

Transforming Chemotherapy Support: An Interactive Chatbot That Boosts Discipline and Satisfaction in Colorectal Cancer Patients in Makassar

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Abstract

Background: Colorectal cancer patients frequently struggled with treatment adherence due to chemotherapy-related toxicities and psychological burden. Digital interventions such as chatbots had emerged as promising tools to support symptom monitoring and patient engagement. This study aimed to evaluate the effectiveness of an interactive chemotherapy-support chatbot on treatment discipline and patient satisfaction among colorectal cancer patients in Makassar. **Materials and Methods:** A quasi-experimental design was conducted involving 60 colorectal cancer patients undergoing adjuvant chemotherapy. Participants were divided into an intervention group using a Telegram-based chatbot (n = 30) and a control group receiving standard care (n = 30). Primary outcomes were chemotherapy discipline, defined as completion of four scheduled sessions, and user satisfaction measured using a five-item Likert scale. **Results:** The intervention group achieved significantly higher chemotherapy discipline compared with the control group (90% vs. 50%). The mean number of completed sessions was higher in the intervention group (3.9 vs. 3.1). User satisfaction was very high (mean score 4.69/5), with the reminder feature receiving the highest rating (4.90). The chatbot also reduced discipline-related psychological issues, with no reported psychological dropout in the intervention group. **Conclusion:** The interactive chatbot substantially improved chemotherapy adherence and patient satisfaction. Its implementation demonstrated strong potential for wider adoption in Indonesian oncology services.

Keywords: colorectal cancer, chemotherapy, chatbot, adherence, digital health, patient satisfaction

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Introduction

Colorectal cancer remained one of the most prevalent malignancies globally and was a major contributor to cancer-related mortality in Asia. Treatment typically required repeated cycles of chemotherapy, which posed challenges due to cumulative toxicities such as nausea, vomiting, fatigue, neuropathy, and hematological abnormalities. These side effects contributed significantly to reduced adherence, delayed cycles, and incomplete treatment, ultimately affecting therapeutic outcomes and survival [1]. In Indonesia, adherence challenges were further exacerbated by socioeconomic factors, limited access to oncology services, and varying levels of patient health literacy.

Digital health technologies had emerged as innovative

tools to address gaps in cancer support. Chatbots, defined as AI-supported conversational agents, were able to deliver real-time monitoring, guidance, and emotional support. Previous studies demonstrated that chatbots were effective in medication adherence, symptom monitoring, and patient empowerment in diverse cancer settings [2]. Despite these advances, implementation in low- and middle-income countries, including Indonesia, remained limited, particularly for colorectal cancer patients undergoing chemotherapy. Culturally adaptive chatbot solutions were therefore needed to improve patient engagement and reduce preventable treatment delays [3].

This study developed and evaluated botkemoterapimks, a chatbot customized for Indonesian colorectal cancer

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patients receiving chemotherapy in Makassar. The study assessed its effectiveness in improving chemotherapy discipline and patient satisfaction, thereby providing new evidence for the integration of digital oncology support tools into local clinical practice.

Materials and Methods

Study Design

This study used a quasi-experimental, two-arm comparative design to evaluate the effectiveness of an interactive chemotherapy-support chatbot in improving treatment discipline and patient satisfaction among colorectal cancer patients. Two groups were observed: an intervention group receiving chatbot-assisted support and a control group receiving standard care. Randomization was not applied in order to maintain continuity of clinical workflow within the chemotherapy units.

Study Setting and Duration

The research was conducted in several chemotherapy units in Makassar, Indonesia. Data collection took place between July and October 2025. Each participant was followed throughout four planned cycles of adjuvant chemotherapy, with intervals ranging from 14 to 21 days depending on the regimen used.

Participants

Eligible participants included adults diagnosed with colorectal cancer who were scheduled to undergo adjuvant chemotherapy and were able to communicate in Bahasa Indonesia. Patients were required to own a smartphone with the Telegram application installed and to provide informed consent. Individuals with cognitive impairment interfering with chatbot use, those enrolled in other digital health programs, those receiving palliative-intent chemotherapy, or those with incomplete baseline data were excluded.

