Comparing Online Registration Systems for Waiting Time and Patient Satisfaction in an Oncology Outpatient Clinic

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Abstract

Prolonged waiting times are particularly burdensome in oncology clinics, where patients require repeated and complex visits. The previous web-based registration system at Dr. Kariadi General Hospital did not provide real-time queue information and was reported to experience stability and loading issues. In contrast, the new application-based model incorporated real-time queue monitoring, automated notifications, and clearer scheduling information. This study aimed to compare outpatient waiting time sand patient satisfaction between the old and new online registration models in an oncology outpatient clinic. This cross-sectional observational study with a comparative design included 317 oncology outpatients recruited between October to December 2025, during a period when both registration models were operational. Participants were classified according to the registration model used (old model, n = 187; new model, n = 130). Waiting time was defined at the interval between the Hospital Management Information System (HMIS)-recorded check-in time and the start of the physician consultation. Patient satisfaction was assessed across the five SERVPERF dimensions. Unadjusted between-group comparisons were performed using the Mann-Whitney U test. Semi-structured interviews were conducted solely to provide supplementary illustrative observations and were not included as a formal qualitative component. The Mean waiting time was 83.10 minutes with the new model and 95.83 minutes with the old model group (mean difference, -12.73 minutes; p = 0.037). Mean overall satisfaction scores were 58.67 and 55.33, respectively (mean difference, +3.34; p = 0.003). Scores for tangibles, reliability, responsiveness, and assurance dimensions were significantly higher among users of the new registration model, whereas empathy scores did not differ significantly between groups (p = 0.071). In this unadjusted cross-sectional comparison, use of the new registration model was associated with modestly shorter waiting times and higher patient satisfaction, although overall waiting times remained prolonged. These findings support the integration of real-time digital features into hospital registration systems while highlighting the need for longitudinal studies to confirm their effectiveness and for strategies to ensure equitable access among patients with limited digital literacy.

Keywords: Oncology, Online Registration, Outpatient Services, Patient Satisfaction, SERVPERF, Waiting Time

INTRODUCTION

Outpatient waiting time and patient experience are closely related dimensions of healthcare service quality, as prolonged delays can reduce patient satisfaction, perceived responsiveness, and confidence in care. Recent studies in outpatient settings have consistently demonstrated that longer actual or perceived waiting times are associated with lower levels of patient satisfaction, whereas environmental comfort and effective expectation management

may influence how patients perceive and experience waiting (Biya et al., 2022; Santos-Jaén et al., 2022; Xuan et al., 2021; Zhang et al., 2023, 2025).

In oncology services, the burden of waiting may be amplified by repeated visits, laboratory testing, multidisciplinary coordination, and treatment-related procedures, creating multiple points at which delays can accumulate. Studies of process redesign in cancer centers suggest that reducing these delays often requires coordinated improvements across pharmacy, infusion, consultation, and patient-flow processes rather than reliance on a single administrative intervention (Hammoudeh et al., 2021; Mesko et al., 2022; Pavithran et al., 2025; Vos et al., 2022). Digital registration systems and patient-facing scheduling tools are designed to reduce administrative barriers by improving appointment access, queue transparency, scheduling information, and automated notifications. Evidence from studies of online registration systems and outpatient service processes suggests that such technologies can reduce certain components of waiting time and improve patient satisfaction. However, their effectiveness depends largely on successful integration with downstream clinical workflows and the availability of adequate service capacity (Kurniawati et al., 2021; Ningsih et al., 2024; Sharma et al., 2022; Wang et al., 2025; Widianto et al., 2023).

Digitalization also raises important equity and usability considerations. Recent studies of patient portals and digital health technologies have showned that factors such as age, eHealth literacy, system usability, and the need for proxy or assisted access can influence whether patients benefit from digital services (Aoun et al., 2025; Bober et al., 2024; Deshpande et al., 2023; Oudbier et al., 2025; Wolff et al., 2022). Dr. Kariadi General Hospital is a national tertiary referral center with a high volume of oncology outpatient visits. During the study period, the previous web-based portal and a newer application-based registration model operated concurrently. The older system did not provide real-time queue updates or automated notifications and was reported in interview participants to experience intermittent errors and slow loading times. In contrast, the newer model incorporated real-time queue monitoring, automated notifications, clearer schedule and quota displays, and access to examination results. The mean outpatient waiting time in the study population was 90.61 ± 67.22 minutes. Indonesia's national hospital quality indicator defines outpatient waiting time as the interval from registration to physician service and sets a target of serving more than 80% of patients within 60 minutes.

