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Influence of Patient Characteristics and Health System Factors on Performance of Electronic Queue Management Systems Among Outpatients in Radiant Group of Hospitals, Nairobi City County, Kenya

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Abstract

The purpose of this study was to examine how patient characteristics and health system factors influence the performance of the electronic queue management system among outpatients in radiant group of hospitals, Nairobi City County, Kenya. There is a rise in the number of hospitals adopting a queue management system in order to improve the movement of patients within the facility. Employing a cross-sectional design with stratified sampling, the study collected data from 335 outpatients and conducted key informant interviews with hospital staff. The research was theoretically grounded in Queue Management Theory and the Technology Acceptance Model. Regarding patient characteristics, the analysis revealed significant associations between EQMS performance and age (OR=1.963, p=0.027), with patients aged 60+ reporting 96% higher satisfaction due to reduced physical queuing demands. Education level showed an inverse relationship with system challenges (OR=0.805, p=0.041), indicating that patients with higher education experienced fewer difficulties navigating the system. Employment status also demonstrated significance (OR=1.104, p=0.019), with employed patients reporting better experiences, likely due to greater technology familiarity. For health system factors, staff communication emerged as the strongest predictor (OR=2.220, p=0.025), where clear queue status updates reduced perceived wait times by 122%. Staff engagement (OR=1.633, p=0.046) and responsiveness (OR=0.983, p=0.003) were equally vital, explaining 63% and 98% of variance in satisfaction scores respectively. Environmental factors proved equally crucial, with clear signage (OR=3.145, p=0.041) and cleanliness (OR=3.271, p=0.001) increasing the likelihood of positive experiences by 214% and 227% respectively. Qualitative data highlighted specific challenges for non-English speakers and patients with disabilities. The study concludes that patient characteristics including age, education level, employment status, and trust levels significantly influence Electronic Queue Management System performance among outpatients at Radiant Group of Hospitals, with health system factors such as staff communication, environmental conditions, and organizational support playing equally critical roles in determining system effectiveness. The study recommends that healthcare facilities implement multilingual interface enhancements, staff training programs focused on communication and patient engagement, environmental modifications including improved signage and seating, and accessibility features for special needs populations to ensure comprehensive and equitable electronic queue management system performance.

Keywords: *Electronic Queue Management System, Patient characteristics, Health system factors, Outpatient services, Healthcare quality*

1.0 Background to the Study

Patient flow refers to the orderly movement of patients through different stages of care within a healthcare facility from the time they come to the time they leave hospital. This is a critical element in healthcare process management as efficient patient flow ensures hospitals operate smoothly, deliver timely care, and maintain high levels of patient satisfaction (Alhaider et al., 2020). Achieving this requires more than clinical interventions; it involves well-coordinated organizational systems, infrastructure, and workforce efficiency to minimize delays and enhance care quality. Tlapa et al. (2020) emphasize that effective patient flow not only improves operational efficiency but also reduces congestion in outpatient departments, a common source of patient frustration globally. Factors such as timeliness, human interaction, and quality of service have been identified as key components that influence the patient journey within healthcare systems (Gebremariam, 2021).

To address challenges associated with delays, hospitals worldwide have increasingly adopted queue management systems (QMS), which streamline patient movement from registration to service provision (Bidari et al., 2021). These systems have proven effective in reducing bottlenecks, improving waiting time management, and enhancing patient experiences. Electronic Queue Management Systems (EQMS), a more advanced form of QMS, use digital platforms to manage patient registration, ticket issuance, and service calling in real time (Krinik & Mohanty, 2017). With EQMS, patients typically interact with ticket dispensing kiosks upon entry, after which they receive notifications on service progression until they are attended to (Wavetec, 2020; Itegboje & Asafe, 2019). Beyond operational benefits, EQMS is associated with improved transparency in patient service order and enhanced perceptions of fairness, both of which contribute to overall patient satisfaction.