A total of 60 participants meeting the eligibility criteria were consecutively enrolled and assigned to two groups: 30 patients in the intervention group and 30 in the control group. Group allocation followed routine clinic scheduling flow without deliberate randomization.

Intervention Group

The intervention consisted of access to botkemoterapimks, a chemotherapy-support chatbot developed using Python and the Telegram Bot API and deployed via the Railway cloud platform. The chatbot content and clinical instructions were validated by oncology specialists and pharmacists. The chatbot provided structured guidance for managing common chemotherapy-related symptoms, including nausea, vomiting, diarrhea, fever, neuropathy, mucositis, and fatigue; automated detection of warning signs requiring urgent medical attention; personalized reminders sent 24 hours and 3 hours before scheduled chemotherapy sessions; and brief educational messages accompanied by weekly motivational support.

Participants in the intervention group received a

short orientation on chatbot use and were encouraged to interact with the chatbot as needed throughout the treatment period.

Control Group

Patients in the control group continued to receive standard chemotherapy care, including routine clinical consultations, printed educational materials, and verbal instructions from oncology staff. No digital reminders or automated symptom-support tools were provided.

Outcome Measures

The primary outcome was chemotherapy discipline, defined as successful completion of all four planned chemotherapy cycles without delays or cancellations. Adherence was recorded as complete or incomplete, and reasons for non-adherence including toxicity, financial burden, transportation difficulties, or psychological distress were documented.

The secondary outcome was patient satisfaction with the chatbot, assessed only in the intervention group using a Likert-scale questionnaire evaluating ease of use, response speed, clarity of information, perceived usefulness of reminders, and motivational value. Overall satisfaction was expressed as the mean score across all items.

Data Collection and Analysis

Demographic data, cancer stage, chemotherapy regimens, and relevant laboratory results were extracted from medical records at baseline. Adherence data were collected at each chemotherapy visit. Chatbot usage logs were automatically recorded and exported for analysis.

Descriptive statistics were used to summarize participant characteristics and satisfaction scores. Differences in chemotherapy completion rates were analyzed using chi-square or Fisher's exact tests. Continuous variables were analyzed using independent t-tests or Mann-Whitney U tests as appropriate. Statistical significance was set at $p < 0.05$. All analyses were performed using IBM SPSS Statistics version 26.

Ethical Considerations

Ethical approval was obtained from the Institutional Review Board of the Faculty of Medicine, Universitas Hasanuddin. All participants provided written informed consent prior to enrollment. Confidentiality was maintained through anonymization and secure data storage.

Results

Participant Characteristics

A total of 60 colorectal cancer patients were included in the study, with 30 patients assigned to the intervention group and 30 to the control group. Baseline demographic and clinical characteristics were comparable between groups. The mean age was similar, and both groups showed a balanced distribution of sex, clinical stage, and chemotherapy regimens. This ensured group comparability prior to the intervention (Table 1).

Table 1. Baseline Characteristics of Study Participants.

Variable	Intervention (n=30)	Control (n=30)
Mean age (years)	53.7 ± 10.2	54.1 ± 9.8
Sex (Male/Female)	17 / 13	18 / 12
Clinical Stage II	8 (26.7%)	7 (23.3%)
Clinical Stage III	19 (63.3%)	20 (66.7%)
Clinical Stage IV	3 (10.0%)	3 (10.0%)
Common regimen (XELOX/FOLFOX)	22 / 8	21 / 9
Comorbid hypertension	10 (33.3%)	9 (30.0%)
Comorbid diabetes mellitus	6 (20.0%)	5 (16.7%)

Chemotherapy Discipline

Overall Adherence

The intervention group demonstrated markedly higher adherence to the four scheduled chemotherapy cycles compared to the control group. A total of 27 participants (90%) in the intervention arm completed all four cycles, whereas only 15 participants (50%) in the control arm were able to do so. This represents a 40% absolute improvement in adherence attributable to the chatbot. The significant improvement in adherence was further reflected in the mean number of chemotherapy sessions completed, where the intervention group averaged nearly a full schedule (3.9 cycles) (Table 2).

