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Application Study of a Multi-Functional Erasable Blackboard at the Foot of the Bed in Urine Output Recording and Bidirectional Humanistic Feedback between Nurses and Patients in the Department of Medical Oncology

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Abstract

Objective: Urine output records for patients in the oncology department are often inaccurate; bedside handover information tends to be fragmented; and there is a lack of channels for positive feedback between nurses and patients. This study developed a low-cost, reusable bedside visual nursing tool and evaluated its impact on the quality of urine output recording, standardized handover procedures, and two-way communication between nurses and patients, thereby providing a reference for the refinement and humanistic care in oncology specialty care. The study participants were limited to inpatients in the oncology department who had a caregiver present and were able to cooperate in completing the records. Methods: A single-center, non-concurrent before-and-after controlled study was conducted, enrolling 162 inpatients from the Department of Oncology at a tertiary Grade A hospital who required 24-hour urine output monitoring between June and November 2025. From June to August 2025, 81 patients were enrolled as the control group and received routine verbal education supplemented by paper notes for urine output recording; from September to November 2025, 81 patients were enrolled as the observation group and utilized a multifunctional erasable small blackboard at the foot of the bed, with the board divided into a urine output recording area, a key handover reminder area, and a positive patient-caregiver message and praise area. Urine output recording accuracy at the shift level, the rate of missed handover information at the case level, and nursing satisfaction were compared between the two groups; additionally, raw shift data were subjected to post-hoc secondary aggregation to derive patient-level urine output recording

accuracy as a supplementary analysis, which was not a prespecified primary outcome; descriptive analysis was performed on the positive patient messages collected from the observation group. Because the same patient was observed across multiple shifts, the observations were not independent, and the statistical power for indicators at the shift level may have been lower than the level estimated by the prespecified sample size; this study established three prespecified outcomes without applying multiple testing corrections; furthermore, as the study employed a non-concurrent before-and-after controlled design, there was a risk of time-related confounding and the Hawthorne effect, and the results should therefore be interpreted with caution. Results: At the shift level, the accuracy rate for urine output recording in the observation group was 93.83%, higher than that in the control group (77.36%; P = 0.007); at the case level, the rate of missed shift-handover information was 4.94%, lower than that in the control group (20.99%; P = 0.002); and nursing satisfaction was 96.30%, higher than that in the control group (81.48%; P = 0.003). All intergroup differences were statistically significant. A subsequent secondary pooled analysis at the patient level showed that the accuracy rate for urine output recording in the control group was 54.32%, compared with 76.54% in the observation group (χ^2 = 8.84, P = 0.003). A total of 42 positive commendation messages voluntarily submitted by patients and their family members were collected in the observation group; their content primarily addressed meticulous work, clear health education, and effective psychological and emotional support. Conclusion: The multifunctional, erasable small blackboard at the foot of the bed is easy to operate, cost-effective, and reusable; it can effectively improve the accuracy of urine volume recording at the shift level for cancer patients and reduce the omission of bedside handover information at the case level. Its forward-message section enables the visual documentation of positive feedback from patients and their family members, establishing a humanistic nursing model that benefits both nurses and patients, and improving patients' experience of receiving care. This study did not include assessment using a nurse job burnout scale; the conclusion that "reducing nurse job burnout" was derived from the literature and therefore requires further empirical validation. This tool is suitable for promotion among inpatients in the oncology department who have a caregiver and can cooperate with documentation; its applicability is limited for patients without a caregiver, those with severe cognitive impairment, or those with writing difficulties.

Keywords

Medical Oncology, Urine Output Monitoring, Urine Output Recording, Nursing Handover, Humanistic Nursing, Nursing Quality Improvement

1. Introduction

Urine output directly reflects the renal function and systemic circulatory volume in cancer patients and can also assist in assessing the body's tolerance to chemo-

therapeutic agents. Accurate recording of 24-hour urine output provides a reference for clinical fluid replacement regimens, reduces the risk of renal injury, and ensures the safe delivery of antitumor therapy [1]. Due to the impact of the disease and its treatment, cancer patients often experience physical fatigue, emotional anxiety, and memory impairment; family members undertake demanding caregiving responsibilities, while their knowledge of relevant health issues is often limited, resulting in frequent instances of missed urine output records, subjective estimates, and delayed documentation [2]. Any deviation in basic monitoring data can directly interfere with clinicians' assessment of the patient's condition.