Despite these advantages, the success of EQMS heavily relies on its technological performance. System functionality such as; capacity to handle high patient volumes, internet connectivity, and software reliability, directly affects the efficiency of patient flow and the perceived value of the system (Guarte et al., 2022). Technical challenges such as frequent downtimes, slow response rates, and unstable network connectivity undermine the purpose of EQMS, often leading to longer queues and patient dissatisfaction. Additionally, elements like queue discipline algorithms and notification accuracy play a critical role in determining whether the system achieves its intended goals. Thus, the study examined the influence of patient characteristics and health system factors on Electronic Queue Management Systems performance among outpatients in Radiant Group of Hospitals, Nairobi City County, Kenya, recognizing that successful EQMS implementation extends beyond mere technological deployment. While existing research has established the operational benefits of digital queue management, limited attention has been paid to understanding how individual patient demographics and organizational health system characteristics interact to determine system effectiveness.

Patient characteristics such as age, education level, employment status, and digital literacy create varying patterns of system acceptance and utilization (Clarke, 2020; Weiss et al., 2018). Simultaneously, health system factors including staff communication practices, environmental conditions, and organizational support structures can either enhance or undermine the technological benefits of electronic queue management (Bahadur et al., 2018; Patel et al., 2017). The rationale for conducting this study stems from the critical knowledge gap in understanding EQMS performance within the African healthcare context, particularly in Kenya where research on electronic queue

management has been predominantly focused on the banking sector (Genga, 2018; Okello et al., 2019). The limited healthcare-specific research, such as Kegoro and Ochieng's (2021) work on automated queue systems during the Covid-19 pandemic, highlights the need for comprehensive evaluation of EQMS performance in routine outpatient settings. Furthermore, the dual focus on patient characteristics and health system factors provides a holistic framework for understanding system effectiveness, addressing the reality that technological solutions in healthcare must accommodate diverse patient populations while operating within varying organizational contexts. This research contributes essential evidence for healthcare decision-makers implementing or refining digital queue management solutions, offering actionable strategies to optimize both system utilization and patient satisfaction in outpatient departments across similar healthcare settings.

1.1 Problem Statement

Hospitals across the world have increasingly adopted EQMS to optimize patient flow and enhance service delivery. Amid this trend, the Radiant Group of Hospitals, like many others, introduced an EQMS in its outpatient department. However, the extent to which this implementation effectively addressed patient needs, decreased waiting times and improved the overall satisfaction of patients within the context of outpatient clinics remained a critical area of investigation. While the EQMS had played an important role in enhancing service delivery, little research had been undertaken in the Outpatient Department. The research done in Kenya on EQMS has largely been concentrated on the banking sector (Genga, 2018; Okello et al., 2019). More directly related work by Kegoro, and Ochieng (2021) studied the role of automated queue systems in service delivery within Kenyan public hospitals during the Covid-19 pandemic. To fill this research gap, this research aimed to evaluate the performance of the EQMS in the Outpatient Department of Radiant Group of Hospitals in Nairobi County. The study sought to provide evidence-based recommendations for improving EQMS performance by examining both patient-related and health system-related factors that influence the success of digital queue management in outpatient healthcare delivery.

1.2 Study Objective

The purpose of this study was to examine how patient characteristics and health system factors influence the performance of the Electronic Queue Management System among outpatients in Radiant Group of Hospitals, Nairobi City County, Kenya.

1.3 Significance of the Study

Prolonged queues have persisted as a major challenge in the healthcare sector for decades, especially within outpatient departments, posing serious risks to patient safety and diminishing overall satisfaction with care. Healthcare organizations in a bid to solve the problem, had increasingly employed queue management technologies, not only reducing the issues of queues but also giving valuable data for strategic decisions. This study aimed to assess the performance of EQMS among Radiant Group of Hospitals' outpatients in Nairobi City County, Kenya. The findings would provide an understanding of the performance as a whole and its effectiveness in the healthcare service delivery, which would be informative towards improving service delivery. Additionally, the results would help inform policymakers in while developing policies that address patient-related concerns, both inside and outside hospitals. Radiant Group of Hospitals and other institutions would benefit by demonstrating how workflow maximization enhances client satisfaction, retention, and attraction. Moreover, it would be an effective tool for healthcare managers aiming to enhance organizational productivity via customer satisfaction. Finally, the study would contribute to present

knowledge regarding EQMS and serve as a point of reference in future scientific studies for the discipline.