The pattern of incomplete chemotherapy cycles differed substantially between groups. Patients in the control group showed a broader spread of early discontinuation, including failures to complete even the second cycle. No participant in the intervention group discontinued before the third cycle, in contrast to the control group where 7 patients withdrew before cycle 3 (Table 3).

Differences in the causes of incomplete adherence were notable. The intervention group reported only three cases of discontinuation and none related to psychological burden. In contrast, the control group had 15 incomplete cases, driven largely by toxicity and logistical barriers (Table 4).

Patient Satisfaction With the Chatbot

Satisfaction was assessed only among participants in the intervention group. The chatbot received a very high overall satisfaction score with a mean of 4.69 out of 5, indicating strong acceptance and perceived usefulness. The highest-rated feature was the reminder system, which

Table 2. Comparison of Chemotherapy Discipline.

Outcome	Intervention (n=30)	Control (n=30)	p-value
Completed 4 cycles	27 (90.0%)	15 (50.0%)	< 0.001
Did not complete	3 (10.0%)	15 (50.0%)	—
Mean number of cycles completed	3.90 ± 0.31	3.10 ± 1.02	0.002

Table 3. Distribution of Completed Chemotherapy Cycles.

Cycles Completed	Intervention (n=30) (%)	Control (n=30) (%)
4 cycles	27 (90.0)	15 (50.0)
3 cycles	3 (10.0)	8 (26.7)
2 cycles	0	4 (13.3)
1 cycle	0	2 (6.7)
0 cycles	0	1 (3.3)

Table 4. Reasons for Non-Adherence.

Reason for Incompletion	Intervention (n=3) (%)	Control (n=15) (%)
Severe chemotherapy toxicity	1 (33.3)	7 (46.7)
Transportation difficulties	1 (33.3)	4 (26.7)
Financial barriers	1 (33.3)	3 (20.0)
Psychological distress	0	1 (6.7)

participants described as essential in helping them prepare for and attend chemotherapy sessions on time (Table 5).

Discussion

The findings of this study showed that the use of an interactive chemotherapy-support chatbot significantly improved treatment discipline and patient satisfaction among colorectal cancer patients in Makassar. The substantially higher chemotherapy completion rate observed in the intervention group was consistent with previous research demonstrating that digital health tools, particularly conversational agents, enhanced adherence and patient engagement in oncology care [4].

Several mechanisms may have explained the improvement in adherence. First, the chatbot's automated reminder system likely played a central role. Automated reminders had been shown to reduce missed appointments and improve compliance in chronic disease and cancer care, where treatment schedules were complex and burdensome [5]. In this study, reminder usefulness received the highest satisfaction score, suggesting that timely prompts helped patients prepare both physically and psychologically for chemotherapy sessions.

Second, the chatbot provided structured guidance for managing common chemotherapy-related toxicities. Treatment-related adverse effects were a major contributor to chemotherapy delays and discontinuation among colorectal cancer patients [6]. By offering clear, culturally adapted self-care instructions and early recognition of warning symptoms, the chatbot may have improved patients' confidence in managing side effects and reduced unnecessary treatment interruptions. This supportive function likely contributed to the lower rate of early discontinuation observed in the intervention group.

Psychological support also appeared to influence adherence outcomes [7]. Notably, no participant in the intervention group discontinued treatment due to psychological distress, in contrast to the control group. Weekly motivational messages and continuous access to

Table 5. Patient Satisfaction Scores.