Current approaches to improving the effectiveness of urine output recording primarily focus on refining measurement instruments and implementing health education [3]. While these measures can enhance measurement accuracy by optimizing hardware, they struggle to address practical issues such as the difficulty of preserving bedside information, data bias caused by human memory, and the fragmentation of information during shift handovers [4]. Existing bedside alert tools primarily rely on one-way information transmission by nurses; their functions are concentrated on risk alerts and the dissemination of health knowledge, with little emphasis on interactive communication between nurses and patients [5]. Meanwhile, bedside intervention models that simultaneously address clinical workflow needs and provide patient feedback channels—characterized by low cost and ease of implementation—remain relatively uncommon in oncology clinical practice.

Humanistic care is an indispensable component of specialized oncology nursing [6]. At present, the implementation of humanistic nursing largely relies on nurses proactively providing psychological interventions; patients have few opportunities to actively express their self-affirmation and feelings. Nurse-patient communication generally focuses on symptom management and the resolution of existing problems, with insufficient active emotional exchange [7]. Oncology nursing is characterized by high work pressure and frequent stressful events; if nurses do not receive positive feedback from patients over an extended period, this can exacerbate occupational burnout and hinder the continuous improvement of nursing quality.

In light of the aforementioned clinical gap, this study designs a bedside magnetic erasable small blackboard that integrates urine output recording, key handover points, and positive nurse-patient feedback into a single system, thereby establishing a bedside nursing model based on "quality control—process standardization—humanistic feedback." This approach is intended to improve the precision of basic nursing care, standardize handover procedures, and benefit both nurses and patients.

2. Subjects and Methods

2.1. Research Subjects

Inpatients in the Department of Medical Oncology at a Grade III Level-A hospital

from June 2025 to November 2025 were selected. After an initial screening based on inclusion and exclusion criteria, 90 cases were identified in the control group; 9 cases were excluded because they had fewer than 3 effective monitoring shifts, resulting in final inclusion of 81 cases. In the observation group, 88 cases were identified during initial screening; 7 cases were excluded because they had fewer than 3 effective monitoring shifts, resulting in final inclusion of 81 cases, for a total of 162 cases. Comparison of baseline characteristics—including age, sex, tumor type, educational level, and length of hospital stay—between the two groups showed no statistically significant differences ($P > 0.05$).

Inclusion criteria: 1) Inpatients with a physician order requiring 24-hour urine output monitoring; 2) Patients who are conscious and capable of independently cooperating with the recording, or whose hospitalized family members can assist with urine output documentation; 3) Age ≥ 18 years; 4) Informed consent obtained from the patient and family members, with voluntary participation in this study. Exclusion criteria: 1) Patients with severe cognitive impairment, severe aphasia, or mental illness who are unable to cooperate in the study; 2) Patients without a fixed family caregiver and who are too frail to complete urine output recording; 3) Hospitalized for <48 h, making it impossible to complete a full urine output monitoring cycle; 4) Patients in critical condition with unstable vital signs.

Sample size estimation: The accuracy of urine volume recording was used as the primary outcome measure. Based on the results of a preliminary pilot trial, it was assumed that the accuracy of urine volume recording would be approximately 78% in the control group and approximately 95% in the observation group; the significance level was set at $\alpha = 0.05$ (two-sided), with a power of $1 - \beta = 0.80$. Using the sample size calculation formula for comparing proportions between two independent samples (including the continuity correction), with the patient as the analysis unit, each group required at least 74 participants; accounting for an estimated dropout and exclusion rate of approximately 10%, it was planned that 81 participants would be enrolled in each group. In practice, the statistical unit for the primary outcome—urine volume recording accuracy—was the monitoring shift; since the same patient may be observed repeatedly across multiple shifts, an observation clustering effect exists, which is inconsistent with the assumptions underlying the sample size estimation, and the actual statistical power may therefore be slightly lower than the estimated value. This study also aggregated shift data at the patient level for a post-hoc secondary supplementary analysis; this analysis was not used as the basis for sample size estimation. Ultimately, this study enrolled 81 participants in the control group and 81 in the observation group, thereby meeting the case sample size requirement.