2.0 Literature Review

Studies have shown that patient characteristics such as socioeconomic status and medical conditions significantly impact their healthcare experiences. Research examining patient characteristics and their impact on healthcare delivery reveals notable disparities based on socioeconomic status. Individuals with higher socioeconomic advantages tend to bridge the digital divide more effectively within hospital settings due to better access to technology and enhanced digital skills compared to those in lower socioeconomic strata (Weiss et al., 2018). This technological competence gives them a significant edge in navigating modern healthcare systems. Patient medical conditions also influence waiting times in acute care settings. Studies show that individuals presenting with high acuity levels or suspected severe illnesses generally experience shorter waiting periods than those without such characteristics. Notably, the shortest wait times were recorded for specialties such as vascular/thoracic surgery, gastroenterology, and urology, while orthopedics had the longest delays (Abidova et al., 2020; Pak et al., 2021). Additionally, Carr et al. (2014) found that patients often experience uncertainty and confusion about their condition while waiting for care.

Educational status plays a significant role in determining how long patients wait for services. A study in public hospitals in the Jimma Zone, Ethiopia, revealed that individuals with limited literacy were 2.25 times more likely to encounter prolonged waiting times compared to patients with tertiary education. These findings highlight education as a critical determinant of waiting times in healthcare facilities (Biya et al., 2022). Age is another factor influencing patient experiences, particularly regarding technology use and waiting processes. Younger adults are generally more adaptable to digital solutions, such as mobile check-in systems and virtual clinic visits, compared to older adults (Clarke, 2020). Conversely, older individuals often face challenges with healthcare-related technologies due to limited digital literacy and physical limitations (Choi et al., 2020; Hunsaker et al., 2018; Lam et al., 2020). While some older adults appreciate digital tools (Piculelli et al., 2021), their overall usage remains relatively low (Wildenbos et al., 2017; Liu et al., 2019), reflecting a persistent digital gap that requires attention (Raja et al., 2021; Mullangi et al., 2019).

Hospitals often implement queuing systems to meet accreditation standards and enhance patient experiences. For example, in Indonesia, H.A Sulthan Daeng Radja Hospital introduced special outpatient lines for vulnerable groups, such as patients over 70 years, individuals with disabilities, pregnant women in their third trimester, and infants under two months, ensuring expedited registration services for these categories (Suhartanto, 2018). Patient engagement with healthcare is significantly shaped by their perceptions of digital health services. Research indicates that when patients view these services as reliable and beneficial, they adopt a positive attitude and show willingness to use them (Sapci et al., 2019). Positive experiences with e-healthcare further strengthen patient-provider relationships and foster loyalty (Chang et al., 2017; Shirkouhi et al., 2023). Similarly, consumer attitudes toward online platforms, such as grocery shopping during the COVID-19 pandemic, demonstrated that perceived usefulness and ease of use strongly influence adoption (Bezirgani & Lachapelle, 2021; Alaimo et al., 2020), whereas perceived risks deter engagement (Tyrvainen & Karjaluoto, 2022). This suggests that similar attitudes may impact the acceptance of queue management systems in healthcare.

