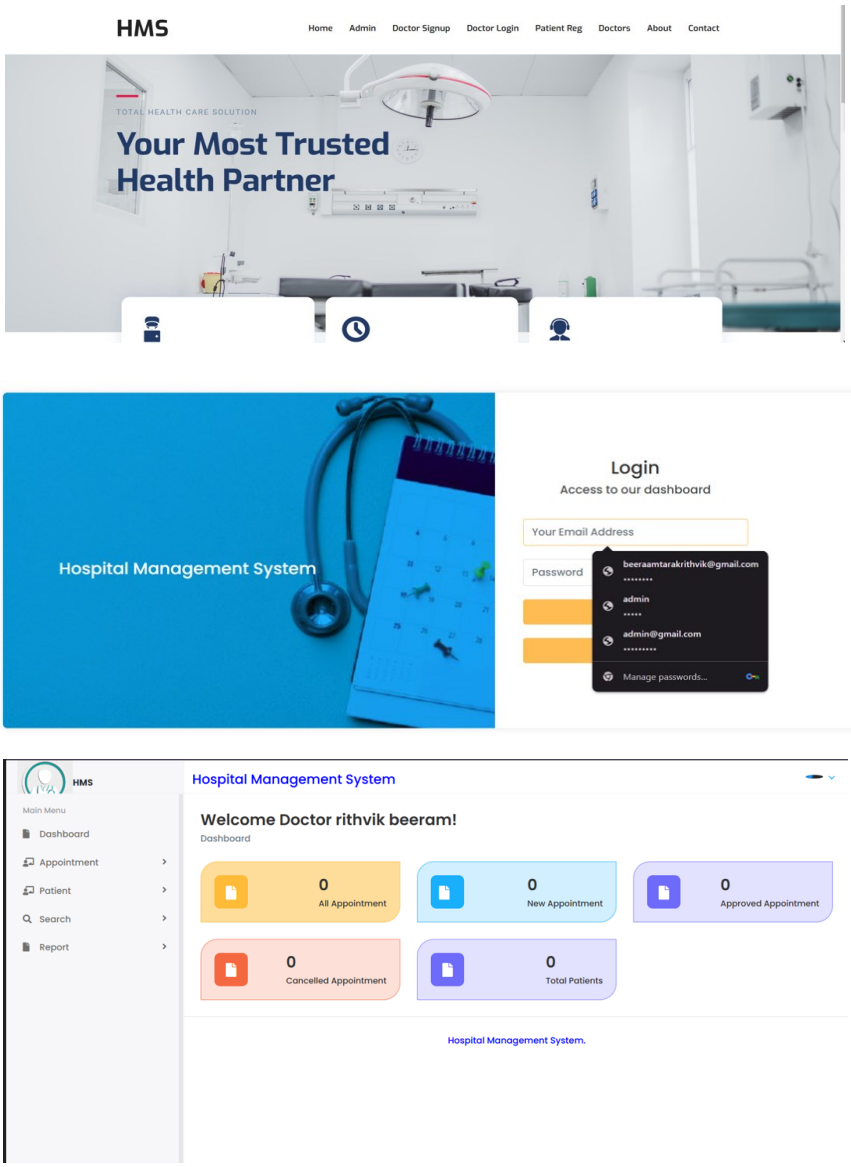


Fig. Change in Measures of Dementia Progression and Caregiver Wellbeing. Box plots of total scores of the following measures at intake and year 1 - (A) Dementia Rating Severity Score

International Journal of Information Technology & Computer Engineering
ISSN 2347–3657
Volume 13, Issue 2, 2025

(DSRS); (B) Functional Activities Questionnaire (FAQ); (C) PHQ-9 and (D) Zarit Burden Inventory. * p<0.001 between intake and year 1 using paired t-test. Numbers in the middle of the boxplot represents the median for each of the measures



Conclusion:

A comprehensive healthcare ecosystem is essential for optimizing health operations and improving patient care. By integrating advanced technologies such as electronic health records (EHRs), artificial intelligence (AI), telemedicine, and data analytics, healthcare systems can enhance efficiency, reduce costs, and ensure better patient outcomes.

Collaboration among healthcare providers, insurance companies, pharmaceutical firms, and regulatory bodies is crucial to creating a seamless, patient-centered approach. Implementing digital health solutions streamlines workflows, minimizes errors, and improves access to medical services, ultimately leading to more personalized and proactive care.

Furthermore, data-driven decision-making enables predictive analytics, helping healthcare professionals anticipate health issues and intervene early. As healthcare ecosystems continue

to evolve, prioritizing interoperability, cybersecurity, and patient engagement will be key to sustaining long-term success.

In conclusion, a well-structured healthcare ecosystem fosters efficiency, enhances patient experiences, and drives better clinical outcomes. By leveraging innovation and collaboration, the future of healthcare can be more accessible, efficient, and patient-focused.

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