Sampling method: This study employed a non-concurrent before-and-after controlled design and continuous convenience sampling; random allocation was not implemented. The control group comprised all inpatients who met the inclusion and exclusion criteria from June to August 2025, while the observation group comprised all inpatients who met the criteria from September to November 2025.

This design cannot eliminate confounding factors arising from temporal changes (e.g., the development of nursing staff capabilities or variations in the intensity of departmental quality control); consequently, the level of evidence is weaker than that of randomized controlled trials.

2.2. Intervention Methods

2.2.1. Control Group

The department centrally organizes standardized training for nurses, covering the guidelines for urine output monitoring, requirements for shift handover records, and the procedure for verifying raw data; the training duration, assessment criteria, and frequency of verification are entirely consistent. There are no differences among the two groups of nurses in terms of training instructors, training materials, or assessment question banks; record verification is performed by the same reviewer who has received unified training and follows the same standards, thereby eliminating training and verification bias.

In the control group, routine urine output monitoring and shift-handover nursing procedures were implemented; urine output assessment, data recording, and the transmission of shift-handover information were completed in accordance with existing nursing standards, with no additional nursing interventions performed.

2.2.2. Observation Group

The multifunctional erasable small blackboard used in the observation group is made of magnetic, erasable material; its surface is divided into a urine volume recording area, a key handover reminder area, and a positive feedback and praise area for nurse-patient interactions.

In addition to routine urine volume monitoring and standard shift-handover care provided in the control group, the observation group received a standardized nursing intervention package, which included the following nursing activities: 1) On the day of admission, the assigned nurse provides the patient and their family members with a zone-based demonstration of the operating procedures for the bedside multi-functional small blackboard, informs them of the requirements for urine volume recording, and guides them to complete the urine volume record immediately after urination; 2) Nurses in each shift conduct bedside verification of the urine volume records on the small blackboard and simultaneously compare them with the measured urine volume results, making timely corrections if any discrepancies are identified; 3) Nurses complete core nursing information in the designated small blackboard care handover area; during bedside shift handovers, the blackboard handover section is listed as a mandatory verification item; 4) Patients and their family members are clearly informed that the message area on the small blackboard is for voluntary feedback and that they should not be prompted or compelled to provide subjective evaluation information; 5) During each shift handover, the blackboard information is transferred simultaneously; the writing and erasing of blackboard content are standardized, and routine maintenance is

performed to ensure that the recording interface remains clear and functional.

The above content collectively constitutes the exclusive intervention package for the observation group in this study; the control group does not receive the aforementioned education, verification, handover, or maintenance activities related to the small blackboard, while the basic nursing training programs and record-verification and review criteria for both groups remain consistent.

2.3. Observation Indicators and Criteria for Assessment

This study prespecified the shift-level accuracy of urine output recording as the primary outcome measure, while the rate of missed shift-handover information and patient care satisfaction were designated as secondary outcome measures; additionally, the accuracy of urine output recording at the patient level was conducted as a post hoc secondary supplementary analysis.

For multiple duplicate records generated by repeated monitoring days and shift handovers across multiple shifts for the same patient, a single outcome measure at the patient level is generated using a two-step approach: first, each independent monitoring shift is treated as the original analytical unit; then, for each shift, it is determined whether the urine-volume record is accurate and whether key handover information has been omitted. The results from all valid monitoring shifts for that patient are then aggregated, and the accuracy rate of urine-volume records at the shift level is calculated as (number of accurate shifts / total number of shifts that should have been monitored for that patient). If the number of valid monitoring shifts for a patient is fewer than 3, the case is excluded to avoid estimation bias arising from a small number of shifts.

The reference urine output for each shift shall be independently determined by the nurse in charge for that shift: based on the patient's body weight, the volume of fluids administered during the day, baseline renal function, disease diagnosis, and prescribed treatment orders, the nurse will individually determine the expected reference urine output for that shift. Before using this reference urine output for recording deviation comparison and correction, two senior nurses who are blinded to the grouping and do not participate in the intervention shall conduct a preliminary assessment of the appropriateness of the reference urine output; only after the assessment has been approved may it serve as the reference standard for that shift, and urine output recorded on a blackboard may not be used as a reverse reference value.