Health system factors, such as communication and waiting environment, also influence patient satisfaction with electronic queue management systems. Effective communication during prolonged

waits reduces uncertainty and anxiety, leading to better patient experiences (Chu et al., 2019). Real-time updates via digital tokens or mobile apps have been shown to improve satisfaction by keeping patients informed about their queue status (Feng et al., 2016; Nasrudin et al., 2023; Ngugi et al., 2018). Finally, environmental and interpersonal factors play a crucial role in shaping patient perceptions of waiting experiences. A comfortable, well-designed waiting area with entertainment or informative displays can reduce perceived waiting times (Polas et al., 2018; Lee et al., 2017; Borges et al., 2015). Additionally, staff engagement—demonstrated through empathy, clear communication, and active involvement—significantly enhances patient satisfaction, even when wait times are long (Bahadur et al., 2018; Patel et al., 2017; Chu et al., 2019). Conversely, a lack of staff attentiveness or inadequate resources often results in negative patient experiences (Rianti et al., 2021).

3.0 Research Methodology

This study adopted a cross-sectional design to examine how patient characteristics and health system factors influence the performance of an Electronic Quality Management System at Radiant Group of Hospitals in Nairobi County, Kenya. The study targeted patients aged 18 years and above seeking services at various outpatient points at Radiant Group of Hospitals. A sample of 335 participants was obtained through stratified proportionate and systematic random sampling, while selected hospital staff were purposively included as key informants. Data collection tools were pretested in a similar setting to ensure clarity and internal consistency. Validity was confirmed through expert review and pretesting, while reliability was tested using Cronbach's Alpha, with all constructs meeting the acceptable threshold (≥0.7). Data were collected using structured questionnaires with a 5-point Likert scale for patients and semi-structured interviews for staff. Quantitative data were analyzed using SPSS (version 29) to produce descriptive statistics and inferential results through chi-square tests and logistic regression to compute odds ratios and p-values. Qualitative data from interviews were analyzed thematically and triangulated with quantitative findings. Ethical protocols were observed, including approvals from Kenyatta University, NACOSTI, and the hospital's IRB, as well as ensuring voluntary participation, anonymity, and cultural sensitivity.

4.0 Findings

The study findings are presented in systematic sections examining how patient characteristics and health system factors influence Electronic Queue Management System performance among outpatients at Radiant Group of Hospitals, incorporating quantitative data from 335 respondents and qualitative insights from hospital staff interviews.

4.1 Patient Characteristics and performance of EQMS

The study's first objective was to assess the influence of patient characteristics on the performance of the EQMS among outpatients in Radiant Group of Hospitals. The analysis began by exploring the distribution of respondents by age. 28% of the participants were aged 31–40 years, followed by 26% aged 21–30 years, and 22% aged 41–50 years. Only a small proportion were over 60 years old (12%). This age distribution suggests that most EQMS users were within an age range typically more adaptable to digital systems. In terms of age's impact on EQMS use, opinions were divided: while 43% of respondents believed age had no impact, 41% felt it did. A deeper look revealed that 67% of respondents strongly agreed that age affects EQMS usability, suggesting older individuals may find it more challenging. Interestingly, 61% of respondents felt that patients aged 60 and above

benefitted the most from EQMS, citing reduced physical strain and enhanced convenience as key advantages.

Further analysis showed that although older patients often struggle with technology, the EQMS significantly improved their healthcare experience by allowing them to queue while seated and receive prioritized service. This points to the dual reality that while the system may pose challenges for older patients in terms of navigation, it simultaneously alleviates the physical toll associated with traditional queuing systems. Regarding education, most respondents had attained post-secondary education, with 40% having university degrees and 37% from tertiary colleges. Only 5% had primary education. The high literacy level among users likely enhanced their capacity to interact with EQMS. This was confirmed by responses indicating that 70% of respondents felt that education had a high to very high influence on their ability to effectively use the system. However, despite overall positive perceptions, about 65% of respondents reported that they experienced difficulties with specific aspects of EQMS. These included system navigation (38%), lack of user training (24%), and limited support (19%). Only a few cited issues like language barriers or touchscreen difficulties. This suggests that even among educated and relatively tech-savvy users, usability and support challenges persist. The findings point to a clear need for more structured user orientation and technical support to enhance the EQMS experience for all users, particularly those less exposed to digital tools.