However, evidence directly comparing a traditional web-based registration system with a newer application-based registration model within the same oncology outpatient clinic remains limited. The research question addressed whether, among oncology outpatients using

these concurrently available models, use of the new application-based system was associated with shorter waiting times and higher patient satisfaction. Accordingly, this study aimed to compare outpatient waiting times and SERVPERF-based satisfaction between users of the two registration models. We hypothesized that use of the new application-based model would be associated with shorter waiting times and higher overall patient satisfaction.

METHODS

This cross-sectional observational study employed a comparative design and was conducted at the oncology outpatient clinic of Dr. Kariadi General Hospital, Semarang, Indonesia. Data were collected between October and December 2025, during a period when both the old and new online registration models were operating concurrently. Participants were classified according to the registration model they used, and assignment to either group was not randomized.

The old model was a web-based registration portal that lacked real-time queue tracking and automated notifications and was reported to experience intermittent errors and slow loading times. The new model was application-based and incorporated real-time queue monitoring, automated notifications, clearer scheduling and quota displays, and access to examination results. The intended purpose of these enhancements was to improve information transparency and facilitate arrival-time planning rather than to alter clinical staffing or consultation processes.

The study population comprised patients attending the oncology outpatient clinic during the study period who completed registration using either model. A total of 317 respondents were recruited using convenience sampling (locally termed accidental sampling), with consecutive recruitment conducted after completion of the outpatient visit to minimie selective recruitment by the study team. Inclusion criteria were use of either online registration model, ability to communicate, and provision of informed consent. Patients with incomplete registration data or those who declined participation were excluded. The sample size was determined pragmatically and included all eligible participants recruited during the predefined three-month study period in which both models were concurrently operational. An a priori sample sie or power calculation was not available in the study records. The final analytic sample comprised 317 participants; however, the exact number of patients screened and excluded because of incomplete registration data or refusal to participate was not recorded in the analytic dataset.

Waiting-time data were obtained from the hospital management information system (HMIS), the hospital's electronic operational database that stores time-stamped registration and outpatient service events. For this analysis, total outpatient waiting time was operationally defined as the interval from the HMIS-recorded patient check-in/arrival time to the timestamp marking the start of the doctor's consultation. Patient satisfaction was assessed after the outpatient visit using a structured SERVPERF-based questionnaire covering tangibles (physical facilities and interface), reliability (consistent and dependable service), responsiveness (prompt assistance), assurance (confidence and perceived safety), and empathy (individualized attention and concern). The instrument demonstrated high internal consistency (Cronbach's alpha = 0.903).

Semi-structured interviews were conducted with a selected subgroup of respondents who had experience using both registration models to explore usability, stability, transparency, waiting experiences, and support needs. Because the available study records did not document the number of interviewees, sampling strategy, interview guide, saturation assessment, coding procedure, or respondent-level verbatim quotations, these interviews were not treated as a formal qualitative study. They were used only as supplementary illustrative observations to contextualize the quantitative results.

Data were analyzed using SPSS. Categorical variables were summarized as frequencies and percentages, and continuous variables as means and standard deviations. The Kolmogorov-Smirnov test was applied only to continuous variables; because the principal outcomes were non-normally distributed, the Mann-Whitney U test was used for unadjusted between-group comparisons of waiting time and SERVPERF scores. Absolute mean differences were calculated as new minus old. Statistical significance was set at $p < 0.05$. Ethical approval was obtained from Dr. Kariadi General Hospital with ethical number 16628/KEPK-RSDK/2025. All participants provided informed consent for quantitative data collection and, where applicable, for the semi-structured interviews.