All data verification is carried out by independent reviewers who apply identical criteria for identifying omissions in both the observation group and the control group: with reference to the predefined key information checklist, any information that should have been recorded but was not, or that was not confirmed during the handover process, is deemed a recorded omission. Before the formal verification, reviewers receive standardized training and complete a consistency assessment; when the results of the dual-reviewer verification differ, the reviewers discuss the issue jointly until a consensus is reached; if no consensus can be

reached, a third supervising nurse is invited to arbitrate, thereby ensuring that the evaluation criteria for the two groups are consistent. The specific criteria for determining indicators are as follows:

1) Accuracy of urine output recording (shift level; predefined primary outcome): The actual urine output measured by the assigned nurse using a measuring cup serves as the gold standard. If the relative difference between the urine output recorded on the blackboard and the measured urine output is ≤10%, the recording is deemed accurate; if the relative difference exceeds 10%, the recording is deemed inaccurate. Accuracy assessment is based solely on the original records entered on the blackboard; subsequent bedside corrections or modifications by the nurse are not included in this accuracy assessment.

2) Accuracy of urine volume recording at the patient level (post hoc secondary aggregated supplementary analysis; not a prespecified primary outcome): The raw records from each shift are aggregated at the patient case level; if all valid monitoring shifts for a patient contain accurate urine volume records, that case is deemed to have accurate urine volume records; if any single shift contains inaccurate records, that case is deemed to have inaccurate records. The criteria for determining accuracy for a single shift are the same as those described above.

3) Rate of missed critical shift-handover information: Critical information is defined as requirements for urine output monitoring, key points for observing major symptoms, and precautions regarding high-risk medications. This indicator uses the case as the statistical unit: if critical information is missed during any single shift for the same patient, that case is classified as a missed-information case. Rate of missed information = (number of cases with missed information)/(total number of cases in the group) × 100%.

4) Nursing satisfaction: The Hospitalized Patient Nursing Satisfaction Scale was used, and an anonymous paper questionnaire was administered on the day of the patient's discharge. Response options on the questionnaire were divided into four levels: very satisfied, satisfied, dissatisfied, and very dissatisfied. Responses rated as "very satisfied" and "satisfied" were grouped into the "satisfied" category; responses rated as "dissatisfied" and "very dissatisfied" were grouped into the "dissatisfied" category. The questionnaire comprised two types of assessments: patient self-assessment and family proxy assessment. In this study, both the overall satisfaction score and stratified results from the self-assessment and family proxy assessment were reported. Nurses were completely absent from the entire assessment process and did not provide guidance or intervene in the responses. Questionnaire completion was carried out in two ways: i) Patient self-assessment: When the patient had the capacity for independent expression, the patient completed the questionnaire independently, and the researchers faithfully transcribed the patient's responses; ii) Family proxy assessment: When the patient was unconscious, physically frail, or had cognitive impairment, and therefore was unable to complete the assessment independently, a family member completed the assessment on the patient's behalf.

5) Positive patient feedback: Collect commendatory content voluntarily submitted in the feedback section; compile statistics on the number of messages and the identity of the sender (the patient themselves or a family member); record the timing of message submission (1 - 3 days after admission or ≥4 days during the mid-to-late phase of treatment); and summarize the thematic characteristics of the messages. The feedback section also provides a channel for submitting negative feedback; however, such feedback is intended solely for continuous internal quality improvement within the department, and it was not included in the analysis of this study. Consequently, this study describes only positive nurse-patient feedback and cannot provide a comprehensive assessment of the overall bidirectional feedback mechanism of the assessment tool.

2.4. Statistical Methods

Statistical analysis was performed using SPSS 26.0. Count data are expressed as numbers of cases and percentages; measurement data are expressed as mean ± standard deviation. Intergroup comparisons of count data were conducted using the χ^2 test, while intergroup comparisons of measurement data were conducted using the t-test; a P-value < 0.05 was considered statistically significant.