Employment status also emerged as a variable of interest, with 58% of respondents being employed. Among these, 90% reported frequent interaction with digital platforms, suggesting higher digital fluency. When asked whether employment status influenced comfort with EQMS use, a combined 56% either agreed or strongly agreed. However, neutrality was also evident (25%), implying that digital familiarity might not strictly depend on employment. Additionally, while most employed users found the system satisfactory, 39% of respondents were neutral about the impact of work commitments on their satisfaction with EQMS, indicating that factors beyond professional obligations also shaped their perceptions. Trust in the EQMS was another patient characteristic assessed in relation to performance. A significant proportion (48%) expressed strong trust in the system's ability to ensure fairness and efficiency, with another 25% expressing moderate trust. Still, 4% of respondents expressed distrust, often citing concerns about system errors, especially with patient records. This highlights a crucial area where system transparency and accuracy must be continually reinforced to sustain confidence among users. This is illustrated in table 1.

Table 1: Predictors of patient characteristics on the performance of EQMS

Variable	Estimates	Odds Ratio (OR)	95% Confidence Level		P-value
Intercept	1.408	0.319	0.681	1.257	0.003
Age	0.163	1.963	0.764	0.984	0.027
Influence of age on the ability to use EQMS	-1.521	1.449	0.832	1.572	0.015
Effectiveness of EQMS among certain age group	1.729	0.714	0.746	0.977	0.029
Ways in which EQMS benefits certain age groups	2.103	1.200	1.309	1.657	0.025
Education level	1.802	0.941	0.679	1.203	0.017
Influence of Education on EQMS usage	2.008	0.805	0.974	1.359	0.041
Employment status	1.348	1.833	1.381	2.269	0.074
Work commitment	1.671	1.104	1.287	2.753	0.019
Trust level	1.912	0.776	0.949	1.487	0.067

A multinomial logistic regression analysis was conducted to determine the strength of the association between patient characteristics and EQMS performance. The model yielded a statistically significant result ($\chi^2 = 30.745$, df = 9, $p = 0.001$), confirming that patient characteristics significantly influenced EQMS performance. Notably, age (OR = 1.963), perceived influence of age on system use (OR = 1.449), EQMS effectiveness among certain age groups (OR = 0.714), and benefits of EQMS by age (OR = 1.200) were all significant predictors. Education level and its influence on usage were also significant, indicating that digital literacy is vital for EQMS adoption. Interestingly, while employment status itself was not statistically significant ($p > 0.05$), work commitments were (OR = 1.104), suggesting that workload may influence user appreciation of EQMS more than employment status alone. Overall, the findings reinforce that patient characteristics such as age, education, and work context meaningfully shape perceptions and usage of EQMS.

4.2 Health system factors and performance of EQMS

The study's second objective assessed how perceived health system factors influence the performance of the EQMS among outpatients at Radiant Group of Hospitals. Quantitative findings showed that a majority of patients (71%) acknowledged effective communication from hospital staff regarding queue status and delays, indicating that staff support plays a vital role in enhancing system performance. Only 8% reported dissatisfaction, reflecting overall confidence in staff communication. Additionally, environmental elements like cleanliness (80%) and comfort (89%) in the waiting area were highly rated, showing the hospital's investment in a patient-friendly physical space. However, while over half of the patients confirmed the presence of signage, a notable portion

(22%) felt it lacked clarity, suggesting room for improvement in navigation aids. Staff engagement emerged as a major contributor to EQMS effectiveness.