Aspect Evaluated	Mean Score (1–5)	Interpretation
Reminder usefulness	4.90	Very satisfied
Clarity of information	4.85	Very satisfied
Ease of use	4.65	Very satisfied
Response speed	4.60	Very satisfied
Motivational support	4.45	Satisfied
Overall Satisfaction	4.69	Very satisfied

informational support may have alleviated anxiety and strengthened patients' perceived sense of support. This finding aligned with previous studies indicating that digital communication tools reduced cancer-related anxiety and improved treatment continuity [8].

Patient satisfaction with the chatbot was very high, particularly regarding reminder functionality and clarity of information. The use of Telegram a widely familiar platform in Indonesia and Bahasa Indonesia likely enhanced usability and acceptability across different age groups. These findings supported earlier evidence that chatbot interfaces were generally perceived as user-friendly and culturally adaptable, making them especially suitable for low-resource settings where healthcare workforce limitations restricted frequent in-person follow-up [9].

Although the chatbot reduced early treatment discontinuation, external factors such as transportation and financial limitations continued to contribute to non-adherence in both groups. Digital interventions alone could not fully eliminate structural barriers; however, their ability to enhance preparedness and reduce psychological burden could significantly improve overall resilience and continuity of care [10].

Despite these encouraging results, several limitations should have been acknowledged. First, the quasi-experimental design without randomization introduced the possibility of selection bias. Group allocation followed clinic scheduling flow, which may have resulted in more motivated or digitally literate patients being assigned to the intervention group. Although baseline demographic and clinical characteristics were comparable, unmeasured confounders could not be excluded. Randomization was not implemented in order to preserve routine chemotherapy workflows and minimize disruption to clinical services. Future multicenter randomized controlled trials were therefore necessary to strengthen causal inference.

Second, this was a single-center study with a modest sample size, which limited generalizability. Makassar represented an urban oncology setting within Indonesia, and outcomes might have differed in other regions with varying levels of digital literacy, internet access, healthcare infrastructure, and socioeconomic conditions. Larger, multicenter studies across diverse settings were needed to assess scalability and broader applicability.

Third, patient satisfaction was assessed only in the intervention group. Satisfaction measures were inherently specific to chatbot use and therefore were

not directly comparable with standard care. While this approach allowed focused evaluation of user experience, it limited comparative interpretation. Future studies should incorporate parallel patient-reported experience or satisfaction measures in control groups to enable direct comparison with standard oncology care.

Fourth, adherence was evaluated over only four chemotherapy cycles. Longer-term adherence, sustained engagement with the chatbot, and downstream clinical outcomes such as survival, quality of life, and healthcare utilization were not assessed. Longitudinal follow-up studies were required to determine whether the observed improvements persisted over extended treatment periods and translated into meaningful clinical benefits.

From a technical and ethical perspective, the chatbot was intentionally designed as a rule-based support system rather than an autonomous clinical decision-making tool. Symptom-reporting pathways and escalation logic were validated by oncology specialists, and the chatbot advised immediate clinical contact for urgent or severe symptoms. This conservative design prioritized patient safety and aligned with ethical standards for digital health interventions. All chatbot data were anonymized, securely stored, and accessible only to authorized research personnel, ensuring confidentiality and compliance with institutional data protection policies.

In summary, this study added to the growing body of evidence supporting chatbot-based interventions as effective adjuncts to oncology care. While digital tools could not fully address structural barriers such as financial or transportation constraints, they meaningfully reduced psychological burden, enhanced preparedness, and improved treatment adherence. With further validation through randomized, multicenter, and longitudinal studies, chatbot-assisted support systems held strong potential as scalable and cost-effective solutions for improving cancer care delivery in low- and middle-income countries.

In Conclusion, The interactive chatbot substantially improved chemotherapy adherence and patient satisfaction. Its implementation demonstrates strong potential for wider adoption in Indonesian oncology services.

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Statement of Transparency and Principles

- The authors declare no conflict of interest.
- The study was approved by the Research Ethics Committee of the authors' affiliated institution.
- The study data are available upon reasonable request.
- All authors contributed to the implementation of this research.

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