RESULTS

Respondent Characteristics

The analysis included 317 respondents: 130 (41.0%) used the new registration model, and 187 (59.0%) used the old model. Overall, 213 participants (67.2%) were female, and 104 (32.8%) were male. The most frequent occupational categories were unemployed (27.4%), private employee (20.5%), self-employed (17.0%), civil servant (14.2%), farmer (11.7%), trader (8.2%), and student (0.9%).

Educational attainment was senior high school or vocational education in 35.0%, bachelor's degree in 26.2%, elementary school in 12.3%, junior high school in 10.7%, diploma

in 9.5%, postgraduate degree in 4.1%, and no formal education in 2.2%. Table 1 compares baseline characteristics between users of the old (n = 187) and new (n = 130) registration models; statistically significant between-group differences were observed for sex and occupation, whereas educational attainment did not differ significantly.

The mean age was 48.05 +/- 13.37 years (range, 13-87 years), and the mean residential distance was 82.89 +/- 118.95 km. Mean outpatient waiting time was 90.61 +/- 67.22 minutes. Mean SERVPERF scores were 11.14 +/- 2.17 for tangibles, 11.39 +/- 2.12 for reliability, 11.36 +/- 2.25 for responsiveness, 11.35 +/- 2.26 for assurance, 11.45 +/- 2.33 for empathy, and 56.70 +/- 10.02 for total satisfaction (Table 2).

Table 1. Baseline characteristics of respondents according to registration model

Variable	CategoryZ	Old	New	P-value
		Frequency (%)	Frequency (%)	
Sex	Male	78 (41.7)	26 (20.0)	<0.001*
	Female	109 (58.3)	104 (80.0)	
Occupation	Unemployed	50 (26.7)	37 (28.5)	
	Farmer	21 (11.2)	16 (12.3)	
	Self-employed	32 (17.1)	22 (16.9)	
	Civil servant	17 (9.1)	28 (21.5)	0.016+
	Private employee	45 (24.1)	20 (15.4)	
	Trader	19 (10.2)	7 (5.4)	
	Student	3 (1.6)	0 (0)	
Education level	No formal education	5 (2.7)	2 (1.5)	
	Elementary school	24 (12.8)	15 (11.5)	
	Junior high school	22 (11.8)	12 (9.2)	
	Senior high school	64 (34.2)	47 (36.2)	0.610+
	Diploma	14 (7.5)	16 (12.3)	
	Bachelor's degree	48 (25.7)	35 (26.9)	
	Postgraduate degree	10 (5.3)	3 (2.3)	

**Chi-Square Test +Fisher's Exact Test*

Table 2. Mean Values of Continuous Study Variables

Variable	Mean +/- SD
Age (years)	48.05 ± 13.37
Distance from residence (km)	82.89 ± 118.95
Outpatient waiting time (minutes)	90.61 ± 67.22
Tangibles score	11.14 ± 2.17
Reliability score	11.39 ± 2.12
Responsiveness score	11.36 ± 2.25
Assurance score	11.35 ± 2.26
Empathy score	11.45 ± 2.33
Total satisfaction score	56.70 ± 10.02

Note: SERVPERF dimensions represent tangibles (physical and technological presentation), reliability (consistent and dependable service), responsiveness (prompt assistance), assurance (confidence and perceived safety), and empathy (individualized attention and concern).

Comparison Between the New and Old Registration Models

Patients using the new registration model had a mean waiting time of 83.10 minutes, compared with 95.83 minutes among users of the old model (absolute mean difference, -12.73 minutes; 13.3% shorter relative to the old-model mean; p = 0.037; approximate r = 0.12). The reduction was statistically significant but modest, and the mean waiting time with the new model remained prolonged (Table 3).

Mean total satisfaction was higher with the new model than with the old model (58.67 vs. 55.33; absolute mean difference, +3.34; p = 0.003; approximate r = 0.17). Significant differences favored the new model for tangibles (+0.69; p = 0.003; approximate r = 0.17), reliability (+0.71; p = 0.003; approximate r = 0.17), responsiveness (+0.63; p = 0.015; approximate r = 0.14), and assurance (+0.79; p = 0.003; approximate r = 0.17). Empathy was +0.48 points higher but did not reach statistical significance (p = 0.071; approximate r = 0.10).