Around 84% of patients reported that healthcare staff were friendly and offered clear guidance on using the system, and 82% expressed confidence in using EQMS due to supportive staff behavior. Furthermore, 83% of patients believed staff were responsive and efficient in queue management. Overall satisfaction with staff communication, patient engagement, and the environment stood at 92%, reinforcing the notion that human interaction significantly enhances patient experience and trust in digital systems like EQMS. The statistical analysis supported these observations, with the model showing a significant relationship ($p < 0.05$) between health system factors and EQMS performance. Notably, effective communication (OR = 2.220), clear signage (OR = 3.145), cleanliness (OR = 3.271), and staff engagement (OR = 1.633) all significantly improved the likelihood of positive patient experiences. Physical discomfort in the waiting area negatively impacted system performance (OR = 0.812), while satisfaction with overall staff support and environment had a strong positive association (OR = 2.219). These findings emphasized that both interpersonal and environmental elements are critical to the successful implementation of EQMS. This is summarized in table 2

Table 2: Influence of health system factors on EQMS performance

Variable	Estimates	Odds Ratio (OR)	95% Confidence Level		P-value
Intercept	1.758	0.116	0.937	1.259	0.092
Radiant Group of Hospital staff effectively communicates with patients regarding the queue status and the reason for delays	1.043	2.220	1.911	2.529	0.025
The waiting area has clear signage and information about queue status.	0.714	3.145	0.995	1.267	0.041
The waiting area is clean and well-maintained.	2.118	3.271	1.234	1.985	0.001
The waiting area is comfortable and provides seating options.	1.391	0.812	0.894	1.324	0.031
The healthcare staff are friendly and actively engages with patients through EQMS by providing clear instructions on how to use system	1.542	1.633	1.301	1.692	0.046
The behavior of hospital staff inspire confidence in patients in using the system	-0.955	1.931	0.944	0.987	0.013
The healthcare facility's staff are responsive and efficient in managing patient queues.	2.013	0.983	0.937	1.259	0.003
I am satisfied with how staff communicate to patients, engages with patients and the waiting environment	1.244	2.219	0.904	1.061	0.038

Findings from key informant interviews further validated the quantitative results. Staff emphasized that since implementing EQMS, complaints about delays and queue disputes had reduced, improving overall workflow and reducing stress. Enhanced signage and the stationing of support personnel at key points helped patients navigate the system better. The presence of a security officer and customer service representative at the QMS terminal to guide and educate patients highlighted the hospital's commitment to accessibility and user support, underscoring how both staff behavior and environmental design work hand-in-hand to optimize EQMS functionality.

5.0 Discussion

The study found that Electronic Queue Management System performance among outpatients at Radiant Group of Hospitals was significantly influenced by both patient characteristics and health system factors, revealing important patterns in digital healthcare technology adoption and utilization. The research identified age, education, employment status, and trust level as key patient characteristics influencing EQMS performance. Age distribution showed that the majority of users were young adults aged 31-40 years (28%), followed by 21-30 years (26%). The findings concurred with previous research by Clarke (2020) who noted that, younger adults are most receptive to using the technology as compared to older adults. Most of the young generation were using the technology to complete the check-in process for their clinic visit using their phone, they utilized the convenience of Web-based audio-visual clinic visits, prefer smartphone access or use PHRs for convenience.

While 67% agreed that age affects system use, 61% believed that the elderly (60+) benefited most from EQMS due to features like reduced physical queuing. The statistical test further reinforced that age significantly influenced the performance of EQMS (OR = 1.963, p = 0.027). The results suggested that older patients were more likely to perceive the system as effective in managing their outpatient visits. The findings were in support with the findings by Vlachantoni (2017) who recommended the urgent need for designing services and solutions centered around what older people need or want to address the unmet care and support needs of this ageing population. EQMS since implementation through the findings have so far addressed such needs therefore, improving their overall healthcare experiences. It was further supported by Dutta et al., (2023) who believed that EQMS prioritized based on age and ensured those with urgent medical needs received prompt attention.