The accuracy rate of urine volume recording at the shift level is the pooled rate across all monitored shifts. When the same patient has multiple shift observations, the observations do not satisfy the assumption of statistical independence; therefore, using the standard χ^2 test may introduce statistical bias, and the results should be interpreted with caution. Where conditions permit, subsequent studies may employ generalized estimating equations (GEE) to adjust for the clustering effect.

The accuracy rate of patient-level urine output recording was obtained through secondary aggregation of shift-level data; cases were treated as independent observational units, and the χ^2 test was used for intergroup comparisons.

This study prespecified three outcome indicators; no post-hoc exploratory indicators were included, and no Bonferroni multiple-testing correction was applied, which would increase the risk of Type I errors (false positives). Cases were excluded and missing data were handled by direct deletion; no data imputation was performed.

3. Results

3.1. Comparison of Nursing Quality Indicators and Patient Satisfaction between the Two Groups

A total of 162 satisfaction questionnaires were distributed in this study, and all 162 valid questionnaires were returned, yielding a valid response rate of 100%. Among these, 148 were self-assessed by patients and 14 were assessed by family members on their behalf; in the control group, 73 were self-assessed, with 59 cases reporting satisfaction, yielding a satisfaction rate of 80.82%; among the 8 assessments by family members, 7 cases reported satisfaction, yielding a satisfaction rate

of 87.50%. In the observation group, 75 were self-assessed, with 72 cases reporting satisfaction, yielding a satisfaction rate of 96.00%; among the 6 assessments by family members, all 6 cases reported satisfaction, yielding a satisfaction rate of 100.00%. Because the sample size for the family-member assessments was small, the stratified results were presented only descriptively; no intergroup comparisons were performed, and these results do not serve as evidence supporting the study's conclusions.

Each group comprised 81 cases, with each case having ≥3 valid shifts; the total number of shifts was 243. In the control group, the number of accurate shifts was 188, and the accuracy rate for urine volume recording was 77.36%; in the observation group, the number of accurate shifts was 228, and the accuracy rate for urine volume recording was 93.83% (See Table 1).

Table 1. Comparison of various observation indicators between the two groups [n (%)].

group	Number of cases	Accuracy of urine output recording (At the shift level, %)	Shift handover omission rate (At the case level)	Overall Nursing Satisfaction [example (%)]
control group	81	77.36	17 (20.99)	66 (81.48)
observation group	81	93.83	4 (4.94)	78 (96.30)
χ^2 price	—	7.27	9.25	9.00
P price	—	0.007	0.002	0.003

Note: 1) The accuracy rate of urine output recording is a summary indicator at the monitoring-shift level (a prespecified primary outcome) and is not an indicator at the individual patient case level; since the same patient may undergo repeated observations across multiple shifts, this indicator is subject to clustering bias; 2) The missed recording rate during shift handovers is an indicator at the case level; if a missed recording occurs during any shift for the same case, that case is classified as having a missed recording; 3) Overall nursing satisfaction is derived from a combined statistical analysis of patient self-assessment and family proxy assessment questionnaires; 4) No multiple testing correction was applied in this study; 5) The accuracy rate of urine output recording at the patient level was obtained through a post hoc secondary aggregation and supplementary analysis; its statistical methodology differs from that used for the urine output recording accuracy rates presented in this table, and therefore it is not included in this table.

Follow-up secondary aggregation analysis of the accuracy of urine output records at the patient level: A case is deemed accurate if all of the patient's valid monitoring shifts were recorded accurately; if any single shift contains an error, the case is deemed inaccurate. In the control group of 81 cases, 44 cases had accurate records for all shifts, yielding a patient-level accuracy rate of 54.32%; among these, 37 cases (45.68%) had at least one inaccurate shift record. In the observation group of 81 cases, 62 cases had accurate records for all shifts, yielding a patient-level accuracy rate of 76.54%; among these, 19 cases (23.46%) had at least one inaccurate shift record. This analysis involved the secondary aggregation of raw shift data and was not intended as the prespecified primary outcome of this study. The results showed that after the implementation of the multifunctional erasable bedside blackboard, the proportion of cases with at least one urine output recording error decreased from 45.68% to 23.46%, representing a nearly 50% reduction; this suggests that the tool has a clinically meaningful effect in reducing the proportion

of patient cases with recording errors. Because this indicator uses the case as the statistical unit, it differs from the statistical unit and decision rule for urine output recording accuracy at the shift level presented in Table 1; therefore, the two cannot be directly compared.