Table 3. Unadjusted Comparison of Outcomes Between Registration Models

Outcome	Registration Model	n	Mean	Median (IQR)	95% CI	r	p-value*
Waiting time (minutes)	New	130	83.10	NR	NR	0.117	0.037
	Old	187	95.83	NR	NR		
Tangibles	New	130	11.55	NR	NR	0.167	0.003
	Old	187	10.86	NR	NR		
Reliability	New	130	11.81	NR	NR	0.167	0.003
	Old	187	11.10	NR	NR		
Responsiveness	New	130	11.73	NR	NR	0.137	0.015
	Old	187	11.10	NR	NR		
Assurance	New	130	11.82	NR	NR	0.167	0.003
	Old	187	11.03	NR	NR		
Empathy	New	130	11.73	NR	NR	0.101	0.071
	Old	187	11.25	NR	NR		
Total satisfaction	New	130	58.67	NR	NR	0.167	0.003
	Old	187	55.33	NR			

*Note. * p-values are from the Mann-Whitney U test. † NR = not recoverable from the retained aggregate analytic record; exact median (IQR) and nonparametric 95% confidence intervals require participant-level data or the original test output. ‡ Approximate effect-size r was derived from the reported two-sided p-value using $r = |z|/\sqrt{N}$ and should be replaced by the exact r calculated from the Mann-Whitney Z statistic when the original data/output are available.*

Illustrative Interview Observations

The supplementary interview observations were organized descriptively into four recurring topics solely to contextualize the quantitative results. Because the number of interviewees, sampling procedure, coding strategy, saturation assessment, and verbatim transcripts were not available, these observations should not be interpreted as formally derived or saturated qualitative themes.

First, respondents described better system stability and usability with the new application. The old web-based model was associated with errors and slow loading, whereas the new model was perceived as more stable, with clearer workflows, more informative displays, and more transparent scheduling and quota information. These observations are consistent with the higher reliability and responsiveness scores.

Second, real-time queue information and notifications improved transparency and helped patients plan arrival times, but did not eliminate downstream delays. Respondents continued to report long waits for laboratory services and physician consultations, which they attributed mainly to high patient volume at a national referral center. No difference in staff attitude was reported; staff were generally described as polite, helpful, and responsive under both models.

Third, participants generally preferred the new model because it was more practical and increased confidence in the service process. Fourth, new users and older adults sometimes required assistance during initial use, indicating that digital implementation should be accompanied by patient education and an assisted registration pathway. These observations highlight support needs, but their frequency cannot be quantified from the available interview records.

DISCUSSION

The principal finding of this study was that users of the new application-based registration model had a 12.73-minute (13.3%) shorter mean waiting time and a 3.34-point higher mean total satisfaction score than users of the previous web-based model. Differences also favored the new model for tangibles, reliability, responsiveness, and assurance dimensions, whereas no significant difference was observed in the empathy dimension. Because assignment to the registration model was not randomized and the analyses were unadjusted, these findings indicate an association between use of the new model and an improved operational experience rather than providing evidence that the application itself caused the observed differences.

The direction of the waiting-time finding is consistent with previous studies reporting operational benefits following digital interventions or process-based redesign in outpatient care. Sharma et al. (2022) reported shorter waiting times and higher patient satisfaction among users of an online registration system (Sharma et al., 2022)while Wang et al. (2025) demonstrated improvements in outpatient flow following the implementation of an intelligent patient-guidance system (Wang et al., 2025). In oncology settings, coordinated workflow

interventions have also been shown to reduce delays across pharmacy, consultation, and treatment processes (Hammoudeh et al., 2021; Mesko et al., 2022; Pavithran et al., 2025; Vos et al., 2022). The magnitude of the improvement observed in the present study was relatively modest, which is plausible given that the intervention targeted registration processes, queue information, and notifications but did not directly affect laboratory capacity, physician availability, or treatment workflows.