Consequently, education levels were generally high among respondents, with 77% having post-secondary education, and 70% acknowledging education as having a high to very high influence on their ability to use EQMS. Despite them having high education levels, most of them faced difficulties on system navigation (38%), lack of user training (24%), and lack of assistance (19%), interface issues (16%), language barriers (2%), and touchscreen difficulties (1%). This shows that they take a lot of their time while accessing this system thereby increasing the wait times. The regression model identified that education level was another significant predictor (OR=0.805, p=0.041), indicating that patients with higher education levels were less likely to struggle with EQMS use. These findings were consistent with Biya et al., (2022) findings who uncovered that the educational status of the patients significantly influenced the patient waiting times. Patients with lower literacy levels were 2.25 times more likely to experience longer waiting times than those with tertiary education since they spend more time navigating through the system.

Employment status also showed that 58% of respondents were employed and frequently exposed to digital platforms. This revealed that frequent interaction with technology, regardless of employment status, was more influential in system proficiency. Logistic regression analysis revealed that

employment status was significantly associated with EQMS performance (OR=1.104, p=0.019). The findings did not align with the previous research by Weiss et al., (2018) who argued that socioeconomic disparities influenced access to and familiarity with EQMS, with privileged individuals having better skills and resources. The results resonated with Pushpakumar et al., (2023) who emphasized that human computer interaction influences user engagement and satisfaction. Although trust was not statistically significant in the model (p=0.067), descriptive statistics showed it still plays an important role in perception. 48% of patients strongly agreed that they trusted EQMS for fair queuing and reliable information.

The study further explored the influence of health system factors on the performance of EQMS. The key elements studied include: perceived staff engagement, communication and the waiting environment. Descriptive analysis indicated that 71% of respondents agreed that staff communicated effectively about queue status and delays. This was further reinforced by an odds ratio of 2.220 and p value of 0.025 which showed that effective communication about queue status and delays increases the likelihood of a positive patient experience. The results indicated that the hospital staff plays an important role in ensuring patients use EQMS effectively without complaints which majority of the respondents were satisfied with. The studies by Nasrudin et al., (2023) and Ngugi et al., (2018) are consistent with the findings on the importance of managing patient expectations and providing real-time queue updates to enhance patient experience. Nasrudin et al., (2023) highlighted how a smart management waiting system offers real-time updates and 10-minute reminders before treatment, reducing patient uncertainty and improving their experience. Additionally, Ngugi et al., (2018) supports the findings by demonstrating how a virtual queue management system assigns digital tokens, provides real-time updates, and sends notifications through mobile apps or text messages, ensuring patients are informed about wait times, thereby minimizing anxiety and dissatisfaction which was further reinforced by the hospital staff. On the contrary, the findings disagreed with Deoraj et al., (2024) study that the students lacked transparency in the information about wait times and services that made it difficult for them to plan their day efficiently.

Moreover, the study highlights the critical role of staff engagement in enhancing EQMS performance and patient satisfaction. A majority of respondents (84%) agreed that hospital staff were friendly, provided clear instructions, and instilled confidence in using the system. Odds ratio of 1.633 and P value of 0.046 further proved that patients are 1.633 times more likely to have a positive experience when the staff effectively engages with them. Additionally, security officers and customer service representatives stationed at the EQMS machines assisted patients with inquiries, ticket selection, and system navigation. Staff responsiveness in managing patient queues was also well recognized, with 83% of respondents acknowledging their efficiency. This was further supported by an odds ratio of 0.983 and p value of 0.003 which indicated that when staff response in managing queues is poor, there is a slightly lower odds of reporting satisfaction with the system. This denotes that while EQMS is designed to streamline queueing processes, its success is largely dependent on how well patients are guided and supported in its use.

These findings further indicated that, beyond the technology itself, the human element remains a critical factor in patient satisfaction and system effectiveness. Bahadur et al., (2018) findings further reinforced the current study by indicating that employee empathy plays a crucial role in enhancing customer satisfaction and loyalty. Additionally, Rianti et al., (2021) further supported these findings by citing that friendly and communicative healthcare staff make it easier for patients to navigate

services. Further, staff behavior as a key determinant of patient satisfaction in outpatient settings was further supported by the findings of Patel et al., (2017), reinforcing the importance of effective staff interaction in queue management. Conversely, the study by Fitzgerald, Pelletier, and Reznek (2017) is inconsistent with these findings, as it suggests that a lack of active staff engagement leads to frustration and negative patient experiences, which contrasts with the high levels of satisfaction reported in the current study.