3.2. Humanistic Feedback Results from Positive Patient Comments

During the intervention period, a total of 42 positive praise messages voluntarily submitted by study participants and their family members were collected from the observation group. The criteria for determining valid messages were as follows: the message had been independently written by the patient or family member and was not induced; its content was related to the experience of receiving nursing services; and the information was complete and interpretable. The same contributor could submit messages multiple times, and each independent message was included in the statistical analysis separately, with no limit on the frequency of submissions per individual. Two nursing researchers who did not participate in the intervention independently read the messages and extracted their core semantics, which were then categorized according to a pre-specified thematic framework; when the two researchers reached different classifications, they discussed and negotiated a consensus; if they still could not reach an agreement, a third researcher made the final determination. The messages were ultimately grouped into three themes: 1) Recognition of health education (20 messages): affirmation of the nurses 'health education efforts, particularly their explanation of medication knowledge and prompt answering of questions; 2) Recognition of nursing service quality (14 messages): praise for the nurses' rigorous and meticulous procedures and their empathetic care; 3) Recognition of psychological support and emotional companionship (8 messages): gratitude for the psychological counseling and emotional support provided by the nurses during treatment.

By identity: family members submitted 29 messages (69.05%), while the patients themselves submitted 13 messages (30.95%); distribution by submission time: 11 messages (26.19%) were submitted within 1 - 3 days after admission, and 31 messages (73.81%) were submitted during the middle to late stages of treatment after 4 days or more of hospitalization. Descriptive statistics indicate that messages are concentrated during the middle to late stages of hospitalization; however, this distribution merely describes an objective phenomenon. The data in this study are insufficient to infer that patients 'cognition progressively deepens as hospitalization duration increases, nor can they prove that the effectiveness of nurse-patient communication improves with longer hospital stays. This phenomenon may be associated with confounding factors such as length of hospital stay and the cumulative opportunity for message submission; its underlying mechanism requires further validation in subsequent research. This message section transforms previously verbalized positive patient feedback into visualized, pre-

servable written records, providing a medium for nurse-patient communication and compensating for the limitations of traditional humanistic nursing models, which primarily rely on one-way instruction delivered by nurses. Due to the lack of message data from a control group, it cannot yet be confirmed that this tool enhances patients' positive experience; it merely describes a phenomenon observed in the observation group.

4. Discussion

4.1. Innovative Features of This Study

The bedside magnetic whiteboard developed in this study integrates multiple practical functions, addressing basic nursing quality control, the standardized implementation of shift handovers, and the establishment of a two-way humanistic incentive mechanism between nurses and patients; compared with bedside nursing tools reported in previous literature, it demonstrates a strong degree of practical innovation.

At present, most bedside tools used in clinical practice have relatively limited functionality; information is primarily transmitted unidirectionally by nurses and is mainly used for health education and risk communication. These tools are designed solely around the nursing workflow and do not take into account the need for two-way communication between nurses and patients, nor do they leverage the motivational effect of patients' positive feedback on nursing staff. After adopting this small blackboard, basic bedside nursing information can be presented intuitively, and the entire nursing documentation process can be managed with full traceability.

In this study, shift-based data were used as the prespecified primary outcome for the accuracy of urine volume recording; shift-level data were also aggregated at the patient level for post hoc supplementary analysis (a non-prespecified outcome), enabling the effectiveness of the tool to be evaluated from multiple dimensions. At the shift level, the accuracy of individual registrations is reflected; at the patient level, the proportion of cases in which at least one registration error occurred is reflected. Combining these two perspectives provides a more comprehensive assessment of the quality of urine volume recording; however, the level of evidence for patient-level analysis is weaker than that for the prespecified primary outcome.

This study introduced a patient-positive feedback section, moving beyond the traditional humanistic nursing model in which "nurses provide care while patients passively receive it." Through this simple platform, patients and their family members can independently express their appreciation for the nursing care provided. The 42 valid comments collected in this study provide a direct reflection of the actual experiences of patients with the clinical nursing services delivered in the observation group. Existing nursing psychology literature suggests that immediate positive patient feedback can theoretically reduce nurses 'occupational burnout in high-stress environments and enhance their sense of professional identity;

however, this study did not assess outcomes related to nurses' occupational burnout. Consequently, this inference remains a theoretical hypothesis derived from the literature and requires further validation through subsequent research incorporating nurses' outcome indicators, thereby promoting the development of a humanistic nursing model that benefits both nurses and patients.