The higher overall satisfaction and four SERVPERF-domain scores are also consistent with broader evidence that waiting time, perceived process control, and service organization influence outpatient experience (Biya et al., 2022; Safitri et al., 2024; Santos-Jaén et al., 2022, 2022; Simanjuntak et al., 2025; Zhang et al., 2023).The application's clearer scheduling, real-time queue monitoring, and automated notifications may have reduced uncertainty and enhanced perceptions of reliability and responsiveness. However, this explanation should be regarded as a plausible mechanism rather than a demonstrated causal pathway, as potential mediators such as perceived control, expectation management, and changes in patient expectationswere not directly measured.

The absence of a statistically significant difference in empathy is noteworthy because the intervention primarily targeted digital access and information flow rather than interpersonal aspects of care. Contemporary oncology studies of technology-mediated healthcare similarly suggest that digital interactions can maintain high levels of patient satisfaction when communication is effective. However, the patient experience remains strongly influenced by the quality of interpersonal relationships, the effectiveness of communication, and the appropriateness of the encounter for virtual or technology-mediated delivery (Granberg et al., 2021; Heyer et al., 2021; O Parsonson et al., 2024; Shaverdian et al., 2021). Accordingly, digital registration should be viewed as complement to, rather than a replacement for, patient-centered and humanistic oncology care.

The supplementary interview observations support this interpretation by suggesting improvements in system stability, transparency, and arrival-time planning associated with the new application, alongside persistent delays in laboratory services and physician consultations. However, because the interview records did not document the number of interviewees, the sampling strategy, coding framework, saturation assessment, or respondent-level verbatim quotations, these observations should beconsidered illustrative rather than formally derived qualitative findings. In addiiton, social desirability bias and the possibility of preferential participation by more satisfied users may have influenced the reported observations.

The health-system implications of these findings suggest that real-time digital registration should be integrated with downstream capacity management rather than implemented as a stand-alone solution. Queue data may support demand-capacity matching, coordination of laboratory and consultation services, and the delivery of targeted notifications, however, assisted registration pathways should remain available for patients who require additional support. Recent digital-health research has identified eHealth literacy, system usability, age-related barriers, and the need for proxy-access as important determinants of equitable digital participation in digital healthcare services (Aoun et al., 2025; Bober et al., 2024; Deshpande et al., 2023; Oudbier et al., 2025; Wolff et al., 2022). These findings therefore support a hybrid model in which digital technologies is complemented by human assistance for patients who need it.

Several limitations should be considered when interpreting these findings. First, nonrandomized design is susceptible to self-selection bias and residual confounding. The significant baseline differences in sex and occupation presented in Table 1 further suggest that the two groups were not fully comparable, and no multivariable adjustment was performed. Second, the use of convenience sampling and the absence of documented screening and exclusion counts may have introduced selection bias. Third, participant-level data and the original Mann-Whitney U and Z statistics were unavailable; consequently, medians with interquartile ranges, nonparametric 95% confidence intervals, and exact effect-size r values could not be reconstructed. Therefore, the approximate r values reported in Table 3 should be interpreted with caution. Fourth, the study did not assess digital literacy, visit type or frequency, disease and treatment characteristics, service throughput, adherence, or clinical outcomes. Fifth, the interview observations served were supplementary evidence rather than a formally analyzed qualitative component. Finally, the single-center oncology setting may limit the generalizability of the findings. Future prospective cohort studies or phased implementation studies should incorporate a prespecified sample size calculation, retain participant-level timestamp data and confounder data, report distribution-appropriate estimates with confidence intervals and effect sizes, and evaluate sustainability of observed benefits as well as digital equity across repeated visits.

CONCLUSIONS

In this single-center cross-sectional comparison, use of an application-based registration model with real-time queue monitoring and automated notifications was associated with a modestly shorter mean waiting time and higher overall patient satisfaction than the

previous web-based model. Waiting nevertheless remained prolonged, and empathy did not differ significantly, indicating that digital registration alone cannot resolve downstream capacity constraints or substitute for humanistic care. Integration with laboratory and consultation workflows, together with assisted registration for patients with limited digital literacy, should be considered in future implementation. Prospective longitudinal studies with participant-level data and adjusted analyses are needed to confirm effectiveness, equity, and generalizability.

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