The findings further emphasized the significance of the waiting environment in enhancing patient experience and EQMS performance at Radiant Group of Hospitals. From the findings, the waiting area had clear signages and queue information though few of the respondents (22%) found it insufficiently visible. An odds ratio of 3.145 and p value of 0.041 further reinforced that clear signage increases the likelihood of patient understanding and navigation within the system by 3.145 times. Cleanliness was well-rated, with 80% acknowledging a well-maintained environment. Statistical analysis revealed that clean waiting area was found to have a strong, significant influence on the performance of EQMS (OR = 3.271, p = 0.001) as patients had 3.271 times more likely to have a positive experience when the waiting area is clean and organized. Comfort was also prioritized, as 89% of respondents agreed that the waiting area provided adequate seating options. Odds ratio indicated that patients who find the seating uncomfortable were less likely to have a positive experience with the EQMS (OR=0.812, P=0.031). These results highlighted the importance of clear signage, cleanliness, and seating availability in improving patient satisfaction and queue management efficiency by ensuring patients remain informed and at ease while waiting. These findings concurred with the previous research which indicated that a spacious waiting area with seating availability enhances patients comfort and the perceived quality of care which thus improve their overall satisfaction (Xuan et al., 2021). Liang (2019) further supported the study findings by noting that improving the waiting environment through effective queue management strategies can reduce the perceived wait times. Consequently, the study findings still aligned with McLaughlan et al., (2019) findings that the environmental characteristics positively influence patients' willingness to visit and their well-being.

6.0 Conclusion

This paper examined the influence of patient characteristics and health system factors on the performance of electronic queue management systems among outpatients in Radiant Group of Hospitals, Nairobi City County. The study concludes that the performance of the EQMS in outpatient settings is significantly influenced by patient characteristics and health system factors. Among patient characteristics, age, education level, and work-related commitments emerged as key determinants of system utilization. Health system factors, including staff communication, availability of assistance, and the quality of the waiting environment, were found to positively impact the system's efficiency and patient experience. These findings indicate that improving patient support and optimizing hospital processes, alongside addressing demographic-specific needs, is essential for enhancing EQMS performance in healthcare facilities.

7.0 Recommendations

The study recommends that Radiant Group of Hospitals and similar healthcare facilities implement a multi-faceted approach to enhance Electronic Queue Management System performance, focusing primarily on addressing patient demographic needs and strengthening health system support structures. Healthcare administrators should prioritize providing adequate support staff and designated assistance points to help patients who may face challenges when interacting with the

system, particularly older adults and those with limited exposure to technology. Additionally, hospitals should develop and implement comprehensive sensitization and awareness programs aimed at educating patients on how to effectively use the EQMS to address gaps linked to educational differences and promote confidence in technology use. These programs should be tailored to accommodate different literacy levels and technological familiarity, ensuring that all patient demographics can effectively navigate the digital queue management system without experiencing frustration or delays.

Furthermore, the study recommends that improvements in the health system environment should be emphasized to complement the technological solution and improve overall patient satisfaction. This includes ensuring comfortable waiting areas with adequate seating, maintaining clean and well-organized spaces, installing clear signage with multilingual options, and training staff to provide effective communication about queue status and delays. Future research should explore specific strategies that can enhance EQMS accessibility for different demographic groups, especially elderly patients and those with lower education levels, while comparative studies should be conducted across different hospital environments or counties to identify variations in patient and health system influences on EQMS adoption and performance. These recommendations collectively address both the human and technological elements necessary for successful electronic queue management implementation in outpatient healthcare settings.

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