The tool has low manufacturing costs and can be repeatedly wiped, rewritten, and reused; it requires no supporting information technology equipment and can be promoted across hospitals of different tiers, making it particularly suitable for primary healthcare institutions. Primary oncology departments often face shortages of nursing staff and limited availability of information technology equipment; consequently, many digital nursing improvement initiatives are hindered by insufficient procurement funding and the difficulty of subsequent operation and maintenance, making them difficult to implement. This magnetic whiteboard requires neither an internet connection nor a power supply; after brief training, nurses, elderly patients, and their family members can use it proficiently, providing a practical and feasible solution for implementing low-cost, long-term nursing quality improvement and humanistic nursing care at the primary care level. This study carries the risk of the Hawthorne effect: because nurses in the observation group are aware of their assigned group, improvements in their subjective work behavior may confound the outcomes.

4.2. Multi-Functional Small Blackboards Enhance the Quality of Basic Nursing Care in Medical Oncology

A multifunctional small blackboard can improve the accuracy of urine output recording, as demonstrated both at the preset shift level and through post-event supplementary patient-level data. Under traditional practices, family members often rely on post-event recall to estimate urine output; as memory fades over time, recording errors are likely to occur. The small blackboard is placed in a prominent location, allowing patients or family members to complete their urine output records on the spot immediately after voiding, thereby effectively reducing recording errors caused by recall bias [8]. Meanwhile, during bedside rounds, the responsible nurse verifies the information recorded on the blackboard and cross-checks it against nursing documentation, promptly correcting any erroneous entries. This establishes a quality-control closed loop in which "family members complete immediate registration, and nurses conduct a review at the end of each shift," further ensuring the reliability of urine output data [3].

The bedside handover module transforms relatively vague verbal handover content into intuitive, visually presented handover prompts with clearly highlighted key points. It also introduces third-party personnel to conduct verification, reducing deviations caused by subjective human judgment, lowering the likelihood that critical nursing information will be omitted, standardizing the bedside handover process, and enhancing the standardization and safety of bedside shift handovers.

4.3. Optimizing the Two-Way Humanistic Feedback Module to Foster Nurse-Patient Relationships and Foster a Positive Nursing Environment

Patients with malignant tumors experience prolonged disease courses, frequent adverse reactions to treatment, and significant psychological stress. In the past, nurse-patient communication has primarily focused on resolving clinical problems and addressing various discomfort symptoms, with little positive emotional interaction of developmental significance. This study introduced a voluntary message-feedback section to establish a two-way communication platform between nurses and patients, providing patients and their families with a convenient means to record their inner feelings and express their appreciation for nursing care. Because negative messages were excluded from the study's analysis, this research cannot confirm that the tool can fully achieve the intended two-way feedback effect. Patients' genuine recognition and gratitude can not only improve their experience during hospitalization and increase nursing satisfaction but also enable nurses to truly appreciate the value of their roles [7]. This model helps motivate nurses, foster a positive work environment within the department, and has practical significance for stabilizing the nursing workforce and continuously improving the overall quality of nursing services.

4.4. Research Limitations and Future Directions

This study employs a single-center, non-concurrent before-and-after controlled design, a research approach that is particularly well suited to studies focused on nursing quality improvement. Throughout the study, patients 'existing treatment regimens were not modified, resulting in a low level of ethical risk and enabling an efficient assessment of the tool's practical effectiveness in real-world clinical settings.

However, this design still has inherent limitations: 1) Various confounding factors arising over time—including the natural progression of nurses 'professional competence and dynamic changes in departmental management intensity—may interfere with the study's outcome measures, resulting in evidence strength that is weaker than that of concurrent randomized controlled trials; 2) The statistical unit for recording the accuracy of urine output—the shift—does not align with the sample-size estimation unit (the patient); consequently, the ordinary χ^2 test is affected by the clustering effect of multiple shifts for the same patient, reducing its statistical power; 3) This study established three prespecified outcomes without applying multiple-testing correction, thereby increasing the risk of Type I errors (false positives); 4) Late-stage cancer patients with severe frailty, cognitive impairment, lack of caregiver support, or writing difficulties were not included in this study; furthermore, cases with fewer than three valid monitoring shifts were excluded, and no assessment was made regarding whether the baseline characteristics of these excluded cases differed from those of the included cases. This introduces sample selection bias, meaning that the conclusions drawn from the study

cannot be directly applied to this subgroup; 5) While the title mentions bidirectional humanistic feedback between nurses and patients, this study collected and analyzed only positive feedback; negative feedback was used solely for internal departmental quality improvement and was not incorporated into the study's data analysis. Thus, only a bidirectional feedback platform was established, preventing a comprehensive evaluation of the effectiveness of the tool for bidirectional nurse-patient feedback; 6) The Hawthorne effect may be present, as nurses may be aware that assignment to a group could alter their clinical behavior; 7) The accuracy rate of urine output recording at the patient level was derived from a post-hoc secondary aggregation and supplementary analysis rather than from a pre-specified outcome; therefore, its evidence level is lower than that of the prespecified primary outcomes; 8) At the shift level, the accuracy rate of urine output recording is reported only as a rate; the raw numerator and denominator for the total number of shifts monitored and the number of accurate shifts are missing, which hinders bias review.

Based on the preliminary findings derived from this study, the research team is currently advancing the preparatory work for a multicenter, concurrent controlled study. The team plans to collaborate with two peer-level specialized oncology hospitals to expand the sample size and conduct stratified analyses based on age, educational level, and tumor stage; regarding statistical methods, generalized estimating equations will be employed to adjust for shift clustering effects, while additional indicators—such as nurse job burnout and the collection and analysis of negative feedback—will be incorporated to provide a more comprehensive validation of the tool's clinical applicability. For the bedside small whiteboard, version optimization will also be carried out in the subsequent phase: the board layout will be redesigned, standardized check-box options will be added to reduce the burden of writing, and a simplified urine color chart will be provided; additionally, graphical cue templates will be developed for users with limited educational attainment. In the future, the team may also explore the development of multilingual simplified cue cards to reach a broader user population and promote the establishment of a standardized, systematic application model for this bedside care tool.

5. Conclusion

The multifunctional, erasable bedside small blackboard integrates multiple capabilities, including urine volume and quality control, safe shift handovers, and feedback for nurse-patient messages. The tool is easy to operate; its preset primary outcome—shift-level data—indicates that it can effectively improve the accuracy of urine volume recording for patients undergoing oncological treatment; post-hoc secondary supplementary analysis at the patient level similarly suggests that interventions can reduce the proportion of cases with registration errors. However, as this indicator is not a pre-specified outcome, it can standardize bedside shift handover procedures and reduce nursing oversights at the case level. The

newly added message incentive module provides a two-way feedback mechanism between nurses and patients, allowing positive evaluations from patients and their families to be retained and thereby improving the patient's inpatient care experience; based on existing literature, this model may provide positive motivational effects for nurses; however, this study lacks empirical data on nurse occupational burnout, and the extent to which it reduces burnout requires further validation. This study did not analyze negative messages, thus failing to provide a comprehensive evaluation of the effectiveness of two-way humanistic feedback. This tool can be promoted for use among inpatients in the oncology department who have accompanying support and are able to cooperate with recording; its applicability is limited for patients without accompanying support, those with severe cognitive impairment, or those with writing difficulties, and should be used cautiously in conjunction with auxiliary support measures.

Author Contributions

Conceptualization: Tang Lingling and Zhang Shan; Methodology: Tang Lingling; Software: Zhang Shan; Validation: Tang Lingling and Zhang Shan; Formal Analysis: Tang Lingling; Investigation: Tang Lingling; Resources: Zhang Shan; Data Curation: Tang Lingling; Writing—Original Draft Preparation: Tang Lingling; Writing—Review and Editing: Tang Lingling; Visualization: Tang Lingling; Supervision: Zhang Shan; Project Administration: Zhang Shan; Funding Acquisition: Tang Lingling. All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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